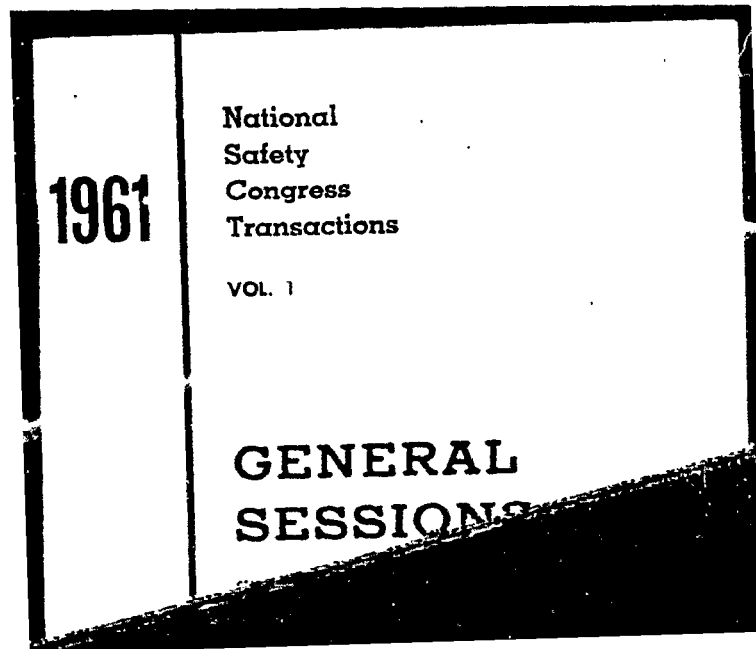


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INVOCATION

By THE REV. CHARLES M. CROWE, D.D.
Pastor—Wilmette Parish Methodist Church
President—Church Federation of Greater Chicago

ETERNAL GOD, Thou who are the creator of the race of men and in Whose care and keeping reside the destinies of nations, we acknowledge Thy lordship over life and the sovereignty of Thy divine laws in all human affairs. Grant, we pray Thee, the leadership of Thy wisdom in the deliberations of this important assembly. May the concerns here expressed for the safety and well-being of the people meet with Thy favor. And may they lead to a greater protection and preservation of the manpower of the nation. Renew among us a deep respect for the sacredness of personality and a genuine consideration for our fellow men. We would make common cause with all who seek to elevate and dignify and make secure the society of free men. Guide the leaders of the nation and the efforts of all responsible people to make peace with honor possible in our time. May all that is said and done during these days of conference be in the service of humankind and to Thy honor and glory.

MINUTES OF THE ANNUAL COUNCIL MEETING

The 1961 Annual Council Meeting of the National Safety Council was held in the Grand Ballroom of the Conrad Hilton Hotel, Chicago, on October 16, with Howard Pyle, President, presiding.

Following the singing of the national anthem, the Invocation was offered by the Rev. Charles M. Crowe, President of the Church Federation of Greater Chicago. Dr. Crowe's prayer is printed on a following page.

In welcoming the delegates, Mr. Pyle extended special greetings to those present from foreign countries, and to the large number of young people in attendance, who were participating in the youth sessions of

the Congress. He then proceeded with the business of the meeting by announcing a quorum present, in person or by proxy.

It was voted to dispense with the calling of the roll; also to dispense with the reading of the minutes of the previous annual meeting, as the minutes had been printed and circulated to the membership.

Mr. Pyle called for the report of the Nominating Committee, which consisted of the following members: Edward C. Myers, Chairman; Walter F. Carey, George A. Jacoby, Robert T. Ross, Walter K. Koch, Franklin M. Kreml, Herman J. Spoerer.

Mr. Spoerer reported in behalf of the Nominating Committee, pointing out that

the Constitution authorizes the Committee to name candidates for election to the Board of Directors and to all elective offices, and to place in nomination at the Annual Council Meeting said candidates, as well as the candidates for election to the Trustees named by the Trustees. The selections of the Committee, Mr. Spoerer stated, were reported to the Secretary of the Council more than 75 days before this meeting, and a printed Nominating Committee Report, announcing all nominees, was mailed to all members of the Council on August 29, 1961.

By reference to the printed Nominating Committee Report, a copy of which had been supplied to each person in the audience, Mr. Spoerer presented nominations for Trustees, Directors, and Officers.

There were no nominations except those presented by Mr. Spoerer. Mr. Pyle announced that there were 27,424 votes favoring the slate presented by the Nominating Committee, and no votes opposed. Those attending the meeting voted without dissent in favor of the nominations, and Mr. Pyle declared the nominees elected. (Secretary's Note: Complete lists of the Trustees and Directors for 1961-1962, including those nominated and elected at this meeting, as well as those continuing in office from previous elections, are given on preceding pages of this volume. A list of the Officers for 1961-1962 is also printed on preceding pages of this volume.)

Mr. Spoerer expressed the Council's special appreciation to two Vice Presidents who are relinquishing their posts this year—John H. Schwartz, Jr., who is leaving the Finance Vice Presidency, and Walter E. Montgomery, who is leaving the Industrial Vice Presidency.

Mr. Pyle brought to the audience a greeting from Ned H. Dearborn, President Emeritus of the Council, who was unable to attend the Congress this year, and introduced various Officers of the Council who were seated on the speakers platform. He also announced that the 1962 National Safety Congress would be held in Chicago, October 29-November 2.

Mr. Pyle reminded the members that a special grant of funds from the Metropolitan Life Insurance Company has made it possible for the Council to recognize outstanding research work in safety by means of an annual award. He then introduced Dr. George M. Wheatley, a Vice President of Metropolitan and the Council's Vice President for Homes, who announced that the 1961 award had been made to J. Stannard Baker, Director of Research and Development of the Traffic Institute, Northwestern University.

The award to Mr. Baker, Dr. Wheatley stated, was based on case studies of traffic accidents which he described as being a "significant, pioneering effort to study traffic accidents in depth." In accepting the award, signified by a plaque and a \$1,000 check, Mr. Baker expressed his appreciation and also gave credit to several associates who had worked with him on the project. The award, he said, should be an incentive to many others to enter the challenging field of safety research.

A report by G. C. Stewart, Executive Vice President, and the President's address given by Mr. Pyle, are also included as a part of these Transactions, on following pages.

R. L. Forney
Secretary

REPORT OF COUNCIL OPERATIONS

By GEORGE C. STEWART
Executive Vice President, National Safety Council

This is the one opportunity of the year when I can tell you something of the operations of your Council.

In the time available, it is impossible to even list, to say nothing of discussing, the hundreds of activities in which the Council is engaged. All I can do is try to give you some highlights.

First, however, let's take a look at the product of all of these activities—the prevention of accidents.

During the period 1950-1960, accidental deaths per hundred thousand population decreased 14 per cent. Not only did the population rate decrease, but there was a decrease in each category of accidents—work, traffic, home and public.

So far this year, three categories are lower and one the same as for the same period last year.

Now for some of your Council's activities—

Training in safety is being, and will continue to be, emphasized. Our purpose is to train more people who, in turn, will become trainers.

We are having a good response to our correspondence training course. Since it was started, there have been 1,000 enrollments. Some 500 of these have completed the course.

We have produced training films, promoted driver training in high schools and encouraged traffic courts to conduct retraining courses.

The true nature of your Council, and its methods of operation are much better understood today than when I spoke to you on this subject a year ago.

The quality, both in appearance and content, of the Council's publications has improved.

We have had a gratifying increase in the circulation of our Family Safety magazine. In the past 18 months, it has risen from 3,000 to 100,000.

The state and local councils have made

substantial progress in strengthening their programs.

The business affairs of your Council are sound. We expect to finish the year with a small surplus of income over expenses.

The Council's relations with other organizations are cordial and cooperative.

I want to say a word about the Council's traffic safety activity. The basis for all of these activities is the Action Program of the President's Committee for Traffic Safety.

The Council endorses, supports, promotes and makes an accounting of the Action Program.

All Conferences contribute to the Council's efforts to achieve the objectives of the Action Program. These objectives are—

Sound and uniform traffic laws.
Adequate accident reports and their use to guide programs.

Good instruction for youth and children.
Firm enforcement of traffic laws and intelligent supervision of traffic.

Strict requirements for obtaining and retaining a driver's license.

Increased safety on existing roads and streets through engineering.

Construction of additional streets and highways designed to carry traffic safely.

Motor vehicles designed and constructed to make them progressively easier to operate safely and minimize the injury potential in the event of an accident.

Vehicles maintained in safe operating condition.

Citizens who are informed as to the need for and nature of safety measures, and who, being informed, support traffic safety programs.

Voluntary coordination of programs and activities among all working for traffic safety.

That, very briefly, is the Action Program. Everything the Council does in the field of

traffic safety is deliberately, thoughtfully and carefully designed to support one of these objectives.

Our basic instrument for carrying this out is the Annual Inventory of Traffic Safety Activities. The Inventory is the public accounting system of the Action Program. It is a report of progress or failure by cities and by states and, in some cases, by counties. It is the only instrument of its kind in existence. It gathers, on a purely voluntary basis, statistics from over 1,200 cities, 49 states, 2 counties and Puerto Rico.

Every year statistics on each of the objectives on the Action Program are assembled. They are analyzed and the performance of each state and city is compared with those of cities and states in the same population groups. These analyses, together with recommendations, are then returned to the people who provided the information. This program is administered by the National Safety Council.

The Inventory is monitored by several national organizations such as the American Bar Association, the International Association of Chiefs of Police, the Traffic Engineering Institute and others. Every year we make an effort to have these groups come in and improve the questionnaires and the methods of comparison and analysis. Every year we try to do a better job.

This is a valuable service. It is the only service of its kind in the world. It goes to the states and cities without charge. Some 30,000 people are involved in filling out these questionnaires and in using the returned analyses.

The Inventory is the basis on which we conduct your traffic safety program. You may think I have stressed the Inventory unduly, but I have a purpose in doing so. There is nothing in this world that is being done that can't be done better. Anybody who turns away from constructive criticism is sick. Any organization that won't critically examine its own operations is dying. But you cannot let action die because of criticism. And any organization that stops trying to do something it knows to be sound and needed, because it is criticized, is unworthy of respect.

Now we get literally hundreds of letters praising the service provided by the Inventory. We also get a few, but rather vocal, criticisms and some belittlements of this activity. Because of these, I think that it appropriate to make this statement—

The National Safety Council works every day of the year with all the resources it has, using all the talent and experience of its members and staff to prevent accidents. And, it is going to keep on working. It is trying to prevent accidents and it is never going to stop trying.

ANNUAL ADDRESS OF THE PRESIDENT

By HOWARD PYLE
President, National Safety Council

Since my address follows that of General Stewart on our program, I should like to express the appreciation I am sure we all feel for the excellent analysis he has given us of the Council's program, its great strengths, its imposing potential and its tremendous responsibility.

At this point in these annual proceedings it is customary for the President of the Council to offer such personal observations and comments as may seem desirable or appropriate, as the full work of the Congress gets under way.

I wish all of you could see this audience from where I stand here this morning. It is tremendous. There is something about it that I think might be illustrated by a good story. I think we might indulge in one bit of laughter at this juncture in spite of the seriousness of the things with which we are dealing.

This story is told of Mark Twain who was inclined to be quite profane. When something happened that he didn't like particularly, he could swear like a section hand, and did, regardless of who happened to be around. On a particular morning he was shaving and by the most unfortunate circumstance he cut himself rather badly and immediately he let go.

It was really blasphemous.

Now his wife, who for many years had been doing her best to try to break him of this bad habit, had learned every single, solitary phrase he knew so well. So, as he tapered off and the air cleared a little, she stepped into the bathroom door and standing there in an attitude of great seriousness she repeated all the things that he had said so he could hear how it all sounded.

He stood there with a dripping razor, the cut bleeding profusely. With a half smile on his face he listened to her go through the whole unpleasant routine.

When she had finished, he said "Honey, you are wonderful. You have the words, but you don't have the music."

The thing about this crowd is that you have both the words and the music. As I meet you in the field, or elsewhere, I am continuously impressed with your zeal and fervor as professionals and as citizens dedicated to the work that occupies us all.

Now on the inside of the front cover of our annual report, and I trust each of you will take a good look at it as you have the time, there is another acknowledgement to which I would like to refer. It says, "In recognition of the thousands of dedicated volunteers and the many official and private agencies and organizations that make up the safety movement in America."

In exactly 25 words this statement of appreciation identifies the main strength of accident prevention as we know it and work with it year after year in all the areas of our several responsibilities.

Let it be said here and now, as it has already been implied by General Stewart, we have only praise and the most fervent gratitude for any and every force, personal or otherwise, that is usefully engaged in this great humanitarian work. If there were twice or three times as many of us working full time in this field of activity, there would still be all kinds of important duties for every force present. This means, my friends, that there is precious little time for any thing that might slow down the work or result in a single death or injury that might have been averted had all of us been hard at it as we should be.

It's a real tribute to the members of the accident prevention community that there has been so much productive cooperation among all concerned. It is one of the many things that has impressed me most about this work in the altogether too brief time I have been associated with it. Should anyone be in doubt about this point, I would suggest a review of the action program and a bit of reflection on the extent of the meeting of minds that was required to produce this answer to our need for immediate action all along the traffic control front.

Now time and further research must and will improve on our plans for the future. In the meantime, however, if a single death or injury occurs while we are hesitating for the want of a more perfect answer, it would seem to me that we would deserve the most critical judgments of every citizen in the land.

We will never know all the answers to anything as complex as the challenges with which we are faced in accident prevention, but we certainly will deserve the stigma of failure and neglect if we are ever slow about acting with the full strength of what is already known.

Of the gravest importance to our mission is this added truth that I am afraid maybe we may overlook once in a while. While we are the custodians of the national safety through accident prevention, we are also obligated to help protect a way of doing things in this country that is as American as Independence Day.

For me there is a very special and heart-warming significance in the fact that accident prevention is essentially a citizen effort. People organized and otherwise doing their utmost for their country, something that needs to be done where the people live, where they work and where they play.

In my personal judgment, from the experience I have had, in doing things many different ways, there is no substitute for the effectiveness of this kind of citizen responsibility.

Now to ignore it or to make less than the most of its potential by failing to inspire it and lead it with every resource at our immediate command, is to risk the loss of a way of doing things that is indispensable to our way of life.

As often as private initiative and local responsibility fails or for any reason is bypassed or pre-empted, something extremely vital, without which a free society simply cannot live, dies. Perhaps I can illustrate what I mean, show you why I have such a deep concern about this sort of thing.

While on duty in the White House, I was once brought into a discussion that proposed the appropriation of several millions of dollars to be distributed among the states under circumstances with which I was convinced the states would not agree. To be

sure of my position I personally called the governors of each of the states by telephone and asked them this question: "If your legislature were now in session and you took this issue to them for approval, would it be endorsed? What would the reaction be? Fundamentally, would they endorse it?"

After all, the state legislatures are generally regarded as the closest possible elected officials to the people by way of the districts in which they live.

Without exception the answer from every governor in the United States was, "No, my state legislature would not approve it," although some of the governors personally were in favor of the idea.

Believe it or not, I lost the argument in spite of the evidence I produced. The political pressures from certain sources were simply too great and the program went ahead. As God is my judge, ladies and gentlemen, this is a true story and if time permitted I could tell you others like it.

I simply cannot believe this is the way we want things done in this country. In fact, I doubt that there is ever any justifiable reason for taking the view—well, the folks at home haven't done anything about it, or enough, so we will do something about it with their money.

Now we cannot speak and we cannot act for others who serve the public, but we can and must speak and act for the thousands of dedicated volunteers and the many official and private agencies and organizations that make up the safety movement in America. The challenge for us is how closely can we and will we work with the people?

How constantly and faithfully can we and will we join with them in advancing the work of accident prevention, while at the same time we protect the people's way of doing things that need to be done for and by the people?

To the extent that we succeed, and believe me, ladies and gentlemen, we cannot fail in this responsibility, we will not only stop accidents, but we will be able to stand with the citizenship of this country as living, incontestable proof to the world that a free people is most of all a responsible people.

In my personal judgment there is no more

urgent business than this at hand today and I would hardly except even the international problems that must inevitably be the responsibility of governments. The peoples of the world need inspired leadership from us just as badly as their diplomats do. Since our constant prayer is that our leaders may deserve to prevail, what then can we, should we and must we do as a people?

Our answer must be to lead them and to help them with such responsibilities as accident prevention, as we have never led them and never helped them before in our entire history. I contend if they are willing to spend billions of dollars every year as a possible deterrent against atomic oblivion, they are willing to help avoid the end of the world every year for more than 90,000 men, women and children who die because of accidents we know could be avoided.

Now this may not seem quite as urgent as Berlin, or the tensions of the United Nations, or the control of outer space, or intercontinental missiles, or whatever your particular attention is in that regard. On the other hand before we draw this kind of conclusion about anything as important and elemental to the structure of the world's well-being and to our well-being as a people,

let's recite together, these very significant bits of literary revelation:

For the want of a nail a shoe was lost
For the want of a shoe a horse was lost
For the want of a horse a rider was lost
For the want of a rider a battle was lost

For the want of a battle a kingdom was lost
And all for the want of a horseshoe nail.

Ours is as urgent a business as I know. We have only begun to handle it as well as we can and as well as we must.

May this 49th National Safety Congress and Exposition multiply our usefulness many times in the name of safety everywhere all the time.

Ladies and gentlemen, may I suggest that you now try to see all the exhibits, and engage in as many of the program activities as possible. This is your Exposition. We are only here to serve you.

In behalf of the officers and the members of the Board, may I express our appreciation for your attendance at this annual meeting and for the interest you have shown.

ANNUAL BANQUET

INVOCATION

By THE REV. EVAGORAS CONSTANTINIDES
Priest, St. Demetrios Greek Orthodox Church, Chicago, Ill.

IN THE name of the Father and of the Son and of the Holy Spirit,
Amen.

Almighty God, in all wisdom hast Thou created the universe and in all love hast Thou made man in Thine image and likeness.

Thou hast established this universe as man's dwelling place, his throne of glory. Thou hast equipped this abode of man with all the blessings for his sustenance and regulated it with all the laws for his safety and well being.

Man has gone a long way in discovering the marvels which encompass him and, pleased with what he discovered, wants to be further inspired by adventures into the cosmos with which Thou hast surrounded him.

With new highways, waterways, airways and spaceways constantly being carved on, in and about the earth, we pray to Thee, Almighty God, that Thou enlighten all men to use these avenues to progress with prudence, love and consideration toward one another, so that they may become factors in man's growth in Thy direction instead of pathways to his extinction.

Grant that man may use his reason in all his movements, regard his safety and the safety of others as an obligation, and thus consider the preservation and safekeeping of his body, the vessel in which Thy Spirit dwells, as a commandment from Thee and allow his life, the most treasured possession which Thou hast given him, to grow in dignity, blossom in safety and culminate its earthly existence by Thy hand, not his.

This we ask in the name of Your Son and our Lord and Redeemer, Jesus Christ. Amen.

NATIONAL SAFETY CONGRESS BANQUET

Congress Banquet

The banquet of the 1961 National Safety Congress was held in the Grand Ballroom of the Conrad Hilton Hotel, Chicago, on October 17, with William H. Lowe, Chairman of the Board of Directors, presiding.

The Invocation was given by the Reverend Evagoras Constantinides, Priest of St. Demetrios Greek Orthodox Church, Chicago. The reverend Mr. Constantinides' prayer is printed on a following page.

During the dinner, banquet guests were entertained by an orchestra under the direction of Bud Dinwiddie, and featuring vocal soloist Larry Gray.

Seated at the speakers table, and at special tables on the ballroom floor, were the Council's officers and members of the Board of Directors. These were appropriately introduced to the banquet guests by the Chairman.

The Chairman read telegrams of greeting from the Honorable John F. Kennedy, President of the United States, and the Honorable Richard J. Daley, Mayor of Chicago.

President Howard Pyle presented the Trustees Award of the National Safety Council to the Honorable John Dempsey, Governor of Connecticut, and to the Honorable Fay Wheelon, Mayor of Sioux Falls, South Dakota, Connecticut and Sioux Falls won the awards for their accident prevention performance in 1960.

The Trustees Award is presented annually

to the state and city which, during the year, did most to protect their citizens from accidents of all kinds. The Award is based not only on actual accident records, but on accident prevention activities by industry, media, churches, civic and youth groups, public officials, and safety organizations.

For earning this recognition Governor Dempsey and Mayor Wheelon received from President Pyle the *Flame of Life* Award. The Award is an abstract crystal sculpture in the form of a flame, which curls in an upward sweep from a narrow base to a pointed top. It is fashioned to symbolize the flame of life which accident prevention seeks to sustain.

In accepting their awards, Governor Dempsey and Mayor Wheelon paid tribute to safety leaders in Connecticut and in Sioux Falls whose efforts played a significant part in securing the recognition. Special guests from Connecticut and Sioux Falls were asked to stand and be recognized.

The banquet address was given by John F. Gordon, President of General Motors Corporation. In introducing Mr. Gordon, the Chairman outlined his distinguished career with General Motors, beginning in 1921, progressing through a succession of responsibilities in various divisions of the Corporation, and culminating in the elevation to his present position in 1958.

Mr. Gordon's address, "Safeguarding Safety Progress," is included as a part of these transactions, on following pages.

SAFEGUARDING SAFETY PROGRESS

By JOHN F. GORDON
President, General Motors Corporation

When I began to think about what I should say tonight, I assumed that the one subject I should not discuss was "safety." For one thing, I am not a safety expert. For another, the subject is being quite thoroughly covered this week, I understand, in scores of expert presentations on just about every conceivable aspect of safety.

However, I soon found out that in seeking another topic I was violating a sound rule: "Never take anything for granted." Governor Pyle and General Stewart assured me quite strongly that I should talk about safety.

So, with the indulgence of you professionals, that will be my theme.

My own interest in safety stems from more than personal considerations. A constructive interest in safety is part of my job. We insist that it be part of the job of all the people in General Motors.

Safe working conditions and safe conduct on the job are essential to the well-being of the men and women of our company—and to their efficient performance.

Safe products are essential to the success of our business—and to the manifestation of our sense of responsibility.

And helping in the promotion of safety throughout the community is a vital part of our role as a "corporate citizen."

The tangible benefits of our occupational safety program in General Motors leave no doubt that a demonstrated interest in safety is worth the effort. Our record is a matter of considerable pride and gratification to us.

By "us" I do not mean just top management. I mean all the people of General Motors, for all share both the credit and the benefits.

Safety promotion in industry is a team effort. Every individual must participate, just as all must help achieve such industrial goals as high productivity and high quality.

This universal obligation for safety adds emphasis to the responsibilities of management.

Down-the-line individual cooperation is a result of sound leadership. Management must provide a safe working environment. It must develop safe procedures. It must train employees. It must assure adequate supervision. It must stimulate safety consciousness through continuing education.

Above all, management must keep everlastingly at the job. Accidents are a continuing threat. Their prevention must be a continuing effort.

In 1960, GM people set a new record of industrial safety for themselves. Out of every thousand GM employees in the United States and Canada, 998 went through the entire year without a lost-time accident or occupational disease. Stated another way, we had less than one lost-time injury per million man-hours worked.

This year, for the fifteenth time, the National Safety Council presented its "Award of Honor" to General Motors.

If you think this sounds like boasting, you are quite right. It is boasting. I admit it without embarrassment because I believe we all should take more conspicuous pride in safety awards. We should be proud not only of the commendation itself but—more important—of the achievement on which it is based.

To give the safety movement the greater momentum it needs, we must build its prestige. We should "blow our own horn" over a safety record as enthusiastically as we do over a production or sales record.

I realize, of course, that an essential tool of the safety professional is the "view with alarm" technique. At the same time, it seems to me that "pointing with pride" should not be neglected.

It will help keep safety in the limelight. It will also help ward off fearful or fatalistic public reactions that can be evoked by an excessive diet of dire warnings.

The latest edition of "Accident Facts" contains, along with sober reminders of the challenges still confronting you, many evidences of heartening progress. For the sake

of your own morale, if nothing else, you ought to look at these from time to time.

Taking the quarter century since 1935, we find that the population death rate for all accidents has dropped almost one-third. Moreover, the total number of accidental deaths per year has declined. And this has occurred despite our great population increase and the greater exposure to hazards in today's more complex society.

In the occupational safety field, we find the death rate down almost one-half and the injury rate down more than half. We note individual company records of up to 31 million man-hours of work without a disabling injury.

On the highway, the fatality rate per 100 million vehicle miles has dropped from 15.9 in 1935 to 5.3 last year—a decline of two-thirds. This gain has been achieved despite the fact that we have almost three times as many motor vehicles traveling more than three times as many miles.

Obviously, there is no basis for complacency in these figures. The record can and must be greatly improved. But there is a basis for confidence—confidence that sustained, intelligent application of recommended measures will achieve continuing progress.

Adherence to this conviction is a necessary defense against certain forces which threaten to impede the safety movement. These forces are many and varied, but they have one thing in common. They are all founded on the false premise that the situation is hopelessly out of control and that a drastically different approach is needed.

From this common starting point, various groups go in different directions. One takes the worn and crowded road to Washington to seek the supposed magic of federal intervention. Another sets forth like medicine men to peddle a new gadget or gimmick. Another, moving backward, urges drastic, "police-state" measures. Still others just roam about looking for scapegoats.

You who have professional competence and responsibility to promote safety must oppose these diversionary forces in two ways. First, you must continue to resist the siren call of alleged panaceas. Secondly, you must demonstrate as effectively as possible the worth of established safety measures.

The organized safety movement in this country is now about a half-century old. At this age, I am sure it is capable of demonstrating considerable maturity in meeting its challenges. Insofar as it does, you will not have to worry about the retarding influence of self-appointed experts.

At the same time, maturity must not dull intellectual curiosity and initiative. You know well that your basic programs, sound as they are, can be further refined and supplemented. While rejecting the obviously impractical, you must continue to adhere to the idea that innovations are both possible and desirable.

There are at least two compelling reasons for doing an even better safety job.

One is the fact, of which I am sure you are aware, that each added measure of safety tends to be more difficult to achieve than the previous one. The law of diminishing returns goes to work unless efforts are constantly improved and intensified.

The other goal to continuing improvement of safety efforts is the fact that technological progress often brings new problems as well as benefits. There are those who deplore progress because of this. Actually, solving newly created problems is simply an inherent part of making progress through innovation.

There are also those who welcome change but who rashly undertake new activities without adequate preparation.

The competent safety worker plays a key role in technological progress by educating both the fearful and the foolhardy. He makes new machines and methods serve us better by showing us how to live with them.

Since I am not a professional, I shall not presume to offer any technical suggestions for keeping safety abreast of progress. However, I should like to urge intensified action in one particular area—off-the-job safety programs.

This is a highly promising and largely unexploited field. The greater our progress in reducing work accidents, the greater the off-the-job accident problem looms in proportion as a threat to individual security, to industrial efficiency and to the general welfare.

In most cases today, the worker is safer

on the job than off the job. More than two-thirds of the accidental deaths and more than half of the injuries to workers occur off the job. In companies with good work safety programs, the ratio of off-the-job injuries averages about 7 to 1.

Certainly, management's most important responsibility in the employee safety area is to help the worker avoid job-related accidents. However, helping him stay safe at home, on the road and elsewhere is a most desirable and quite feasible extension of a company's safety program.

The many companies which are already active in this area of safety promotion endorse it highly on the basis of their own experience. And I am sure that public safety authorities welcome this further support from their colleagues in industry.

Reference to off-the-job safety immediately brings to mind the biggest single part of the whole accident problem. That is highway traffic safety.

Because of its size and complexity, the traffic accident problem calls more urgently than any other phase of safety for intelligent thinking and aggressive action.

This need is further underscored by the fact that the traffic safety field has in recent years been particularly beset by self-styled experts with radical and ill-conceived proposals.

The current popularity of automotive safety engineering as a hobby for people in all walks of life has contributed little of importance, I'm afraid, to this highly technical field.

The general thesis of these amateur engineers is that cars could be made virtually foolproof and crash-proof, that this is the only practical route to greater safety and that federal regulation of vehicle design is needed.

This thesis is, of course, wholly unrealistic. It also is a serious threat to a balanced approach to traffic safety.

To begin with, it is completely unrealistic even to talk about a fool-proof and crash-proof car. This is true because an automobile must still be something that people will want to buy and use. Safety, in any environment from a bathtub to a bomb shelter, is a relative term, not an absolute. In the case of the automobile, we can only

design into it the greatest degree of safety that is consistent with other essential functional characteristics. Beyond that, we must depend on intelligent use.

The suggestion that we abandon hope of teaching drivers to avoid traffic accidents and concentrate on designing cars that will make collisions harmless is a perplexing combination of defeatism and wishful thinking. It is a little like suggesting that we neglect good health habits in favor of reliance on miracle drugs — and on some method of compelling people to take them. And it ignores the notable progress that so many states and cities have made in accident reduction through driver improvement.

Certainly, the design and performance characteristics of the automobile are a factor in the problem. Automobile manufacturers have long worked diligently and productively to make good driving easier and to provide increased crash injury protection. I hardly need detail for this audience the long list of improvements that have been developed and adopted.

I assure you that this progress will continue. New designs and devices will be adopted as rapidly as our research, development and test work assures us that they are practicable and desirable.

Progress will continue, that is, if we may continue to adhere to the approach that has produced the gains of the past. Every year's new model cars are safer as well as better in other respects, but these improvements are in response to forces at work in our free competitive economy — not in response to regulatory forces.

There is certainly a proper and productive role for government in safety promotion. However, the imposition of arbitrary controls as a substitute for strongly motivated voluntary action by competent engineers in industry might well inhibit progress.

There is little doubt that today everybody is for safety. This is true in the highway area as in other fields. I believe the vast majority of people want to drive well and are deeply concerned about traffic hazards.

In my opinion, you don't have to sell highway safety as such. You have pretty well overcome any public indifference to your basic objective. To this extent the public is already with you.

Your major task now is to spell out and sell the measures that will achieve greater highway safety. This can be done—if three conditions are met.

First, always be sure that the measures for which you ask support are fully worthy of support. The public is not apt to buy an inferior idea just because its objective is safety.

Secondly, always do a competent selling job. The mere fact that safety is important guarantees neither an audience nor an impact.

Thirdly, always be specific in seeking a public response. "Public support" is an abstraction that must be translated into concrete terms. Tell people exactly what they should or should not do to reduce the number and severity of accidents.

It has been my experience that long-term public information and education programs need frequent critical reappraisals.

It is wise to ask ourselves repeatedly: *Are we saying the right things? Are we saying them clearly and persuasively? Are we really reaching people?*

In sheer volume of publicity, traffic safety is probably second to no other good cause. And there is no question but that much of what is being done, both locally and nationally, is of excellent quality.

However, the persistent and proper emphasis of traffic safety workers on the need for greater public support suggests that the effort can and should be further improved.

The problem may lie in part in the fact that this is the one area of traffic safety for which responsibility is not clearly allocated. Perhaps the benefit of highly diverse participation in public information activities

is being diluted by lack of fully adequate coordination.

Or it may be that still higher performance standards in the field of safety communications must be defined and applied.

I do not pretend to have the answer, but I am convinced that this problem merits your continuing, earnest attention.

With public support for necessary action more fully mobilized, progress in highway safety will be greatly accelerated. People will no longer merely say, "Why don't they do something?" They will know what needs doing and they will help get it done—as good drivers, good parents and good citizens.

Moreover, the benefits will extend to other fields of safety. Today, the term "highway user" doesn't mean a special class. It means just about everyone. Thus, greater safety consciousness on the road will have a broad and potent carry-over to every other activity where safety is a critical factor.

I have full confidence in the ability of the men and women of the organized safety movement to make accelerating progress—both in technical areas and in mobilizing public support.

You have all the requisites to render distinguished public service: unselfish interest, professional competence, cooperative spirit and unflagging energy.

And you have this great organization, the National Safety Council, as an invaluable mechanism to help give direction and impetus to your efforts.

I am sure that I am joined by all thinking persons in commending you, wishing you well and pledging support in your great humanitarian work.

SAFETY EXPOSITION EXHIBITORS—1961

Acme Protection Equipment Co., South Haven, Mich.
Industrial gas masks, chemicals and accessories.

Advance Glove Mfg. Co., Detroit, Mich.
Work gloves.

Aetna Casualty & Surety Co., Hartford, Conn.
Safety educational and services including Aetna Drivetrainer

Akron Brass Mfg. Co., Inc., Wooster, Ohio
Fire Hose Nozzles and accessories.

Alan Wood Steel Co., Conschoocken, Pa.
Abrasive rolled steel floor plate.

American Allsafe Co., Inc., Buffalo, N. Y.
Sweat Bands and Greenline emergency release.

American Biltrite Rubber Co., Chelsea, Mass.
Rubber, composition and neoprene safety soles.

American Chain & Cable Co., Inc., Bridgeport, Conn.
Sling chains and sling chain assemblies, wire rope slings and assemble-your-own wire rope slings.

American Industrial Safety Equipment Co., Inc., Cleveland, Ohio
Face shields, goggles, gloves and mittens.

American LaFrance Corp., Elmira, N. Y.
Fire apparatus and fire fighting equipment.

American Optical Co., Southbridge, Mass.
Head, eye, respiratory protective devices; safety clothing, safety specialty products.

American Society of Safety Engineers, Chicago, Ill.
Society for the professional safety specialist.

Ampco Metal, Inc., Milwaukee, Wis.
Non-sparking, corrosion-resistant safety tools.

Ansul Chemical Co., Marinette, Wis.
Dry Chemical fire protective equipment.

Antrex Corp., Chicago, Ill.
Battery-powered public address megaphones, helmet radios, tape recorders.

Apex Safety Products, Detroit, Mich.
Safety hats, caps, face shields.

Atlas Safety Equipment Co., Inc., Brooklyn, N. Y.
Industrial Safety Belts, harnesses, and straps.

Auto-Crat Mfg. Co., Los Angeles, Calif.
Safety belts, interceptor harnesses, baby-guard belts.

Bachrach Industrial Instrument Co., Pittsburgh, Pa.
Instruments for gas analysis and air measurement.

Bashlin, W. M. Co., Grove City, Pa.
Linemen's and industrial safety equipment.

Bauer Mfg. Co., Wooster, Ohio
Wood and aluminum safety ladders.

Bausch & Lomb Optical Co., Rochester, N. Y.
Safety glasses, ortho-raters and "Titan" safety frame.

Beam's Mfg. Co., Reading, Pa.
Auto safety belts.

Best's Safety Publication, New York, N. Y.
Publishers of "Safety Maintenance" magazine, "Best's Safety-Maintenance Directory" and "Your Safety News."

Bethlehem Steel Co., Bethlehem, Pa.
Wire Rope slings, standard and braided slings.

Brossard, Lester L. Co., Chicago, Ill.
Traffic mirrors and traffic lane markers.

Browne, Stewart R. Mfg. Co., Inc., New York, N. Y.
Electrical safety equipment, explosion-proof and vapor-proof portable inspection lites, explosion-proof flashlites, grounding devices.

Buhrke, R. H. Co., Chicago, Ill.
Occupational safety equipment and products for construction and maintenance.

Bullard, E. D. Co., Sausalito, Calif.
Industrial safety equipment.

Bustin Steel Products, Inc., Dover, N. J.
Star tread material.

Campbell Chain Co., York, Pa.
Sling chains, welded and weldless chains.

Chance, A. B. Co., Centralia, Mo.
Hot line maintenance tools and line construction tools.

Charleston Rubber Co., Charleston, S. C.
Electrical worker's gloves. Bulldog wood safety clamps, red danger flags, plastic and fabric coated industrial aprons and sleeves.

Chemical Corp., The, Springfield, Mass.
Protective hand creams, cleaners and lotions.

Chicago Eye Shield Co., Chicago, Ill.
Head and eye protective equipment.

Chrysler Corp., Detroit, Mich.
Automobiles and trucks.

Clark, David Co., Inc., Worcester, Mass.
Safety Equipment, sound protector, space suits.

Clark, J. R. Co., Spring Park, Minn.
Industrial ladders.

Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Alloy steel sling chains.

Cornelius Co., Minneapolis, Minn.
Portable high pressure air compressors.

Davis Emergency Equipment Co., Inc., Newark, N. J.
Respiratory protection, combustible gas indicators, safety and first aid equipment.

Detex Watchclock Corp., Chicago, Ill.
Watchmen's clocks.

Diets, R. E. Co., Syracuse, N. Y.
Automotive lighting and safety equipment.

Dockson Corp., Detroit, Mich.
Welding helmets, face shields, cup and spectacle type goggles, respirators and eye savers.

Dow Corning Corp., Midland, Mich.
Sight saver cleaning stations, shoe saver, safety shoes.

Dräger Oxygen Apparatus Corp., New York, N. Y.
Safety equipment.

Eagle Mfg. Co., Wellsburg, W. Va.
Safety cans, oilers, oil and gasoline containers.

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Edmont Mfg. Co., Coshocton, Ohio
Coated fabric work gloves.

Electronic Specialties Co., Batavia, Ill.
Warning lights, barricades.

Elkhart Brass Mfg. Co., Inc., Elkhart, Ind.
Fire extinguishers, municipal and industrial brass goods.

Elliott Service Co., Inc., Mount Vernon, N. Y.
Accident prevention displays, safety conference programs, Supervisor's Weekly Bulletin, suggestion system, service.

Emerson, J. H. Co., Cambridge, Mass.
Resuscitators, inhalators and safety matting.

Encyclopedia Britannica, Inc., Chicago, Ill.
Technical reference service.

Falcon Alarm Co., Inc., Summit, N. J.
Automatic fire detectors and systems, audible safety signals.

Federal Sign & Signal Corp., Blue Island, Ill.
Sirens, warning lights, horns, bells and electronic sirens.

Fendall Co., Chicago, Ill.
Head and eye protection equipment.

Ferno Mfg. Co., Washington C. H., Ohio
Emergency folding stretchers and chairs.

Fibre-Metal Products Co., Chester, Pa.
Eye, Head, and face protection and welding accessories.

Fine Organics, Inc., Lodi, N. J.
High flash, low toxicity safety solvents.

Ford Motor Co., Dearborn, Mich.
Ford automobiles, featuring lifeguard steering wheels, sun visors, seat belts, instrument panel padding, and door latches.

Frommelt Industries, Dubuque, Iowa
Portable welding shields and protective heat cloth.

Fyrepel Products, Inc., Newark, Ohio
Aluminized glass cloth, heat protective clothing for industry and fire fighting.

Fyr-Fyter Div., Fyr-Fyter Co., Dayton, Ohio
Fire extinguishers, resuscitators and respirators.

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Safety Exposition Exhibitors

General Fire Extinguisher Corp., Chicago, Ill.
Fire extinguishers and allied products.

Glendale Optical Co., Inc., Valley Stream, N. Y.
Chippers and welders goggles, face shields, safety spectacles.

The Globe Co., Products Division, Chicago, Ill.
Grip-Stru grating, stair tread materials.

Globe Safety Products, Inc., Dayton, Ohio
Resuscitation and breathing equipment.

Goodrich, B. F. Footwear & Flooring Co., Hood Rubber Co., Watertown, Mass.
Waterproof industrial footwear, hood waterproof industrial footwear, Hood industrial coated and unsupported gloves.

Granet Corp., The, Framingham, Mass.
Coated Fabric work gloves.

Grinnell Co., Inc., Providence, R. I.
Fixed pipe fire protection systems.

Gro-Cord Rubber Co., Lima, Ohio
Neoprene, rubber, composition soles and heels for safety footwear.

Halperin, A. E. Co., Inc., Boston, Mass.
First aid kits, safety equipment, burn-quel.

Haus of Krause Safety Shoes, Rockford, Mich.
Men's safety shoes for distributors serving industry.

Haws Drinking Faucet Co., Berkeley, Calif.
Emergency eyewash fountains, emergency showers and goggle wash fountains.

Hild Floor Machine Co., Inc., Chicago, Ill.
Explosion-proof vacuum cleaners and floor machines.

Hopfeld Industrial Mfg. Co., San Rafael, Calif.
Fiber glass ladders, structural members.

Horizon Industries, Minneapolis, Minn.
Pre-measured toilet bowl cleaner in tablet form.

Hygiene Research, Inc., New York, N. Y.
Protective ointments and mastproofing cloth for goggles, welding masks, windshield.

Hy-Test Safety Shoe Div., International Shoe Co., St. Louis, Mo.
Safety footwear; also conductive and special types of atomic usage.

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1961 National Safety Congress

Industrial Acoustics Co., Inc., New York, N. Y.
Audiometric examination room, technical publications and industrial hearing conservation programs.

Industrial Gloves Co., Danville, Ill.
Leather, asbestos, duck, wool, Woven-Gard, Permaproof, and aluminized duck and asbestos finger guards.

Institute of Industrial Launderers, Washington, D. C.
Industrial Launderers and cleaners.

Insto-Gas Corp., Detroit, Mich.
Torches and furnaces.

International Film Bureau, Inc., Chicago, Ill.
Safety films and film library supplies.

Interstate Rubber Products Corp., Los Angeles, Calif.
Safety trafficones for traffic control.

Iron Age Safety Shoe Div., H. Childs & Co., Inc., Pittsburgh, Pa.
Linemen's and women's leather and rubber industrial safety footwear.

Jackson Products Air Reduction Sales Co., Div. of Air Reduction Co., Inc., Warren, Mich.
Insulated electrode holders, cable connectors, face shields and goggles.

Jamleson Laboratories, Inc., Van Nuys, Calif.
Air filtration device for use in industry.

D. Jay Products, Inc., Newark, N. J.
Safety marking rope.

Jomac, Inc., Philadelphia, Pa.
Industrial clothing.

Jones & Co., Providence, R. I.
Full vision visor goggles.

Junkin Safety Appliance Co., Inc., Louisville, Ky.
Power press guards, grinding wheel shields, stretcher equipment.

Justrite Mfg. Co., Chicago, Ill.
Safety cans, oily waste cans, safety electric lanterns, flashlights and fire extinguishers.

Karel First Aid Supply Co., Chicago, Ill.
Industrial hospital equipment and medical supplies.

Keystone View Co., Meadville, Pa.
Occupational and driver vision test, lantern slide projectors.

Safety Exposition Exhibitors

Kidde, Walter & Co., Inc., Belleville, N. J.
Fire detecting and extinguishing equipment, ultrasonic burglar alarm.

Kimball Safety Products Co., Cleveland, Ohio
Personal protective devices for industrial workers.

Klein, Mathias & Sons, Chicago, Ill.
Linemen's safety equipment and tools.

Knapp Brothers Shoe Mfg. Corp., Brockton, Mass.
Safety Shoes.

Kunz, J. Glove Co., Chicago, Ill.
Linemen's, bridgemen's and welder's quality gloves.

Lawter Chemicals, Inc., Chicago, Ill.
Fluorescent safety colors.

Legge, Walter G. Co., Inc., Chicago, Ill.
Safety floor maintenance materials, conductive coating, static eliminators.

Lehigh Safety Shoe Co., Emmaus, Pa.
Leather and rubber safety footwear.

Liberty Mutual Ins. Co. of Boston
New survival car II.

Logan Emergency Showers, Inc., Glendale, Cal.
Emergency showers and decontamination showers.

Lynrus Finishing Co., Inc., Poughkeepsie, N. Y.
Flame-retardant fabrics.

McAn, Thom Safety Shoe Div., New York, N. Y.
Safety Shoes.

McDermott, Julian A. Corp., Ridgewood, N. Y.
Warning and safety lighting for municipal, industrial, utility and aviation use.

McKay Co., Pittsburgh, Pa.
Industrial chain, tire chains, arc welding electrodes, stainless and alloy wire.

Malco Electronics, Inc., Minneapolis, Minn.
Audiometers for industrial hearing testing.

Marsh & McLennan, Inc., Chicago, Ill.
Insurance broker and agencies.

1961 National Safety Congress

Martindale Electric Co., Cleveland, Ohio
Protective dust masks, eye protectors, face shields, safety electric test instruments.

Medical Supply Co., Rockford, Ill.
Flexible unit aid, snake bite first aid, burn first aid.

Metropolitan Life Insurance Co., New York, N. Y.
Useful materials for use in community health and safety programs.

Meyer Machine, Inc., Red Wing, Minn.
Safety clamps.

Micro Switch, Div. of Minneapolis-Honeywell Regulator Co., Freeport, Ill.
Safety interlock switches and electric controls for power machines.

Milburn Co., Detroit 7, Mich.
Ply skin protective creams, ply garb safety and protective clothing, plygloves plastic coated work gloves, ply waterless hand cleaner.

Miller Equipment Co., Inc., Franklin, Pa.
Linemen's safety belts, strap accessories and industrial safety belts.

Mine Safety Appliances Co., Pittsburgh, Pa.
Safety equipment for every industry.

Minnesota Mining & Mfg. Co., St. Paul, Minn.
Heat reflective "Scotchshield" brand chemical fabric used in protective clothing for fire fighters and industries with heat problems.

Mobile Classroom Rental, Inc., Chicago, Ill.
Mobile classroom equipped with Drivo-trainers.

National Chemsearch Co., Chicago, Ill.
Safety solvents and other safety chemicals.

National Medical Supply Co., Chicago, Ill.
Industrial first aid supplies equipment and instruments.

Newco Mfg. Co., Inc., Kansas City, Mo.
Wire rope fittings, safety hooks, load protectors.

Notifier Corp., Lincoln, Neb.
Fire detection, sprinkler supervisory, watchman tour, municipal alarm systems.

Occupational Hazards, Cleveland, Ohio
Publishers.

Ohio Chemical & Surgical Equip. Co., Div. of Air Reduction Co., Inc., Madison, Wis.
Complete array of modified E & J life-saving resuscitative equipment.

Safety Exposition Exhibitors

Onox, Inc., San Francisco, Calif.
Onox, skin toughener and footmats for athlete's foot.

Osborn Mfg. Corp., Warsaw, Ind.
Safety pliers and tongs for feeding punch presses.

Oxygen Equipment & Service Co., Chicago, Ill.
Respiratory equipment.

Oxy-Gear, Inc., Chicago, Ill.
Portable emergency oxygen inhalator kits, controlled flow pure oxygen.

Pac-Kit Co., Greenwich, Conn.
Unit type first aid equipment.

Packwood, G. H. Mfg. Co., St. Louis, Mo.
Safety industrial skin cleaners and dispensers.

Patent Scaffolding Co., Inc., Chicago, Ill.
Wood, aluminum and magnesium safety ladders, suspended sectional steel tubular steel and aluminum scaffolding, sidewalk protection canopies, steel grandstands and fold-a-way scaffold.

Peck's Products Co., St. Louis, Mo.
Solvents, hand soaps.

Pioneer Rubber Co., Willard, Ohio
Gloves; all kinds, liquid proof.

Portable Light Co., Inc., New York, N. Y.
Vehicular and emergency searchlights, general alarm sirens.

Porto-Clinic Instruments, Inc., New York, N. Y.
Driver testing and training equipment and visual aids for driver and traffic safety.

Positive Safety Mfg. Co., Cleveland, Ohio
Power press guards.

Prairie State Products Co., Chicago, Ill.
Metal and electrical safety and directional signs.

Progress Industries, Inc., Warwick, R. I.
Safety goggles.

Protectosol Co., Chicago, Ill.
Fire prevention equipment for flammable solvents.

Pulmosan Safety Equipment Corp., Brooklyn, N. Y.
Respirators, eye protection, helmets, protective clothing, asbestos and leather gloves.

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Radne Glove Co., Inc., Rio, Wis.
Gloves, apparel, protective equipment—leather, asbestos, and steel reinforced.

Radiator Specialty Co., Charlotte, N. C.
Safe-T-Cone rubber traffic guides.

Rhett Woodworking Safety Guards, Wilmington, N. C.
Jointer and shaper guards.

Rockwood Sprinkler Co., Worcester, Mass.
Automatic fire protection systems; sprinklers, waterfog, fogfoam and foam.

Rose Mfg. Co., Denver 4, Colo.
Industrial safety equipment.

Safeguard Mfg. Co., Woodbury, Conn.
Modern press guards.

Safety Box Toe Co., Boston, Mass.
Safety steel toes.

Safety Clothing & Equipment Co., Cleveland, Ohio
Safety clothing and equipment for every type of industrial worker.

Safety First Products Co., Elmsford, N. Y.
Fire extinguishers.

Safety First Shoe Co., Inc., Holliston, Mass.
Safety steel toe shoes for men.

Safety Tower Ladder Div.; Air Space Device, Inc., Burbank, Calif.
Safety equipment for fixed ladders and scaffolds.

Salisbury, W. H. & Co., Chicago, Ill.
Linemen's rubber protective equipment.

Sarole, Inc., Linden, N. J.
Non-traumatic carrier.

Sawyer-Tower, Inc., Watertown, Mass.
All types of protective and safety clothing.

Scott Aviation Corp., Lancaster, N. Y.
Scott air-pak demand inhalator, demand respirator, hydro-pak.

Searjeant Metal Products, Inc., Mendon, N. J.
Punch press safety guards, controls and accessories.

Safety Exposition Exhibitors

Seiberling Latex Products, New Bremen, Ohio
Rubber and neoprene industrial gloves.

Sellstrom Mfg. Co., Palatine, Ill.
Face and eye protection equipment.

Servus Rubber Co., Rock Island, Ill.
Rubber footwear of all types.

Speakman Company, Wilmington, Del.
Industrial emergency showers, eye-wash fountains.

Standard Safety Equipment Co., Palatine, Ill.
Industrial safety equipment.

Standard Signs, Inc., Cleveland, Ohio
Signs for industrial accident prevention.

Stephenson Corp., Red Bank, N. J.
Automatic resuscitation equipment and chemical breath test for intoxication.

Stonehouse Signs, Inc., Denver, Colo.
Industrial accident prevention signs.

Step-Fire, Inc., Monmouth Junction, N. J.
Fire extinguishers.

Surety Rubber Co., Carrollton, Ohio
Personal protective equipment for industrial and electrical workers.

Switzer Brothers, Inc., Cleveland 3, Ohio
Fluorescent safety paint for high-visibility marking of hazards.

Swiveller Co., Inc., New York, N. Y.
Universally adjustable lighting equipment.

Taylor, S. G. Chain Co., Inc., Hammond, Ind.
Alloy steel sling chains and allied products including alloy steel drop forged hooks.

Tect, Inc., Northvale, N. J.
Vythene and other tectsolve safety solvents.

Titmus Optical Co., Inc., Petersburg, Va.
Safety eyewear, ophthalmic instruments, lenses, frames and sun wear.

1961 National Safety Congress

U-C-Lite Mfg. Co., Chicago, Ill.

Explosion-proof portable electric hand lamps and emergency lights.

Union Wire Rope Corp., Kansas City, Mo.

Wire rope slings, towlines.

United States Rubber Co., New York, N. Y.

Industrial safety clothing, safety footwear.

United States Safety Service Co., Kansas City, Mo.

Modern industrial eyewear, sold direct to user.

Wagner Sign Service, Inc., Chicago, Ill.

Wagner changeable copy displays.

Wamsutta/Pacific Industrial Fabrics, New York, N. Y.

"Safetex" flame retardant fabrics—durable to laundering—for safety clothing. Protective fabrics for industrial uses, made of various fibres.

Watchmoke Optical Co., Inc., Providence, R. I.

Plastic eye protection and safety signs.

Welsh Mfg. Co., Providence, R. I.

Safety goggles, lens, face shields and helmets.

West Side Iron Works, Inc., Grand Rapids, Mich.

Barricades, warning lights, safety vests.

Wheeler Protective Apparel, Inc., Chicago 10, Ill.

Industrial safety clothing for heat and abrasive hazards.

Williams Jewelry & Mfg. Co., Chicago, Ill.

Safety awards, badges and trophies.

Willson Products Div., Ray-O-Vac Co., Reading, Pa.

Industrial goggles, gas masks, helmets and respirators, and allied safety devices.

Wilson Rubber Co., Div. of Becton, Dickinson & Co., Canton, Ohio

Rubber and synthetic industrial gloves for every use.

Woolrich Woolen Mills, Woolrich, Pa.

Acid resistant industrial safety clothing.

Zenith Radio Corp., Hearing Aid Div., Chicago, Ill.

Diagnostic audiometers that also can be used for individual and group screening.

Safety Exposition Exhibitors

EDUCATIONAL EXHIBITORS

Chicago Police Dept., Education Section, Traffic Div.

Traffic safety display.

Inter-American Safety Council, Inc., New York, N. Y.

"The Safety Council serving Latin America."

National Society for the Prevention of Blindness, New York, N. Y.

Educational material on conservation of eyesight in industry.

Division of Accident Prevention, Public Health Service, Washington, D. C.

Accident prevention program & materials.

Recreation Shooting Safety Committee, National Safety Council, Chicago, Ill.

Recreational shooting safety program materials.

U. S. Forest Service, Washington, D. C.

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AEROSPACE SESSIONS

COMPETENCE, CONFIDENCE AND COOPERATION —THE SAFETY DIRECTOR'S CHALLENGE

By B. G. BONNER

Safety Engineer, General Dynamics Corporation, General Atomic Division
San Diego, Calif.

In this age of modern scientific technology, the problems of a safety engineer and the hazards to workers are as different from those encountered in the 1940's as the modern jet bomber is from the piston-driven bomber of World War II.

The nature of work being undertaken by modern industry is such that a good safety engineer cannot devote much of his time to routine matters of machinery guarding, wearing of personal protective clothing, and housekeeping problems.

General Atomic Division, General Dynamics Corporation, is an example of the type of industry which will become more prevalent in the '60's although there are few comparable industries in operation today. Its primary activities are research and development in the nuclear field. Here are some of its projects:

An advanced high-temperature gas-cooled graphite-moderated reactor for generation of electric power

Nuclear reactors for research, training, isotope production, and medical and industrial uses

Experimentation with atomic beams

Research in controlled thermonuclear reactions

A gas-cooled reactor and closed-cycle gas turbine plant for marine propulsion

Nuclear energy for space travel

Chemical and metallurgical research on metallic hydride characteristics

Thermoelectric research and other basic and applied research projects

Competence, confidence and cooperation are synonymous with an effective safety program. Competence and confidence must be developed by the safety engineer, and if properly developed, cooperation will take

care of itself. None of us is totally competent to cope with today's safety problems, for to do so would require each of us to be graduates or to have studied extensively in chemistry, physics, metallurgy, electronics, nuclear energy and associated fields. Most of us have prepared ourselves in one or perhaps two of these fields. It is our challenge to develop ourselves in those fields in which we are deficient.

The academic background of today's industrial workers is higher than ever. Approximately 1350 people are employed at General Atomic. More than 60 per cent are college graduates, including approximately 10 per cent who have Ph.D. degrees. A large number of those who do not have degrees have completed a part of their college education and continue to pursue their degrees in night school. Many of the senior scientists and engineers have been drawn from the professional staffs of leading universities in this country and abroad.

Once the safety engineer has proved reasonable competency, developing confidence is no real problem. Mutual confidence must exist between the safety engineer and other personnel whether he be a senior scientist, technician or maintenance man. It is easy to see that a chemist, physicist, or metallurgist will have much more knowledge of the hazards peculiar to his work than will the safety engineer. It is extremely advantageous for the safety engineer to avail himself of this knowledge, but in most cases, it is not available until the safety engineer has indicated reasonable competency and has gained the confidence of the scientist. It is, of course, necessary for the safety engineer to have confidence in the people with whom he is dealing. This normally comes only through experience. It doesn't take long to find out whether a person has

a sincere interest in safety or merely give it lip service.

Management at General Atomic has the philosophy that its members should pursue their scientific research with a maximum of freedom and a minimum of regimentation and rules. This is conducive to academic freedom which in turn stimulates creative research, but it does introduce some problems which brings us to the matter of co-operation. Our management requires safety department appraisal and approval of certain aspects of work such as pressure vessels, use of liquid hydrogen, high voltage and similar hazardous operations, but prefers not to exert regimentation in other areas of research. For this reason it is extremely unlikely that I would ask a senior research person to stop an operation because of the safety hazards, although this could be done if conditions were severe enough to warrant such action.

Through personal contact with supervisory personnel, a fairly successful program of selling safety has been developed. This has been done almost entirely through cooperation rather than through rigid rules and regulations. Bear in mind that good scientific personnel are not always easy to obtain, so every reasonable means is exerted to retain the good ones. Well educated people are not difficult to convince that there are other important aspects of a safety program besides the safety record and Workmen's Compensation insurance premiums. Having a minimum of safety rules requires a maximum of cooperation to obtain the desired results.

Perhaps you would be interested in hearing about some of the safety problems which have been encountered in certain types of work being undertaken at the Laboratory. Time will permit only a brief discussion of some of them.

One of our laboratories has been specially equipped to manufacture liquid hydrogen in small quantities which is used by some of our staff in research projects. Liquid hydrogen is used rather than liquid helium principally because it is less expensive. In one particular experiment, liquid hydrogen serves the purpose of slowing down the neutrons and reducing their temperature, in this instance, 20° Kelvin or -423° Fahrenheit.

The liquid hydrogen laboratory is approxi-

mately 14 by 20 feet and contains in addition to the usual laboratory apparatus, a cryostat for liquefying hydrogen. Within this laboratory is a storage room approximately 6 by 8 feet in which the hydrogen gas manifolds are installed and in which is located a storage dewar for the liquid hydrogen. Both areas are equipped with an alarm system set at 20 per cent LEL which is connected to our Gamewell system located in the main security guard station. Each room has a sensing element near the ceiling. A small diameter copper tube extends from each sensing element to the outside of the laboratory where a gas tester is kept in stand-by condition to determine, during an emergency, if hydrogen actually exists inside the laboratory without unnecessarily exposing personnel.

The ventilation system provides one air change every two minutes in the main laboratory and two and one-half changes per minute in the storage room. The storage room has smooth walls and high pitch plexiglas ceiling to prevent any accumulation of hydrogen, contains no electrical switches, fixtures or motors, has conductive flooring and is equipped with spark-proof tools. Operating personnel, which is limited to two well-trained people, wear protective clothing when entering the storage room during hydrogen liquefaction. Adequate warning signs and lights are displayed during liquefaction operations and special emergency procedures have been adopted. A safety check-off list is rigidly followed prior to start of liquefaction.

Moisture and oxygen entering a storage dewar could cause an ice formation which, when broken, could set off electrical sparks with disastrous results. We avoid the possibility of this by connecting a dual column oil bubbler to each storage dewar when it is outside the laboratory. Each storage dewar is equipped with a special adapter for venting and transfer. This adapter, when inserted into the neck of the dewar, provides a vent to carry off the vaporized gas and is designed so that the transfer tube may be inserted into the dewar through an opening at the top without removing the adapter. The adapter has a slight overpressure of helium or hydrogen gas when the transfer tube is being inserted which further minimizes the possibility of ice blockage in the neck of the dewar.

Dr. Earl Long, one of the nation's outstanding authorities on liquid hydrogen, is assistant director of the General Atomic Laboratory and has contributed invaluable assistance in helping resolve our liquid hydrogen safety problems. At the time the liquid hydrogen operation was being considered, Dr. Long was director of the institute for study of metal, low-temperature lab, University of Chicago and was a consultant for General Atomic.

One of our groups is conducting a classified study involving the use of controlled nuclear pulses for propulsion of space vehicles. This is a unique application of nuclear energy. Many safety hazards have been encountered for which safety precautions have been developed.

Another interesting study is research in controlled thermonuclear reactions called the Fusion Project, which is being co-sponsored by the Texas Atomic Energy Research Foundation, a group of 11 Texas utility companies, and General Atomic. As you know, fusion is concerned with the fusing or joining of atoms whereas fission is the splitting of atoms. In effect, the Fusion Project seeks to harness the power of the hydrogen bomb.

The basic equipment in this experiment is the torus, a doughnut-shaped device made of copper which employs a magnetic field around its circumference and a bank of condensers on the lower level of the building to supply power. These condensers are capable of generating for a microsecond, 75,000,000 kw, equal to about one half the total generating capacity of the United States. The torus contains heavy hydrogen, also known as deuterium gas, to which is applied approximately 90,000 v. of current for experiments.

Experimental work is focused on the basic problems of raising the temperature of the particles in ionized gas to temperatures ranging from one million to one billion degrees and keeping them suspended so they will not touch the walls of the material container. The ultimate goal of controlled fusion research is to develop a source of inexpensive power which uses a virtually inexhaustible source of fuel, heavy hydrogen

which exists in the sea in great quantities. It is estimated that the potential energy of one gallon sea water is equal to about 350 gallons of gasoline.

Many safety precautions have been taken for personnel protection. Interlocks have been installed on all doors, both outside and inside, to preclude unintentional firing, and a flashing light is in operation at the main entrance during firing. Personnel at the control panel are protected against possible flying objects from the torus by a laminated blast shield which is constructed of alternating layers of 1/4-inch steel and 1/2-inch plywood. Personnel wear ear muffs during high power experiments. All persons assigned to the project have been trained in basic first aid. A building coordinator keeps the keys for the control panel and all doors. Before any work can be done on the condensers, each one must be shorted manually using a shorting bar. At least two persons must be present at all times and they must be in sight of each other.

Many other safety problems, both industrial and radiological, are encountered around a facility such as General Atomic. Many specially designed pressure vessels are in use which have required particular attention. Some of these vessels operate in both the vertical or horizontal position so it is not practical to provide underground containment. We have constructed large above-ground, double-walled steel barriers which are used in conjunction with blasting mats to contain flying objects that may be propelled from the vessel. Nuclear materials, beryllia, highly toxic materials and pyrophoric metals are handled according to methods prescribed by the Atomic Energy Commission, federal, state, and local agencies.

So, it seems to me, that the challenges facing a safety engineer in this frontier of science are twofold—first, obtaining and obtaining the support of the individuals who are directing the research and development is absolutely basic and essential. The other challenge is to continually strive to learn some of the basics of highly refined scientific disciplines—and this isn't easy for a guy like me who only had college freshman physics.

INTEGRATING SAFETY INTO A MODERN WEAPON SYSTEM

By THEODORE R. MIKEL

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From man's early existence, he has been concerned with safety and has attempted to make himself safe, not only from a hostile environment and enemy attack, but also from the implements and devices that he has conceived to extend his capabilities. As man's implements have become more complex, so have their hazards. ICBM and IRBM Missiles are examples of modern nuclear-armed weapon systems that reach a new level both in complexity and in potential hazard to both operating personnel and the populace in general.

This complexity in modern weapons has forced the Armed Services to evolve the weapon system concept, and that concept in turn has placed the responsibility for system safety directly on a weapon system manager. Before describing some of the problems and factors of safety encountered during modern missile developments, we should consider an approach to weapon system safety.

For any military weapon system, it is the Armed Services that must have the ultimate responsibility for safety, but while the responsibility for safety as well as all other aspects of the weapon system must lie with the Services, that responsibility cannot be fulfilled without the enthusiastic and wholehearted support of the aircraft and missile industry.

It is to industry that the military must delegate the major responsibility for defining safety requirements, designing and developing a safe system, and establishing safe operating procedures. In accepting responsibility for weapon system management, industry also must accept the responsibility for providing a safe system.

In modern weapons it is not practical to save the consideration of safety until after the system has been built and put into operation, nor is it sufficient to leave safety to the individual designers. In manned systems, efforts directed to safety of the crew are well known. Fire warning sys-

tems, ejection seats, communication and emergency systems, all contribute to safety of man in a machine. In unmanned systems safety has taken on a much broader meaning and it has become increasingly apparent that system analysis is required to define clearly the safety problems prior to preliminary design, and a constant monitoring effort is required through detail design, production, and operational use.

It is very much the responsibility of the military service and industry to see that, for a given weapon system or project, a safety program is designed to encompass all safety aspects from system studies, preliminary design, integration of system, manufacturing, system test and demonstration through to operational use. All of these phases must include protection of both operations personnel and the general populace from equipment failure or human error.

It will always be a goal to achieve as near 100 per cent safety in a system as practical. This is a noble stand. However, no one will disagree that safety has its price, both in dollars and in degree of mission success. In the design of today's nuclear weapon system, capable of mass destruction, we cannot afford to leave the decision concerning the degree of safety to chance or that which is practical.

The decision as to the degree of acceptable risk must be made with the best possible knowledge of probable results. While the degree of acceptable exposure is a responsibility of the military, it is also the responsibility of industry to conduct system analysis to determine reasonable safety parameters. The problem does not end with the establishment of safety criteria, however.

The success in avoiding inadvertent launch or detonation of a nuclear device must be determined before a weapon goes into operational service. Therefore, industry must develop the ability to predict quantitatively,

with accuracy and confidence, the degree of safety that can be expected from a given system design. Industry has undertaken this task, and thus far experience has shown the safety measures have been adequate. New systems, however, require greatly improved safety controls.

A review of the Minuteman system will illustrate how a safety program was developed and is managed at Boeing.

Initially, general system requirements and specifications were developed by the Air Force. These were evaluated by space technology laboratories and transmitted to Boeing as general design criteria. Boeing formed a Minuteman Safety Committee to study the technical design criteria and to more fully define and detail safety requirements for the design engineers. This committee had representation from all company organizations concerned with the program. Included were representatives from medicine, fire, security, human factors, safety engineering, industrial hygiene, training, manufacturing operations, systems test, ordnance, and design engineering.

These groups spelled out specific safety requirements which were considered feasible from a design standpoint. A conscientious effort was made to avoid dictating design but to establish safety limits and parameters within which the designer would have freedom of selection. Within these safety limits, the designer produced optimum items consistent with the state of the art, performance, weight, configuration and environment. In those areas where recommended safety considerations could not be incorporated in the design, the Committee recommended alternate safety criteria

and procedures to achieve safety objectives established for the system.

Since several contractors are associated with this program, Boeing recognized the need for an integrated approach to the safety problem and presented a proposal for a system safety management program at the Air Force-Industry Missile Safety Conference in Los Angeles in September, 1959. The Air Force concurred in the proposal and negotiated a contract with Boeing to provide centralized administration and direction for an integrated weapon system safety program under the policy direction of ballistic systems divisions and space technology laboratories. Boeing then established a weapon system safety management office.

A Weapon System Safety Group was established for the purpose of providing the affected Air Force commands and contractors, participating in the Minuteman program, with a uniform method of defining, controlling, and managing the weapon system safety program.

In summary, we may conclude that system safety can be integrated into the design and development of a weapon system by:

1. centralized direction and management,
2. determining risk factors,
3. establishing design parameters,
4. providing technical skills,
5. documenting procedures, and
6. operator/hardware integration.

The Minuteman safety program to date has been very successful. We believe that this success adds validity to the system approach to safety.

SAFETY IN THE MACH NUMBERS OR ELSE

By RICHARD WILKINS

Administrator, Industrial Hygiene & Safety
North American Aviation, Inc., Los Angeles, Calif.

A tremendous explosion presents a graphic picture of the accident potential which we are now facing. Imagine that no injuries occurred to personnel during such a holocaust; this was no accident. Many months

of study, planning, and action paid off in the saving of death or serious injury to operating personnel. Bunkers and block houses afforded barrier-type protection. Breathing protection was provided by venti-

lating systems, as well as self-contained breathing equipment. Protective clothing was used to prevent chemical and thermal burns. Last, but certainly not least, procedures assured that personnel were not exposed during critical periods of the test run.

Our profession has jumped from a status where speed could be measured in miles per hour to a position where it must be measured in mach numbers. Many seemingly insurmountable problems were faced at the start. An example of this was the selling of eye protective equipment to management. We were constantly faced with objections to the use of safety glasses or goggles by supervision and workers alike. By the same token we suffered many serious eye injuries because of a lack of this type of equipment.

The requirements for putting over a program of this nature were tenacity and salesmanship. I believe all of you will agree that eye protection is not one of our greater problems of today.

Another example of one of our trying problems was the selling of supervision on safety. Our reception by supervision ran the gamut, from halfhearted acceptance of safety responsibilities, all the way up to a threat of physical removal of the safety representative from the area. Here again, it was necessary to employ a lot of stamina, grit, and follow-through to overcome this problem. The technical requirements were not great, and here again I feel that we, as a group, have done a tremendous job in obtaining the cooperation and help of our supervision.

I can recall when the formation and functioning of a safety committee was almost impossible to attain. In one instance, the chairman of a supervisory safety committee had extreme difficulties in attending these meetings. It so happened that this general superintendent was provided with a company car, and some special trip in this car was almost always necessary when the meeting was scheduled. This had a very bad effect on other members of this committee, and soon a condition existed wherein no one attended the meetings.

Two signs were made up with the wording "Supervisory Safety Committee Today at 2:00 P.M." One of these signs was placed on the Chairman's office desk, and the other was hung on the controls of his company

car. When it came time for the meeting, our chairman was seated at the head of the table grinning sheepishly and saying, "I get the message." From this time on, this committee became very effective, with good attendance and participation by all members.

I believe all of us can appreciate by now, through review of these examples, that it would not require a brilliant person to make great headway when we could gauge our progress in miles per hour.

We have suddenly had to face sweeping challenges in our profession. Two major fields have appeared which are forcing us to change from a sub-sonic approach to our safety problems to a super-sonic necessity.

The hydrostatic testing of pressure vessels used to be our salvation when we were battling to obtain safe operations, as well as a limited budget. Should failure occur in the vessel being hydrostatically tested at 100 psi, no more hazard was presented than a stream of water, should the vessel fail. Now that we are testing in the area of 10,000 psi and above, we no longer have a safe, simple technique for pressure testing.

Let us look briefly at the change in magnitude of our responsibilities. We can all remember the problem presented with sand blasting operations in our beginning. The silica sand generally used presented a definite, known, hazard. We were blessed, however, with instrumentation which could be used to monitor the hazard and assure us that we were working within safe limits. In addition, we could engage in fistfuffs with our purchasing department and sell a substitute material which fell into the nuisance category at a higher price than the silica sand.

Compare this to some of the exotic materials which we are now using. In many cases, the allowable limits are so low that it is almost impossible to obtain instrumentation capable of adequate measurements. In addition, nine times out of ten, there is no reference literature to guide us. The material itself must be used with no possibility of a non-toxic substitute.

Another example of changing exposures in which we must deal is radiography. Many years ago our radiographic equipment was used in a well protected booth. Our industrial work which had to be subjected to this type of inspection could be easily trans-

ported to the booth, which was equipped with interlocks, shielding, and other protective measures.

Now we are faced with the problem of using either X-ray equipment or radioactive sources on the floor, without the luxury of being able to transport the product to an enclosed area. We are also faced with the dilemma of not being able to require an entire production force to leave the area while these operations are taking place.

We can easily see that if we failed in our job during the first stages of our safety development, we probably would have affected one person. Now, however, we must have performance in the mach numbers, or there is every likelihood that our failure will result in a catastrophe. We must qualify ourselves to measure up in our current responsibilities.

If we fail to provide intelligent practical services, we may rest assured that other groups will of necessity take over and offer safety services. During the early years of aircraft development, an engineering department's concept of safety was a factor which had to be built into the aircraft because of specifications. This safety factor was in no sense comparable to the safety factor which we had been accustomed to. As a matter of fact, it was a tremendous bugaboo to the engineering profession, because it represented additional weight.

Now, through the use of exotic fuels and materials, elevated temperatures, extreme pressures, etc., the engineering people have had to become cognizant of safety requirements through necessity. As a matter of fact, specialized groups, such as human factors and research teams, have been specifically developed, in order to cope with the current safety and industrial hygiene problems.

Quality control groups, who seemed to have one assignment in the early years, that of slowing down production, are presently engaged in extensive non-destructive testing operations. As an example of this type of testing, we have the radiographic work. There is a constant desire on the part of this profession to handle its own monitoring and safety requirements, in order to expedite the job.

Our production departments, who once felt safety was a necessary evil, recognize the fact that it is next to impossible to clear complete buildings, in order to conduct safety or structural integrity tests. They also know that, due to the size of many of our products, it is not possible to pick them up and transport them to a protected area for these tests. They, therefore, are extremely interested in controlling safety precautions, in order to eliminate production slowdowns as much as possible.

Let's face it, safety is now recognized as a necessity, in the present state of the art. We must either accept this challenge and keep up with the times, or another group will do it for us.

For years and years we have all been exposed to harangues and a desire to upgrade our profession. Many attempts to bring about this upgrading, through acceptance of additional job responsibilities and improvement in the personnel who have entered the field, have been tried. We do not have to try to upgrade the safety profession any more. The upgrading has been thrust upon us and the question now is whether we can live up to this upgrading or not.

I seriously question management's current interest in hidden costs, or any of the other old hackneyed approaches that we used during the early 40's. Even rising compensation costs have difficulty in competing for interest with situations which could result in a catastrophe, should something go wrong.

We know that we must still cover our routine safety responsibilities, involving such things as strained backs, hernias, and falls. We must add to these responsibilities and change our thinking from a miles per hour concept to a mach number concept, or face either a catastrophe through inability to provide proper safety coverage, or the assumption of safety responsibilities by other groups. If either of these two situations come to pass, we will undoubtedly stagnate with the routine safety job as we have known it for many years.

Our opportunity has arrived. Let us attain the same fine results that we have in the past.

INTRODUCTION TO GUIDED MISSILE AND ROCKET SAFETY PRESENTATION

By COLONEL RICHARD H. PETER
Commanding Officer, U. S. Army Ordnance Field Safety Office

We would like to make Army Ordnance safety facilities available to personnel of the Chemical and Aerospace Sections of the National Safety Council as well as to the Armed Services. This is in consonance with the desire of the chief of ordnance to carry out the safety policy of the President of the United States which is to have all federal agencies cooperate with management, labor, state and local governments and safety organizations in developing and applying modern safety standards.

You can't very well make use of our facilities and activities unless you know what they are, so I am going to devote a few minutes to telling you about them, with the help of slides.

1 & 2. Our office is located at Charlestown, Indiana, which is near Louisville, Kentucky.

3. One of our principal activities is the operation of the U. S. Army Ordnance Safety School.

4. This slide shows the courses which are available to your personnel during the balance of the 1961-62 school year.

We have courses in guided missile, rocket and nuclear weapons safety scheduled for November and February which you may be interested in attending.

Copies of a brochure which contains complete information on our safety courses is available. The brochure contains descriptions of these courses and how to apply for attendance at them. Your personnel may attend the missile courses or any of the others on a space available basis. We are already close to capacity for all courses, so I would like to suggest that your people get their applications in soon. Their applications will be processed on a first come, first served basis.

Applications should be forwarded through the ordnance district in which your company is located.

5. This is a photo of our air-conditioned

classroom, which is completely equipped with the latest training aids.

6. This is a photo taken during the industrial safety course which we conducted during the past two weeks. Courses are taught by safety engineers who are assigned to our inspection and investigation divisions. These engineers conduct safety inspections and investigate accidents at 92 ordnance activities and 120 privately-owned plants.

7. This photo shows the chief of our inspection division and three of his safety engineers planning inspection schedules for 1962. By inspecting Ordnance Corps installations and privately-owned plants, we try to prevent accidents through the elimination of unsafe equipment, facilities and practices.

I would like to show you four of the latest color slides which are typical of the training aids used in our school.

8. This photograph shows what was left of the inside of a mixer room after an explosion at an Army Ordnance plant last July. Damages were estimated at \$700,000 but only 11 minor injuries resulted. If this had not been a remote control operation, all personnel in the mixer room would have been killed. Preliminary investigation indicated that the probable cause of the explosion was friction between metal parts and propellant in the packing gland areas of a Baker-Perkins mixer. Adjacent buildings, separated by the required quantity distances, received extensive blast damage.

9. The walls surrounding the mixing bay were constructed of 12-inch reinforced concrete—three feet apart. The space between the walls was filled with earth.

This photograph shows the damage to the walls surrounding the mixer. Notice the complete severance of the concrete walls in the center of the photo.

10. This photograph shows torn and twisted structural members and complete cracking the concrete wall.

11. This outback building was located approximately 210 feet from the explosion. Transite siding and Corloz panels on this building were destroyed. Two persons working in the building at the time of the explosion received minor injuries.

12. The U. S. Army Ordnance safety equipment exhibit, which was established recently, is a valuable source of training aids for the school. Leading manufacturers of safety equipment who are genuinely interested in promoting safety have furnished over 300 items for this exhibit.

13. Students at Ordnance Safety School courses are given a complete conducted tour of the exhibit and selected items are used for instructional purposes in the classroom. A conducted tour of the exhibit is a safety education in itself. You do not have to attend the safety school in order to visit the exhibit. We will be happy to have you drop in to see this exhibit whenever you are in the Louisville area. It is the largest permanent display of safety equipment in the world and it has been completely air-conditioned for the comfort of our students and visitors. Safety personnel and operating personnel should be thoroughly familiar with the latest safety equipment in order to prevent accidents and fatalities.

14. For example, this is a photograph of a routine Jupiter missile operation which resulted in a fatality. The crane operator was lowering the spreader bar which was attached to the crane hook. The spreader bar caught on one of the small nose cone projections and slipped off the hook. A workman standing below was struck on the head by the spreader bar and killed. He wasn't wearing a hard hat and he had no business standing under the crane.

15. However, a safety latch like this on the crane hook would have saved his life. It costs only \$2.75.

16. We have several different types of safety latches and hooks in our exhibit. Three of them are shown on this slide. None of these cost more than a few dollars. The use of any one of them would have saved a man's life.

Safety items such as these safety latches and hooks are demonstrated to students in our courses and shown to exhibit visitors.

We also have the latest resuscitation equipment, fire fighting equipment, deluge sys-

tems, machine guards, non-sparking tools, warning devices, safety hats, safety shoes and protective clothing.

17. This slide shows one of our safety engineers demonstrating the latest protective clothing for missile fuel handlers. He is wearing a rubber suit and a rubber mask with a plastic window. The rubber gloves have a slip joint fit which seals them to the suit.

18. This slide shows seven hands belonging to seven men employed at one Ordnance installation. These hands were involved in accidents which could have been prevented by the use of guards like these.

19. Students attending our courses are shown how to use these guards and—what is more important—how to get others to use them.

20. Army Ordnance publishes three monthly safety periodicals. The Safety Information Letter specializes in short articles and the latest safety news.

The Safety Digest contains longer technical articles on all types of safety, including the manufacture, transportation and storage of chemicals and high energy solid propellants.

Statistical information on accidents, fires, explosions, injuries and fatalities is published in the Statistical Summary. This information is analyzed in an effort to spot accident trends which may be developing at our installations. Corrective action can then be taken before too many accidents occur.

21. These publications are distributed monthly to Ordnance installations and companies having Ordnance contracts.

22. With the world situation as it is, we must do everything in our power to prevent accidents, injuries, fatalities and property losses. We can't afford to lose trained personnel or essential production facilities as a result of accidents.

The objective of our presentation is to pass on to you as much practical safety information as possible on the manufacture, storage, transportation and handling of guided missiles and rockets.

We are fortunate to have personnel on our staff who have a combined total of 300 years of ammunition, missile, rocket and explosives safety experience.

SAFETY IN STORAGE, TRANSPORTATION AND HANDLING OF GUIDED MISSILES AND ROCKETS

By RAY L. MYERS
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The safety of a plant must be a constant consideration of those in charge of it from the conception of the original idea around which it is designed, and throughout the entire period of its construction and operation. Safety must begin on the drawing board, as otherwise its necessary consideration later becomes a matter of increasing difficulty and cost, and the latter all too often becomes prohibitive.

Safety in the storage, transportation and handling of guided missiles involves several important factors; i.e., (a) the determination of the hazards inherent in the operations, equipment, buildings and areas; (b) the development and adoption of a proper protective procedure to eliminate these hazards, if possible; (c) to reduce their effect in the event of an accident, if they cannot be eliminated; and, (d) the establishment and continued application of methods of inspection to insure the maintenance of these protective measures.

The safety engineering approach to the general problems of guided missile and rocket safety has been a large factor in the remarkable record of the U. S. Army Ordnance Corps establishments that store, transport and handle guided missiles and rockets.

As an example, during World War I, 240 persons were killed for every billion pounds of propellant and explosives processed; whereas in World War II, this figure was reduced to five persons.

These statistics interpreted simply mean that the lives of more than 10,000 persons engaged in these operations during World War II were saved by safety measures that were put into effect.

Without these safety precautions, a billion dollars' worth of plant facilities might have been lost and, what is more important, our combat troops would not have received the

kind and amount of ammunition that they needed when they needed it!

The storage, shipment and handling of packaged missiles, rockets or their components, at present, poses no serious problem. However, the advent of ever-larger missiles and heavy rockets will create correspondingly greater challenges in storing, packaging, transporting and handling.

The type of storage facility provided guided missiles and heavy rockets or their components, is controlled by the hazard, or potential hazard, of the component itself. Explosive components, such as war heads, rocket motors, igniters, etc., require igloo storage. Liquid propellants, including both fuels and oxidizers, may be stored, properly segregated, in liquid propellant storage areas, in properly designed and constructed buildings.

The storage of present and future missiles containing solid propellant rocket motors however, takes us into an additional problem area—that of explosive safety. The presence of these explosives—loaded rocket motors—demands that the safety of personnel handling, storing and shipping this material, the protection of government property and the safety and protection of the lives and property of surrounding communities will have been carefully pre-planned and is rigidly enforced.

How is this done?

First, safe distances must be provided between locations containing explosive materials. This includes operating buildings, storage magazines, loading docks and any other explosive facility. Inhabited building distance must be maintained between explosives locations and inhabited buildings. Intraline distance is the minimum distance permitted between any two buildings within an operating line. Magazine distance is the mini-

mum distance permitted between any two storage magazines.

Guided missiles and rockets are classified according to the expected damage if they explode or ignite. The maximum amount of explosives permitted in any location is specified in the quantity-distance tables, Section 17, ORD M 7-224. It is mandatory that local limits be established in amounts no greater than those consistent with safe, efficient operations.

Keep in mind that the cardinal principle to be observed in any location or operation involving guided missiles and rockets is to limit the exposure of a minimum number of people, for a minimum time to a minimum amount of hazardous material consistent with safe and efficient operations. All operations should be scrutinized to devise ways and means of reducing the number of people exposed, the time of exposure or the quantity of material subject to a single accident.

Guided missiles, rockets and their components are stored in accordance with applicable Ordnance Corps storage drawings. War heads, motors, igniters and other explosive components require igloo storage. An igloo magazine means an arch-type, earth-covered magazine which may be constructed of concrete, metal or wood. A "standard igloo magazine" means an earth-covered, reinforced concrete, arch-type magazine, with or without a separate floor barrier, constructed according to approved standard service drawings.

Liquid propellants (fuels and oxidizers) must be stored in an area separate from all other activities. The facilities must comply with the requirements and standards for various propellants. All buildings, tools and equipment must be compatible with the various chemicals. The propellants will probably either be stored in approved shipping containers or bulk storage tanks meeting all the safety requirements. Among some of the liquid propellants used today are hydrazine, hydrogen peroxide, unsymmetrical dimethylhydrazine, nitrogen tetroxide, liquid oxygen and nitric acid.

At present, the shipment of large guided missiles and rockets, regardless of their hazard classification, is offering no particular problem. Future missiles may reach 15 to 20 feet in diameter and 75 to 100 feet in

length and weigh as much as 100 tons or more. Such dimensions offer not only new problems in packaging and handling but also in shipment irrespective of the mode of transportation. The size and weight of these future components will necessitate further revision of the loading and blocking concepts.

The advent of these ever-larger explosive-loaded items will probably cause revision of the ICC Regulations to permit their movement by common carrier. The ICC Regulations are published in the 1949 edition of the Code of Federal Regulations, Title 49, parts 71-90, Transportation. Those regulations are also published in various freight tariffs.

Our present public highways have a maximum height clearance of 13 feet, six inches; yet, as has been pointed out, components of the new large missiles may be as large as 15 to 20 feet in diameter. Not only are our highways as presently constructed inadequate for the transportation of items of this size but the railroads will also have difficulty in handling any item whose loading height, plus the car height, exceed 15 feet, one inch. Such items usually require special handling and special routing.

Present guided missiles, heavy rockets and their associated components are loaded, blocked and braced in accordance with Department of the Army Ordnance Corps drawings. Truck and rail loading drawings have been developed after many tests to insure the best possible protection during shipment of the guided missiles and rockets. All of the Ordnance Corps drawings are approved by the Bureau of Explosives, Association of American Railroads, and are binding upon all shippers of guided missiles and rockets by, for and to the Ordnance Corps.

Shipments of guided missiles, rockets and liquid propellants must comply with the following regulations:

1. Interstate Commerce Commission Tariff Books;
2. Army Regulation 55-355;
3. U. S. Coast Guard Regulations and Instructions;
4. State and Municipal Laws and;
5. Ordnance Safety Manual, ORD M 7-224.

The handling of guided missiles, rockets and liquid propellants involves much more than the mere off-loading and out-loading of these items as packaged. In many cases, special handling equipment must be designed and fabricated for these operations. The handling of any item depends on the hazards involved. The handling of the unpackaged guided missile body, rocket motors and other associated components and/or hazardous material present special problems. In this connection, the size and weight of the component of the new missile, which the future may bring us may exceed the safety limits of the material handling equipment now being used.

It is of utmost importance that the nature and characteristics of the various items be fully understood by all who are required to handle them. Established rules have been developed as needed to fit actual cases. In general, all operating personnel must be taught the nature of the hazards involved in the handling of the guided missiles, rockets and liquid propellants.

The three basic hazards to be dealt with in operations involving these items are:

1. Fire;

2. Explosions; and,

3. Toxicity poisoning or chemical burns. Any or a combination of these hazards may be present in a given situation.

Fire protection and prevention are a must at all times. Areas used for storage of combustible materials, fuel and oxidizers must be kept separated. Fire fighting equipment and extinguishing agents must be available to the type of fire which may occur with a particular fire and oxidizer. Where flammable vapors are present, electrical equipment must be of the approved explosion-proof type, and equipment and containers must be grounded. Non-sparking tools, shoes, and non-static generating apparel should be provided where required.

The principles guiding the elimination and control of fire hazards are generally applicable to explosion hazards as well. Shock-sensitive materials must be handled carefully and protected from vibration, friction and impact.

The protection of personnel from poisoning and chemical burns involves:

1. Engineering prevention to minimize spills and leaks and insure adequate ventilation;

2. Use of appropriate personal protective clothing and equipment and;

3. Conducting of periodical health surveys;

4. Periodic physical examinations;

5. Constant education of supervisors and employees regarding safe procedures and practices.

In summation, the storage, transportation and handling of guided missiles and rockets involves, in general, highly hazardous materials. Consequently, in order to do the job safely the hazardous properties of each item must be fully known, recognized and understood. Specific and detailed safety standards to be followed in all operations involving these materials have been established. These safety standards are outlined in various publications in a manner adapted to the needs of the safety engineer, plant superintendent and operations supervisor.

Supervisors must devise and enforce a system of inspection to ascertain that all operations are being conducted in accordance with the prescribed safety requirements. Unless successful control for the hazards involved in the operations is maintained, sooner or later a fire, explosion, poisoning or chemical burn will occur at the plant. Therefore, during the storage, transportation and handling of guided missiles and rockets close adherence to all safety requirements is a must, and demand constant alertness to every new indication of a need for a change in the safety standards through actual experience.

SAFETY IN ROCKET PROPELLANT MANUFACTURE

By ROBERT J. SHIROCK

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Charlestown, Ind.

The cardinal principle of hazardous operations; i.e., "In any location or operation involving explosives, ammunition, severe fire hazards or toxic materials, exposure must be limited to the minimum number of people for a minimum time to a minimum amount of hazardous material consistent with safe and efficient operations," must be the basic premise for all propellant manufacturing operations.

The introduction of rockets and guided missiles into the nation's weapons system for defense of our country has raised a question—what changes have resulted in the safety requirements for manufacture, handling, storage, and use. The assumption that the term rocket propellant connotes the unusual; therefore, the hazards must also be unusual is wrong in most cases. Most often, careful and objective study of the material discloses the hazardous properties. Thus, there have been few major changes to the basic safety requirements. Specific changes due to chemical and/or components have resulted. Each of these require individual research in order to formulate the necessary safety requirements.

Rocket propellants are, in general, highly reactive materials designed to deliver large amounts of energy in short periods of time. Fuels and oxidizers, and their reaction products possess hazardous properties which must be fully understood by all who handle them in any manner.

Missile propellants are grouped according to the physical state in which they exist. At present, only two types are in general use—liquid and solid.

The hazards of liquid propellants are fire, explosion and toxicity. In the case of fire and explosion, the principles guiding the elimination and control of each are generally the same. As to toxicity, prevention of poisoning and chemical burns of tissues of the body require (1) proper engineering design of operations, (2) personal protective equipment, periodic health surveillance procedures and (3) trained supervision.

The hazardous properties of liquid fuels, oxidizers and starting mixtures can be easily determined.

The manufacture of solid propellant motors for guided missiles and rockets has introduced many potential hazards. The safety requirements for the manufacture of single, double, triple bases and cast and composite propellant have been developed over many years. Now, however, the ingredients of each are being combined. This has created new safety requirements.

Safety in manufacturing operations must start during the research and development stages of a particular item.

Many of the explosions which have occurred in the manufacture of rocket propellants are a direct result of the lack of complete and adequate research and development.

Solid propellants are basically high-energy mixtures of a fuel and oxidizer which, after certain process steps, are a solid mass possessing properties consistent with the manner in which they will be used. Because of their composition, combustion progresses in the absence of air or other externally supplied oxidizers. The fuel and oxidizer are either chemically bound or in solution as in single and double base propellants, or are chemically separate entities consisting of a generally elastomeric fuel and crystalline inorganic salts. Other ingredients are normally added to impart and control desired physical and ballistic characteristics to the propellant.

The particular chemical and physical differences of the propellants being developed and manufactured require a wide variety of process methods. These methods can be catalogued into major functional processes; i.e., raw material preparation, mixing, casting, curing and motor finishing.

The physical conditions such as increased size, sensitivity of ingredients and ability to detonate are important.

This has meant redesign of present equipment and development of new, unique types of equipment.

No single factor exerts more effect upon a solid propellant operation than the safety procedures under which the work is performed. The objectives of safety are well understood, but the impact of safety measures themselves tends to be underestimated by persons unfamiliar with explosives and industrial operations.

The Ordnance safety manuals are the regulatory explosives safety publications used at Ordnance Corps plants and private plants operating under Ordnance Corps contracts. The rapidly changing nature of solid propellant formulations results in areas for which the safety requirements have not been developed.

The safety manuals in the explosives and chemical field have been written in "blood." This was after the fact safety. Now we must, of necessity, build safety into our propellant operations before the fact.

The custom of designing and installing equipment and facilities and then examining it for hazards is obsolete. Consideration of safety after development becomes a matter of increasing difficulty and cost. The cost factor all too often becomes prohibitive.

The mechanization and automation of processing and loading techniques have gone

forward. Many things have been accomplished in the field, but the most important insofar as safety is concerned is the reduction in the amount of explosive materials which might be subjected to a single accident.

Advances in the art have been so rapid in the propellant and explosives field that there are many instances of equipment and processes becoming obsolete before they are actually put into production.

The explosions which have occurred during mixing, curing, finishing and testing of solid propellant motors have been the result of make-shift equipment and lack of complete knowledge. Technical advances have increased the efficiency of our propellants; however, this increase can result in disastrous results because of improper procedures.

Safety involves the determination of the hazards inherent in the processes, equipment, buildings and areas—the development and adoption of proper protective procedures, either to eliminate these hazards or, if they cannot be eliminated to reduce their effect in the event of accidents and to minimize the frequency of such accidents, and last—the establishment and continued application of methods of inspection to insure the maintenance of these protective measures.

SAFETY BEFORE THE FLIGHT

By WILLIAM F. MAHONEY

Manager, Development Jet Engine Test, General Electric Co., Lynn, Mass.

100 people die in plane disaster!

This is the type of headline that we are trying to avoid. But if we are to be successful in the quest for air safety, we must spend several years developing and perfecting our jet engines.

When you read in the newspapers that a new aircraft has been unveiled, it means that years of effort have paid off, that trial and error, success and failure, have been climaxed by completion of a project.

From the very inception of an engine program reliability and safety are very important factors. Before the engine is allowed to fly it must pass a pre-flight rating which is generally of 50 hours dura-

tion. The next official milestone is the completion of a 150 hour model test which, if completed successfully, allows engine shipment. However, in the time span between these tests the engine model is run for several thousands of hours. All of these test hours are accumulated for the purpose of insuring the best performance and engine reliability.

The most valid test, certainly the toughest, is long-term endurance. Most engines run about 200 hours each time they are installed in a test cell. The major portion of this being 150 hours of endurance testing to military specifications.

In a view of one of our propeller en-

gines just prior to the start of such a test, you note that the engine is mounted in the same manner as it will be on the aircraft. Also, this same model engine will be run for 1000 hours. We use a typical aircraft propeller so that the engine will be subjected to the same vibrations it will receive on an aircraft. The orifice or band, behind the plane of the prop is used solely for the purpose of preventing recirculation of air in the test cell, as this would raise the prop stress level. Such a problem is not encountered in flight.

A second view shows another 1000 hour engine on test. Actually the view shows the test man running the engine. The face of the clock in the foreground is painted to coincide with the test schedule to help prevent human error in the running of the test. This test calls for running 2000 half-hour cycles that typify a helicopter flight such as might be flown by Chicago Airways, which employ gas turbine helicopters. The engine is shut down for five minutes between each cycle, thereby allowing it to cool down before restart, which, of course, subjects it to the worst possible conditions.

Although endurance testing is the most meaningful and time consuming part of any program, there are many aspects to the testing business which insure flight safety.

For example, many of the components that make up an engine are tested separately and are given very extensive tests, especially to make sure that there is a more than adequate safety factor in the design. A good example of such a test is that given engine rotating parts such as turbine wheels and compressors. A high speed pit is used to run rotating parts at well over their design speeds to prove their integrity. A small engine compressor is lowered into a pit where it will be run at 3000 rpm above the maximum top engine speed.

A step further toward proving turbine integrity is a power turbine destruction test. In this case, an engine shaft was intentionally blown up by an explosive charge, so that the turbine could be purposely overspeeded to determine at what speed engine parts would fail, and to make sure that the engine turbine casings would contain

the failed parts. This action was recorded by high speed cameras and other very accurate measuring devices. The people running the test were protected by sand bags and wooden beams.

A very important factor in component testing is that concerning the combustion system. There is a combustion facility which has the capability of testing combustion tests at both sea level and altitude conditions. This enables us to develop a liner and find out if there are problems at altitude before the engine is flown.

On a main fuel control stand facility, the fuel control, one of the most complex parts of the engine, is developed. This particular engine part not only schedules fuel to the engine but varies the geometry of the engine compressor, thus controlling the flow of air through it. Because the main fuel control is the heart of the engine, it must be subjected to more extensive testing than other parts.

In our new power control facility we must prove that the control is capable of going through rigid requirements set by the Government. A panel houses the controls of the test equipment. The stand has other features such as automatic cycling provisions, and a fuel system capable of delivering fuel from -65 to 150°F.

The chamber that the control is tested in, running at a speed of up to 3000 rpm, will maintain an ambient temperature anywhere from -65 to 275°F. It has a special safety feature of a blow-off roof to protect the operator.

This specific control test consists of some 900 hours of running which includes: 500 hours of cyclic testing, accelerated aging to dry out "O" rings, room temperature running for 250 hours, 150 hours of contaminated fuel running, introduction of a salt solution into the control, a hot soak of the control at 200°F; also the control must be soaked at -65°F for 72 hours and then run for 20 hours at the same temperature, including 10 starts and shutdowns.

Many other jet engine accessories are also put through various acceptance tests; for example, an ignition system is checked out. Items such as cables, spark plugs, generators and alternators are tested. They are checked out at both sea level and altitude conditions, and the ambient tempera-

ture in the chamber of this stand can be controlled from -100°F to 200°F .

Oil pumps are also tested. I could go on and on, as there is a test facility for each engine accessory. All components are tested for thousands of hours so that all of the faults can be detected and corrected. Just another step in insuring flight safety. Of course, in proving the value of a product, the final answer lies in testing the entire engine.

As I pointed out earlier, most cell testing is of an endurance nature whereby various engine models are put on test stands and run until they break. In fact, in the early days of a program we run units to break them so that we can find out where the faults are. However, we must go a step beyond this and run engines under extreme conditions; every conceivable problem that can take place in flight must be paralleled in a test cell. For example, an engine must be run for 50 hours on contaminated fuel.

A tank truck is located beside the engine test cell. The contaminate, consisting of such items as acid, iron oxide and lint, is put into the fuel, which is thoroughly mixed by a circulating system so that the contaminate will not settle; and the engine continually receives the bad fuel. You will note that the truck is parked a safe distance from the cell and the system is properly grounded.

By conducting such a test we not only accumulate data about the engine's performance, but also what adverse effects these contaminants might have on engine parts.

Another sea level test we conduct is to spray salt water into the inlet of a jet engine compressor to see what amount of deterioration is caused by salt spray. A simple type of spray rig is used to inject ocean water into the engine. In conjunction with this test, we are experimenting with various methods of cleaning compressors after they become contaminated. Also, different types of coated blades are being used in an effort to minimize the buildup of deposits on blades.

One of our latest test sites is an outdoor facility which houses an ice ball gun. The proper name for this test is hailstone ingestion. The gun is used to propel an

ice ball at a running engine. The gun consists of a 20 foot length of 2-inch diameter brass pipe. The pipe is attached to a frame which can be adjusted by two jacks to give elevation and traverse. The propulsion force is compressed air, which is stored in a coded pressure vessel and released by a quick-operating air valve. Air travels from the receiver, through the fast acting valve and into the breach of the gun behind the shell and projectile.

In our particular test, the projectile is an iceball or hailstone which varies in diameter from $\frac{1}{4}$ to 2 in. The gun is lined up on a track in the cell, located directly in front of the engine. Prior to such a test target practice is actually taken so that a predetermined area is hit and also that the proper velocity is attained. (By regulating air pressure in the air receiver, it is possible to achieve a wide variety of velocities.) To record the test results, high speed motion pictures are taken of the firing shot. (A 16 mm camera is used operating at 8,000 frames per sec.)

The gun's muzzle has two photo-electric high speed traps located directly under it which give an electrical impulse that is used to determine velocity measurement. Also, an engine might be seen in the stand with visible damage from an ice ball. From this test facility we hope to gain important data concerning compressor ingestion. This, of course, will have to include bird ingestion, if we are to cope with the problem of wild life flying into jet engines.

Still another test just recently completed is illustrated in the T64 engine, equipped with inlet duct and cowl, G3E60 propeller and spinner, and the aircraft oil system, which is located in the exact position it will be in the aircraft in relationship to the engine. The purpose of this test was two-fold: (1) to get engine running time in the test cell with the actual components that will be flown in the aircraft, and (2) to run investigative tests on the oil system before the flight. Incidentally, one such system did fly up in Canada.

To further improve jet engine credibility before the flight, many other approaches are made. Climatic tests are run in such places as Mt. Washington and the Navy's aircraft engine laboratory in Phila-

delphia. This allows us to investigate further problems which could occur at altitude or during adverse weather conditions. For example, testing an engine in an altitude chamber to check starting characteristics is very important to an engine program.

In fact, such a program has borne out the need for using ethylene oxide for making altitude starts. One of our engines in a missile is launched from a B52 at high altitude and needs help to start. E.O. will ignite easily and act as a pilot light to start the engine. An example of such a need is the fact that our U-2 plane, shot down over Russia, had to lose altitude after engine flame-out in order to re-start its engine. Low atmospheric pressure and temperature make high altitude re-light difficult.

While on the subject of ethylene oxide, I would like to point out the fact that it not only assists jet engines but also, of course, it creates a handling problem for us in the test business.

We use a cage to house a 50-gal. drum of E.O. The cage is sand bagged and of course is equipped with a water spray and an emergency CO_2 system. Double check-valves are used to prevent reverse flow; also we use nitrogen to pump the E.O. Safety steps are also taken at our remote storage site, namely, a continuous water spray in warm weather and a 40 psi nitrogen pump on the tank.

One of the most important phases of testing is the subject of vibration; therefore, I would like to discuss some of the aspects concerning this problem. Many vibration investigations are undertaken by the engine maker for the purpose of establishing the mechanical integrity of the engine such that the users can be assured that they have maximum quality, safety and comfort in the end product.

First, engine components are studied separately, such as compressor blading and turbine buckets. Normal mode frequency characteristics are calculated and experimentally determined to ascertain their reliability. These studies are undertaken on model blades, and design changes can be made compatible with the aerodynamic and mechanical configurations required.

Having established a final design on the blades and buckets and the material to be used, the endurance characteristics are then

established. This is done experimentally by simulating the mounting conditions of the specimen and exciting it to vibrate in various normal mode frequencies by an external driving force. The amplitude of the specimen is increased until failure. In this manner, the endurance of each blade or bucket configuration is established for the principal normal mode frequencies.

To determine the areas of maximum stress for these normal modes of vibration, strain gages are applied to the blade and/or buckets. The specimens are then vibrated in their normal mode frequencies and stress distribution curves are obtained.

Having eliminated or minimized the possibility of mechanical excitation of the specimens from known engine generated excitation, studies are made of the blades and buckets during actual engine operation to determine if they will be exposed to any excessive aerodynamic excitation. Strain gages are applied in the optimum location to give maximum information. Strain data from the rotating members is transmitted through a slip ring and displayed on suitable electronic equipment.

I might mention that to measure these and other engine parameters, requires that we maintain approximately one million dollars worth of instrumentation. It is only through instrumented tests that you can determine if theoretical calculations are sound.

The entire operating range of the engine is explored, and the vibration stress behavior of the blades and buckets is investigated. Once a satisfactory configuration has been established, the above investigations are undertaken in altitude test facilities for final approval.

Next, the natural frequency characteristics of each compressor and turbine wheel are calculated and experimentally measured, to determine if any critical frequencies fall in the operating range of the proposed engine.

Having satisfied this requirement, the individual wheels are high speeded separately to check out their mechanical integrity.

Accessories such as fuel controls, ignition boxes, actuating systems, etc., must perform their function in the vibration environment of the engine. To insure that these components will perform satisfac-

torily, they are subjected to vibratory surveys. Each component is mounted on a shaker table and a frequency survey is made over the operating range of the engine. The component is then vibrated at twice the amplitude anticipated in service, over the entire speed range in each of three mutually perpendicular axes.

Having eliminated or minimized resonant frequencies in the various engine components that could cause troublesome vibration problems, we then become concerned with the vibration behavior of the system as a whole. The engine is mounted in the test dolly in the cell and a series of vibration shake tests are undertaken. As a result of these tests, an optimum vibration pickup location is selected, and a maximum allowable vibration limit is established.

After a period of time in which we are able to obtain the vibration history of a particular engine design, the vibration limits are reviewed and adjusted, if necessary, to be compatible with safe operation of the engine, to further illustrate the importance of the subject of vibration.

Endurance tests are conducted on propeller engines to find out just how much propeller imbalance an engine will withstand. This type of running is called an abusive test. It is accomplished by placing known amounts of tape on various positions on each prop blade thus inducing specific amounts of imbalance. Concurrently, engine vibration is measured resulting in the establishment of limits for varying amounts of prop imbalance.

Another form of testing is that area covering inlet distortion. It is extremely important to determine how an engine will react when the inlet is obstructed. It is not only necessary to find out aerodynamic characteristics but also how the blades in the compressor will react to this different type of loading.

A screen is mounted to the bellmouth at the forward end of the engine (compressor entrance). To properly conduct a distortion survey, small segments of various screen meshes are attached to the bellmouth screen. Several static and total pressure probes are located aft of this screen so as to establish a pressure profile at the compressor inlet. Also, during such a test, strain gages are attached to the

compressor blades to determine what effect distortion has on the blades mechanically, and also establish a stress limit, or what the maximum allowable stresses will be.

There is still another very basic and important step that is taken to insure maximum safety. This comes under the heading of quality control requirements for material. The raw material supplier must give results of tests on all properties. Tests such as ultrasonic, radiographic, magnetic particle and fluorescent penetrant inspections are just a few of the many tests that have to be performed to demonstrate material quality.

Furthermore, the processes involved in these tests have to be approved. Heat treating and welding techniques are clearly spelled out in a specification; in fact, all work performed on engine material must be done so, in accordance with very strict rules.

Finally, the vendor of the material must issue a statement of conformity certifying that all specifications have been met. If any parts do not meet requirements such as dimensional discrepancies they must be submitted to a material review board for disposition. It is only through this medium that a part that is only slightly inferior could possibly be accepted.

In line with checking materials, we in test run endurance tests on various metals, rotating them at high speeds and temperatures. This is accomplished by running these materials, shaped in the form of a disc, in a vacuum vessel. This vessel includes a steel rupture guard and a refractory lining. Heating is accomplished by radiation from calrod elements with a total input of 6650 watts, resulting in a maximum temperature of 1200°F. Also this facility is equipped with a drive turbine capable of 60,000 rpm.

Safety is even emphasized in still another manner and that is the orientation of personnel who are to work on these engines. If qualified, well trained people are not employed in the maintenance of engines then air safety is in jeopardy. To prevent such a problem, several classes are conducted. Also, literature pertaining to the engine and its operation is published.

While on the subject of orientation, we make it a practice to brief test personnel

on the subject of safety; consequently, we have experienced a good safety record in the factory.

Of course one of the final steps that has to be taken before commercial flying is the flight test phase. For this purpose several flight test centers throughout the country are used, two of the most popular being G.E. Flight Test Center in Schenectady, N. Y., and Edwards Air Force Base in California. In fact, at both of the locales, G.E. has its own aircraft. A helicopter is used quite extensively in New York to further improve the in-flight reliability of the Navy's T58 turbo shaft engine; and in California a T38 Air Force trainer is putting the turbo jet engine through its paces.

Flight testing is very necessary, as fac-

tory testing cannot simulate gyroscopic moments nor help predict the effects that altitude has on the lube system. Therefore, many thousands of flight test hours are logged annually.

The subject of flight safety is very important to us in the jet engine manufacturing business. It is indeed a tremendous challenge, one that must be successfully met if we are to stay in business. I have tried to give you a brief description of some of the steps that we take to help insure engine reliability, and in turn make aircraft safe to fly in. I am sure that you will agree that flight safety will become one of the most important aspects of this general subject of safety. And that it is of greater importance for us to guarantee safety before the flight.

FORMING PRACTICES WITH HIGH EXPLOSIVES

By JOHN J. DOUGLASS

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The object of this paper is to discuss current practices in the use of high explosives for shaping a variety of metal parts. The comments are derived from the Du Pont Company's four years experience in this field, and illustrations are presented which show some of the actual forming jobs that we have done. A variety of commercial explosive devices are available to those desiring to do explosive forming, and some typical pieces that can be formed from each of these explosives are illustrated.

Although the state of the art is infancy, relying quite heavily on trial and error methods, a start is made towards (1) an engineering approach to the charge requirements for producing a given piece, and (2) the die design requirements to withstand the required explosive forces.

It should be emphasized at the very beginning that we have not found any radical departure in the metallurgical or mechanical properties of explosively formed metal pieces that would not be expected from mechanically formed pieces. For ex-

ample, we found that the rated static elongation properties of a metal are still the confining limits as to how much a piece may be formed before requiring annealing.

It should be emphasized that in our opinion explosive forming should be used only after a complete investigation of currently available facilities show that conventional forming techniques cannot be used to fabricate the desired shape. In general, explosive forming cannot compete economically with conventional forming techniques on a high production basis.

There are, however, definite advantages to the explosive forming process that give it a role in industry today and give the design engineer a new degree of freedom. Among the disadvantages are:

(1) Reduced die cost, since only a single female die is used rather than a complete punch and die set (this is not to imply that in all cases low-cost die materials can be used).

(2) Large capital investment for presses can be eliminated.

(3) Springback of metal being formed is minimized although not completely eliminated.

(4) Some shapes that are difficult or impossible to form mechanically can be formed explosively.

(5) An assembly can frequently be formed in one piece to replace a number of small pieces welded together.

(6) Improved surface finish can be obtained, since a punch (which may scratch the piece) is not used.

(7) Intermediate anneals required in mechanical forming can often be reduced by increased utilization of the available metal elongation properties.

(8) Explosive pressure can be distributed uniformly over the entire area of a surface, thus eliminating localized stress concentrations that may be encountered when using mechanical systems.

All comments in this paper are directed to the use of high explosives rather than low explosives, such as black powder and smokeless powder. We have used high explosives exclusively in our forming development work because the die arrangement is simple. High explosives can do their work independent of confinement because of their high rate of pressure development, whereas a gas tight arrangement is needed when using low explosives. Hence, the size of the piece that can be formed with low explosives is somewhat limited—while with high explosives forming there seems to be none.

The typical high explosives forming system consists of an explosive charge, a die, and a metal preform. First, there is the explosive itself which is immersed in a medium, usually water, to transmit the pressure generated by the explosive to the work piece. The explosive charge can be in many forms and many sizes. They may range from a small blasting cap to several pounds of high explosives in the form of a tube, rod, or ball.

The shape of the explosive used can largely determine its effect on the piece to be produced. For example, a point or spherical charge can be used, or a linear charge, or perhaps a disc of EL-506 sheet explosive, depending on the shape of the piece to be formed.

The effect of standoff, or the distance between the explosive charge and the piece to be formed, is of great importance. Actually, we have found it a more critical factor than the weight of the explosive charge itself. The pressure acting on a metal surface is approximately inversely proportional to the standoff distance between the surface, and the explosive charge while pressure-generated varies with the weight of the explosive charge to the one-third power.

An interesting phenomenon was noted during one of our basic studies on the cupping of various metals; it developed that when using a disc charge of sheet explosive (EL-506), the closer the standoff, the better the cupping results. Actually, with a greater standoff distance, fractures occur.

Yet by bringing the disc charge closer, hemispherical cups were obtained. It is hypothesized that the closer the explosive disc is to the plate to be formed, the flatter is the shock front, thus eliminating the possible high pressure peak in the center.

Another variable in the explosive forming system is the transfer medium itself. In general, water is used since it is the most readily available and cheapest of the liquids. Air can be used, but it is much less efficient than water, and the noise of a shot made in air can be objectionable. When a water medium is used in explosive forming, the noise is reduced to a great degree. Very slight improvement was obtained when such liquids as glycerin, kerosene, etc. were used.

Some typical case histories drawn from our experience are detailed below to illustrate the wide range of explosive charges that are available and their typical applications.

Blasting Caps as Forming Charges

The smallest charge used is an initiator or the blasting cap. There are a great variety of commercial blasting caps available with varying charge loads ranging from one to twenty grains of high explosive. Generally, for explosive forming use, electric blasting caps are preferred over fuse type—primarily for safety reasons. With electric blasting caps the operator has control over the exact instant of charge initiation.

In Figure 1, we see a diagrammatical sketch of a typical setup using a blasting cap in explosively forming a cylindrical piece. In this case, the cap containing approximately 20 grains of high explosive was immersed in the center of a 3" diameter tube of .010" thick wall of AM-350 stainless steel. The simple die arrangement was used (as shown); sealing was accomplished by setting the die on a rubber pad with a grease seal on the bottom.

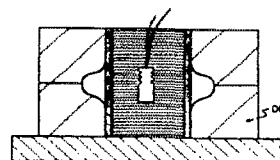


FIGURE 1
BELLWOWS CONFIGURATION
3" O.D. X .010 WALL AM-350

Forming a small flat object can be accomplished by using a blasting cap as in Figure 2. Here an expendable container, such as a cardboard cylinder, is mounted above the flat object to be formed. Alternatively, the entire die and charge system can be immersed in a shooting tank or pond. Again, approximately 20 grains of ex-

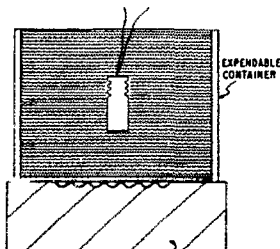


FIGURE 2
FUEL FILTER DISC
.006" THICK 302 STAINLESS

plosives two inches away from the piece produced the configuration. The piece, made from .003-inch thick 302 stainless steel, is used as a fuel filter for a jet engine. The detail and sharpness of the explosively formed piece were greater than that obtained when conventional pressing techniques were used.

Mild Detonating Fuse (MDF)

The next step up the ladder of explosive force is obtained with Du Pont mild detonating fuse (MDF). This is a high explosive core encased in metal tubing, and can be obtained in strengths ranging from 1 to 20 grains per foot. A typical system where this type explosive charge can be used to advantage is formation of a corrugated cylinder six inches in diameter from .010-inch thick A-286 stainless steel. The mild detonating fuse was suspended along the axis of the piece, and initiated by an electric blasting cap. The die conformity obtained was excellent and tolerances obtained for this piece were $\pm .002$ -inch on diameter.

"Primacord"

Again, stepping up our explosive ladder we come to the use of "Primacord" (manufactured by the Ensign-Bickford Company, Simsbury, Conn.), which is a string or cord-like explosive available in various explosive loadings from 30 to 400 grains per foot. Typical applications for such an explosive charge are in the forming of medium-sized cylindrical pieces. One example is the sizing of a missile motor case. In this operation, a welded missile tank, slightly undersize, was placed within a die. Normal welding techniques could not meet the tolerances required by the missile manufacturer so it was desired to expand the tank and produce good dimensional tolerances both diametrically and axially. The piece was .010" thick AMS-6434 steel and a tolerance of $\pm .005$ " was met.

Du Pont EL-506 Flexible Sheet Explosive

The most versatile explosive we have used for forming is—Du Pont EL-506 Flexible Sheet Explosive. This material resembles vinyl tile in form, texture, and flexibility. A great variety of explosive shapes can be fabricated from this novel material such as dies, rings, tubes, etc. Pellets or cylindrical shapes can be made by simply

cementing together several cut discs of sheet explosives. Du Pont EL-506 Flexible Sheet Explosive is relatively insensitive and, therefore, safer to handle than many other explosives used in forming work.

A single bladed cutting instrument, such as a lineoleum knife should be used to cut sheet explosives to insure against metal rubbing against metal and creating a spark. Do not use scissors.

All of the following examples have utilized EL-506.

One way of utilizing this explosive is in the forming of heavy cylindrical parts. A seven-inch diameter by three-eighths-inch thick wall tube of 8740 steel was expanded to a maximum diameter of nine and three-quarters inches on an eccentric axis. This is an example of an operation where it would be extremely difficult and probably impossible to form this piece in one operation by mechanical means. (The previous method of manufacturing this piece consisted of welding two forged ends to a cast cylindrical mid-section.)

A central loading of a cylinder of sheet explosive was used. The sealing was obtained by welding a metal bottom on the piece to produce a watertight "can." The tolerances obtained here on the main cylindrical portion were $\pm .003$ -inch. Intermediate annealing was required in forming this piece.

In forming flat corrugated sections, a pellet-shaped charge was obtained by cementing together several layers of EL-506. One of the versatile features of the sheet explosive is that during the experimental stages, when endeavoring to obtain the proper charge weight, it is a simple matter to add or subtract discs from the pellet configuration.

The same general system was used to form another shaped piece. The six-inch diameter dished head was formed from a flat sheet of .090-inch thick "Vasco-Jet" 1000. For this job it was found that by using several stacked two-inch diameter discs of sheet explosive, satisfactory forming results were obtained.

In the forming of large diameter dished heads, we have found that it is an advantage to use a ring shaped charge of EL-506. This system minimized the metal

wrinkling obtained when central point charges were used. This piece was difficult to form mechanically because of the high ratio of diameter to thickness, and normal pressing or spinning operations tended to wrinkle the metal.

Another operation utilizing EL-506 was the sizing of mechanically formed dished heads. In this case, the heads were preformed to nearly the dimensions required but were purposely left undersized by approximately one per cent. Again, this was a missile application where dimensional tolerances were rigid and could not be met by mechanical pressing alone.

The preformed head was placed in a die and sealed. Water was pumped into it and by detonating a ring charge of sheet explosive (average weight one-third to one-half pound) near the flange area of the head, the required dimensional tolerances of $\pm .010$ -inch were obtained. After trimming, the tolerances were $\pm .003$ -inch on pieces up to four and one-half feet in diameter and .110, .250 and .350-inch thick.

To give an insight into what is involved in designing a charge and a die necessitates a discussion of the static and dynamic pressures involved in the high explosive forming system. We know that at the instant of detonation pressures as high as 35 million psi are generated within the explosive. We know also that as we move away from the central core this pressure diminishes. Although the pressure is still very high, it acts only for a matter of microseconds.

Experiments were designed to obtain data so that we could better estimate our charge weight and design dies to withstand explosive forming pressures. Using tubing of known mechanical properties and detonating linear explosive charges axially located within it, the explosive charge was gradually increased until the tube just yielded plastically. This point was indicated by strain gages mounted on the tube. Thus, the explosive load in grams, which just yielded the tube, was assumed to be generating a dynamic pressure equivalent to static yield pressure of the tube.

Numerous experiments were run until a curve was obtained. Utilizing this curve, one can determine what explosive load will just yield the tube. These data have been

checked out quite well with tube diameters up to 24".

The die for explosive forming applications is perhaps the most important single element. We have heard much about low cost die materials and have used them, but we find that these relatively low strength dies can be used only for short runs and for pieces where tolerances are not critical. Our experience with cast materials for dies has, in general, been poor, usually because of casting defects. If possible, wrought materials should be used. These do not have to be tool steels but, if possible, should be designed with higher yield strength than the pieces being formed. The surface finish of the die is extremely important and controls the finish of the finally formed piece. In many cases, the configuration of the piece will necessitate a split die construction. We have successfully used standard high strength socket head screws for fastening such split dies. Quick opening devices such as channel designs may be desirable for production runs.

In general, no allowance for springback is made, although some may occur. In the head sizing example, we found that the cast die was actually growing after repeated shooting. Although the die had expanded diametrically .095 inch, with the proper adjustments of explosive load, the tolerances of $\pm .003$ -inch could still be obtained.

General considerations for forming applications include among other things the evacuation of the air from the die cavity. In the forming of deep drawn shapes, for example, it was necessary to evacuate the air from the die cavity to prevent deforming the piece. A vacuum of 26 inches to 28 inches of mercury was usually necessary for deep drawing of pieces with a single shot. Lubrication definitely assists in the amount of forming that may be obtained. One word of caution, however, is that the lubricant must be confined to an area where trimming is done so any entrapment of the lubricant between the piece and the die will not mar the finished surface. In the forming of deep drawn objects, such as dished heads, a hold-down ring was required to control the wrinkling and thinning of the piece. Prevention of water leakage between the die and the forming piece was an absolute necessity because leakage results in a deformed piece. Numerous meth-

ods have been used successfully for sealing such as "O" rings or rubber pads, gaskets, tape, or putty.

The general trend of those interested in explosive forming has been a desire to set up their own facility. Many companies have established either experimental or production explosive forming facilities at their own plant sites.

One of the initial considerations before starting explosive forming should be that of legal and insurance matters. Local ordinances usually regulate the use and storage of high explosives in populated areas so responsible officials should be contacted and their advice followed. The insurance companies should also be contacted to determine how explosive facilities can be built and operated within their regulations.

The extent of the facilities depends in a large degree upon the size and number of pieces that are to be produced. Some of the smaller pieces, which can be formed with small explosive charges, can be produced inside existing plant buildings. Larger explosive charges may sometimes be used indoors if sufficient barricading is provided and remote locations selected.

Outside forming facilities, the usual selection, may range from a simple sand bag barricaded shooting table to extensive underwater tank facilities with elaborate materials handling equipment. Again, the extent and complexity of the facilities installed depends upon the size of the pieces to be formed and the scope of the program.

The storage requirements for commercial high explosives are usually determined by local and state regulations. The Institute of Makers of Explosives has compiled and published the "American Table of Distances for Storage of Commercial Explosives" which has become a part of many state codes. The distances between the storage magazine and various installations such as other magazines, inhabited buildings, highways, and railroads are well defined. Separate storage magazines for the initiators and explosive stocks are required.

As previously mentioned, water is usually used as the pressure transfer medium in outside locations. Detonating explosives underwater tends to minimize the noise problem considerably. The general procedure in forming medium to large size pieces con-

sists of immersing the die and preform, with the explosive charge properly located, into a tank or pond of water. In some cases, however, a separate shooting pond is not required. An example would be in the forming of cylindrical or conical shaped pieces where the die itself, along with the preform can act as its own reservoir for the water. For applications where the explosive charge must be placed above the blank, as in dish head forming, a practicable solution is the use of expendable containers such as open-ended fiberboard drums mounted above the blank.

Of course, equipment suitable for handling the dies as well as the pieces to be formed is essential. This equipment may be in the form of a monorail or crane system or portable lift trucks.

Safety for operators and near-by workers should be the main consideration when setting up explosive facilities. We cannot emphasize too strongly that unless properly handled, explosive charges can be extremely dangerous. It is essential, therefore, to have a person in the forming crew who is trained in the safe handling and use of explosives. In some states licensed blasters may also be required.

The distance from the shooting area to the blaster's station will vary somewhat depending upon the amount of explosives shot and setup used. A barricade of some sort is recommended for the blaster. The preparation building for the makeup of explosives charges should be separate from tool storage area so that any impact and friction from

the striking of tools will be well away from explosive charges. The bench where explosive charges are prepared should have a smooth soft surface. Clean rubber belting with no cracks or crevices is satisfactory. Blasting caps should be kept separated from the main explosive charges until the last possible moment. A check for stray electrical currents should always be made before using electric caps.

Personnel should be chosen for explosive handling with emphasis on maturity, intelligence, and common sense. Explosives have been used in industry for years and the record for safety is an admirable one, but it is only through constant surveillance and supervision that this record is maintained.

In summary, we wish to point out that in our opinion there is a definite place for explosive forming in industry. There are a great variety of explosive charges that can be used and selection should be made after careful analysis of the forming problem. Properly applied, explosive forming can supplement present commercial forming processes and give the designer a new design dimension, because of the intricate and accurate shapes that can be formed with explosives.

ACKNOWLEDGMENTS

Grateful acknowledgment is given to the personnel at Eastern Laboratory, Explosives Department, E. I. du Pont de Nemours and Co., Inc., Gibbstown, New Jersey, who contributed to the data for this paper. Special credit is given to Dr. C. H. Wroning for his work in high speed photography and to Messrs. J. P. Sved and Bruno Chudzik for their work in the cupping tests.

AIR TRANSPORT SESSIONS

SOUND FILMS AT BARGAIN BASEMENT PRICES

By IRA THATCHER
Training Film Specialist
United Airlines, Inc., San Francisco, Calif.

Probably many of you have already made an excellent safety film. I have no doubt that any of you could make just as good a film as I can. I say this because I know that you, as safety engineers, have a great deal of creative skill, a large amount of initiative and unparalleled zeal in your work. If you did not have these qualities, you would not be safety engineers.

Good, economical, sound films can be made by your in-plant film maker, or by a commercial film maker in your area. The in-plant unit can be in your department or some other department in your plant. I would like to set the record straight from the very beginning. I believe that a good film must be made by a film maker, no matter how small his operation may be, and not made by a suggestion man, a personnel man, engineer, even a safety engineer, if he intends to make more than a single film. I have heard it stated that nearly one-half of the in-plant motion picture units have started in a safety department. That certainly is the way our unit started.

I started out making training films because we needed them in safety work, and all of a sudden I was making movies—not being a safety engineer. A safety engineer has a full-time job and so does the movie production man. If you go out and buy some equipment and start to make your own sound films, you will be starting a film unit in a small way, with a low investment, and as it gains acceptance, I am sure it will be expanded, but who, then, will do the basic safety work in your plant?

I still think safety engineering is a very rewarding work and you can continue in your profession as safety engineer and still have motion pictures at bargain basement prices. You will get them in exactly the same way that you get any bargain

basement price. I think you will agree that this is accomplished only by knowing what you are looking for, where to look and quite a good deal about the item you want; that is, how it is made, what kind of material it should have in it, and also, just as important, what you don't need in the item.

With some basic knowledge of what it takes to make a film, you will be able to get the help you need to make the film and not pay for help you do not need. You can do much of the work yourself without special equipment and techniques. You can provide help for the professional, that will reduce time and effort which are costly.

Here is a list of twelve steps in film making that must be taken into consideration by you to control costs: 1) your specific problem; 2) research; 3) creative work (story script); 4) studio and set rental; 5) locations; 6) electrical needs (lights); 7) camera and crew—motion and still; 8) film stock; 9) actors and props, narrators; 10) retakes; 11) laboratory processing (cutting, editing, recording, music); 12) animations.

With this basic list in mind, acquire one or two of the many books available from photographic stores or public libraries on movie production to help you determine just how to proceed with the parts of the production you can do yourself.

(1) Looking at number one on the list, what is the specific problem for which you need a film. Find it, analyze it, determine who your audience is to be and specifically, what is the purpose of the film. Never forget this point . . . is it to change an attitude, to teach, to get someone to take action? . . . determine your purpose. Get realism in the film. If this is clear and well defined, it will greatly cut the cost of any film regardless of who makes it.

(2) The second item is research. Actually, you are the only one who probably has already done all the research necessary, but you must know how to effectively pass the information on, or sum it up. When is the best time to shoot? Where is the best place? Where can the necessary props be acquired? Can you eliminate extra sets? How should the sequence of events be shot and how will they best show what you want of the operation in mind.

(3) The third item, creative work, is really important to cost. You, or someone in your plant can do this. Find a story, get a rough script, determine what will interest the audience, keep them interested, and explain your purpose in the simplest terms. What will show the action in the clearest way and what are some effective comparisons. Costs are in direct proportion to the amount of creative work you do and what you expect the producer to do.

(4) The fourth item is acquired studio rental, set design and construction. If you can't eliminate it, keep it to a minimum as it is an expensive item. Use your own plant work area and natural surroundings.

(5) The fifth item is location expense. In the air transportation business we sometimes lose sight of what it costs to travel from one location to another. But I am not talking about a film taken all over the United States. You can waste a lot of money in location expense if you have to move the camera and lights to several new locations right in your own plant. If possible, eliminate as many locations as you can. You will save expense and time.

(6) The sixth item is lighting. If the film can be made out of doors, you have completely eliminated a very big item. Lighting equipment is expensive to buy and use. I recently came across a list which someone composed which he maintained was the minimum lighting needed for an industrial film unit. It consisted of 23 lights in the \$100 to \$500 per unit class, a total of 30,000 watts. I know you engineers do not have to get out your slide rules to know that this would take better than 500 amperes, and where would you get juice like that in your plant? So, find out about lighting and you will make great plans to eliminate as much of it as possible from your film.

(7) Camera and crew—motion and still. This is where you need professional skill and professional equipment, but you can give assistance if you understand the problems. One of the problems you will have to deal with is the people in your plant who are absolutely sure that anyone can take an automatic camera, aim it, give a coast down, fire at all his eyes can see, and all the thoughts he is thinking will come out of the can in perfect picture and concise, clear, sound.

Another problem is the fellow who knows all about taking motion pictures. He has a home movie camera. There is nothing to it. He has been taking pictures since last Christmas. Don't think I am bitter—these are big problems and it will take skill and diplomacy, as well as knowledge, for you to convince these people, who may control the purse strings, that here is one place to spend what little money you have for a film.

Shoot a home movie of your vacation trip and the scenes, when projected, can bring back to you the town you stayed in, the delicious dinner you had, the sunset that day, the sunrise you saw to the east, the station where you got gas at gas-war prices, and many other memories, but only to you and those who were with you. Any training film, safety or otherwise, must show and tell, in complete detail, its story. The viewer relies on the film to understand the story.

Your eye is a marvelous thing—it sees wide angle, telephoto, close up—all at the same time in very good or very poor lighting conditions. Everything is in focus. Now try to take that picture with a camera. It would require many different lenses and cameras, special lights and editing skill to present it, and would require about ten times as long to put the same image on the brain.

(8) Item number eight is raw stock. This is the least expensive item in making a film, regardless of whether you make the film by shooting five times what you need or 500 times what you need. But, you can make terrific savings if you know what type of film is available and will be best for your specific situation. There is very little difference in the cost of using black and white and color, and there are several

color films for good light or poor light. The type of film available in 8 mm is limited.

(9) Actors, props and narration. If the film has realism in it, the actors are the people who do the job, and the machines and shops are theirs, an audience of them will be very interested. You also save the expense of hiring actors and constructing dummy props. With a little practice on a tape recorder you, or someone in your plant, can probably do a better job of narration than the local news commentator on the subject of your film.

(10) Item number ten—retakes. This is where you can save money on a film. Be careful, when a scene is taken, that it is the way you want it. You will find that an in-plant film can tolerate some imperfections. So try to use a scene, or part of it, rather than rushing out and retaking.

(11) Item number eleven is laboratory processing of the film. This includes many things and nearly every one of them requires expensive equipment and specialized personnel. There are hundreds of these labs all over the country competing with one another to do this work, and I assure you that the prices in most cases are very, very reasonable. These include developing, printing, trick photography, fades, dissolves, enlargements, reductions, recording, cutting, editing, dubbing and music. Many film pro-

ducers specialize in this part of film making. They will be very glad to help you with the phases you can do yourself.

(12) Item twelve is animations. There are many places where they can be effectively used, but are probably the most expensive item in making a film. Special equipment and art work are required to make animations.

I have not touched on 8 mm sound movies as they have absolutely nothing to do with the subject we are discussing. They are a new and marvelous step forward for the home movie field and will some day move into many phases of industry. But, the basic principles of film making are the same, regardless of the film size. Today, even the most ardent advocates and manufacturers of 8 mm sound equipment recommend shooting industrial films in 16 mm and reducing it to 8 mm.

In most cases, you can make sound motion pictures for your safety programs at bargain basement prices when you have a basic knowledge of the art of film making and take into consideration the twelve items we have discussed—doing for yourself those things you are capable of doing, buying from experts the things you cannot do without special equipment or skills, and realizing what the frills or accessories are which you do not need in an industrial film.

STORES TRAINING—RIGID PURPOSE, FLEXIBLE METHOD

By D. B. LANE

Supvr.—Stores Training & Packaging, Trans World Airlines, Inc., Kansas City, Mo.

This presentation on Stores Training systems, methods and facilities, as applied by TWA, was described and demonstrated by the use of projection slides and tape recordings.

The following is a verbatim copy of the narration.

The requirement for technically educating and training personnel assigned to the meticulous task of maintaining and protecting the physical inventory of the multi-

million dollar supply stores for TWA, became apparent.

When the company was young, the manpower markets provided personnel with adequate qualifications. Training involved only the teaching of procedures, which were peculiar to the company along with a minimum of technical information related to the physical handling of materials.

As the industry grew and the transport aircraft became more complicated, the man-

power market thinned. Technically qualified personnel became increasingly difficult to hire.

Supervisory workloads increased. — Procedures became more involved with the advanced steps toward automation and machine accounting. — Time available for adequate detailed on-the-job instruction became less and less.

When the new TWA overhaul base was activated early in 1956, the requirement for "wall-to-wall" training became a "must".

New procedures, methods and equipment — placed in use simultaneously with the new base activation required a change-over from the old systems to the new systems within a relatively short period of time.

To implement the changes and establish an effective means of educating new employees as replacements for vacancies created by promotion, etc., — a specific section of main stores was originated and entitled "stores training".

The stores personnel are scheduled through training courses in three phases: Phase One is designed to make a new employee with the stores department a productive employee in only five days.

This phase of the training program does not teach the exceptional procedures (which require experience with the department to permit understanding). It provides the basic routine, which covers the majority of production by any job assignment.

Phase One is presented in four steps—receiving, binning, order filling and shipping. Each step involves three hours of classroom training, followed immediately by approximately five hours, on-the-job indoctrination and practice, carefully audited by the instructor.

Phase One is completed with a written examination which was carefully developed to assure that the passing grade is a direct measurement of retention equivalent to knowledge gained by approximately five years with the department, without formal training.

Phase Two of the stores training program is presented to the trainee no earlier than sixty days later and is more comprehensive. Given to the employee when his job assignment has stabilized, it is a

course in which he receives the instructions on specific materials handling, exceptional procedures, and the "hints and kinks" of the specific job.

The titles of some of the Phase Two courses are: metals and raw materials, hardware, radio & electrical, airframe, engine, instruments and hydraulics, R&R procedure, catalogue reading, unit of issue, packaging.

There are many others, but these titles will give you some idea of the detail studies presented as Phase Two lectures.

Phase Three is presented every six months and is comprised of the changes to published procedures and methods, which have taken place within the past six-months' period. Designed for updating the employee, it provides refresher training in the areas necessary.

Special courses, training classes and presentations are being developed consistently as the requirement is recognized. Special courses are generally included in Phase Two training.

To fully understand the systems and methods used in teaching, as applied by the stores training facility, we look first at the classroom training.

For those persons who have had teaching experience, this explanation is not new . . .

A human being capable of mental acceptance and retention can be depended on to form opinions and make decisions which is guided by education.

That! is the prime purpose of classroom training. It provides opportunity to study the details and background of the job, which is necessary if accuracy is to be gained with peak production.

In the classroom, the trainee receives technical lectures and participates in discussions which enhances his mental guidance and reasoning when applying his physical efforts on-the-job.

Hence, the old saying when defining training as applied:

"You educate a man—you train a horse."

On-the-job training is given to the trainee after leaving the classroom. Based on retention percentage versus time, the trainee is placed on the job in a productive position. On-the-job instruction is given to assist the trainee in adjusting physically to the

assignment area and location of the tools used on the job.

Physical motions involved on the job are demonstrated and the trainee's duplication of trained efforts are audited for efficiency. Reports of audits are furnished to the supervisor in charge.

To repeat this in brief form . . . the trainee is given the why and how in the classroom and converted to habitual motions on the job.

To teach in the most organized manner and provide the trainee with the best opportunity for self audit and understanding: all courses are developed in the order of material flow. For example: the Phase One basic course for the new employee starts with receiving and is followed with binning. Therefore, when studying binning procedures, the trainee reviews and notes the errors he made previously during the receiving operation. The same applies during the entire processing cycle.

There are twenty-six separate types of mechanized and powered material handling equipment in use by the TWA main stores department.

All employees have been given an operator's check on each type. All individuals assigned to operate specific pieces of equipment, repetitively on a job, are given experience evaluation checks, and qualification records are maintained perpetually.

Such items as road checks for truck drivers, are given over frequently-traveled routes. Lift truck and other equipment operators are checked over hazard routes. The "do's" and "don'ts" described in the classroom are pointed out and demonstrated during this on-the-job check procedure.

On the subject of training aids—Within the stores training classroom, the complement of visual audio aids, and their operation is of prime importance to the over-all stores training operation and the following is a brief description of the facility and aids.

The classroom will seat a maximum of seventeen trainees, although classes of one are sometimes necessary when scheduled presentations have taken place during a vacation or period of illness. Returning employees must be updated to be able to do their job correctly.

Exhibits of parts, materials and forms are classified, categorized, grouped and wall-mounted for convenience.

Generally a new employee has had little, if any, experience or exposure to parts, materials, procedures or handling information, as applied to the airline business.

Recognition of metals by color, gram, measurement systems, etc., are taught from these exhibits and sample displays.

General hardware exhibit is categorized and displayed for easy recognition and basic guidance.

Radio, electrical and electronic parts are sampled and used for demonstration of proper handling, protection, recognition, etc.,

Textiles and fabrics are exhibited for recognition, special handling and measurement techniques described.

Material flow forms—their color codings—and informational forms—their applications, procedures and standard color codes—are exhibited and consistently studied for improvements in design and handling compatible to better training.

The blackboard—to aid the instructor during extemporaneous discussions and portrayals—instructor techniques in training aid use and development require extensive and continuous instructor training.

In addition to wall-mounted charts and exhibits, visual audio aids used during classroom presentations involve the use of 16MM sound motion pictures, primarily for showing commercially available films for supervisory technical training.

The 8MM motion picture equipment is used for showing films produced by the stores training section. Correct or incorrect methods, involving job motions, are shown for study and discussion.

The 35MM slide projection equipment is of the magazine load type which is synchronized with tape-recorded narrations, and can be used for detail studies of procedures and associated forms, processing, etc., when discussion between scenes is necessary, but motion demonstrations are not necessary. (Updating the recordings after repetitive showing permits editing to include the answers to most questions before they are submitted.)

Cameras of several types are used . . . the majority of them are available as by-

products of the business—obtained as unclaimed articles from the lost and found department.

The stores training permanent library includes three 16MM films—45-8MM films and 110 slide tape packages. These films and packaged courses are continuously updated to include all changes to be ready for class presentations, as required. All recorded presentations are retained and filed when superseded by updated packages.

This has been of considerable advantage when reviewing previous showings for referee use or debate purposes.

The use of slide-tape packages for detailed study has become increasingly convenient to use by providing masters for duplication and assignment to field stations for their repetitive review of subjects too comprehensive for retention by one-time viewing, or extensive manual study.

For example:—system training of the IBM 650 R&R material control procedure was duplicated twenty times and the twenty packages have been assigned system-wide for repetitive showing as required.

Proper development and editing of recorded presentations are found to be particularly advantageous because the normally monotonous monotone voice of the instructor, who is required to read prepared pas-

sages is replaced with the advantages of recordings to include sound effects, etc., when desirable. In addition, all employees hear and see the instructions identically without exceptions and instructor variations.

Classes can be held several months apart without forgotten points and factors.

Classroom sessions are more accurately and efficiently timed by tape-time standards.

More presentations can be given per instructor by reduction of fatigue factor.

The stores training section of TWA main stores maintains an extensive set of records to provide supervisors with information relative to each employee's training and his capabilities.

Studies are currently in progress toward development of a measuring system, which will indicate an employee's production gains throughout successive steps of training, as compared to production levels without training.

The purpose of the study is to provide proof of value received and the justification of training given.

To summarize . . .

This is:
Why We Do It
When We Do It
How We Do It

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AUTOMOTIVE AND MACHINE SHOP SECTION FERNANDO'S HIDEAWAY

By BRUCE PODZIUS
Safety Director, Detroit Diesel Engine Div., General Motors Corp., Detroit, Mich.

The Fernando that I am going to discuss is not a character in a song. Fernando is a machine operator at Detroit Diesel. Fernando's Hideaway was the inside of a machine and the object that he concealed was a tobacco can containing six small Allen wrenches. Every morning at starting time for four hundred eighteen (418) consecutive work days, Fernando would carefully remove four screws and take off a cover from the side of his boreumatic machine. Next, he would reach inside and retrieve his tobacco can treasure chest which he had hidden at quitting time the previous day.

On the morning of November 18, 1952, Fernando's luck ran out. As usual, he first pressed the starting button for the motor in order to cycle and warm up the hydraulic system for the machine wherein the tobacco can was hidden. Next, he removed the cover. As he reached inside, his left third finger was caught and amputated between a revolving "V" belt and a pulley. Fernando's Hideaway had finally been discovered!

It was almost incredible that a General Motors employee working in a safety-minded plant could perform a flagrantly unsafe act twice a day for four hundred eighteen (418) consecutive days without ever having been detected or corrected by his supervisor, his fellow employees or his safety department. It makes you stop and think, doesn't it?

We in the safety department did plenty of thinking. At first we consoled ourselves by saying, "It is difficult to control the human factor." Next, we reminded ourselves that the business of building Diesel engines is classified as heavy industry and serious accidents are more likely to occur in heavy industry operations.

Then came the thought that in spite of the fact that our safety program provided an hour and a half safety induction talk to each new hire, in spite of the fact that

supervisory safety meetings were regularly held, in spite of daily five-minute safety talks to employees, in spite of safety inspections, safety procedures, safe job instructions, safety rules, signs, slogans, bulletins—in spite of all this and more, it could not be denied that Fernando's unsafe action climaxed an entire year of several serious accidents at Detroit Diesel. Somewhere we were missing the boat. Four conclusions were finally reached:

First: All people perform unsafe acts.

Second: If one employee with better than average intelligence and with a previous accident-free record was able to perform a flagrantly unsafe act twice a day for nineteen months, it would involve higher mathematics to determine the number of unsafe acts that three thousand employees in the same plant would perform in the same time interval.

Third: In many instances a history of an employee's unsafe practices was discovered after actual injury took place. We needed a plan of action to detect and correct unsafe practices before an actual injury would result.

Fourth: The safety department needed help—plenty of help.

Early in 1953, the Detroit Diesel "Unsafe Practice Observation Plan" came into existence. Management, traditionally safety minded, accepted the "Unsafe Practice Observation Plan" as a supplement to the safety program based on the General Motors "Six Basic Principles of Safety."

It was decided to try the plan in the manufacturing division first. The energies and talents of thirty men were made available. These men were thirty manufacturing division foremen. Overnight the safety department had been enlarged 750 per cent. These foremen were the first recruits enlisted in an all-out war against the dangers of employee unsafe practices.

A letter from the works manager informed all manufacturing foremen that an

"Unsafe Practice Observation Plan" was going into effect immediately. The purpose and function of the plan was explained to the foremen by their general foremen. Each foreman was asked to observe, correct and describe in his own words a minimum of three unsafe employee practices each month. Each foreman was supplied a form to aid him in this work. On the back of this form were listed 44 reminders which serve as a thought stimulant to the foreman. The foreman after listing his observations and corrective measures would submit them to his general foreman.

After being reviewed by the general foreman, the unsafe practice observations, as described by the foreman, are compiled and sent to the printing department. Every foreman knows that his written safety contributions are being read each month by all supervisors in the manufacturing division from the foreman all the way to the works manager. This supervisory exchange of corrected unsafe practices and unsafe conditions is actually a take-off on the corporation "Safety Idea Exchange" plan.

By 1957, the "Unsafe Practice Observations" program had undergone two major changes. First, the original group of thirty foremen had been reinforced by seventy additional foremen. Manufacturing, material handling, inspection, toolroom and maintenance foremen had joined the ranks to combat the endless numbers of human errors. The second change for the better was brought about when the foremen streamlined the somewhat lengthy title of "Unsafe Practice Observations Plan" by nicknaming it "U.P.O."

The most astonishing aspect of "U.P.O." after its first five years of existence was the unaltered enthusiasm that the foremen themselves had in carrying out the three-way role of private eye, educator and author. This was reflected in the ever increasing numbers of items submitted by supervisors. In the minds of the participating foremen, this was not just another safety drive. They believed in "U.P.O." Fernando's tobacco can had become a plant-wide symbol for an employee unsafe practice. By 1960 it had become a matter of record that supervision at Detroit Diesel in seven years discovered over 15,000 unsafe practices.

To keep the record straight, it must be said that not everyone at Detroit Diesel welcomed "U.P.O." with open arms. A certain department head and his supervisors felt that to describe on paper something that was a part of their daily work was wasteful from the time standpoint and, furthermore, had a boastful tone. Traditionally, this particular department had averaged three lost-time accidents every two years.

There were times when we in the safety department felt a need to solicit the persuasive ability of top management to alter this department head's thinking, but we did not yield to this impulse because we subscribe to the belief that you cannot compel or coerce safety consciousness—it must be won. The passage of time solved this particular problem. In September, 1957, the above department head retired. His successor readily accepted "U.P.O." The results were amazing.

The new department head has yet to experience the heartache that accompanied a serious disabling injury to one of his people. Better than three years without a single disabling injury is truly a unique experience for this department.

At this point, I would like to describe an example of "U.P.O." at work. On August 1, 1960, Foreman Jim McCook submitted a "U.P.O." item wherein he stated, "While making a check for miscellaneous materials being stored inside electrical control panels, a panel was found with the 'on' and 'off' switch inoperative. The machine could not be locked out for maintenance employee safety during repairs. Condition was corrected."

The next day I asked Jim the reason for his safety inspection of electrical panel boxes. He replied that he read of foreman Al Voegel's experience in a "U.P.O." item written two months previously. I dug out the May 31 edition "U.P.O." and read Voegel's report, "Made a safety survey of electrical panel boxes in department. Found towels, tools and grinding wheels stored inside. Explained to all my employees the danger of this unsafe practice."

Foreman McCook's reaction to foreman Voegel's experience is the same reaction that you and I get when we read Ken Hedge's "Safety Idea Exchange" bulletins.

It is the same reaction that motivates you and me to look at our own plant operations so that we would not experience a repetition of the accident described in the corporation bulletin.

"U.P.O." through the medium of thought exchange builds hazard awareness in the minds of foremen.

I remember a few weeks ago, a visit that was made to our plant by Ben Gieslik and Ralph Deeds. Ben is Ken Hedge's right arm and also his left arm. Ralph had just become a member of the corporation labor relations staff. Ben and Ralph listened to an explanation of how a typical General Motors safety program operates. "U.P.O." was briefly mentioned. Later, while out in the plant, Ralph expressed a desire to meet and talk with a departmental foreman.

The first one we encountered was Ziggy Dombrowski. Ziggy is in charge of engine block machining. He was asked to explain the manner in which he operates his departmental safety program. Ziggy took off with all the enthusiasm of a hungry Detroit Lion football player chasing a Chicago Bear fumble.

Ziggy unloaded. He talked about his 100 per cent eye protection program. He talked about safety shoes, safety rules, safety guards, and then he said, "Oh, yes, I almost forgot unsafe practices. I always carry my 'U.P.O.' reminder sheet with me so that I can jot down observed items the moment I see them."

Ziggy took his "U.P.O." sheet out of this pocket and handed it to Ralph. Ralph proceeded to read out loud, "Jobsetter informed me that he had observed a machine operator place his fingers too close to a pinchpoint at an automatic indexing machine. A plant work order was issued to guard the hazard."

Cooperation on the part of the foreman is the very heart of "U.P.O.". This cooperation is obtained by employing the technique of job recognition. The various department heads at Detroit Diesel take careful pains to publicly demonstrate their approval for the "U.P.O." efforts of their line supervision. In addition, the safety department takes every opportunity to praise their "U.P.O." efforts through the medium of plant-wide bulletins. I have in my hand an example of how this is done.

Automotive and Machine Shop Section

In the Safety Idea Exchange Bulletin dated August 4, 1960, the last grim sentence states, "This is the fourth fatality in G.M. in 1960 due to a fall and again emphasizes the importance of using every precaution when working overhead."

Attached to this corporation bulletin is a Detroit Diesel intra-plant bulletin addressed to all supervision, which reads:

To: All Supervision

The attached Safety Idea Exchange describes the fourth General Motors fatality this year due to a fall. This type of tragic mishap has been singularly absent from Detroit Diesel.

After reviewing recent "Unsafe Practice Observations" by Detroit Diesel supervision, the writer takes this opportunity to thank fifteen supervisors. These fifteen supervisors corrected conditions that could have caused fatal falls similar to those that took place earlier this year in four G.M. plants. Listed are three typical examples of excellent supervisory safety alertness:

Foreman R. Dillaha: "Found 18 foot wood ladder with badly split side rail from the bottom to first rung. Ladder was removed. Condition was corrected."

Foreman E. Verkerke: "Observed millwright working approximately 15 feet above the floor. He was standing on top of a three inch diameter pipe safety railing which was part of a work platform. I warned him of this extremely dangerous practice. He came down and obtained another work platform of proper height."

Foreman R. Matchko: "Observed employee #712-122 standing precariously on top of lift truck while installing cable into a hoist approximately 12 feet above floor. He obtained a ladder."

This bulletin was concluded with "Please be alert for similar unsafe practices and unsafe conditions in your department. The life you save may be a co-worker's."

All General Motors plants have made tremendous progress engineering safety into methods and machinery. The principal plant problem in safety, therefore, is no longer methods or machinery. The principal problem is people. In order to reduce accidents, we must do a better job of engineering safety consciousness into the minds of people.

We believe that "U.P.O." has made our foremen much more safety conscious. Many of our foremen have told me that they particularly enjoy the correct-it-themselves aspect of this program. This is understandable when you consider that any foreman in any plant would prefer to personally correct employee mistakes and unsafe conditions in his department rather than to have some other member of management

do the correcting. "U.P.O." has helped make our foremen more responsible and more valuable members of the management team.

At this point it might be appropriate to look at the record. Seven years of "U.P.O." will be compared with the seven years that preceded "U.P.O." The comparison concerns itself with severity and frequency rates and accident compensation.

The average severity rate (number of days lost for every million hours worked) in the seven "U.P.O." years has been reduced 80 per cent.

The average frequency rate (number of lost-time accidents for every million hours worked) in the seven "U.P.O." years has been reduced 71 per cent.

As you know, accident compensation costs in recent years have risen enormously throughout industry. In our plant "U.P.O." has helped to reverse this national trend of soaring costs. Accident compensation paid at Detroit Diesel in these past seven "U.P.O." years was 72 per cent lower than the seven preceding years. This reduction represents substantial savings, but — more important — it indicates a minimum of disabling injuries to our employees.

This look at the record would not be complete without referring to the year 1957. For it was in 1957 that the men and women of Detroit Diesel worked ten consecutive months without a disabling injury. This accomplishment of 6,000,000 man-hours worked without a disabling injury established a national record in the field of engine manufacturing. This record still stands.

Do not interpret these references to the record as an indication of self-satisfaction or complacency. In the first nine months of 1960, Detroit Diesel supervision described more "Unsafe Practice Observations" than any single year in "U.P.O." history. The sober realization and reflection that accompanies page after page of recorded unsafe actions received each month makes complacency impossible.

As you know, the first of the seven General Motors "Basic Principles of Safety" emphasizes active top management support. It might interest you, therefore, to hear the reaction of three members of

top management at Detroit Diesel relative to "U.P.O."

Mr. Eugene Kelly, works manager, has said: "Unsafe Practice Observations are the backbone of our safety program. One half of safety is awareness of unsafe acts and unsafe conditions; the other half is prevention and precaution. These two needs are fully met by unsafe practice observations as we use them."

Prior to the discovery of Fernando's Hideaway, we at Detroit Diesel did not have this awareness of unsafe acts that Mr. Kelly mentions. We were forever locking the barn with corrective measures after the horse had been stolen, after the accident had happened. Today, we believe that "U.P.O." locks the barn before the accident takes place.

Mr. John McKenna, production manager, stated: "Our safety record in the material division, we feel, has been exceptionally good inasmuch as we have had but one lost-time accident in the past seven years. We feel that this is unquestionably due to our constant observation and correction of unsafe practices."

Mr. Stanford Varblow, chief inspector, declares: "The use of the plan has made every member of the Inspection Division a more active member of the 'safety team.'"

A little over two years ago, I attended a meeting with George Humphrey, safety director, at the Cadillac Motor Car Div. During intermission I told George of our "U.P.O." success story on five years of experience. The question was raised: "Will 'U.P.O.' work in another General Motors plant whose operations are vastly different than those at Detroit Diesel Engine Division?"

If this same question is in your mind, the answer is: "You will never know unless you try it."

Cadillac Motor Car Div. did try it. Cadillac titled their program "Before The Accident." At the present time the energies and talents of over five-hundred supervisors are being successfully employed in discovering the unsafe actions of Cadillac's Fernandos.

Do you recall our concern back in 1952 as to the potential numbers of unsafe actions that three-thousand employees might

perform in nineteen months? Do you recall that Detroit Diesel supervision uncovered over 15,000 unsafe practices in seven years? It therefore should not surprise you that supervision at Cadillac in six months uncovered 9,466 unsafe practices. When I received those figures from George Humphrey, I phoned my thanks and asked him: "George, three years ago if someone would have had the nerve to make a statement to the effect that close to 10,000 unsafe actions and unsafe conditions would be discovered in your plant in a six-month period of time in 1960, what would you have said?"

"I would have had serious doubts regarding his sanity," was George's reply.

Cadillac with their "Before The Accident" program is experiencing the same unexpected phenomena that we experienced at Detroit Diesel with "U.P.O." I am talking about the enthusiasm that all levels of supervision have for this "do it themselves" safety approach. Typical of several top management testimonials to their new safety concept are the words of Mr. R. L. Pratt, assistant superintendent, final assembly.

Mr. Pratt said: "We at Cadillac for many years analyzed all accidents. Not just the major or serious accidents, but also the minor scratches and cuts. Every hospital pass we investigated with reports, charts, records and statistics. We still continue this after the accident activity. With the 'Before The Accident' approach, we feel that we are preventing accidents before they happen instead of analyzing an accident after it happens."

George Humphrey sums up the Cadillac adaptation of "U.P.O." in this manner: "Our 'Before The Accident' program has greatly contributed to a gratifying Frequency and Severity record this year at Cadillac. In addition, we went four months — March, 1960 to June, 1960, inclusive — accumulating over 7,000,000 man-hours worked without a single lost-time accident."

Incidentally, I might add that George has

set up some spirited competition between participating divisions, wherein the total number of items submitted per division is divided into the number of man-hours worked within the division. Supervision in the material control division are currently submitting the amazing average of eighteen "Before The Accident" items a month per supervisor. This competition between divisions must be working when you analyze the fact that almost 10,000 potential accidents were prevented by Cadillac supervision in six months. This is foremanship motivation at its best.

The Frigidaire foremen participation program is titled "Job Observations." One of Frigidaire's plant managers came up with the idea. Although Frigidaire had never heard of "U.P.O." or Fernando's Hideaway, they discovered that they had their share of Fernandos also. Frigidaire reports over 1,000 "Job Observations" per month.

All plants have their share of Fernando Hideaways. Our concern should be to discover them. Frigidaire, Cadillac and Detroit Diesel supervision are aware of the fact that people with all their human shortcomings will perform unsafe acts. This awareness, coupled with determined action, definitely prevents accidents.

It would be most pleasant to conclude the story of "Fernando's Hideaway" with the words: "and as a result of the 'Unsafe Practice Observations Program' accidents ceased and they lived happily ever after at Detroit Diesel." Of course, this is not the true ending. All of us know that there will never come a time when anyone can say: "This is it . . . now all accidents will cease."

We do believe, however, that "Unsafe Practice Observations" have made Detroit Diesel a better and safer place to work for our employees. I wish to thank you for your attention, and I sincerely hope that you have been given an idea or two that might be of value to you.

TRADIN' POST

Presiding: LEWIS R. MORRISON, Corporate Mgr.-Safety, ACF Industries, Inc., New York City.

BOB REEVES, Mgr., Safety Services Sect., Ind. and Comm. Relations Dept., Allis-Chalmers Manufacturing Co.
Subject: Safety Modifications of Standard Push-Button Controls

Here are two gimmicks on push-button controls that we have made standard at our West Allis Works and which may be of interest.

Overhead Doors — Normal controls are "Raise, Lower, and Stop," momentary contact push buttons permitting the door to be stopped at any height. This is tough on floors, and possibly personnel, from dislodged loads when clearance is misjudged and door is struck by a truck.

We corrected this exposure by eliminating the "Stop" button and requiring the "Raise" control to be automatic. (The latter is standard on many units.) Under this arrangement, a single actuation sends the door to its top height with no way of over-riding or stopping it. The "Lower" button requires continuous pressure so the operator must stay at the control where he can make sure no one is caught under the lowering door. Removal of pressure on the

"Lower" button stops the door at any point. Of course, it's possible to bring the door back down to less than maximum open height on cold days, but we have found no tendency to do so.

Electric Elevating Platform—These are normally equipped with both a floor-operated set of controls and a platform set. If the operator leaves the platform while in up position, it is possible for a person on the floor to bring the platform back to the floor, leaving the upper man stranded. Also, the platform could be moved while in use. We require a selector switch on the platform control by which the operator can lock out the set of floor controls so the platform cannot be taken away without his knowledge.

These are both simple wiring operations that are easily accomplished. We find that several hazards have been eliminated by requiring them as standard hookups.

II

CLARENCE E. JOHNS, Safety Supvr., Canton Works, International Harvester Company, Inc.

Here are two ideas that we have used with success for the past year.

1. Captive wrench for acetylene cylinders. The assembled unit is attached to the



acetylene cylinder under the regulator mounting nut. The wrench has the distinct advantage in that it is always in place when it is needed.

2. Replacement for oil cans. Oil cans may cause trouble due to puncture wounds



The can may be damaged easily. We have replaced our oil cans with plastic containers, such as liquid detergent bottles. To make them into an oiling unit, we merely drilled a hole in the cap. The bottles are economical, easy to replace, remove an injury potential. Even more important, our employees like them and they become quite proficient with them.

III

E. SKINNER, Safety Administrator, St. Louis Assembly Plant, Chrysler Corp.
Subject: Trailer Safety Jacks at Shipping and Receiving Docks

This is one solution to a problem that I think we have all had in the past. You've noticed the different methods that are used for securing the trailers when they come in so they won't jump up in front when the fork lift goes in. We've made a set of jacks that we secured to the face of our loading dock or receiving dock. These

jacks swing out when the tractor or the trailer comes into place. They can be raised to any elevation. One problem—aluminum trailers. When we first used these, we were bending the structure underneath some of the aluminum trailers. To eliminate this, we put on a wood adapter which covers more of the trailer surface.

IV

H. L. KIRK, Mgr., Personnel and Safety, ACF Industries, Inc., Berwick Plant.
Subject: Air-activated Safety Gate

The walkway leading from one of the doorways of one of our buildings (Freight Erection) is located beneath the truck-carrying crane which travels past this door-

way to supply trucks to the track. Due to the usual amount of noise in this building, and the fact that the crane is overhead, workers stepped through the doorway

directly beneath the passing crane. In order to eliminate this hazard, we installed an overhead air-activated drop gate.

This gate consists chiefly of a round bar from which is suspended straps of asbestos. When the crane nears the doorway, contact is made with a third rail, which energizes the air-activated piston, which in turn

causes the drop-gate to lower. The asbestos straps on the gate are approximately 2½ feet long and swing freely on the bar from which they are suspended, so that if a worker should be immediately under the gate as it drops, he would not sustain any injury.

V

E. JAMES, Safety Dir., Sunstrand Corp., Rockford, Ill.

Subject: Relocation of Cooling Fans

Our air circulating fans mounted on pedestals were being placed in hazardous locations such as aisles and other areas having heavy traffic.

Our hydraulic division's plant engineering department picked up this problem, studied it, and solved it this way. They removed the fans from their pedestals. They then placed the fans on permanent mounts which

had been attached to selected building columns. The building columns used were those selected on the basis of air movement needed during the hot summer months.

This change not only removed a serious injury potential, it also eliminated a lot of controversy over who was going to use or place the fan.

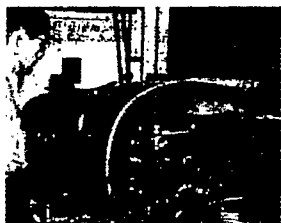
VI

J. K. SKIPTON, Safety Supvr., WKM Div., ACF Industries.

Subject: Shaving Shield on an Engine Lathe

A shaving shield on an engine lathe protects the operator from flying shavings thrown off by the chuck jaws or the revolving work.

The principle used here is a curved horizontal 12-inches-wide shield on roller



bearings that can be pushed left or right on a ¼ inch by 2 inch angle iron track the length of the lathe carriage. It can be pushed over the engine housing to the operator's left when he needs to chuck his work or to his right clear of tool post. The operator uses the shield as work dictates and at whatever point needed depending on location of the cutting tool. It has a removable plexiglas window to have work and tool visible. Where a coolant is used, it contains it within the machine. The skirt on back of shield under the ¼ inch angle track protects adjacent operations and helps balance the front overhang.

The roller bearings make it very easy for the operator, with a fingertip touch, to move the shield freely without interference to his production.

The shield has been successful in preventing burns and other injuries from the flying chips.

VII

ARRON COX, Supvr. Safety & Fire Prevention, ACF Industries, Inc., Albuquerque Div.

A. Magnesium Extinguishing Powder Cart

This piece of fire protection equipment is basically a garden and lawn cart with an attached lid and leg tray. The lid is attached



to disallow contamination of the extinguishing powder with metal chips and other debris. The leg tray is added to the cart to support a 2X shovel blade while the shovel handle rests on the cart handle.

This magnesium fire extinguisher has proved to be a very useful piece of equipment. It is very portable, holds 50 to 60 pounds of extinguishing powder; the wide opening of the lid makes the powder very accessible, and the 2X shovel provide an ample amount of powder plus being a useful tool to remove burning particles and for clean-up operations.

The cart and shovel are both painted red and marked "FOR MAG FIRES ONLY" in white letters.

B. Crane Hot Line Lights

Two red lights extending from a 440 volt to 110 volt transformer which is tied directly in line from the crane power supply act as caution lights to crane operators and maintenance personnel. There are two hot line stations on each crane circuit mounted above the crane rails, and are clearly visible in the crane operators and other personnel.

The hot line lights are not used to indicate the crane power line hot or not hot, but are used mainly as caution indicators and disconnect monitors.

C. Magnesium Scrap Cans

The magnesium scrap can is a safe means of controlling magnesium scrap and in providing a system of control for the fire potential involved in magnesium scrap within a plant area.

The can is made of ½-inch steel plate. It is 36 inches deep and 30 inches in



diameter. At 90 degree segments there are braced 2½-inch pipes extending 5 inches from the wall of the can. With this construction, should a fire exist in a magnesium scrap can, a lift truck or crane can easily and rapidly remove the can to a safety area without danger of the burning magnesium being contained in a shop or spreading it about while attempting to remove it from a shop area.

While a magnesium scrap can is in a shop, it is provided with a lid made of rolled one-inch angle iron and 1/16-inch sheet steel with a large handle attached to the lid center. The lid is basically used to disallow scrap contamination with other materials and to hold back the fire potential from cigarettes and lighted matches.

D. Lever Drop Lock

The machine lever drop lock was installed on an engine lathe housing between the high and low range back gear lever positions to prevent accidental range speed change of the back gear. The drop lock is set on an angular plate with an offset pin in the drop lock arm base to always cause it to be extended. In order to change range



speeds, it becomes necessary to raise the drop lock arm before repositioning of the back gear lever can be obtained.

The drop lock not only acts to prevent accidental change of the lever but also is a reminder to the lathe operator that he is changing operating speeds.

In the case of this installation of a drop lock the ratio of speed change was about 8 to 1.

E. Special Welder's Glove

A glove designed to meet a dual purpose. To allow operators of automatic welding equipment touch control and positive feel of the equipment's operating panel and to safeguard against ultra-violet rays causing damage to the operator's hands.

The glove hand is made of thin goat skin to which is attached a heavy five inch leather gauntlet to provide protection between glove and sleeve.

F. Welding Snood

A welding snood, made of black wool, is used to prevent ultra-violet ray burns to the back of the head and neck of welders working inside of cylinders and bowls of bright metals where reflections are prevalent. The welding snood is made to be attachable to the headband of the welding helmet easily. There are only two snap hooks involved in the attachment.

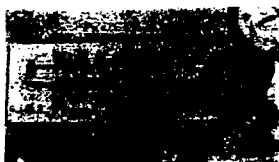
Along with use of the welding snood, the welding helmet is equipped with a fresh air plenum to supply the welder with



a constant supply of filtered fresh air removing possible heat, smoke, and fume problems.

G. Fire System Indicator Board

The purpose of the fire system indicator board is to mark attention to any part of the plant sprinkler and fire main system



that may be reported non-operational. With the marked attention to a non-operational part of the fire system, the plant security force and the plant fire protection section can maintain a closer vigilance over the indicated section, and be prepared to operate under a secondary system in advance should it be necessary.

The indicator board is a photo copy of the drawing of the plant fire protection and sprinkler system. The purpose of the photo copy is to reduce the board to a more suitable size. In this case it was reduced from a drawing 36 inches by 126 inches to 14 inches by 34 inches.

The photo copy was marked with colored indicators to represent the various valves and equipment of the system and each

indicator was numbered or lettered to correspond with its actual valve or equipment. Hydrants are indicated by a fluorescent green triangle; sectional valves on the main are indicated by a fluorescent orange square, and building sprinkler valves are indicated by a yellow circle.

The fully indicated and marked photo copy is mounted over a plywood back and under a piece of clear plastic glass. Below each marked indicator a 1/16-inch hole is drilled through the mounted board so that a non-operational indicator could be placed if needed. The non-operational indicator, a

round fluorescent red plastic tack with a 1/16-inch shaft, is placed in the mounting hole of the corresponding non-operational equipment. The easily noticed red indicator when placed on the board becomes a caution notice that a part of the system is non-operational.

A procedure requiring the reporting of any change in any operation of the fire protection system, either repairing, construction, testing, etc., to the plant security force and plant fire protection section is the first step of functional value for the basic purpose of the indicating board.

VIII

WILLIAM F. PITCHER, Safety Administrator, Kokomo Plant, Chrysler Corp.

Subject: Limit Switch for Electric Carts

We found that the employees using an electric cart had a tendency to ride with their foot out of the left hand side of the cart. This practice resulted in a four-day lost time injury earlier this year. To eliminate this source of injury, we substituted a limit switch for the ignition switch.

The limit switch is located on the left floor board. The employee must keep his left foot on the switch to maintain a closed circuit so that the cart will run. This is a simple change and cost us about \$12.00.

IX

MILTON RATHERT, Personnel and Safety Dir., Hages Hinge Co., St. Louis, Mo.

Subject: Metal Drum Check and Disposal

Our metal drums through hard use become ragged or torn at the top; and, as a consequence, created quite an injury potential. We frequently had difficulty in removing the ragged drums from our operation due to the fact that as soon as they were empty, they would be re-used. The procedure we set up to eliminate the re-use of bad drums consisted of:

1. Having our safety engineer mark a yellow X on the torn or ragged barrels he found.
2. The foreman sends all barrels marked with an X as soon as it is empty to the scrap bin.
3. An electric magnet is dropped on the drum, thus removing it from further use.

X

A. CAVANAGH, Safety Dir., The Budd Co., Inc., Detroit.

Subject: "I'm a Bug"

We had a problem. We went through a period which many of you have gone through and many of us are starting to limp back out of—a process of changing people from being of nervous individuals, people who are unsure. In short, I'm saying

we went through a period of a potential grave hazard, the changing around of people within a plant.

We had tried quite a number of things, the same things that I know most of you fellows have tried—posters, "Safety Every-

where . . . All the Time," "Knowing is Not Enough," etc. We had posters all over the plant; we had safety committees: everything you can think of, but we still had a problem because these things had been used. They were no longer new.

I had a brain storm, and this is my baby. He did a terrific job for us in four of our Budd plants; and, because he did a terrific job, we want to hand him to you. The program is entirely new, is attention getting, is talk-inspiring, is interest-arousing and includes everyone from the president to the newest sweeper if you want to make it do so.



Our program follows four basic steps. We call this the "I'm a Bug" program. I called together my executive plant safety committee, and I proceeded to make them "I'm-a-Bugs." This little character, "I'm a Bug," is symbolic. Here's the idea. "I'm a bug on safety. That's all he is, and it is easy to guess, but you'll be amazed at the number of other answers that it generates as you unfold your purpose.

I called this executive safety committee together, and I proceeded to outline to them the four steps we would follow, and I made them "I'm a Bug" simply by putting on their lapels an "I'm a Bug" pin. They became at that moment a bug on safety. Then, we hit the personal side by saying, "Fellows, as executive safety members, you are now bugs on safety and you are the stepping stone in our program that is going to take four weeks to cover. In that time you must, to make the program successful, follow implicitly the outline. By that, I mean for the next week you cannot tell anyone what that pin means. You have only one answer. The guy comes up to you and

says, 'I'm a Bug.' What's that about? What's it mean?' You say, 'You'll find out.'"

You know, that came to be a watchword overnight. "You'll find out." Pretty soon everyone was saying, "You'll find out."

During the first week, our executive safety committee, comprised of our top management in the plant, including our plant manager, wore pins that nobody knew anything about. The following week, we conducted our monthly foremen's meeting, and at that meeting we decided to bounce this program to them. We made them "I'm a Bug" simply by handing them the pin, telling them to put it on, wear it all the time you are in this plant. Further, don't tell anybody what this is about; just say, "You'll find out."

At the end of our second week with all our foremen and all our executive safety committee wearing this pin, there was no one who knew what it was all about except the wearers. We had a lot of curiosity aroused in our plant. At the beginning of this program, the first poster appeared on a Sunday afternoon throughout that plant anywhere there was a spare piece of blank wall, poster board or anything else. That poster appeared on Sunday afternoon with nobody in the plant. People coming in on Monday morning or Monday afternoon or Monday's third shift, everywhere they looked they saw an "I'm a Bug" staring at them. And it was talked about.

The second week, as far as the employees were concerned, foremen were wearing the same pins that were appearing all over the plant on posters. During the third week, our instructions to our foremen were that they would receive as many pins as they had employees working for them. We told them, "We want you to make your people 'I'm-a-Bugs.' This is how you can do it. You can make an "I'm a Bug" out of one of your employees if you see him doing something about which you have cautioned him and he is doing it right and he is doing it safe; or, he comes to you with an idea to prevent an accident in any way or form. We don't even care if it's a good idea or a lousy idea. As long as this man is thinking and has an idea that is acceptable or not, he is thinking safety. He is a bug on safety. Make him an "I'm a Bug." Tell him why, and tell him don't divulge it but

say, 'You'll find out' to any employee that asks him who is not wearing an "I'm a Bug."

Most important we had people talking, and we had them talking about something that, to them, was important. Those in the know thought they were pretty sharp. Those who were not in the know, we double crossed; we really double crossed them.

At the end of that third week, I sent a letter to all employees in our 6,000-man plant and this included our officers. The letter stated: "We suspect that the Budd employee in your family has already let you know about the little fellow, 'I'm a Bug.' He has become well known to all our people as 'I'm a Bug' born at the Budd Company's Detroit plant less than a month ago. He gained immediate acceptance by all who met him. In the campaign he has been conducting, he gained scores of followers every day.

"The only way in which we can describe him is to say he is an idea which has grown into an attitude and that is what an 'I'm a Bug' is. 'I'm a Bug' simply means 'I'm a Bug on safety. I am such a bug on safety that I am constantly alert for those things that cause accidents. Since most accidents occur because someone does something wrong, I'm always taking a look at the way I do things. I'm finding ways to do them better and more safely. I believe in bugging other people too if I find them taking chances, but such an idea is not confined to work out at the plant.'

"A fellow's wife bugs him until he cleans up that fire hazard in the basement, gets rid of the tripping hazards on the basement stairs, puts a new bulb in the dark closet, and many more too numerous to mention; but we can retaliate by pointing out that matches should be placed out of reach of children, high heels should not be worn on highly waxed floors, the radio should not be played in the bathtub and you know how it goes; but, when it comes to being a bug on safety, just think how we bug our children, teaching them to cross the street safely, teaching them to ride their bikes safely, and teaching them to live a full life safely.

"The Budd employee in your family is probably wearing a bug pin already. It was

given to him by his foreman in recognition of a fact that the employee believes in and practices safety. (Here comes the double cross.) If he hasn't received his pin yet, maybe he hasn't earned it by using safe practices."

I never heard such repercussions as we received from that letter. We had women calling, "What's my husband trying to do, kill himself over there? Does he practice safety, does he want to get hurt, can you control him? Make him do it."

We had men coming into my office, the plant manager's office, and the superintendent's office saying, "Look I want a doggone pin. I don't want to get hurt. What's this thing all about?"

That was the fourth week. These letters went out at the end of the third, so we told our foremen the plan of operation for the fourth week. The last week you have about 40 per cent of your people who are not "I'm-a-Bugs." As yet, they still don't know what it's all about until they read that letter. Now, you take five minutes and talk to every man who doesn't have a pin on. Explain why. You watched him for weeks trying to find one thing right that he was doing safely. One little extra thing or the fact that he didn't come to you with anything concerning a safety idea. Explain to him why "I'm a Bug" is important.

Now you give him a pin. Join the group. Become a bug on safety. We finished up those four weeks and very truthfully not because of my efforts, but because of the efforts of our foremen who ran this and the employees who loved it. We had a far better program, far more results, far greater and far revealing results than we ever would have anticipated.

The Greater Detroit Council is now handling this program. It is available to you. They in turn are going to make a little bit of money on it, not much, and they are going to use it for civic projects. During the week, our foremen received their pins.

One foreman in our tool shop had at home a little six year old daughter, who asked, "Daddy, What's the pin about?" So, he told her, "This is an 'I'm a Bug' pin. The safety man gave it to me over at work today, and I'm supposed to bug people on being safe so they don't get hurt. That

means I've got to watch what they are doing. I've got to get them to work safely," and with that he closed the subject.

He came up to my office on the second day. He said, "Look, I gotta have another pin." I said, "Only one to a person. That's what we agreed. Unless you can give me one whole of a good reason that you have to have another pin, that's the only one you get." He said, "Okay; my little daughter took that pin to school with her and she wore it, and the teacher wanted to know what it was about. So she told him, 'My Daddy got this over at Budd Company and that means he is a bug on safety. He's gotta watch people and he's gotta bug them

on safety.' The teacher took the pin and put the class to work, and she proceeded to copy that little guy up on the board as closely as she could and from that day on, she started teaching safety to those children for just a few minutes a day. They became 'I'm a Bug.' 'Remember, when you go home tonight, I'm a Bug on crossing streets. Remember tonight, when you go home and you play, I'm a Bug when I'm riding my tricycle.'"

There's a big wide open field. It's quick, short, inexpensive probably less than ten cents per employee, and I hope if you use them that you'll find the results even better than what we did.

XI

ROBERT H. CROSS, Supvr., Safety, Ternstedt Div., General Motors Corp., Flint, Mich.
Subject: Band-cutting Tool

As a result of an employee suggestion, a workable tool was developed for cutting bands on carton materials and coil steel. Present methods of cutting bands is to use some object, usually a hinge, to support band and to hammer band until it breaks. When cutting shears are furnished to the job, they disappear in a few days. The tool

developed as a substitute is much safer, is not attracted to other uses, and remains on the job.

A hardened drill rod is split, welded to a 1/4-inch pipe, and threaded for coupling to a handle. The tool is slid over the band, backward and forward motion being used until the band is sheared.

XII

HARRY A. HARRIS, Engineering Safety Coordinator, Farm Equipment and Research Engineering Center, International Harvester Company, Inc.

A. Test Engine Safety Clamp

The metal bands used to fasten our engines to skids were replaced with safety clamps to reduce the hazard of band cutting. The safety clamps fit on and become part of the skid. It is fastened with a spring loading nut, which secures the engine to the skid. The clamp can be moved back and forth along the skid to give maximum use

B. Spring Loaded Drums—Good For the Last Drop

Drums on storage racks frequently have to be tipped to empty the fluid. We put a spring loaded clamp on the rear of the drum. When the drum is full, the spring is down. As the drum empties, the spring raises the rear of the drum enough to allow the drum to empty as desired.

XIII

K. L. LEWIS, Safety Engineer, Delco-Remy Div., General Motors Corp., Anderson, Ind.
Subject: Center Post for Tumbler

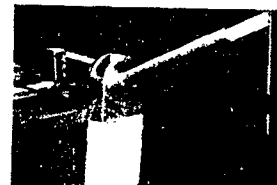
This idea is for the employee who gets his clothing caught on the outside of the tumbler. The idea involves adding a center post in the tumbler with a bolt attached.

A nut is attached to the cover. This allows the lid to be fastened at the center, thereby eliminating the projections on the side of the barrel.

XIV

ROBERT BEESON, Supv., Safety and Training, Perfect Circle Corp., Hagerstown Plant.
Subject: Fluorescent Tube Disposal

Our chief electrician saw the need for a way to dispose of used fluorescent tubes. We had been placing them in a drum and hauling them to the dump. As we began using longer tubes, this was a real problem because of breakage and the tubes being difficult to handle. The machine is placed



over a steel drum for the broken glass to drop in.

We require the men to wear eye protection and gloves when operating this machine but have had no trouble with it. It really does the job.



XV

PAUL KRAMOS, Chief Safety Engineer, Butler Mfg. Corp., Kansas City, Mo.
Subject: Safety Trip Bar for Plate Bending Rolls

An emergency safety trip bar was designed and installed on a 14 inch by 14 foot plate bending roll. This roll was originally equipped with an air cylinder operated end cap and interconnected top roll lifting mechanism. With slight modifications, this safety feature can be adapted to other makes and styles of rolls.

The heart of the mechanism is the limit switch installed above the trip bar at the center of the roll. The "up" or normal position of the lever on the limit switch

has the upper contacts closed and the lower contacts open. In the "up" position, the contacts are in series with the "stop" button on the magnetic switch for the motor. On the "down" position, the contacts are in parallel with the "down" button for the solenoid operated 4-way valve which operates the end cap.

The safety trip bar has spring plungers below and stop bars above to balance the weight of the bar and to prevent vibration

from tripping it. When a foot is placed on the bar, anywhere along its length, the top contact of the limit switch is broken which breaks contact on the motor starter holding coil and stops the motor. As the bar goes on down, the bottom contact of the limit switch is closed and the solenoid on the 4-way air valve is energized, allowing air to flow to one side of the air cylinder. This forces the end cap from the roll, and in turn through a rod linkage also raises the top roll.

The solenoids for the 4-way valve, which operates the end cap cylinder, are normally

controlled by two push button stations, one at each end of the roll. After the safety trip has been operated, it is necessary to push the "up" button at one of the two stations to close the end cap or the roll. Then the "start" button can be pressed to close the magnetic starter circuit and start the roll motor.

The approximate cost of this installation is \$125 material and \$125 labor.

If additional information is desired, contact Clifford Holt, Butler Manufacturing Company, 7400 East 13th Street, Kansas City 26, Missouri.

LOW VOLTAGE SHOCK HAZARDS

By T. W. McCREADIE
Div. Staff, Liberty Mutual Insurance Co., Chicago

If I were to say that high-tension electricity deserves the utmost respect, there would be no disagreement with the statement. Let's review some of the factors involved in the injuries and fatalities from voltage less than 440 volts which is usually called low voltage and see if some of this respect cannot be extended from the high to the lower voltages.

To illustrate my first point concerning the hazards of electric shock from low voltage electricity, I'd like to review two accidents involving electricity which were written in the daily paper a short time ago.

The first case involves a girl who had a habit of listening to the radio rather constantly and had even formed the habit of carrying the radio into the bathroom. The reconstruction of the accident estimated that the radio was on the side of the bath tub and accidentally fell in the tub and the girl grabbed hold of it to lift it out receiving a fatal shock from the standard house current.

Let's move on to another newspaper item. This concerns a Charles Brown, lineman for an eastern utility, who had been working on a de-energized 66,000 volt line, using ground chain and all standard precautions. At end of job he removed the chain just as the line was energized and received severe

burns of hand arm and neck through his leather jacket. He was thrown clear, he came to, drove his car 6 miles to a hospital and then spent 6 months in the hospital recovering from his burns.

Why did Charles Brown live through an attack by 66,000 volts while the girl taking a bath and many others you have read about in the newspapers die with ordinary house current of 120 volts?

The difference between the two incidents is contact. By the law of electric circuits called Ohm's Law, current equals voltage over resistance. To rephrase this law as it might apply to a shock condition we can write this law as follows: Current through body varies directly with the voltage applied to body and the resistance of that body. Resistance in turn is dependent upon amount and condition of body contact.

Current through body

Voltage applied to body

Resistance of body and contact

By means of an illuminated meter and electrodes I will illustrate this principle.

If you will watch the movement of the needle on the meter you will see how much current flows through my body under dif-

ferent contact conditions although the voltage in the circuit is consistent throughout, 90 volts. You notice that when I touch the two contacts together the needle swings to about 100.

Now as I gingerly hold these contacts with the fingers of each hand you will notice that there is a movement on the needle but it is not very high. As I contact more of each hand onto the electrodes you will notice that there is an increased amount of flow and as I grip the electrodes tightly with each hand I get rather closely to the direct contact reading that we had initially.

What have I been doing? The voltage has been constant, there has been no change in the internal resistance in my body and this highly variable shock current has been produced merely by changes in the contact resistance.

We can now see why low voltage shock varies so much from a trifling tingle to a severe jolt and sometimes to a lethal dose of electricity depending upon how poor or how good the contact resistance is that connects us to the circuit.

Take a situation in your own home. Under what conditions are you likely to be making good connection to ground and at the same time a good contact to some defective electrical device? Your basement is a somewhat dangerous place because basements are damp, but of all places your bathroom is the most dangerous.

If you get into a tub of water you have a very large area of wet contact with ground through the water in the tub and piping eventually leading to the earth. If you handle any portable electrical device whatever, whether it be a defective curling iron or a defective portable heater or a defective motor-driven device or a radio that had fallen into the tub you may touch a part that has become charged and your resistance of the body and its contact will be extraordinarily low. You will get a correspondingly severe shock to your body.

Now to illustrate to you how accidental electric shocks may occur through use of common electrical devices we have what I will call a Robot. This Robot is an associate in a uniform, on which are fastened strings of small lamps. These lamps will show how the flow of electricity would pass through his body when handling defective

devices. You may be sure however that we carefully insulate both of his hands and both of his feet from the contact in this demonstration.

These wands that I hold are now connected into the circuit supplied by the lighting system of this building. The most common form of contact is hand to hand, across one arm crossing near the heart and down the other arm. Again, the current may enter by the right arm, travel down the whole torso and leave by the right leg, or could cross over and leave by the left leg.

Now the Robot stands on two strips of metal, one foot on each and the wands are touched to the strips. Now this goes up one leg and into the torso and down the other leg and out. This is the type of shock received by a man stepping from the running rail to the third or live rail of a rapid transit system.

Now the Robot has both feet on a metal strip that represents a wet floor or ground outdoors and his right hand grasps a wand the other wand being moved down to the metal strip. Note this carefully as it is the most common way in which people get electric shocks. Standing on the ground they take hold of some electrical device that is defective and receive a charge in this manner. As you see, the current comes in through the hand and the current flows down the torso and slips into two branches, one going down each leg to each foot to ground. You will note that the lamps on the arm burn more brightly than those on the two legs.

The question of how electricity kills is one to be answered more properly by the medical profession, however, there seem to be basically two causes paralysis of the respiratory center and fibrillation of the heart muscles. The paralysis of the respiratory center has probably been well proven by the many instances of successful artificial resuscitation. This is a situation in which manual movement has overcome the paralysis of the respiratory center.

The situation in fibrillation is that when the stimulus given heart muscles by the electric current the heart is caused to flutter and operates so rapidly that it cannot perform its normal function and death follows very shortly. There have been instances of laboratory control. I am told, when the application of an equal and opposite electric

shock has successfully stopped fibrillating action, but this is only under precisely controlled laboratory conditions. In most instances a heart that goes into fibrillary contraction seldom comes out of it again.

Before we go into the demonstration of the equipment which we have on this panel I probably should first cover the point that has been made by some people that their house circuit is protected with fuses of rather low capacity 15 amps. In this equipment we have a 6 ampere fuse and I shall not depend on it for protection. In experimental conditions 220 volts with 1/4 amp. has killed a cow and I don't feel I am quite that strong.

Now I would like to show you the normal grounding circuit usually found in homes. The public utilities ground all their equipment, and the house equipment is usually grounded at the meter.

I have displayed on this board a variety of lamp sockets very commonly used for different purposes, and all are plugged into receptacles for operation on the supply line coming to this table. This demonstration is not a criticism of any manufacturer nor of any product.

These metallic sockets, for example, are perfectly safe to handle where the person using them is not grounded and where the live parts inside them have the insulation in the manner originally constructed, and have not become defective through moisture or damage. Also they must have been properly and carefully wired so that not even a single strand of wire is carelessly contacting the outside metal shell. To be certain, it is considered better judgment not to have brass shell sockets where it is possible to grasp the socket and be standing on ground of any kind.

On this next brass shell socket we have a pull chain. You will observe that the shock current continues whether the light is on or off. Please observe that the shock current continues even though the robot leaves the shell itself and starts down the pull chain. Of course when he passes the insulating link he is in a protected area.

We have seen a newspaper article concerning an overhead lamp in a boiler room in which a wire had been used to lengthen the pull chain and there was no insulating link. When an employee with wet shoes

attempted to light this lamp he received a fatal shock. The insulating link is not expensive but is very important. It is preferable to have these installations operated from wall switches.

The porcelain type socket should not be used where it would become subject to physical damage. On this next socket with a pull chain the porcelain is an excellent installation but any metal on the outside of that socket tends to make that socket potentially dangerous. None of the four sockets demonstrated thus far should be used under moist conditions.

This next socket (rubber covered, with pigtail) is one that should be used where moisture exists, such as in a laundry or basement and similar places. Even though this next and last socket is a safe one, it still requires proper maintenance and care to prevent damage to it. I observe that the Robot has indicated a shock current. I see that the socket is damaged. Apparently it was struck by something and the rubber got torn.

Now let's consider some industrial applications of electricity and the hazards of fixed and portable electric devices. First we'll wheel in our facsimile of a 50 hp motor. Any motor this large, of course, is securely bolted in place on a frame. Power is usually supplied in conduit. Installation is in accordance with the National Electric Code, and the frame is grounded.

However, as in the case of the electric lamp sockets we would like to show you that this motor will operate whether it has a defect in it or not. The Robot will step forward, please, and hold this motor. The motor is operating satisfactorily. This motor has a defect in it. The internal insulation has been damaged and has contact with the case of the motor.

The Robot will now put his foot on the grounded plate. Note that the motor does not change speed but that the lights come on, indicating a shock current from the motor through the body to ground. The National Electric Code requires grounding of the metal frame of the motor either through continuous conduit connection to ground or separate metallic connections to ground. This is a standard practice. This required grounding protection should be checked at intervals to be certain that it has not deteriorated and become useless as protection.

When we were talking about the contact through ground we frequently mentioned moisture. The Robot and I would like to demonstrate how little water is necessary to create this current-conducting moist condition. Notice that I have now fixed the ground plate so that there is a piece of blotting paper between the ground connection that we have to the water faucet and the plate on which the Robot is standing. I will now take about, oh, say a quarter teaspoon of water and place it in the holes on the top plate on which the Robot is standing. (At this point the lights on the Robot come on gradually.)

You will notice that not much water was used and there is now a complete ground circuit in operation. At this point it might be well to mention that several studies made at a munition plant during the last war proved to their satisfaction that concrete was a good conductor for relief of static charges, so let us, for purposes of electrical installations, not consider concrete automatically as insulation. Wood, rubber, leather are consistently better.

I have heard of instances where multiple deaths were due to electric shock because the person or persons observing the initial accident rush to help without taking proper precaution of disconnecting power or insulating themselves from the shock current. One incident that comes to mind is the one that occurred a short time ago in a coal yard where a coal loader which operated on 220 volts was being moved to a new location in the yard by two men and in the maneuver the supply cord which had not been disconnected was twisted in such a manner that the frame of the loader became charged.

The two men were instantly killed and two others observing the accident ran over to lend assistance and also were killed. There also has been a recorded instance of an employee teaching another employee how to operate an electric drill, the drill was defective and while the men had their four hands on the drill their feet touched a grounding source and both were killed.

In talking about electric drills, let's see our expensive half inch drill so that we may demonstrate the addition of a ground wire and the benefit which can be derived from such protection. As I said on the

sockets and as I have repeated, when manufactured the equipment is in good order and is safe to use, but through abuse, misuse, moisture or some other contaminating influence the case of the machine can be electrically charged. Now you will notice when the Robot holds this drill it continues operating regardless of the fact that it is defective and some current is passing through the Robot's body.

Let's change the equipment so that we can demonstrate the benefit of a grounding device. Now we are placing this ground wire on the frame of the drill and we will plug it in so that it will operate. You notice that a fuse has blown and that the lights on the Robot did not light up.

Through the use of this ground wire we provided a path for the electricity which was easier for the electricity to travel in than through the body of the user.

Check your equipment to make certain that the additional wire which the manufacturers are supplying as standard equipment on portable tools is always used for a continuous circuit to ground and is not being considered as that "little pigtail that is in the way" and is snipped off. It is a life-saving feature that can only save a life when it is utilized.

To summarize: control the situation of one hand on a faucet and one hand on a bare pull chain—get an insulating link in those pull chains, if you cannot put in a wall switch.

Electrical devices used in the bathroom should not be near the tub, that is the point of the maximum low resistance contact.

Portable tools should be grounded, extension cords should have a third wire so that they can carry the ground back to the proper location when a portable tool is used at a distance from the socket. Large portable machines should have polarized plugs so that they cannot be used without being grounded first—like this type of outlet. (Hold up polarized plug).

Electricity can continue to be your best servant if you do not let it get to be your master. Use the protective devices available, make sure that all others do too. Spread the gospel that electricity should have respect whether it's high voltage or whether it's low voltage.

POWER PRESS AND FORGING SECTION HOW POWER PRESS OPERATORS GET HURT

By E. D. SALLEE
Mgr., Safety & Industrial Hygiene, American Can Co., New York City

Even to a neophyte in the business of attempting to improve effectiveness of a power press safety program, the title of this presentation may seem somewhat trite. Everyone who has seen a power press in use undoubtedly has some definite ideas of the types of personal injury hazards involved, and how the press operators might get hurt unless effective preventive measures are maintained.

It is probable that most such opinions are correct. It certainly isn't difficult to arrive at the conclusion that getting hands or fingers under a descending press punch can result in tragic, bloody injury. This is the picture, apparently, that commonly enters the mind during everyone's first consideration of power press safety. But this is far from the complete story. Keeping hands out of the area between a punch and die is of cardinal importance. However, it is only one of a great number of aspects that are essential in a good power press department accident prevention program.

American Can Company has been both a manufacturer and a user of power presses for the past sixty years. We have learned a great deal about power press safety during that time—and there is much more to be learned. A check with several other major users of power presses indicates that their accident facts, and development of preventive measures, closely parallel ours. Sharing of this experience may spark some ideas on how you may improve your accident prevention effectiveness.

The purpose of this presentation, therefore, is to review the facts about causes of accidents among press department workers in my company. From such analysis we get pertinent and helpful information on who gets hurt, where they get hurt and how badly; and most important, how and why they get hurt. Facts on these salient points then lead to logical steps on how most effectively to go about eliminating the causative factors.

The study covers all power press department accidents reported in our metal operations last year. Some 2810 of the presses are for punching out and forming the ends for metal cans at rates up to 400 strokes per minute. About one-third of these are automatic, the operator's main task being merely to keep the feed hoppers filled with stock. About 2000 of the total number of operators work at either semi-automatic single-action presses in which the plate is fed and positioned by hand and the press activated by a foot treadle. Plate fed into the presses ranges up to 24 gauge, although the bulk of it is in the order of 0.006 to 0.009-inch thickness.

We consider our presses well-guarded. Each of them is provided with a point-of-operation barrier, the flywheel is totally enclosed and there are no exposed gears. Where the point-of-operation guard is the hinged type it is connected to an electrical interlock to shut off power when the guard is open. Die blocks and appropriate tools for cleaning scrap or "jams" from the dies are provided with each unit. Scrap and product ejection or stripping is automatic whenever the press is practical.

A great deal of time, effort and money has gone into the attempt to make the presses free of significant hazard. We are convinced that this has paid off. Despite this, however, we are far from satisfied with our press department injury rates.

In view of the money and effort spent toward eliminating hazards, it is sometimes a little difficult to explain why accident costs and frequency rates are not lower. The answers, of course, can be found by digging out the accident facts—the causes or reasons for the accidents that result in employee injuries.

In this quest for accident causes it would seem only natural to turn to the persons who are closest to the operations—the press department foremen and their long-service employees. One would think, certainly, that

the individuals with many years of direct on-the-job experience would have some clear-cut opinions on who gets hurt, how and why.

We find, however, that even among these experienced specialists there is divergent opinion. The operators and mechanics themselves are prone to attempt fixing the blame on the machine, the materials and tools furnished or the working conditions, but rarely on the possibility that they made an error or committed an unsafe act. The foreman, on the other hand, has a tendency to over-emphasize employee shortcomings and generally play down any unsafe conditions, since admitting to the latter would be largely self-criticism.

On many occasions we've asked press department foremen for their opinions on the greatest sources of employee injuries in their respective departments. Despite the fact that their departmental accident records were essentially the same and the equipment and working conditions practically equivalent, we usually get varied answers to this question. The following opinions are typical:

"Operators swing the guards away and stick their fingers between the dies to clean them out, rather than using the picks or longers."

"Mechanics neglect to use the die blocks."

"Operators now-a-days just aren't careful."

"Operators 'jimmy' the limit switch so they can open the guard with the press still under power. Get jimmy-proof switches and we won't have any more injuries."

"Despite all the care taken to assure good clutch maintenance, brake motor maintenance, etc., once in a blue moon something goes wrong and we get a 'repeat'. Eliminate repeats and you've solved the problem."

"The mechanics get in too much of a hurry and put their fingers between the dies before the flywheel has stopped, even though the power is turned off. The press repeats and they get hurt."

"The set-up men often want to try out the machine before replacing the guard. Make sure the guard is always replaced before the power is on or the flywheel can be moved, and you'll have no accidents."

Most of these are good observations. Even though they're varied, they have one thing in common—there is universal concern for prevention of the exceptionally severe injuries, the bloody and tragic amputations. The cases in which descending dies chop off hands or fingers are the more morbidly dramatic or spectacular type, and it is natural for these to stick in the supervisor's mind.

But these are certainly not the complete picture. If press department supervision's preventive efforts are limited to forestalling such injuries, largely neglecting the myriads of other potential sources of accidents, then trouble in large doses is bound to result. Any really successful preventive program must be well-rounded, and it must be based on fact. The general impressions related by individuals, even those with direct work experience, can be misleading.

Accordingly, we have made extensive effort to establish the facts about our accident prevention needs. We find that proper use of past experience is a major aid in getting the needed facts. For that reason for the past several years we have been using a business machine system for correlation of information obtained in accident investigations. Each accident that results in injury of such severity as to warrant a doctor's attention is thoroughly investigated, with particular emphasis on the accident causes and the preventive action taken to prevent recurrence. The information is then coded and transferred to punch cards, from which correlations of company-wide experience can be obtained conveniently for any type of operation, type machine, type injury, etc. It's a good tool for getting maximum use from accident investigation information.

Use of such means of data correlation requires, of course, that the numbers involved be large enough to warrant business machine tabulation methods, and that the information fed into the machines is valid and representative. We find that correlation of all "doctor case" accidents satisfactorily meets these requirements. With respect to accident causes the information on the sequence of events or circumstances culminating in a particular type accident does not necessarily vary with severity of injury. It's the severity of the injury that is frequently influenced by chance, not the prime causes of the accidents.

For purposes of this particular study our 4262 press department employees were grouped in three categories according to their work duties: (a) 66 per cent are operators whose duties are to feed the press or off-bear, (b) 22 per cent are mechanics whose duties include all die-setting and direct maintenance, repair and adjustment work, and (c) the remaining 12 per cent are other press department employees with various miscellaneous jobs such as operation of equipment auxiliary to the press operations, bringing stock to the press area, packaging finished product, janitor work, quality control inspectors, electricians, etc. No employees in this third category work directly on or with the press machines, although all of them are engaged full time in the immediate vicinity of the presses.

Last year our press department employees made a combined total of 40,000 individual visits to our plant first aid rooms for occupational reasons. These same employees suffered a total of 610 doctor-case injuries, of which 42 were disabling. Detailed analysis was made of the accident investigation information on the 610 doctor cases and results of the correlation are summarized in the accompanying charts.

Fig. 1—Press Dept. Accidents—How They Got Hurt

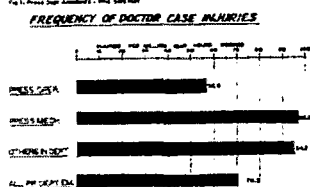


Figure 1 shows the incidence of doctor-case injuries for the three categories of press department employees. For convenient comparison purposes, incidence of these cases has been converted to the familiar frequency rates—the number of injuries per million man-hours worked. Bear in mind these are doctor-case frequency rates, not disabling injury frequency. Note that per unit of time worked operators get hurt significantly less often than mechanics. Other workers in the department also get hurt

more frequently than operators and at practically the same rate as mechanics. The press machines themselves, however, are not involved in the accidents to the miscellaneous workers in the department.

The relative magnitude of the overall preventive or corrective attention required is a function of the product of frequency rate times number of employees in each category—66 per cent are operators, 22 per cent are mechanics, and other workers in the department comprise 12 per cent of the department population.

Fig. 2—Press Dept. Accidents—How They Got Hurt

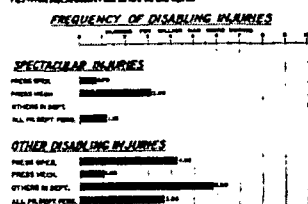
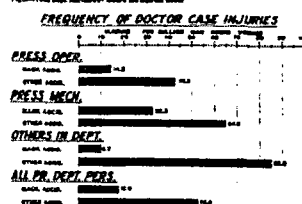


Figure 2 shows who suffers the extremely severe or disabling injuries. For purposes of this discussion we have further classified these in terms of frequency rates for (1) the so-called dramatic or spectacular injuries (permanent partial disabilities), and (2) all other disabling injuries. The latter involved no permanency of disability, just lost time only. Note that all the spectacular injuries were suffered by press mechanics and operators, none by other department workers. Four operators and two mechanics had fingers amputated—all during work directly at the presses. The remaining four spectacular injuries (permanent partial disabilities) were severe lacerations and fractures, all of which occurred during work at the presses. However, only 10 of the total of 42 disabling injuries, or 1.6 per cent of the total doctor case injuries, were of the spectacular type—the type that foremen and many others tend to remember, and to base preventive action accordingly.

Figure 3 is summarized information on where the employees were working when they got injured, shown as doctor case frequency rates, in which the power press

Fig. 3—Press Dept. Accidents—Where the Injuries Occurred



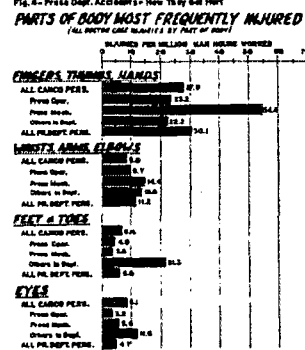
itself was directly involved. This is compared to incidence of accidents when the press machines were not involved. Note that with all categories of press department workers, far more accidents occur at activities away from their machines than at them. While the spectacular injuries are more likely to be suffered at the presses, the large proportion of other injuries incurred away from the machines warrant commensurate preventive effort.

The next four charts, Figures 4-7, present more detailed basic information on the nature of accidents and injuries to these same employees. Again, the data are expressed in terms of doctor-case injury frequency rates. Only the more important factors are shown. The several additional miscellaneous items involved in the accidents and resultant injuries, while important individually, are too few in number to influence general direction of a preventive program. For general comparison purposes, data on these same factors are given for all plant employees, to give a better idea of how press department workers rank in our overall accident prevention program.

Figure 4 gives relative incidence of the various Parts of the Body Injured. Fingers and thumbs are the most frequently injured members in all of our operations, but note that incidence of such injuries is considerably worse for press mechanics than for the average plant employee. Press mechanics also give their hands a bad time. As will be noted later, much of this is due to mishaps in their use of hand tools, which is an obvious hazard in common with duties of mechanics in all departments.

Injuries to wrists, arms and elbows among press department personnel are only slightly

Fig. 4—Press Dept. Accidents—How They Got Hurt

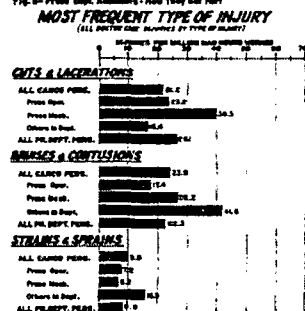


higher than the general average, but press mechanics again have the worse record.

For other press department employees (those that handle the material skids, pallets and other bulky items), there is a prevalence of damage due to their dropping these materials on their feet and toes.

Figure 5 is a summarization of the nature or type of injury suffered. As might be expected where the major material handled

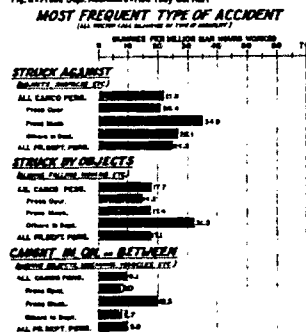
Fig. 5—Press Dept. Accidents—How They Got Hurt



is sharp-edged plate, cuts are the most common injury. As might be expected, incidence of these lacerations among press operators is higher than the company average—press operators have higher than average exposure to tin plate, in feeding the presses, off-bearing, piling and unpiling it, clearing jams and wrecks from the machines and conveyors, etc. But incidence of cuts suffered by mechanics is surprisingly high despite the fact that, by comparison, they handle plate relatively infrequently. Indications are that since handling plate is not part of their regular routine, they have not developed the knack of handling it safely.

Miscellaneous press department employees are out of line with respect to incidence of bruises, strains and sprains. This too is in keeping with the fact that they handle the bulky and heavy materials.

Fig. 6—Press Dept. Accidents—How They Got Hurt



Types of accidents in which these workers are involved are recapped in Figure 6. Accidents in which employees inadvertently "strike against" (objects, surfaces, machines, materials, etc.) are the most common type. Mechanics are again the bad offenders in this category. Mechanics seem to have a rough time in inadvertently banging their hands against machine parts, guards, etc., when their wrenches or other hand tools slip.

For other workers in the press department,

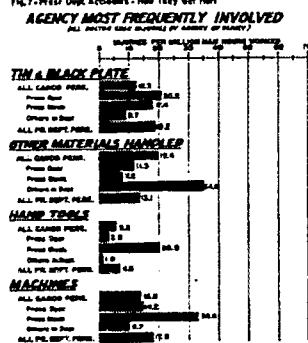
the accidents involving "sliding and falling objects" are the most common. This is plausible since these are the workers that are occupied principally at material handling and transporting jobs—work around stacks and piles of raw materials, skids, finished product, etc.

The "caught in (on, or between)" category includes, obviously, our few spectacular injury cases as well as the accidents resulting in less severe injuries. Mechanics have the poorest experience, getting fingers caught under dies, or lacerated or bruised in plate feed or product discharge mechanism. Note, however, that incidence of such accidents is comparatively low for operators, which speaks well for our guarding effectiveness. These are the factors, of course, that make good guarding imperative, with particular emphasis on employees' effective use of the guards.

Note, also, that even with the press mechanics the "caught in" type of accident is not the most common. They represent only one-fifth of all injuries suffered by mechanics. Obviously, it is a highly important proportion of their mis-haps, but it should not be over-emphasized at the expense of overlooking more frequent types of injury.

Figure 7 is a recap of the item most closely associated with the accident. It is that agency or item which was used improperly

Fig. 7—Press Dept. Accidents—How They Got Hurt



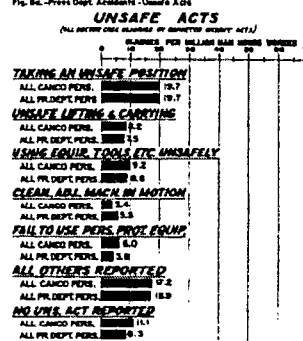
or could have been corrected. Note that both operators and mechanics get hurt more frequently than the average employee due to handling plate. Other employees in the department don't routinely handle plate—their mis-haps with plate are primarily due to inadvertent brushing against stacks of it or in handling the scrap. But these miscellaneous employees routinely handle or are exposed to various materials other than plate, such as trucks, skids, cartons, packages, etc., and their accident experience is influenced almost proportionately.

As mentioned previously, mechanics have a comparatively high incidence of accidents in which hand tools are involved, the most common type being improper use of wrenches in tightening or loosening a nut—the wrench slips off and they bang their hands on the machine or other objects. Also as might be expected, the mechanics have relatively high incidence of accidents in which machines are involved. This "figures" since most of their work is with machines.

Up to this point in our discussion we've reviewed facts about *which* press department employees get hurt, where they get hurt and how. It's sometimes hard to differentiate between *how* people get hurt and *why* they get hurt. Let's now examine some of the reasons *why* press department workers get hurt, as shown by analysis of information obtained on their accidents last year. These are the unsafe acts, the unsafe conditions and other factors which contribute to the sequence of events and circumstances resulting in accidents.

Starting with the unsafe acts, Figure 8a lists the most common incorrect actions that led to the various injuries suffered by our press department workers last year. Taking an unsafe position, with respect to the work being done or the particular activity in which the employee was engaged, was the most common error resulting in injury. This includes a variety of unsafe acts, such as: climbing on, over or around machinery or other items; sticking hands and fingers too close to a recognized hazard; standing, walking or sitting in the way of department traffic, trucks or other workers doing their jobs, etc. In each instance such actions were entirely unnecessary to perform the work and are in violation of established safe practices. They are not the type of hazard that can be controlled by further guarding

Fig. 8a—Press Dept. Accidents—Unsafe Acts



or practical alterations in production processes.

Unsafe lifting and carrying results in a significant number of accidents but press department workers are no worse than the average plant worker in this respect. Using equipment, tools, etc., unsafely is also a significant causal error although, again, press department people are no worse than others.

Cleaning, adjusting or repairing equipment while it is in motion results in comparatively few accidents but we are particularly critical of these since such accidents are almost invariably the bad ones—the spectacular injuries mentioned previously. It is a cardinal rule to do this work only when the machine is stopped and power turned off—but, obviously, there is not always strict compliance.

There are, of course, several other specific types of unsafe acts, not listed, accounting for a combined total of about one-quarter of the total unsafe acts committed by press department workers, but the numbers of these additional individual types of unsafe acts are too few to be statistically significant. As indicated, there are also a number of accidents in which no unsafe act was committed, the mis-hap in such cases being due entirely to an unsafe condition or other contributing factor other than an error by the injured employee.

Fig. 9a - Press Dept. Accidents - Unsafe Acts

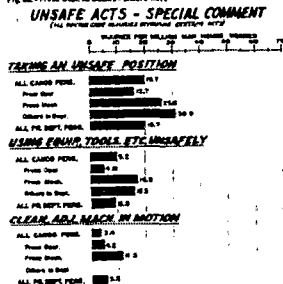


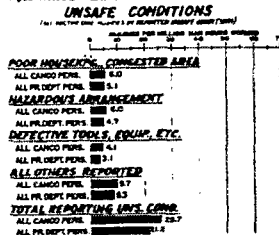
Figure 9a gives further breakdown of common unsafe acts committed by press department workers. Note that operators are better than average in refraining from positioning themselves or parts of their bodies in vulnerable positions. But mechanics, and particularly the other press department workers, frequently get out of line in this respect.

In unsafe use of equipment and tools, mechanics and miscellaneous workers are the frequent offenders.

Violation of the rules prohibiting work on machinery in motion is most common among mechanics, but in view of the relative proportion of time spent in direct work on machines, they are probably not worse than the average employee. This particular unsafe act gets our safety men hotter under the collar than any other rule violation, because of severity of injuries involved, but "machinery in motion" accidents actually account for only 7 per cent of the total.

The influence of unsafe conditions in our press department accidents is summarized in Figure 9b. These data corroborate our justifiable pride in our guarding program, and the success achieved in controlling unsafe conditions. Unsafe acts are involved in 88 per cent of our accidents in press departments; unsafe conditions in 30 per cent. In 18 per cent of the cases a combination of unsafe act and unsafe condition is involved.

Fig. 9b - Press Dept. Accidents - Unsafe Conditions



If we could eliminate all unsafe acts our accident toll would be reduced 88 per cent. This, obviously, is where major preventive effort is in order.

Fig. 9c - Press Dept. Accidents - Unsafe Conditions

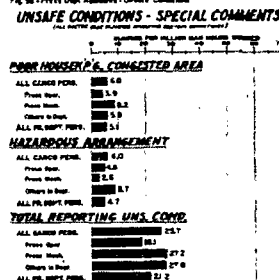
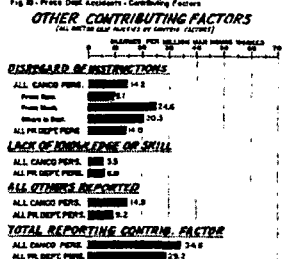


Figure 9b gives further breakdown on the major unsafe conditions encountered by our press department employees. Housekeeping, congestion of equipment and materials, or their hazardous arrangement, are the prime factors in this category. Housekeeping is critical with respect to mechanic accidents—it is sometimes difficult to maintain good housekeeping when machines are torn down for repair or overhaul. Hazardous arrangement of materials, of course, is

significant in the safety of the miscellaneous department personnel that handle bulky packages, skids, etc.

Fig. 10 - Press Dept. Accidents - Contributing Factors



In many instances there are readily discernible reasons why unsafe acts are committed or unsafe conditions develop. We call these contributing factors and they are recapped in Figure 10. In any good investigation of an accident, effort should be made to find these underlying reasons. Not all accidents, of course, have recognizable contributing factors, but where they are known, such information can be decidedly helpful in programming preventive efforts. Known disregard of instructions, for example, plays a significant role in the unsafe acts and resultant accidents occurring to mechanics and miscellaneous press department workers, indicating need for further enforcement. Lack of knowledge or skill points up deficiencies in getting workers adequately trained. In our press department this training or skill deficiency accounted for a total of 6 per cent of our accidents. We were able to recognize definite contributing factors of one kind or another in only 40 per cent of the press department factor-case accidents. Others, not detailed on the chart because of their relatively small number, are physical deficiency of the injured person and unsafe actions of persons other than the injured person.

Summarizing the highlights of this entire study, our experience shows:

- Press operators get hurt less frequently than either press mechanics or

the other miscellaneous workers in power press departments.

- Almost half the press department injuries are suffered by employees other than the machine operators.

- In only one-quarter of the total press department accidents was the press itself directly involved. The remaining 75 per cent were suffered at activities other than press operation or maintenance.

- All of the extremely severe injuries were suffered at the presses although these account for only one-quarter of the total number of disabling injuries in the press department.

- Cuts and bruises from handling stock and other materials are by far the most frequent type of press department worker injuries.

- Unsafe conditions are the cause of relatively few press department accidents. Unsafe conditions alone resulted in only 12 per cent of our press department injuries. Unsafe acts alone resulted in 70 per cent of the accidents. In 18 per cent both an unsafe condition and an unsafe act were involved.

The foregoing is *how* power press department employees get hurt. But there is little point in digging out the facts on how people get hurt unless this is followed up by what's to be done to keep them from getting hurt. The only real purpose of getting accident facts, such as those just examined, is to point out the most effective means of prevention.

In our war against accidents one of the fundamental points requiring further emphasis is *our defense*.

We are all familiar with the benefits of emphasizing defensive driving in street and highway traffic safety—the driver is expected to be on the alert at all times for any damnable thing any other driver might do to trigger an accident. And the driver is charged with a preventable accident if he fails to do everything he possibly can to avoid or prevent the accident.

Certainly, in our war against accidents in our plants we should do no less than to take the same *defensive* stand. We must be on the

alert at all times to any factor—unsafe act, unsafe condition, improper attitude, or whatever it is—that might lead to an accident. And knowing as we do that almost every accident in one way or another is preventable, we can't be satisfied with our efforts until we have done everything we possibly can to forestall an accident.

Keep in mind too, the old adage that in war the best defense is a good offense—we have to be aggressive in going out looking for those unsafe factors and attitudes to be successful in rooting out the hazards and potential troubles before they cause accidents.

To do everything we possibly can to prevent the wide variety of pressroom accidents means doing a lot more than merely putting guards on the presses and keeping them in good condition. Even though these factors are all-important, a lot more must be done. It means that in addition to controlling unsafe conditions we must work out safe operating methods, improve employee safety attitudes, effectively enforce safety rules, and a host of other items—in short, a "complete" accident prevention program.

Well then, what is a "complete" program?

You've undoubtedly seen a great number of write-ups on this subject. I don't have any startling simple, new or magic formula. I don't believe it's possible for anyone to come up with one. It still takes a lot of work to get optimum effectiveness in prevention of accidents. However, there are several fundamentals that I consider imperative for a program to be adequately effective and I'd like to re-emphasize these.

I Get the Facts

Every good program must be based on facts.

What accidents are being experienced, or are potential?

Who is likely to have them? Where? When? How? Why?

This calls for observation, study, investigation, analysis.

II Use the Facts — Promote Safety Awareness

There must be a purpose and aim of the fact-finding, and appropriate planning of how the facts are to be used. This calls for clearly defining

the purpose or aims of the preventive program and communication of the facts—the accident data, the causes, the *why* is. They must be communicated upward to top management, and back down in appropriate form to the people charged with carrying out the detailed preventive action, the foremen and employees. The facts must be used as tools for building accident prevention awareness and safety-oriented attitudes on the part of everyone—the top boss, foremen, employees.

III Eliminate Unsafe Conditions

Having gathered the facts and communicated them properly, specific action must be taken—what we must *do* and get others to *do*—to prevent accidents. Such action includes the safety engineering — improving or changing equipment and layout, guarding, improving job processes, minimizing potential hazards, etc.

IV Eliminate Unsafe Acts

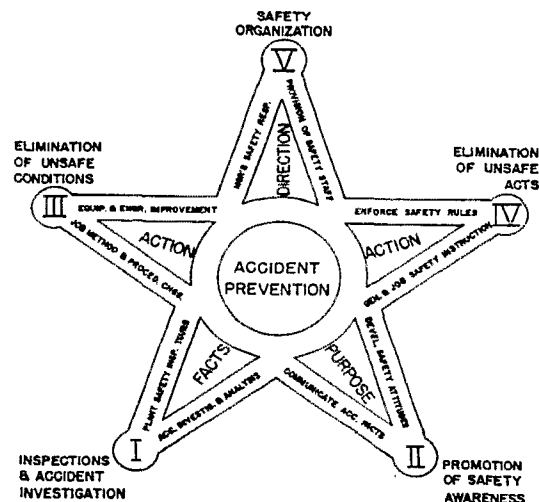
This phase of detailed action calls for general safety indoctrination, specific job instruction, and their appropriate follow-up. The latter includes enforcement of safe practices—all the time.

V Get the Right Safety Organization

This is the all-important part that makes or breaks the entire program. Active acceptance and support of the safety program by top management is essential, since only management can make other parts of the program possible. The safety engineer does not by himself create a safe plant—he must get other people to think and work safely. The "safety organization", therefore, includes top management with his insistence that accident prevention be an integral part of every job, from manager on down through staff, supervisors and employees. Included in management's responsibility for seeing that there is proper organization to implement the program—management must (1) provide the safety specialists charged with the task of gathering and using the facts and coordination of acci-

dent-prevention functions and (2) management must see that all supervisory personnel and employees have

opportunity and facilities for carrying out their accident prevention responsibilities.



Furthering the simile that our job is to war against accidents and injuries, this five-point program can be shown graphically in the geometric figure illustrated in Figure 1. It is the "Pentagon" from which our war is directed.

Several conclusions can be drawn from this graphic presentation of the program:

1. The center or core is accident prevention. This helps us keep our sense of proportion—there is no point in an elaborate safety "program", as such, unless it prevents accidents. And the most informal of programs can be the

best one, if it does the best job of preventing accidents.

2. This geometric picture illustrates the theorem that, formal or informal, our safety efforts are incomplete unless all five parts are there. Any single missing element weakens or destroys the whole structure.

3. And in common with all symmetrical figures, it looks the same from any angle. It's possible to start from any angle and still wind up with a balanced, effective program as long as you make sure that all five parts are included.

I prefer to start with the facts of the safety problem, then use them to get the purpose of the preventive effort clearly understood. From there I would proceed toward getting the detailed action done—correcting unsafe conditions and unsafe acts. But no part of the program will proceed properly unless we have proper management interest and direction.

One closing comment on points III and IV, the action phases—in this entire discussion I have attempted to emphasize the point that it is essential to have a complete, well rounded program for prevention of accidents in the power press room. Persons who feel that the only really important factor is making the equipment or physical working conditions as safe as practical are most surely due for a rude awakening. Certainly, if your presses are unsafe, you can make a big dent in your accident record by correct-

ing the unsafe conditions. But if you do only this, you'll still wind up with far too many accidents and injuries. The best guarding program in the world won't stop all accidents. Remember, by far the majority of them are caused by unsafe acts.

Please understand clearly, however, that it is not my intent to de-emphasize in the least the importance of guarding or maintenance of safe presses. This is of cardinal importance and tempo of such action must be increased, never reduced. My plea is that for optimum effectiveness include all the important factors in your program. Even though unsafe acts may cause more accidents than unsafe conditions, don't expect employees to cooperate fully in correcting their errors unless it has been demonstrated first that every reasonable effort is being made to control unsafe conditions—which is the exceedingly important theme of the panel discussion to follow.

THE NEW POWER PRESS SAFETY CODE

(An interpretation and discussion of the 1960 revision of the American Standard Safety Code for Power Presses, B11.1-1960.)
Moderator: ARTHUR S. KELLY, Asst. Mgr., Industrial Dept., National Safety Council, Chicago.

(a) PURPOSE AND SCOPE OF THE CODE SECTION II—DEFINITIONS SECTION III—REFERENCES TO OTHER CODES

By ARTHUR S. KELLY

This revision of the B11 Code was finally completed in December of 1959. It was approved as an American Standard on January 19, 1960 and was published the middle of this year.

The American Standard Association is really a federation of national organizations brought together in the interest of standardization. It includes engineering societies, federal and state agencies, trade associations, representatives of employees through the A.F.L.-C.I.O. organization and it is administered by a staff of about 110 people. It is made up of a series of boards and com-

mittees that are responsible for the development of these standards. The top group in the American Standard Association is the Standards Council. ASA is made up of what they term representative member bodies.

Operating as an arm of the Standards Council are some 18 Standards Boards. There is an Electrical Standards Board, a Mining Standards Board, a Nuclear Standards Board, a Safety Standards Board, etc. Each one of these Boards develops and approves the standards within its particular scope of interest. In some instances there is an overlapping of interest between two

Standards Boards, in which case they set up a coordinating committee to cover the particular problem.

Individual safety standards are controlled or sponsored by trade associations, engineering societies, government agencies and others. Please keep in mind that any standard is a voluntary standard. The basic requirement for approval of a standard is that the standard represent a favorable consensus of the committee developing it. I will probably use the phrase "consensus" repeatedly.

Anyone who has an inherent interest in the scope of a standard may have representation. Usually this representation is through an organization to which the particular person's company belongs. Nevertheless it is entirely possible for an individual company to be represented if it cannot be represented otherwise.

The membership of a committee developing a standard by the sectional committee method includes six basic groups: (1) manufacturers of equipment, (2) users (purchasers) of equipment, (3) government agencies, (4) representatives of employees (labor organizations), (5) independent specialists such as technical and professional societies and associations, and (6) insurance agencies.

The interest of the members of a committee, as well as everyone concerned with the code, are further protected by the ASA requirement that not more than one third of the total membership of a sectional committee may be made up of one of these particular classifications or groups. In other words, there is no way to load a particular sectional committee, a policy very carefully controlled by the Standards Council.

It is true that standards can become the basis or background for safety regulations. In fact, some states adopt a standard almost verbatim and make it a matter of law within their particular state. I should like to point out however that the B11.1 code was first published in 1922, and in the intervening 39 years only 9 states have adopted this code in its entirety. Other states have adopted portions of it and have written laws concerning the safe operation of power press equipment which vary from the code.

This code has been revised four times since 1922, the last time in 1948.

The need for further revision was realized several years ago. The large number of press amputations which continued to occur and the past experience with press equipment clearly showed the need to give serious thought to improving safety in press operations.

The press manufacturers have done much, particularly during the last ten years, to improve the safety of press operation. Such improvements have included better frames, improved clutch mechanisms, the development of better press control systems which made it possible to apply tools and dies that permitted automatic, semi-automatic or even remote feeding.

Power press design features developed within this decade also have facilitated the application of safety devices that insure operator safety on those operations which have to be fed "under the punch."

While this improved technology is now available, it will be years before the total effect will be apparent in press operations. The average age of the more than 250,000 presses in operation today, is about 20 years. By converting clutches, air valves, limit switches and control systems, many of the older presses can be brought up to date.

To return to the American Standard Association for one reference, I want to tell you that the Review or Steering Committee, which developed the draft of the present revision was maintained in proper balance insofar as the six classifications of membership were concerned. The Review Committee was divided into five subcommittees, and the chairmen of these subcommittees had the privilege of going outside the B11.1 sectional committee for the members of his subcommittee.

Also I want to say a word about the Appendix. The Appendix is not a part of the code. The Appendix is intended to interpret the code provisions and to explain and illustrate how the requirements of the code can be complied with by companies with press operations. It gives many examples and many hints that will help apply the standard.

Now I should like to refer to the Foreword of this code. It, also, is not a part of the code itself. For one thing, previous editions of this standard dealt with hand and foot presses as well as power presses. It was felt by the committee that a separate stand-

ard dealing with hand and foot presses should be developed and this project is under consideration. Mr. L. A. Faulkner whom I have introduced to you has been selected as the general chairman of the B11.1 committee to succeed Mr. Henry B. Duffus.

Safeguarding of power presses has never been considered an easy accomplishment. Safeguarding has been complicated by the wide variety of operations and operating conditions due to variations in size, speed, and type of presses; size, thickness and kind of pieces to be worked; design and construction of dies; required accuracy of the finished work, skill of operator; and length of the run. Because of these varying factors a wide variety of feeding methods, point-of-operation guards, and devices have been covered in the standard.

The revision has been developed on the premise that maximum safety can be obtained by providing the means that make it unnecessary for the operator to place his hand or any other part of his body in the point of operation. Improvement of press design, performance and a wide range of safety devices kept influencing the Review Committee on Revision against setting safety standards that would assure operator safety under most operating conditions.

The committee felt that the objective of this code could be accomplished by:

- (1) Automatic or semi-automatic loading and unloading of the dies, with proper point-of-operation enclosure guard; or
- (2) Limiting any point-of-operation opening to one-quarter inch; or

- (3) If the methods outlined in (1) and (2) cannot be applied, auxiliary protective devices should be used to control access to the point of operation.

In addition to the use of safety devices, full consideration also should be given to the use of hand tools for feeding and stock-removal methods which would make it unnecessary for the operator to place his hands into the point of operation.

The three most significant changes in the 1960 standard are:

- (1) The revised standard covers only power presses.

- (2) There is now a clean-cut definition of a guard and of a safety device. A guard is defined as a physical barrier between the operator and the point of operation—either

a permanent part of the press or die, or interlocked into the press control circuit so that the guard must be in place to make the press operative.

A device is a machine control or an attachment which allows the operator access to the point of operation for loading or unloading the die. It either prevents normal operation until the hands are removed, or automatically removes his hands from the point of operation as the press slide descends. Or, it may be a barrier device which does not meet the definition of a point-of-operation guard.

- (3) A more complete definition of hand tools and hand-tool feeding is provided.

It is recognized that the B11.1 standards are the minimum requirement for safe operation of power presses. As with all other American safety standards, this standard has been developed under the consensus principle, so that each party having a reasonable interest in the standard has a voice in its acceptance. Again let me point out that the Appendix is not part of the standard; it is used to describe and illustrate other suggested means of protection for press operators and to define or describe any parts of the standard that might be misinterpreted.

My first assignment in the discussion of the code itself is to cover the scope and application. The scope is as follows:

"These requirements apply to those powered machines which shear, punch, form, or assemble metal or any other material by means of tools or dies attached to plungers or slides, but do not apply to bulldozers, hot-metal presses, forging hammers, or hot-bending presses."

This code applies to all power presses, all dies and all auxiliary equipment installed subsequent to the adoption of this B11.1 code. Power presses, dies and auxiliary equipment installed prior to its adoption, January 19, 1960, need not be modified to conform to its rules unless the supervising authorities having jurisdiction consider that sufficient hazard exists to warrant such action, or definite improvement is made in the existing law. What I have just said constitutes the "grandfather's clause."

Further provision is made for cases of practical difficulty and unnecessary hardship. In such cases, the enforcing officers or body may grant exception to the literal requirements of the standard or permit the use of other devices or methods, but only when

it is clearly evident that equivalent protection is thereby secured.

Section II of this standard covers definitions. The committee spent considerable time in making this section of the code inclusive enough to satisfy everyone. Further, the committee consulted many authorities to arrive at reasonable and understandable definitions. An example is the term "slide." The question arose, should we use the term "slide" or the word "ram." Should we use some of the other terms that go along with it and try to pick out words that would increase in usage and apply them. Then in determining what we were to use we looked pretty much to the trade associations and trade publications and the technical societies to give us a clue. We spent considerable time in differentiating between "hand feeding" and "hand-tool feeding," again to show the difference between these two particular terms, and in the hope that it would be accepted.

I have already given you the definition for a guard and a device. In this section you will also find definitions for the specific types of devices, such as the adjustable press-barrier device, the electronic-control

device. We have also defined guard, point of operation, die-enclosure guards, fixed-barrier guards, and interlocked-press barrier guards.

Specific comment on the difference between guards and devices as applied to power press safety will be discussed in more detail by Mr. Kraklow when he covers Section V, safeguarding at the point of operation.

Another section I want to comment on is Section III, references to other codes. I mentioned to you earlier that there are some 170 safety codes, standards, recommended practices, and specifications. Those which apply to the operation of power press equipment are listed in Section III.

Briefly, some of the other codes which have equal application to the operation of a power press include codes for industrial lighting, portable and fixed ladders, mechanical power transmission apparatus, compressed air machinery and equipment, conveyors, pressure piping, both the national electrical code and the national electrical safety code and others. Copies of these standards may be obtained from the American Standard Association, 10 East 40th St., New York 16, N. Y.

(b) SECTION IV—

PRESS CONSTRUCTION AND INSTALLATION

By NORMAN DUNLAP

The Minster Machine Co., Minster, Ohio

Mr. Kelly stated that there was no way of loading the sectional committee developing an American Safety Standard. I want to verify this as a definite fact. I tell you that I felt rather lonesome as a member of the review committee serving with the men on this panel and four or five others.

When we started working on a revision of the 1948 code it was soon obvious that everyone on this committee not only had a tremendous amount of experience to draw from but was also dedicated to the job. It was a real education working with these fellows and I want to thank the National Safety Council, the National Machine Tool Builders Association, and our fellow press builders for the opportunity of working on this committee.

The N.M.T.B.A., which I represent on the committee, was very much interested in becoming a part of the revision of this code because of the continuing and increasing number of accidents that we see in our day to day operation. When you dig into these accidents, the investigation almost always reveals that one or more simple, basic rules had been violated, too often with a serious accident and injury resulting.

The first approach to Section IV of the code was drafted on the basis of covering all phases of press construction and the many approaches to each phase—such as the proper construction of clutches, counterbalance cylinders, frames, drives, etc.

It was immediately apparent that this ap-

proach would be entirely too voluminous to be used as code material.

After many discussions the obvious solution appeared to be a pretty big lump for press manufacturers to swallow, in that it was completely against human nature and the practices of any product manufacturer. We had, in effect, to tell what could go wrong with our products, where and how they could wear out.

With this approach, it soon became apparent that much of our material was not code material, but material that would best serve the cause of power press safety in the Appendix. Actually, this material now appears in the code portion of the 1960 revision of B11.1 in few basic major points, the bulk of the material remaining in the Appendix.

The major points in the code itself that differ from the 1948 version concern the insertion of new coverage, such as air clutches and brakes, methods for disconnecting power, and control circuits and current interruption.

Without trying to read Section IV, I want to mention a couple of points. Power presses equipped with fly wheels, shafts, clutches, and gears not confined within the press frame are required to be arranged with guards or brackets with such a design,

construction and strength as to retain twice the weight of any broken gears, shafts, clutch parts, or fly wheels. In discussing the strength of a bracket, which is the determining factor more than the gauge of a metal used for the guard, it was determined that a bracket made of one-half inch by two and one-half inch steel, of whatever length was desirable, and secured to the frame with two or three three-quarter-inch cap screws would do the job.

Usually with this setup, a fly wheel breaking from the shaft will spin harmlessly within the confines of the guard itself. It is only when the fly wheel falls clear to the floor and gets a purchase against the floor and then with the terrific inertia and momentum rolls through the shop, that we have the destruction and injuries that are so feared from this particular mishap.

One last point I want to mention concerns air-friction clutches and brakes. Pneumatically operated friction-clutch and brake units are required to be designed and constructed so that the brake is applied and the clutch disengaged in the event of an air or power failure.

As I said the bulk of the material developed by the subcommittee working on Section IV has been put into the Appendix. I am sure you will find it interesting and helpful.

(c) SECTION V—

SAFEGUARDING AT THE POINT OF OPERATION

By THEODORE A. KRAKLOW
Dir. of Safety, Deere & Co., Moline, Ill.

Needless to say, this section of the code received a lot of reviewing, debating, changing and compromising before an agreement could be reached.

Well informed, aggressive safety men and management people are all generally agreed that it is not enough to assign a worker to a power press and tell him he must work safely and not put his hands under the die when the press is in motion. We have learned not to rely on this method. We have learned, in fact, that no human being is entirely reliable.

Guards and devices designed to keep hands out of dies were developed for this purpose. Devices are two-hand controls, sweeps, pull-backs, electric-eyes, and gates. Some of these have been on the market and used on punch presses since 1920-21. Yet, punch press accidents and amputations continued in spite of these efforts. Why? Because of the simple fact that most people, buying and installing these devices do not follow the manufacturer's instructions, provide no continuing maintenance, mount them on presses for which they were not intended,

or allow operators to tamper with them or disconnect them, or just do not enforce their use.

The manufacturers of this equipment furnished data and booklets stressing the need for providing inspection and maintenance of these devices to assure their satisfactory performance. However, usually, this was more or less ignored and when the device failed, the accident was blamed on malfunction of the device or malfunction of the press, forgetting that a press is capable of turning out 6,000 to 8,000 pieces per day, some two to two and one-half million strokes a year. It isn't hard to visualize what happens to equipment subjected to this kind of use without any continuing adjustment, inspection or repair.

With this as a background, I would like to give you the reasoning behind the material written into Section V, safeguarding at the point of operation.

If a man's hands are never required under the slide or between the dies (in the point of operation) to place or remove stock, then he will not be injured if a malfunction of the press or device occurs.

The opening statement in Section V is the key to the entire section. It says, "Each press shall be equipped with a point-of-operation guard or a point-of-operation protection device for every press operation performed except where the point-of-operation opening is limited to $\frac{1}{4}$ " or less." This simply means that one of these methods must be provided in order to give protection at the point of operation.

An attempt has been made in the Code to spell out performance requirements for guards and protection devices.

A "guard" must be an enclosure attached to the press or the die with openings to permit stock feeding, but designed and arranged to prevent hand entry into the point of operation by reaching over, under or around the guard.

Four examples of guards include: (1) point-of-operation opening limited to $\frac{1}{4}$ inch or less; (2) a die enclosure guard; (3) a fixed press barrier guard; and (4) an interlocked press barrier guard.

A "device" on the other hand, is a method, control or attachment to the press or die that permits entry into the point of opera-

tion for loading or unloading the dies. The device either prevents normal operation until the hands are removed from the point of operation or automatically removes the hands from the die area as the press slide descends or it may be a barrier device which does not meet the requirements of a point-of-operation guard.

Six examples of devices include: (1) adjustable barrier; (2) the gate or movable barrier; two-hand controls; the pull-back device; the sweep device; and the electronic or "electric eye" control.

Hand feeding tools are not accepted as guards or devices but are intended to be used as accessories or auxiliaries on all point-of-operation devices.

A review of the Code material will readily give you the performance requirements intended to be followed in providing guards or protection devices on power presses, stressing certain do's and don'ts in order to provide maximum and ultimate safety for press operators.

However, I want to stress the Appendix. Do not overlook it when you run into a statement in the Code that appears to be difficult to interpret. In the Appendix, which is not Code material (that is, not enforceable), more detail is supplied and there is a wealth of information answering the questions concerning why guards and devices must be installed in certain ways, why they must be inspected, maintained, and otherwise kept in good operating condition.

The Appendix material supplies the answers to questions of why openings in adjustable press barrier devices must be a certain size.

Other questions that are answered include why gate or movable barrier devices must be in place before the press is tripped and how this can be accomplished. The Appendix explains why two-hand controls must be located at least 21 inches apart and why they are not recommended on positive clutch presses unless certain precautions are taken. The reason for pull-back devices needing adjustment for each operator and each press setup are given as well as the importance of frequent inspection.

The advantages and limitations of sweep devices are presented and you will learn why sweep devices are most effective when used on small dies and slow-acting presses,

and also you will learn the reasons why timing with the press stroke is important. The Appendix also explains why electronic

control devices should not be used on positive clutch presses and other precautions that need to be taken.

(d) SECTION VI — POWER PRESS AUXILIARY EQUIPMENT

By GEORGE A. STILES
Engineering Dept., Aetna Casualty & Surety Co., Hartford, Conn.

My discussion of Section VI will be brief. In this Section, we cover what is termed auxiliary equipment. Auxiliary equipment is a very important part of power press safety. So many times one goes through a plant where one sees, for expediency's sake or because somebody is convinced that nobody should do this or that, that press pedals are not covered with a guard. I think it safe to say that no responsible person acquainted with the problems or preventing injuries on power presses will attempt to defend the fact that a pedal cover isn't a mandatory requirement.

This Section also includes requirements for pedal-return springs, and I think you will recognize that there is considerable chance that there might be a malfunction of a press because of a broken spring.

When you consider the millions of strokes that occur on any press over a period of time, you must recognize how easy it would be for springs to break. The Code requires that such springs shall be of a compression

type, operated on a rod or guided within a hole or tube. When operated on a rod the inside diameter of the spring shall be no greater than the diameter of the rod plus $\frac{1}{16}$ inch. When guided within a hole or tube, the inside diameter of the hole or tube must be no greater than the outside diameter of the spring coil, plus $\frac{1}{16}$ inch. Further, each spring, in its initial compressed position, must be wound so that the space between the coils of the spring is less than the diameter of the wire used in the spring.

The single-stroke mechanism, covered in this Section, is important. During the development of this revision, committee members argued long and loud and there was considerable soul searching before we were able to say precisely what we wanted to say and as it now appears in the code. This happened, because, for one thing, there is a misconception between a non-repeat device and a single-stroke mechanism and we have tried to spell out the difference so that there will not be any question.

(e) SECTION VII — DESIGNING, CONSTRUCTING AND SETTING OF DIES

By L. A. FAULKNER
Supvr., Industrial Plant Service, Liberty Mutual Insurance Co., Boston, Mass.

Section VII was prepared primarily as the result of the cooperation of a group of people from the American Society of Tool and Manufacturing Engineers, who within the last five or six years have given considerable attention to safety in tool and

die design, and this attention is very much in evidence in their society's handbook. The A.S.T. & M.E. have scheduled a session on safety in tool and die design on the agenda for their annual meeting for this year. Personally I think they should be congratulated

for giving the thought they have to this problem, and I hope they will continue to do so.

This particular section was needed, we felt, because the initial step in the provision of safe and efficient operation of a power press is in the planning of the method to produce a particular stamping. Obviously, there are certain fundamental factors to safety of pressroom personnel which must be considered and incorporated into the design of a particular die.

I am quoting at the moment from the introductory paragraph which will become part of the Appendix of the Code Section. "This part of the Appendix is prepared with the general idea in mind that there are certain elements of tool design necessary if the overall objective of this particular Code is to be achieved." It includes, as you will on reading it, only those items of tool design which are closely related to safety and discussed in other sections of the Code. There is no attempt to include in the Code or in the Appendix of the Code the fundamental principles of tool design as such. It is only in relation to the safety factors involved in the design of a specific tool.

The Code recognizes semi-automatic and automatic feeding devices and therefore this section describes the various types of semi-

automatic and automatic feeding devices which are available and which should be given consideration by the tool and die designer at the time he is planning the processing of a given piece.

The Appendix includes diagrammatic sketches and pictures of the various items in the code as a means of helping in the interpretation of the Code. You will note this particular section also includes, in addition to the designing and construction of dies, the setting of dies. It was decided by the committee that this was the place in which to provide some basic information in relation to die setting, but only in relation to those hazards involving the die setter which could be eliminated as much as possible by giving them consideration at the time the tool was being planned for processing.

As an example, die fastening and die handling problems, work measure and stroke designations, are being included as a part of the responsibilities of the tool and die designer in relation to minimizing the possibility of accidents and injury to the die setter, or the employee who is required to operate this particular machine if such information is not available to him. The section includes other items such as the necessity for turn-over bars, inclined-press stops, safety blocks, and others.

(f) SECTION VIII — INSPECTION

By NORMAN DUNLAP

I want to go back and add some further explanation to the remarks I made about Section IV, Press Construction and Installation. In Section IV we refer to the American Standard Safety Code for Mechanical Power Transmission Apparatus, B15.1-1958. This Code covers the guarding of gears, chains, levers, belts, arms, etc. But we elaborate somewhat or deviate from that code in that, on the press construction phase, we wanted to tie in the necessity of making guards cover twice the gravity weight of the rotating parts, such as shafts, fly wheels and clutches. There was considerable discussion on this point among the committee present today as well as on the sub-

committee of which I was chairman, that developed this section. We didn't feel we had to cover the energies involved. In other words if you would try to make a guard that would handle the energy of a 60-inch fly wheel turning over at 100 rpm, you would have a tremendous guard.

Actually, the experience in the field has been that fly wheels seldom have a tendency to take off and go through the building unless they are dropped. So we felt that making a guard to take twice the gravity weight would prevent them from dropping far enough to get the traction required to propel them through a brick wall. This has happened—we know. But it isn't too

much of a job I checked on a 60-ton machine which has a 1200-pound fly wheel on it, a fly wheel type machine at 100 rpm. Two brackets at the bottom of the fly wheel guard that are $2\frac{1}{2}$ inches by $\frac{1}{2}$ inch securely fastened to the frame with at least three $\frac{3}{4}$ inch cap screws would fill the Code requirement. On clutches, we have mentioned positive type clutches in conjunction with springs. There again, the wording is such that we are asking for a spring design so that if the spring does break, the broken ends will not wind into the other part of the spring and lose the effect of the spring entirely.

We mentioned brakes for positive clutches, primarily for the safety of the die setter. There is no need to go into the hazards which exist when the brake on a machine will not hold the slide at mid-stroke. In discussing air-friction clutches or other types of drives we mentioned brakes again in conjunction with counter balance cylinders and surge tanks so that you will not have a condition which will result in the slide falling.

We felt that hydraulic presses could be covered very well if we followed the code for pressure piping, B31.1-1935. This is an

extremely important code in the safe operation of power presses and we feel that every safety man or management representative having responsibility for power press safety should have a copy of this code and should make certain that the piping setup complies with it. In a hydraulic press we have a plunger similar to the slide in a mechanical press. The speeds are different but basically the same amount of safety can be obtained by using the same safe practices as on a mechanical press.

We discussed controls to some extent. I think we are all familiar with the hazards of low voltage under certain conditions and we tried to cover that.

Now so far as Section VIII is concerned, the inspection and maintenance section of the Code, I would like to say that the Appendix is devoted almost entirely to recommended inspection sheets. We made quite a survey and all the companies we contacted were very free in giving us the information from their records of inspection and maintenance. We feel that if you have a record of your troubles you will do something about them. I think this covers Section VIII. If you have any questions, please let us have them.

A NOTE ON SECTION IX — OPERATION

Mr. Kelly, Section IX, Operation, is really quite simple. It has two provisions. One is that no one under 18 years of age shall operate or assist in the operation of machinery covered by this Standard. The other point has to do with instruction of operators and specifies that before starting work

on machines covered by this Standard and before starting work on any operation with which he is not completely familiar, the operator shall be carefully instructed in the particular operation and a safe method of work.

QUESTIONS AND ANSWERS

Question, Please explain what is meant by applications. How does this requirement affect my 30- or 40-year-old presses.

Mr. Kelly, Any of us can answer that but as long as I am on my feet I shall. Basically, the code doesn't affect those presses inasmuch as the Code says specifically it is applicable after the date of adoption or approval, which was January 19, 1960.

As I mentioned earlier, this Code and all

other American Standard Safety Codes are developed for voluntary adoption by the people concerned with the subject of the Code. There is no legal status whatsoever so far as this Code is concerned until it has been adopted in part or completely by a state.

The states have not been too quick to adopt this Code. There are some 20 or more states that do not have any regulations at all

for the safe operation or safeguarding of power presses. This goes back clear to 1922, almost 39 years.

To answer your question specifically, I would say the Code would affect your older presses only insofar as new dies—built after January 19, 1960, are concerned.

Question, Can a press be purchased that will comply with this Code? Will it be completely fail-safe?

Mr. Dunlap, Well, to answer your first question, yes, a press can be purchased that will comply with the Code. Fortunately, Minster is not the only company that builds such a press. I think all press builders will come up with a machine that does a beautiful job complying with the Code, and can even go further. Most of the press manufacturers are doing this now, and that is adapting control circuits to handle point-of-operation guarding and the many other items that are covered in the code. So if you want to comply with the Code, one of the best ways of doing it is to start out with a new machine.

"Will it be completely fail-safe?" No. Unfortunately, these presses seem to run forever. It has been my experience to run across a group of machines that are 35-40 years old or older, but as long as you are subjecting a piece of metal or equipment to the shock that is involved in exerting anywhere from a 5-ton load to a 100-ton load or sometimes over, you will be involved with stresses. When you get involved with stresses in a machine, you get involved with flexure-life. The way you train your disetter, the way you design your dies, all control the amount of flexure life you will get out of a press.

We would like to feel that we design them so they are fail-safe. But for us to make the claim would be foolish, because it seems like the smarter our engineers get, the smarter the people become in getting around the safeguards that we design into the press in the first place.

Question, What is meant by a "fail-safe" valve?

Mr. Dunlap, A fail-safe press valve is a multiple valve arrangement wherein a failure of any valve part, or a failure of the protecting arrangement, will result in either immediate or normal top of stroke stopping

of the machine, and also prevent further operation.

The Minster random valve with macro-current detector accomplishes this by arranging two three-way valves in series with a valve position detecting assembly mounted in each valve and a control for these assemblies mounted within the press control. Both position sensors must be in the off position to initiate a press cycle, and both must shift to operated condition to maintain a press cycle. Thus both valves and both sensing arrangements must be working normally not only to initiate a cycle, but to maintain it, since both valves must operate to start a cycle, but either shutting off will stop the cycle.

Question, Why should a device be used, when hand tools are used and the tool does not require the operator's hands to be placed into the point of operation? And why aren't hand tools recognized as devices?

Mr. Kraklow, Hand tools are not attached to the press in any way. They can be laid aside and just not used. As a result they do not comply with our definition of a device. As far as the first part of your question is concerned, I refer you to the opening statement in Section V, safeguarding at the point-of-operation, which I read to you. It says, "Each press shall be equipped and operated with a point-of-operation guard or a point-of-operation protection device for every press operation performed, except where the point-of-operation is limited to $\frac{1}{2}$ inch or less."

Question, Does the Code recognize that a point-of-operation guard can be effectively used to establish an "out of bounds" area for hands when the feed opening must be too large to be considered as an effective barrier?

Mr. Kraklow, Yes, the Code does take care of this. What you have described is a barrier device and not a guard, because of the size of the opening that would permit the hands to be placed between the dies. The Code specifically says in Paragraph 5.3.1.2, "If it is necessary to feed manually within the point-of-operation, hand tools should be used as an accessory to all point-of-operation devices."

Question, Although several powered machines similar to power presses, such as

bulldozers and forging hammers are specifically excluded, neither power brakes or riveters, both of which fit the definition as mentioned, are included.

Mr. Kelly. Let there be some misunderstanding, there is an American Standard Safety Code for forging and hot-metal stamping, B24.1. This would take care of the first part of your question. A power brake is not within the scope of this Code as outlined unless power press dies are fitted into it. I know that some power brakes are now manufactured specifically for the utilization of power press dies. I would say very definitely that in such cases it is no longer a power brake but a power press and this code would apply to any metal stamping or forming operations performed on it. Riveting machines do not comply with the scope of this Code.

Question. What is the difference between applying two-hand control devices in regard to positive and friction-type clutches?

Mr. Kraklow. As we have tried to point out in the Appendix, the difference between positive-type clutches and friction-type clutches is that, on the positive-type clutch, two hand controls are nothing more than operating mechanisms because, once the press starts the cycle, there is no way in which you can stop it until it has completed its cycle.

I might quote from the Appendix on that particular point: "On positive-clutch presses, hands are free the instant the slide starts down. Therefore, the tripping device must be located so the slide completes its downward travel before the hands can reach into the point of operation, if maximum safety is to be achieved."

"On presses with friction-type clutches, or any type of slide cycle which can be interrupted during its stroke, maximum safety can be obtained if the controls are adjusted to require constant pressure of the operator's hands until the slide has descended to a point where there is no longer a hazard."

So we made that definite distinction, because a lot of people would purchase two-hand controls and stick them on a positive clutch press and then assume they had a safe press and give no consideration to the fact that a malfunction of the device or a malfunction of the press, as the man

was reaching into the point-of-operation area, would cause amputations.

Question. How do we get our die designers to give more thought to safety? What reference material is available?

Mr. Faulkner. I think this is an important question. I have heard it said that there would be a hell of a change in the type of die design if the die designer himself or his wife or his daughter had to run that particular job with the particular die he had designed. You see badly designed dies in practically every plant you go into. But more and more as time passes, we are getting increasing interest on the part of the die designers; they are getting into this overall picture to a greater extent. This interest is not only in the production of a given part in a certain way, but also in the safety of the employee. I could cite two or three plans recently adopted which have been fairly successful and which I believe would be more or less the answer to this particular question—the general idea being that where the designer was brought into the picture some minor change of that particular die has resulted in a safe operation.

In one plant, they have a committee which meets periodically to discuss the planning of a given die in relation to the types of safety devices or safeguards that are to be incorporated into that job. As an example, the design of a special die for the use of a particular type of device involves certain considerations. If you are going to provide the operator with a pull-back device, for example, there are certain things that should be taken into consideration in the designing of the particular die. If you are providing a two-hand trip and hand tools, obviously there are certain other things that should be taken into consideration. So, basically, it is a question of getting this overall interest in this particular subject accepted on the part of the various management people who should assume the responsibility. It starts with creating some kind of management policy within a given company as to the type of devices that are to be used, and consideration given to the die designers at that particular time so the device can be used effectively.

Question. Mr. Dunlap mentioned that the Code stated that the brake capacity should be sufficient to hold the slide and die at

mid-stroke. How is the press manufacturer expected to determine the weights of the various dies which the press user might insert in this particular press in years to come?

Mr. Dunlap. Actually this requirement has been in the specifications of individual companies for some time. It was treated in the Joint Industry Committee. Normally, we consider the weight of the moving parts in the press itself, and I think J.I.C. now stipulates one-fourth of the die area in steel.

Question. How can you set a brake tight enough to hold on mid-stroke with the press power off on a 200-ton press that makes 60 strokes per minute and does not burn up the brake or cause too much drag?

Mr. Dunlap. I think this question is answered in paragraph 4.1.3.2 of the Code. On larger machines where it is not normally possible to hold the slide at half stroke, check valves should be used in conjunction with counter-balanced surge tanks to prevent slide and die from falling in the event of an air or power failure. What we mean here is counter balances with surge tanks that have check valves so that if you have an air failure you do have trapped air.

On the larger machines, 200 tons on up to the very largest, I would say that the press manufacturer designs to this J.I.C. Standard or that the standard is accepted pretty well, in that 25 per cent of the available die area is solid steel. However when you get into higher speeds, large presses, 200-ton machines running at 60 strokes a minute, there are many design modifications which would give you a problem of holding all this weight plus the weight of the extremely heavy parts in the press itself. I can't see where this 60 strokes a minute in this machine would give you a problem, because if you can run a 200-ton press at 60 strokes a minute, you are going to have plenty of brake on to stop it from coasting.

You do have a tremendous problem of stopping the press as speed increases. As a matter of fact, inertia has to be calculated on the basis of the square of the speed; and when you are talking about ratios on these machines, around 8:1 or 9:1 and use the W/R square factor, you will have to have plenty of brake on the machine. If you stop such a machine properly at 60

strokes per minute, you won't have any trouble with your static loads for the setting or at mid-stroke. Counter balances can be used to offset problems which you run into, designwise.

Question. Some parts, particularly large drawn parts, must be fed by hand for subsequent redraw, trim, etc. operations. While the hands are in the die area during feeding or removing the stock from the dies, would the use of two-hand trips meet the requirements of the Code?

Mr. Faulkner. The answer could be yes, if the two-hand trips were installed on the particular machine in accordance with the requirements of the Code I would assume, however, that since they are talking about a large press on redraw operations, it would be a type of two-hand control that could apply constant pressure in relation to the friction drive, or a machine that could be stopped within the stroke. If, for example, it was a large positive-clutch press and two-hand controls were installed, it would not meet the requirements of the Code.

Question. Using pull-back devices, what is the company's position when some mechanical failure occurs such as a pin dropping out, a leather strap breaking, etc.?

Mr. Kraklow. Well, that is the point that we have been trying to stress throughout our discussion of this Code insofar as devices are concerned. You just don't buy something and hang it on a press and walk away and forget it and say, "We have accomplished our purpose." It is just like anything else. It has to be maintained. It has to be adjusted and it has to be inspected periodically to see that everything is satisfactory.

If these things are not done, then you are going to have a malfunction of the device because there is nothing—no device made that will not wear out. No one claims that they won't wear out.

We tried to spell this out quite fully in the Appendix because this has been the greatest problem that industry has experienced with such devices on presses. We think they will accomplish exactly what the manufacturers claim they will accomplish. However if the purchaser doesn't follow the advice and counsel of the manufacturer, he certainly can't blame the device if it doesn't perform properly.

Mr. Faulkner. I would like to add one point, since we are talking about pull-back devices. It is of the utmost importance when you decide to buy or install pull-back devices that you obtain from the manufacturer, and use, the material and the instructions that come with the device so that you can get the most effective use out of it. These companies have booklets and instructions, very well illustrated on all phases of installation, adjustment and maintenance and the information is available. As a matter of fact, most of the companies manufacturing these devices will help train your people in the proper maintenance and inspection of the devices.

Question. What is meant by "regularly scheduled" inspections? Would you tie in a definite specified time to "regularly scheduled?"

Mr. Dunlap. By "regularly scheduled" we feel, rather than put this on a time-interval basis, that it should be on a usage basis. Let's take an air valve, for instance. Most air valves have a life expectancy of from 6 to maybe 30 million cycles. Now if you are using an air valve on a single or double geared machine that runs 25 strokes a minute, and you operate it at the rate of 15 strokes a minute, then your frequency of inspection wouldn't be as often as if you used this same air valve on a 35-ton OBI that is running at the rate of 130 strokes a minute.

You could, conceivably, single stroke this machine up to 60 and 70 times a minute—and there are cases where presses are single stroked that fast. Then again you would have to take the number of cycles that this unit is being subjected to into consideration in your regularly scheduled maintenance.

I think the best answer is to go back to the manufacturer's criteria of the critical components. I am sure they all have minimum life expectancy and it is a matter of simple calculation to project your frequency into the inspection period. One of the points we cover on installation is making sure the basic supplies to the machine are in good shape. You have to consider that point, too. If you have, for example, an air-conditioner in which large, mildly aged air pipes are subjected to a lot of shock and vibration, or if they go out of one

plant and into another one so that they are subjected to a lot of temperature change, and if you have water and scale conditions, then you have to check your filters in accordance with the experience that you have in your own operations.

Question. 1. Do press manufacturers have recommendations available relative to inspection and maintenance of their product?

2. Even with frequent scheduled inspection and overhaul, loosening of screws, guards, braces, etc., is a constant problem on presses in constant use. Press manufacturers seem to be lax on this point. Why?

Mr. Dunlap. I would say "yes" to the first question. All manufacturers have service and operating instructions, and they are readily available. Most of the manufacturers make it a practice to mail instruction manuals along with the machine when it is delivered.

However, we know these manuals end up in the purchasing department or in the general manager's office, and the fellow who is supposed to do all the things we recommend in the manuals never sees them as he should.

The second question is "loaded." Actually, in plants that have a regularly scheduled preventive maintenance program, the problem as described isn't as acute as the question indicates. In plants where maintenance is done on the basis of necessity, where you have trouble with loosening screws, gibs, connection barrels, there is a trend developing. The days of greasing the squeaky wheel are fast disappearing. Preventive maintenance is very important, more so with newer machines than with the older ones. If you have a condition or situation in which guards, bolts, and screws are loosening up, it is quite possible that that press is not being used for the purpose for which it was designed.

In some plants I have run across an old, positive-clutch machine with a block clutch geared and it was designed to run at 30 strokes per minute. Someone put a bigger sheave on it and really wound it up. Well, the shock and impact is going to increase, naturally, and it is obvious that something has to give, and the strains and stresses are going to increase.

PRESS FORGING WITH SAFETY

By HAROLD J. ALLOR

Quality Control Mgr., Detroit Forge Plant, Chrysler Corp., Detroit, Mich.

Now for a conducted tour of the crankshaft operations at the Detroit forge plant. Previous to this setup, all of our crankshafts were made on 12000-pound steam hammers. By the use of the forging press we have made our operations safer, have reduced costs and improved the quality of our product.

Our plant consists of ten buildings, including a die shop, maintenance building and power house.

Steel comes into our plant via trailer and railroad gondolas. Steel from which crankshafts are made is unloaded for storage by use of a crane and electro-magnet. The magnet is powered by a 230-volt generator set of which we have two, with one on standby service. At no time do we permit loads to be carried over the heads of employees. The magnet is used for ease of handling and for safety as no hook-up man is required.

Each heat of steel is checked by the metallurgical laboratory to make sure that it meets the specifications of the engineers in order that quality and safety will be built into the forging. Many tests are necessary before a heat of steel can be released to production.

When approval is given, the stock is removed from the storage area and the handling straps are broken. The steel is then aligned on the ground. A lift of steel is then picked up by the crane and placed on the stock rack of the normalizing furnace, or oven, where the steel is heated to prevent shear cracks. It is then pushed through the oven by a hydraulic cylinder onto the conveyor to the shear.

Wherever possible we use mechanical handling devices to eliminate strains and burns, which are common in a forge shop.

All gas furnaces are equipped with safety valves which operate on a gas, combustion air or electrical failure.

After shearing, a quality control man checks the multiple for size. The multiple then moves along a conveyor to an elevator which raises it to the height of the furnace

hearth. It is then placed on the hearth of the rotary furnace by means of a water-cooled, hydraulically-operated loading boom. The furnace is brought to heat using natural gas, then switched to a fuel oil. Stock multiples are placed side by side on the hearth and, as the furnace revolves, is brought to forging heat, approximately 2200 degrees.

The multiple is now removed and placed on a chute-type conveyor which brings it to a water descaler. It then passes through a preforming roll which prepares the billet for forging. As it passes an electric eye the roller is turned over to bring the tone end towards the operator.

The billet is now positioned on the block-and-press of the die by means of an air-operated cylinder controlled by the operator. The press strokes, after being actuated by a foot pedal controlled by the operator, then the billet is rolled into the finishing impression. The press strokes again and the forging is rolled onto the conveyor as the right of the die which carries it to the next operation, which is trim.

Water-cooling spray and die lubricant are applied without the operator placing his hands in the die area, another way in which we have built safety into our operations.

At the trim press, the flash is removed and placed on a beneath-the-floor conveyor, which conveys it to a gondola for return to the mill. At the back of the trim press, an operator removes the trimmed crankshaft from beneath the die and transfers it to the twister operation. Suspended tongs are used to eliminate muscular strains. In this twister, the crank is twisted 90 degrees to give correct pin position. Since this film was made, we have gone into a 100 per cent hard hat program, which to date has saved six employees from head injuries. I can sincerely recommend the filming of any operation to bring out the hazards which might otherwise go unnoticed.

Following the twister is a restrike operation, where the forging is struck in two positions, then hung on the cooling line. Note

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that the tong jaws are replaceable in case they are bent or broken.

At regular intervals a quality control man takes a crankshaft from the restrike for a routine check, after which it goes back on the cooling line if the check shows no flaws.

From the cooling line the forging is transferred to the heat treat line, where employees wear steel foot-guards.

Three sets of gas-fired furnaces process the forging through hardening and stress-relieving cycles. Each furnace is controlled by pyrometers and guarded by safety valves, which close on gas, combustion air, electrical failure, etc.

After passing through the hardening furnace, the forging is quenched in water. At this point a crankshaft is removed for a hardness test by a quality control man. Records are kept of the readings.

From the hardening furnace, the forging moves into the stress-relieving furnace, after which a sample is taken for another test.

The forging is taken from the conveyor after stress relieving, and placed on a conveyor, where it is transported to a wheelabrator for removal of scale.

Our sample forging is now centered, and marked for a location point for the engine plant who will machine it. The operator stamps an identification mark on the crank which makes him responsible for the work done on the locating spot.

The crank is now checked again by placing it in a fixture equipped with a dividing head. This check completes the inspection of the crank, except for a visual check just before the loaded container is shipped to the machining plant where the engine is made.

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Cement, Quarry and Mineral Aggregates

SAFETY ASPECTS OF GROUNDING PORTABLE TOOLS

By E. J. MATOUSEK
Mgr., General Engineering
International Minerals & Chemicals Corp., Skokie, Ill.

My discussion will not be concerned with the why or how portable tools can become a hazard, but in the event they do, what steps should have been taken to prevent any personnel hazard.

The National Electric and Fire Codes have directed industries and residential construction into safe and reasonable avenues. However, there are certain aspects that may need a bit of historical explanation. Most 110-volt single phase systems have one line grounded. This grounding procedure grew from the prevention of fire caused by lightning primarily in residential construction. There are other valid reasons for grounding 110-volt systems, but to digress into the pros and cons of grounded versus ungrounded electrical systems, would be beyond the scope of this discussion.

We are concerned with grounded electrical systems powering portable tools. In some respects the addition of the ground tends to increase the shock hazard because it brings in one lead of the two necessary to close the circuit and cause the shock. What I mean by this is—in order to cause a shock, the human body must be inserted in the circuit.

Normally a person will not intentionally touch a hot line, but this is exactly what happens when a workman uses a portable electric tool, which has the hot line shorted to its metal frame. The system and the man are both grounded; the man becomes a part of the circuit and is subjected to a shock.

Basically, the human body can be considered as a salt solution encapsulated with a thin insulated membrane which is the epidermis portion of our skin. This is why intensity of shocks is increased in the event that hands become moist or minor skin wounds are involved. In other words, the skin's larger resistance breaks down and the current flows readily through the "saline solution."

The severity of the shock depends upon the vital organs that are affected, namely the

heart and the brain. This is why shocks between arm and arm, or between arm and leg, are much more hazardous than between leg and leg, or let's say—hand and elbow of the same arm.

Another aspect worth considering in this understanding of shocks is that normally, voluntary muscles operate from electrical impulses generated in the nervous system and usually respond to a frequency of about 50 cycles per second. Hence, contact with 60-cycle extraneous voltage causes a saturating signal that tends to lock the various muscles involved. This is why some shock victims cannot let go of a hot wire, but must fall away from it.

This saturating effect blanks out normal signals; if this occurs in the vicinity of the heart or brain, artificial respiration is required to keep the oxygen entering the body until the paralyzing effect is dissipated and the normal functions of the body take over.

With this brief resume of the physiology of the shock, and applying this understanding to the elimination of a shock from a portable hand tool, it seems obvious that the solution is to prevent the man from becoming a part of the circuit. How is this done? One answer is to completely insulate all metal or current carrying exposed parts. The advent of plastics and the extension of its physical characteristics of strength and temperature resistance, makes this possible. I am sure that in the future the insulating technique will provide solutions for many portable tool problems. However, with the existing tools and appliances, which have exposed metal parts on their exterior, we must provide another answer.

The best solution is to ground all metal exposed parts of an appliance with a separate conductor, thereby providing a low resistance path for the stray ground current. Electricity, like humans, will take the path of least resistance. The ground wire protects the man, by taking him out of the ground return circuit. The fuse will blow because

of the excessive ground current, and the defective unit will be isolated.

The ground wire has become almost standard in industrial construction for the last ten years. Generally the ground return circuit is formed by a conduit system and receptacles are provided which connect the separate grid. Standardization of plugs and receptacles has been difficult to achieve, and even the solution now accepted does not necessarily solve all problems. Receptacles now in common use provide the ground connection. A major problem is that many tools and appliances do not have three-conductor cords and cannot be used in some receptacles unless an adapter plug is provided. Similarly, a tool with a three-conductor plug cannot be used in a shop which is equipped with the out of date two-wire receptacles. The accepted solution is by a plug and receptacle that is adaptable to both two and three plugs. If the tool does not have a ground wire, it can be used, but the safety aspect of the three-wire receptacle would be lost.

In a sense, the ground wire in the three-conductor cord is your insurance policy for safety on portable tools with the metal exposed parts. The problem here however, is that one never knows when this insurance policy will expire. Ground wires break or become disconnected, and when this happens—and it happens all too frequently—the user of the tool is exposed to a possible lethal shock.

This happened to a construction worker doing work for a major company some years back—even though they had a strict grounding policy. As a result of this accident, a tool checker was devised to automatically check electrical tools before they were issued. This device acted primarily as a "go—and no go" test for a storekeeper who issued tools. The checker automatically passed a high current through the ground wire and maintained this high current long enough to burn out any whiskers, if that was all that was left of the ground wire. After passing this test, the tool was then

subjected to a high voltage test, approximately 500 volts, to check deteriorating insulation. It also tested for a short circuit in the motor armature. If the tool passed these tests, the tool would then be subjected to run voltage and a run test, if the "on" switch of the tool was pressed.

Another feature of this tool checker was its built-in safety factor. In order to operate the tool tester, the tool had to be pressed against a spring plate on the vertical portion of the test panel on the tool checker. Pushing the tool against this panel, besides assuring a good ground connection, the tool frame operated a micro-switch directly behind the panel to initiate the test procedure. If the tool was faulty, an audio and visual indication was provided and the test would not proceed to the point of applying voltage to the tool. Accessories for testing existing cords were also provided. This automatic tool checker has never been produced commercially, although a unit that uses the same tests but on a manual basis is being marketed.

The essential steps for safe operation of portable 110 volt single phase electrical equipment can be summarized as follows:

1. Use a grounded power system with adequate overcurrent protection for all feeders.
2. Maintain a good ground grid. This can be either a properly installed conduit system, or a supplementary ground wire network.
3. Use standard three-wire receptacles and make sure the ground wire is connected to the ground grid.
4. Use three-wire cords for portable tools and appliances.
5. Periodically check portable tools to be sure that your ground wire insurance is in force.

If these steps are followed, needless loss of life by electrocution from defective 110 volt portable equipment will be prevented.

GROUND FAULTS IN QUARRY ELECTRICAL SYSTEMS

By H. P. CASSEL
The Whitehall Cement Mfg. Co.

Well-planned installation of electrical equipment takes for granted that such equipment will be well grounded, at least to the minimum requirements of the National Electric Code. In the application of both large and small portable electrical equipment, we have at times been negligent in the installation and maintenance of proper grounding.

The use of large, portable, electrically driven equipment in quarries, such as draglines and shovels, usually requires operation at voltages of from 2300 to 13,000 volts. The fact that such voltages are used, plus the uncertainty of obtaining good grounds in areas such as quarries, demands that we carefully examine our grounding practices in this area.

WHAT IS A GROUND FAULT?

When one of the main conductors of power accidentally touches the framework of the machine involved we speak of this as a "ground fault." This accidental contact may be caused by the breakdown of insulation anywhere on the machine. It may be at the point of entrance of the portable cable, in the switches or wiring on the machine, or in the windings of the motor or generators driving the machine. Such a breakdown may occur at anytime and without warning.

When such ground faults occur, personnel standing on the ground and touching the frame of the equipment involved may be subjected to electric shock ranging in intensity from slight to fatal. Since even the best insulation, installed in the most expert manner, is still subjected to occasional breakdown the safety problem involved concerns control of the intensity and duration of the shock hazard when such breakdowns occur.

WHAT CONSTITUTES A SHOCK HAZARD?

A good deal of investigation has been undertaken to determine the limits of human

reaction to electric shock. Due to the great variations in individuals and their varied reaction to shock, and to many other variables, the evidence of these studies is only generally conclusive. However, broad limits may be set which will apply to most cases and conditions.

All investigations agree that the severity of any electric shock is a function of intensity and duration.

The intensity of the shock depends on the voltage encountered and the bodily resistance of the individual in that portion of the body through which a particular electrical current may pass. Investigations in this area have set values ranging from 500 to 1000 ohms.

The amount of current flowing through the body having such resistance will depend on the potential or voltage encountered. The following is an indication of what probably will happen with varying amounts of current flowing through the body:

1. 1 milliamperes—No sensation.
2. More than 5 ma.—Painful shock.
3. More than 10 ma.—Muscle contraction—25% of population will freeze to contact.
4. More than 15 ma.—50% of population will freeze to contact.
5. More than 30 ma.—Breathing difficult—unconsciousness may occur.
6. 50-100 ma. Possible ventricular fibrillation of heart.
7. 100 ma.—2 amps.—Certain fibrillation of heart.

With these results in mind the mining industry, some years ago, set 100 volts as the maximum allowable potential that should exist between the frame of a machine and the earth during a ground fault.

WHAT HAPPENS WHEN GROUND FAULTS OCCUR?

Let us now examine what might happen when ground faults occur under various types of installations.

A. An ungrounded system:

With an ungrounded system, a single line may be the ground. There will be no interruption of service and unless special ground detection equipment is installed such a ground may go undetected indefinitely. A second ground fault in the frame of a shovel, for example, will cause a fault current to flow through the frame of the shovel, through the treads where they contact the earth and thence through the earth to the original fault. The amount of current flowing will be determined by the total impedance of the system. Since a large part of the total impedance will consist of the rather poor contact between the shovel treads and the earth, a large portion of the full line potential will appear between these two points. Any person standing on the ground and touching any part of the frame would be subjected to this potential. If the line potential would be 2300 volts and the body resistance taken as 500 ohms, almost 4 amperes could flow through the body, with almost certain fatal results.

B. Underground distribution system—with frame of machinery grounded.

There has been some thought that the addition of a ground connection to the frame of the machine, running to a ground rod would eliminate hazards due to ground faults. Actually, such protection is far from adequate. With such a ground connection and a ground fault to the frame of the machine plus failure of another phase wire, ground fault current will flow through the machine, the ground connection, to earth and so to the fault. Since the total impedance of this path has been reduced by the lowered resistance to earth of the ground rod, a larger ground fault current will flow than in the previous case. If the ground rod resistance path is in the order of 10 ohms (which seems to be a reasonable value to expect in most quarries) fault currents could be in the neighborhood of 50 to 100 amperes, on a 2400 volt system, and thus a potential of from 500 to 1000 volts would appear between the machine frame and ground. Again assuming the body resistance to be in the order of 500 ohms, this would indicate between 1 and 2 amperes of current through the body, again a fatal dose.

C. Another system makes use of a solidly grounded neutral in a Wye-connected distribution system, with the point of transformer ground being carried along with the power conductors to the frame of the shovel. With a ground fault, a large ground fault current will again flow, which should cause the protective relays to trip out the power circuit. However, during the time necessary for these relays to operate, the frame of the shovel will probably be at a dangerous potential for a short period of time.

D. Having looked at the previously described system, it may be seen that a high degree of protection may be secured by:

1. Providing the lowest practical resistance between the shovel frame and ground.
2. Limiting the ground fault current to such a value, so that the voltage drop between the frame and ground will not exceed a voltage which is ordinarily considered dangerous. The mining industry has set this limit at 100 volts.
3. Disconnecting the power feeders when a ground fault occurs with as little delay as possible.

It is to secure these benefits that modern installations are using impedance or resistance grounded neutral transformer distribution systems. In the event of a ground fault, the ground fault current will flow from the transformer terminal through the main conductor to the shovel frame, returning through the ground conductors to the neutral resistance and thence to the neutral point of the transformer. Under these conditions the ground fault current is limited by the neutral resistor to such a value so that, under the ordinary conditions encountered in quarries, the voltage drop between shovel and ground would not exceed the safe limit of 100 volts. In addition to this, protective relaying is installed in the neutral of the transformer, that will immediately be responsive to ground fault currents and remove the entire feeder circuit from the system.

Summary

Adequate protection of human life and health against electrical shock hazards can be provided. It will consist of these features:

1. All electrical installations to be made with the highest degree of skill possible.
2. Neutral point of Wye-connected trans-

formers to be grounded through a resistor which will limit ground fault currents to 50 amperes or less.

3. Ground connections from this resistor to be carried through the portable cable and terminated on the frame of the machine involved.

4. Relaying to be installed in the neutral of the transformer which will remove the faulted circuit from the source of supply.

5. Ground connections, cables and rods

to be periodically tested to insure the lowest possible resistance in the ground circuit.

To accomplish this may add somewhat to the cost of installations. It will certainly require some effort, time and money to maintain in working order, but unless we agree to do the job to the best of our knowledge and ability, we cannot say we have done everything in our power to make our plants a safe place in which to work.

HAZARDS CAUSED BY IMPROPER APPLICATION OF KNIFE SWITCHES

By G. J. REYNOLDS

Tech. Mgr., United States Gypsum Co., Chicago

The United States Gypsum Company has had several serious accidents in the past several years through the closing of inadequate knife-type so-called "safety" switches on stalled motors or short circuits. This is the greatest single cause of electrical accidents in the company.

Many of the knife switches have been applied in the past as safety lockout devices ahead of motors. The hazard exists in that the knife switches are usually of the lightest type available as intended to be visual disconnect only and to be opened or closed only with the power off, not to interrupt energized circuits. Our main objective is the elimination of the knife switch entirely where possible, where a lockout switch is required. If it cannot be locked out conveniently because the main breaker is too far away, a safety lockout circuit breaker should be added for this purpose.

The purpose of this switch is only to visually open the circuit for safety reasons after the power is off. The reduced voltage starter for the motor is at the lower right and the starter stops and starts the motor by means of a push-button above. Therefore, after the motor is stopped, theoretically, it should be perfectly safe to open or close the knife switch as there is no load on the circuit at that time.

In one case the starter contacts had fused when inching the motor but the knife switch

was safely pulled without damage. Later when it was closed on a starting load, because essentially the starter contacts were fused shut, the switch was closed on a load which the switch did not have capacity to take and the switch exploded.

A maintenance mechanic had been assigned the job of servicing the rollers of the White Raymond mill. He serviced them by positioning them manually in line with a port in the side of the housing and had completed four of the five rollers in this manner. He experienced difficulty in getting the fifth roller into position for servicing. He pointed this out to another mechanic who was walking through this area. The latter said he would "inch" the motor for him. The first mechanic removed his lock on the safety switch and then returned to the Raymond Mill so that he could observe the positioning of the rollers.

He signalled to the second mechanic when he was ready. At the signal, the second mechanic closed the safety switch, pressed the starter button momentarily and only long enough to allow the fifth roller to turn into position. This would have meant that the mill made only one fifth of a revolution before the operator released the starter button.

The first mechanic states that the mill made no more than a fifth of a revolution and that the fifth roller stopped in the

With the co-operation of our safety director, Mr. E. C. Beuthin, the program was reviewed with management and their support and approval for future appropriations was obtained.

Our next step was to disseminate the information to our 60 plants in the field through channels that would set up authority for execution and to assume the responsibility for compliance. This was handled through our operation managers, through

their production managers and plant works managers.

The seven-page Information Bulletin #604, referred to above, was compiled to cover classification, survey and alternate methods of making correction and was issued to all plants as an operating bulletin for execution.

Completion of each separate plant project, in accordance with the above, is being followed up by the production managers.

FALLS DURING BULK MATERIALS LOADING OPERATIONS

By JAMES M. CHRISTIE
Safety Engineer, Portland Cement Assn., Chicago

My paper is directed to a problem in our industries that is certainly not new. As a matter of fact, in my research I ran across an accident report describing a fatality in this same type of situation back in 1920—just a few years before I was giving any thought to safety work. The title of my paper, "Falls During Bulk Materials Loading Operations," is intended to be specific to a current problem. And I believe it accomplishes this. However, as I stated, this problem is not new. It is merely being brought to our attention most recently, because of an increased usage of trucks for bulk hauling of our products. And, naturally there have been many injuries sustained by our employees.

I wish to tell my point with a few case histories. The case of the fatality I mentioned earlier involved a fall from atop a rail car. A 15-foot fall, the approximate height of a rail car, is certainly a potential fatality whenever it may occur.

Essentially, our problem involves falls to a lower level—whether loading into truck trailers or rail cars. However, it is not necessarily limited to this. One injury that I learned of involved an operator loading a trailer with bulk lime—he tripped and fell on top of trailer and fractured three ribs on his right side. But this accident did not exhaust all the possibilities for injury. He could have fallen into one of the

open hatches on the trailer—with the resultant possibility of suffocation.

This happened to a worker loading finely divided material—he tripped while on top of a rail car and fell into a loaded section of the car. For a brief interval he was completely submerged in the material. Fortunately, quick action on the part of another employee saved his life.

Or—another case—this time on a truck. The employee stepped into the opening on top of truck with one leg—suffering severe bruise in groin.

Now the fall to a lower level. Basically—from the top of the rail car or truck trailer to the ground—distances ranging from 10 feet to 15 feet. Would you condone a situation in which an employee regularly works on an irregular surface near an unguarded dropoff of 15 feet? There is much condemnation of such work practices in our industries. It appears that the thinking has been something like this—railroad men and truck drivers do it why can't we? Does this sound familiar? Or, the safety equipment creates more hazards than it alleviates—hogwash. I'm sure you have all heard these excuses many times.

In plants where these and similar excuses have been allowed to prevail, we know of many injuries resulting from the falls that occurred. An interesting sidelight is the fact that in almost all cases, after an in-

jury has occurred, some action is taken to prevent further injuries. But only after someone has been injured.

These are the case histories of some injuries sustained in falls during bulk loading:

A bulk car loader lost his balance and fell to the ground when a hatch door that he was pulling open released quite suddenly. He fractured his heel. Another case of lost balance and a fall to the ground from a rail car resulted in multiple fractures, bruises and brain concussion—both of these are similar as the start but the consequences are vastly different.

On truck trailers, I learned of a case where the truck driver drove away from the loading point while the loader was still on the truck. And yet another case of lost balance—this time from a truck trailer—the loader suffered a broken arm when he tried to jump to a platform 8 feet below to avoid a fall.

These case histories certainly are not all inclusive in either number or types of accidents. They do lead us in the direction of solving the problem, however. At the risk of over-simplifying this problem, let me say it in this manner. We have people working in locations where they are exposed to injuries from falling. Our job is to prevent these falls—How? By tying the people in place or by building a fence around them.

By way of explanation, my organization, The Portland Cement Assn., has established certain safety precepts that our members use to guide their safety efforts. We call them "model safe operating practices." The one that is specific to this situation states, in part, "A safety belt and line properly attached, adjusted and incutted shall be worn by each person working on an unprotected perch more than five feet above a lower surface."

I might add that this model safe practice, and all the others, is intended as a minimum requirement for job safety in the cement industry. Our members find need to expand these and to make them specific to certain work locations and situations. We believe this model safe practice covers both the "tying in place" or "building a fence around" situations.

Directly, if a man is on top of a rail

car or truck he is working on an unprotected perch—more than 5 feet above a lower surface, and needs the protection of a safety belt and line. On the other hand, if a fence is built around his work location, his chances of falling to a lower surface are negligible. So, I say again, "Tie him in place," or "build a fence around him."

Now, gentlemen, I would like to show some specific examples illustrating the two points I have mentioned.

1. Man on car with belt and line attached to horizontal overhead cable.

You will recall that I told you of a case involving a loader who fell into a hatchway and was momentarily submerged in lime. This picture involves the same type situation. Except, this man was using the belt and line shown and only went into the hatchway to around his knees. There is quite a difference in the potential consequences of these two similar cases.

In attempting to apply the principle of "tying the man in place" you will encounter some physical difficulties at your loading points. It amounts to answering the question, "What can we tie the man to?" With a roof overhead, a cable can be extended horizontally over the length of the loading area. As in this case, the life line can be permanently attached to the horizontal cable. Also, a ring attached to the top of the life line allows your bulk loader to work the entire length of the car or truck trailer.

2. Silos or buildings on both sides of loading area.

If you don't have a roof or structure over your loading area, you may have structures on either side, as shown in this slide. Here you will note the cables extended over and across the loading area that support the cables extending the length of the loading area. To these, then, the life lines are attached. Please note that these life lines are pulled up and tied off. This is to allow for the 22-foot vertical clearance requirements over the top of the rail.

3. Pole installed as upright support for one corner of cable arrangement.

This is intended to show the extent to which one plant has gone to provide a place to tie the bulk loader to his job. They didn't have adequate overhead structure or buildings on both sides of the loading area.

so they installed this post as the corner support for their cable. Again, note the life line pulled out of the way for rail movement.

4. *Boom pivoted from side of silo for truck loading.*

One plant has solved the problem of what to do by installing a boom on the side of their silo. The boom is pivoted at the silo and is actually a monorail. The life line is attached to a carriage on the monorail and the user can safely traverse the entire length of the boom.

5. *Platform over truck loading point.*

This platform is designed to virtually eliminate fall hazards during bulk loading. It illustrates the point of building a fence around the work location. At this plant, the loader never goes onto the truck trailer. However, the problem is not completely eliminated because someone (in this case the truck driver) must open and close the hatch covers. This practice appears to be quite common around the cement industry. The employer of this worker needs to attend to his protection.

6. *Handrailed walkway alongside silos.*

This is an illustration of the fencing principle as used in loading aggregate from silos. The discharge chutes can be lowered into position and the flow of materials controlled from this handrailed walkway.

7. *Pivoted walkway to get out to truck.*

This situation does not fit neatly into either of the categories I have tried to establish. However, it does involve need for both fencing and tying the loader. The platform on which this employee is standing is hinged and counterweighted to keep it out of the way when a truck trailer (or railroad car) is being spotted. Then it is used as the access to the truck or car. It has handrails; however, once an employee goes beyond these he lacks protection. So, this represents a situation in which both tying and fencing may be applicable.

8. *Suspended handrails at a truck bulk loading point.*

An example of applying the "fencing" principle to a truck bulk loading situation shows the slatted grating leading to the trailer, then the handrail that extends around the working area.

An additional safety innovation is evident in the stairs and catwalk that are used for access to points where maintenance work will take place. I think you will agree that a great deal of thought has been given to these work situations.

9. *A situation that is not common all over the country.*

On a trip into New York State I saw a type of rail car that I had never seen before. It is called a bottle car and consists of 4 or 5 large metal containers on flat bed rail car. There are no ladders on the sides of the "bottles," and no catwalk from one "bottle" to another. As a partial solution to the problem of how to position a man for loading these cars, one plant installed hinged grating alongside the loading area. These are kept in a raised position until a car is spotted. Then the platform is lowered and it offers a convenient working surface for the loader. I might add, that this arrangement could be improved by installing a cable overhead for use with a safety belt and life line.

There is one other mechanical device regarding bulk loading that I want to discuss. In many of the examples above, you will recall that the bulk loader had to climb up the ladder on the rail car or truck and then hook up his safety belt to the life line. This allows for exposure to falls during the climb up and down the ladder, and momentarily while he is not hooked up to the life line.

I don't want to be accused of advertising a commercial product and I don't have any stock in this company, but I do want to tell you about a product that is being used in some cement plants. It amounts to a life line that is mounted on an automatic reel. The reel contains 16 feet of steel cable that extends or retracts automatically with the normal movement of the user. Then, should he lose his balance and start a rapid extension of the cable, a locking mechanism in the reel stops the movement in about one foot.

To use this device in a bulk loading situation for example, you still need a cable extended horizontally over the loading area. Then, the reel containing the extendable and retractable life line, should be attached to the horizontal cable. It will slide on the horizontal cable allowing free-

dom of movement the length of the rail car or truck trailer.

The life line will allow for safety during the loaders vertical movements getting on or off a rail car or truck. In answer to possible questions, I would like to explain that I do not know of any tests that have been made on this device—other than by plant people—one plant has dropped a 250-pound weight and the locking mechanism worked properly.

Falls during bulk loading of materials can result in serious, even fatal injuries. They have happened in the past and will happen again unless we exert efforts to provide work situations where fall potential is either eliminated or drastically re-

duced. And, this won't be an easy task. You are all familiar with the resistance one encounters when attempting to institute any new safety practices or equipment. You may expect such resistance regarding fall protection—both from management, supervision, and employees. However, there are many plants in which the employees are protected from falls and they are still producing efficiently.

I'm sure you realize that I have not covered every conceivable situation—I'm certainly not knowledgeable about all of them. I do hope, though, that I have been able to stimulate you to review your bulk loading situations with an eye towards reducing fall potential and eliminating these injury sources.

BELT CONVEYOR HAZARDS

By LESLIE S. VOLTZ

Safety Engineer, Consumers Div., Vulcan Materials Co., Chicago, Ill.

My remarks are pointed primarily to the management of the smaller companies who do not have actively organized accident prevention programs, and to the larger companies who do have such programs but fail to make them effective because of the poor attitudes of operating personnel. As a safety engineer I cannot be honest if I judge our progress as an industry by a code of legalistic moralism. I must judge the results on our success in preventing all personal injuries.

The tragedy of belt conveyor accidents is that we do know how to prevent them. We do know the essential rules, on the mechanical and electrical devices and their operation, to eliminate such hazards to our employees. We do know the necessity of specific rules and regulations which must be hammered (and this can be taken literally for some employees) into the minds of our management and men concerning the operation of belt conveyors.

Some of the things I say here may make you angry and I hope they do—in fact I wouldn't care if you got so mad you pushed me out the door—if in so doing I could only convince some of you of your lack of

an intelligent approach to belt conveyor safety.

Possibly many of you have stood by a belt conveyor and watched it roll along quietly with its load, the occasional click of the splices passing over the rollers being the only sound you heard. It doesn't make a lot of noise to put fear in your mind and seems so innocent as it travels along at 350 to 450 feet per minute. This very characteristic makes it fascinating and seemingly harmless.

In fact, I have often thought of this type conveyor in the same manner as a person might think of the waves that roll in so quietly and peacefully at a beach. Yet we know in many cases beneath all this serene beauty there is a deadly undertow. You may be only a few feet from danger . . . and so it is with a belt conveyor. You may be only a few inches from a serious personal injury.

The following should never let you forget one basic rule of belt conveyor accident prevention, that is, provision for an effective "lock and tag" system. I have called this "Death Takes a Holiday."

A working foreman about my size and age was instructed to repair the chute at the bottom of a 42-inch belt conveyor from the screening building to the load out bins. The conveyor was not running and, according to the man's statement, he pulled the emergency cord to make it inoperative. He then proceeded to get on the belt and start the repairs.

All head and tail pulleys should be guarded, but the wing type tail pulley is a particularly dangerous type; however it did not contribute to this accident. A general view up the conveyor from the tail pulley shows the emergency cord. This is the long trip our man will have to take—220 feet to the head pulley at a belt speed of 400 feet per minute.

A view of skirt plates at the chute to be repaired would show the emergency cord on the left which the foreman said he pulled at this point. The employee was standing between the angle supporting the skirt plate and the conveyor cover when the belt was started from the control center at the load out bins.

He was knocked down by the cover and started up the conveyor head first. As he was traveling about seven feet per second, he could not pull the emergency cord.

He was flattened by the 3/4-inch belting, used to shape the material on the belt before it comes to the weighing device. The clearance from the bottom of the 3/4-inch angle supporting this is 21 inches and it is only 11 inches from the trough of the belt to the crown of the belting.

Again, he entered the conveyor covering to continue his journey. His last view of daylight was at the weighing device, where once more he went under cover. Surely, at this point, "death was his companion."

At the chute to the screen, where the employee went over the head pulley and into the chute, there was only a 12-inch clearance. He was able to get out by himself and walk from the tower with some assistance. Examination at the hospital did not disclose any fractured bones or serious lacerations. His body, however, was so severely bruised all over that he was disabled for 22 days.

No one can deny that this man was blessed and that "Death" did indeed, "take

a holiday!" But why did it have to happen? The plant had been provided with danger tags. Only the previous week locks had been received to institute lock-out systems. The employee had three separate places to tag out, lock-out, or both tag and lock the power to this conveyor, as follows:

1. At the emergency switch at the head pulley of the conveyor.
2. On the control panel at the load out bins.
3. The circuit breaker for the unit under the load out bins.

However, none of the tags were placed at any of these points. Who, then, was responsible? You can each answer these questions for yourself and your own operation.

1. Had the employee been instructed personally on the use of these tags?
2. Had management and supervision insisted *every single time* on the use of the tag out system?

A two hundred foot walk on the part of the employee would have insured his security. Yes, Death took a holiday but don't depend on it! Good management cannot afford to gamble with such odds.

If you are interested in seeing an excellent film on lock out systems get "Lock and Tag." See the June 1961 issue of *National Safety News* for the source for this film.

The next series lists some of the hazards encountered in the process of repairs, or as the result of repairs or maintenance. Please review your own operation as these are given.

1. Guard not replaced following repairs.
2. Ladders incorrectly placed or used.
3. Conveyor walk-ways with openings, no toe boards and absent or missing cleats. The latter are a necessity where frost, or freezing water can accumulate.
4. Falling Hazards—Man trap, material left on stairs or platforms.
5. Pinch bar left on walk-way.
6. Removal of bearing race with 8 lb. sledge hammer.
7. Compressed gas cylinder—unsupported oxygen tank.
8. Tools in bad condition—mushroomed chisel. Note oxygen tank in background.

9. Unguarded platforms, openings, absence of cleats, etc.

10. Unguarded flexible couplings, motor to speed reducers.

11. Unguarded conveyor drives.

12. Incomplete guarding.

13. Unguarded back stop.

14. Unguarded wing type tail pulley.

15. Overhead dangers. "A Safety Hat Saves a Life."

A quarry mill employee, age 29, was cleaning the tunnel floor under a 42" belt on the tight side, (opposite the emergency cord) where there was an 18-inch clearance between the conveyor structure and the wall. He was using a long handled scoop shovel and throwing the spilled material back onto the top run of the belt. A troughing idler was involved in the accident, and a vertical angle supported the skirt plates. The handle of the shovel was caught between the operating belt and idler, pulling the left arm and shovel blade under the belt. The throat of the shovel held part of the weight off of the employee's arm, and prevented the idler from turning. The employee's statement was as follows:

"It seemed to me an eternity before I was found, although I think it was between two and three hours. I hollered from time to time as loud as I could whenever the conveyor was stopped and on one occasion I unlaced one of my shoes and wedged it between one of the rollers in an attempt to lessen the pain. I also took a shoelace out of the shoe and wound it around my arm as a sort of tourniquet to stop the loss of blood. When released by my fellow employees I fainted and woke up in the hospital."

The report of medical treatment was as follows:

"He was treated for 3rd degree burns of the left forearm and hand. This involved the tendons, muscles, nerves, arteries and veins. He had multiple debridement of the left arm. In order to prepare the arm for the skin grafting, his right thigh was chosen by the doctor as the donor site, and from this area three strips of split thickness skin was taken and placed on the defects. Approximately 75 per cent of the forearm was covered, leaving the other 25 per cent which was composed of dying and exposed flexor

tendons in the area of the wrist. Iodoform gauze was packed into the wound and extended proximally down between the radius and ulna in the lower third of the forearm. Vaseline pressure dressings were applied followed by fluff dressings."

He was discharged from the hospital 103 days later, but had to report to the hospital three times a week as an out patient for further debridement of the skin and conditioning of the skin graft. The donor site dressing was changed after two weeks and revealed this wound to be completely healed with no particular difficulty. The only thing remaining is the volar area of the wrist in which remains some of the fibers of the deep flexor tendon which should be saved to give him a pinching mechanism of the thumb and index finger. Therefore, it was impossible to graft over these areas. Enclosure had to be achieved by secondary intention. After 46 more days, the man was sent to a sanitarium for physical therapy treatment to help reconstruct the function of what remains of the power in his left hand.

Seven and one half months after the accident the employee was re-examined and it was reported that the wounds were healed except for two small areas on the volar aspect of the wrist.

"His fingers reveal very little, if any, active motion and almost no passive motion. He does have 25° of active flexion of the distal phalanges of the thumb and 15° of active flexion of the proximal phalange of the thumb. He has a loss of sensation compatible with injury to both the median and ulnar nerves. This hand and forearm, in my opinion, represents a 100 per cent disability because of the marked stiffness of the joints of the fingers. I believe there is little hope of obtaining active motion by further ten's surgery. If it were possible, by continued physiotherapy, to obtain some passive motion, there would then be some chance for further surgery. The gap in the median nerve is so great that nothing short of nerve graft would be of any value."

"It would be my impression that either the total disability should be accepted, or to continue with a trial of physiotherapy and splinting to try to mobilize the small joints of the hand. If these small joints can be mobilized, one would then have to plan a large pedicle abdominal flap to replace the scarred tissues on the volar aspect of the

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CHEMICAL SECTION

AN M.D.'S USE OF ELECTRONIC DATA PROCESSING IN HEALTH AND SAFETY

By BERT W. BROOKS, M.D.

Dir., Industrial Health, The Upjohn Co., Kalamazoo, Mich.

Electronic data processing has, in recent years, become almost routine in industry. Most of you here today, I am sure, have had some contact, in the various industries that you represent, with representatives of your data processing departments. Records of sales, sales forecasts, shipping, the various accounts and payroll data, even supplies in many maintenance departments, and sums of available stock are a few of the functions of such a data processing department. The ease, accuracy, and speed of the reports from this type of department save hundreds of man power hours each month. If such facilities are available, why then shouldn't we in medicine and safety utilize them to assist us in not only day-to-day work, but also in long range planning and forecasting?

I am sure most of you know the concept of modern occupational medicine. Man power conservation is growing more important each and every day. There are few industries today that are not looking for some way to conserve their man power. I believe that health and safety parallel each other and, because of this, we should look at some medical statistics; and in this way, perhaps, gain further insight into the total problem of safety.

Within the past five year period, I was a consultant to Occupational Health Service, and during this time had the opportunity to study the results of over 60,000 physical examinations done at many locations on working people. The results to me were astonishing. Utilizing mobile equipment, over 30 different industries were visited in 16 states. For example; a paper corporation in Texas, a candy company in New Jersey, coal miners and quarry workers in Virginia and West Virginia, employees of one of our largest electronic firms in Ohio, and a utility corporation in New England.

As you can see, we had representation in many geographic locations as well as representation of many various types of industry. These were voluntary examinations done during working hours and paid for by management. Of the industries visited, none had less than 90 per cent participation of their employees, from top executives to the lowest rated employee. I think it important to mention that these examinations were done on supposedly well people, because if an employee was not at work he was not examined.

Also, to add to the statistical significance of these examinations, the same laboratory technicians performed the tests in each location, as well as the same board specialists for interpretation of such things as cancer smears, X-rays, electrocardiograms, etc. This, I feel, gives us a valid statistical base.

Electronic data processing played its part in this study. Without the use of electronic data processing adapted to medical records and laboratory results, little information could have been learned from this study. Each aspect of the medical examination was tabulated utilizing IBM equipment and from this data we quickly were able to produce accurate statistical reports of our work.

Let us briefly go through the various procedures that were done on each examination to give you an idea of the depth of this study. With each of our physical examinations:

A. A medical history was taken, utilizing a modification of the Cornell Index. Type History, including past medical history, present medical history, family history, operative history, and social history. An individual completed his history form with the aid of a nurse and a "marked sense deck of cards," including the above mentioned history. At the same time the individual was given 100

grams of glucose in orange juice for a more accurate blood sugar determination.

B. The height and weight were recorded and classified according to Metropolitan Life Insurance Tables based on body build, sex, height, and age.

C. Visual testing included the use of the Harrington Flocks method for visual field screening and the Ortho Rator for near and far vision, color vision, depth perception with and without glasses.

D. Because of the importance of hearing conservation, each individual was given threshold screening evaluation from 250 to 5,000 cycles per second.

E. A 12 lead electrocardiogram.

F. A routine physical examination which included neurological evaluation, rectal and pelvic examination, and papanicolaou smears in all females.

G. A routine chest X-ray.

H. In the laboratory the following laboratory procedures were performed: hematocrit, hemoglobin, blood sugar, serology, routine urinalysis, cholesterol.

I. Yes, I am sure you will agree, is more than a typical screening-type medical examination.

What were the results of these examinations? Twenty-five per cent of the people examined, regardless of job, age, geographic location or industry involved, showed a medical condition that might limit their survival in an industrial environment. One out of four of the people we examined, therefore, were found to have a serious or potentially serious medical defect. This fact alone might not shock you, yet 70 per cent of the individuals found to have a serious medical defect did not know it existed. The incidence of asymptomatic disease was found to be quite high. It is no wonder, therefore, that we are confronted with so many problems in our safety work. Certainly a sick individual is more prone to accidents than a healthy one.

When one considers minor medical defects, the results are again shocking. As high as 50 per cent of the individuals examined exhibited minor defects. Minor medical defects, in my opinion, are those which if left unattended might develop into more serious findings. I am speaking here of allergies, hemorrhoids, low back syndrome,

the myriads of fungus, etc. When you add the minor medical defects to the major findings in this study, approximately 75 per cent of the working population examined had recognizable medical defects, and yet most of them thought they were well.

Many other studies such as this have been reported and I am not presenting these statistics as the last word, yet this was a unique study done under rigid medical conditions and I feel should give you some basic medical insight as to the causes of many accidents.

I think it is interesting to note the increase of chronic debilitating disease from 46 per cent around 1900 to 81.4 per cent in the mid-1950's. On the same graph is noted the decreasing incidence of acute disease. This statistical evidence may be confusing.

Actually, the point to remember here is with the advent of the so-called miracle drugs, such as the potent antibiotics that physicians have in their hands today, acute disease is much better controlled now than it was in 1900 and if this is the case, it is the chronic debilitating disease that presents the challenge today. This is why the occupational medicine prevention or preventive medicine is assuming such an important role.

Of interest too is the percentage of accidents. This figure is relatively unchanged since 1900, and it is my opinion that illness plays an important role in keeping this figure at that level.

You all know that accident is the number four killer in the United States and for every person killed at work, three are killed at home and four are killed by automobiles. As late as 1957, 14,000 men were killed at work and 83,000 were permanently impaired, and in 1960, 13,800 were killed and there were 1,946,000 lost time injuries causing 84,000,000 days lost from work. You are also familiar with the fact that physical hazards cause only about 15 per cent of our accidents, human behavior 85 per cent.

Why do 4/5 of the accidents happen to 1/5 of our employees? Why are there so many repeaters year after year? I feel these can be predicted if we analyze records of their job, health, credit, and even social service records. Here is where electronic data processing can step in and play an important role.

DESIGN AND TESTING OF A NEW HIGH PRESSURE CELL

By

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Chemical research activities today are vastly different from those of previous years. Many new technologies are being utilized to produce new products and processes. Among these new technologies is the use of high pressure, and the application of high pressure techniques has moved the chemist from his laboratory into many types of barricaded structures.

The types of reactions conducted at elevated pressures are quite varied, but usually involve a pressurized vessel in which an exothermic chemical reaction is carried out. Any pressure vessel or exothermic reaction presents some hazard. When the two conditions are combined, as in an exothermic reaction under high pressure, a considerable hazard may be involved. This is particularly true in research activities where the reaction and reaction rates are not known.

The possibility of the rate of reaction, being carried out at high pressure, approaching those found in explosive decompositions is very possible; therefore, extra precautions are required to provide proper safety for personnel. Some of the safeguards that should be employed include specially trained personnel, well-designed and engineered equipment, proper safety devices such as relief valves and rupture discs, provision for control of exothermic reactions, adequate barricading.

Each of the above mentioned safeguards is of considerable importance in the safe operation of a high pressure laboratory. This paper deals primarily with the subject of adequate barricading.

There are two general approaches to the use of barricades. In the first, personnel are placed in the cell with the equipment

placed in the open. This system is used in rocket and missile test work, and in the testing of conventional and nuclear explosives. In the case of high pressure chemical research it is conventional to place the equipment inside the cell. The primary function of the cell is to protect against missiles, and for hydrostatic test work the cell wall is usually made of steel or a combination of wood and steel.

A second type of missile, resulting from a runaway chemical reaction, is more difficult to stop. Under this condition a concrete cell wall is generally preferred. In the case of a chemical explosion, it is also necessary to protect against the resulting shock wave. For protection against missiles a completely closed cell would be preferred, whereas for the relief of the blast pressure a wide open area would be ideal. Cell design, therefore, is generally a compromise between the two. An additional function of a barricade is to isolate incidents, that is, prevent the involvement of adjacent areas.

Since high pressure laboratories are often operated in close conjunction with other laboratory facilities, protection of adjacent buildings is important. Mechanical failure of an experimental unit may allow the release of considerable volumes of combustible gas inside the cell. Because of the large energy release possible from the explosion of a gas-air mixture, it is necessary to guard against this condition by the use of forced ventilation.

Data on cell design were collected from many sources including other chemical companies engaged in similar work. The design we have chosen is based upon a com-

bination of the information received from U. S. Army Ordnance Proving Ground, Terminal Ballistics Laboratory, Aberdeen, Maryland and the high pressure laboratory of the Union Carbide Plastics Company located at Boundbrook, New Jersey.

The design objective was to build a cell that would minimize the effects from a runaway chemical reaction operating under pressure. Therefore, the design must satisfy five basic premises in the event of an explosion. These are as follows:

- (1) Prevent injury to personnel by fragments and missiles from vessels and accessories.
- (2) Prevent the spread of gases throughout the laboratory by an explosion or rupture of a pressure line.
- (3) Isolate the incident within the barricade so that adjacent facilities are not affected.
- (4) Contain an explosion without significant damage to the cell. The barricades must be capable of withstanding the effects of a sudden energy release of 25,000 BTU.
- (5) Confine fire.

The work done on a barricade wall by an explosion is a function of the cell venting. This venting is most easily done with an open top cell arrangement but because of the need of a roof, which would cut down the effectiveness of the vent, the open top approach for the cell design was abandoned. Literature has indicated the best protection against missiles is afforded by a wall constructed of a heavy wood panel between two steel plates.

However, since investigators also disclosed that a 12" minimum concrete wall gives excellent missile protection, along with more mass in cell walls with the corresponding increase resistance to shock waves, concrete was chosen. The recommended ratio of volume of experimental equipment to

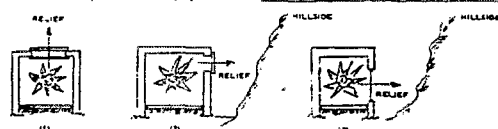
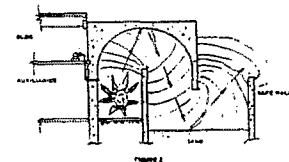
volume of cell is 1:1,000 with 1:10,000 preferred.^{1,2} The small cell in the high pressure laboratory has a volume of 820 cubic feet. It is anticipated that equipment size will be limited to one gallon capacity thus the ratio will be 1:8,100.

Those familiar with the present day construction practice of high pressure barricades or cells will recognize basic sketches (1), (2), and (3) of Figure 1.

The energy release is designed to break through a panel of light construction, (rigid plastic, wood, light sheet metal, masonite, etc.) which is lightly fastened in position. This method depends upon hillside or wide expanses of unused and unoccupied land to absorb resulting missiles. Missile and energy absorbing type mats were rejected as not solving the problem in addition to not being functional.

An obvious and somewhat simple solution is to direct the shock wave and missile discharge to an unoccupied position. The easiest and best location is down into sand placed in front of the cell. Aberdeen's terminal ballistic laboratory confirmed this idea by showing us their labyrinth of concrete cell passages connected to their cells for venting and reducing the sound of each explosive charge.

From our cell the shock wave will change direction (see Figure 2). It will move around



the curved section 180° to the sand and then out of the cell at about 45° upward. Some portion will reflect from the "safe" wall but its dissipation back to the main cell building will be generally of lower order. Missiles will be absorbed in the sand.

Once the inside curved shape was agreed upon it was decided to square off the top exterior making it much thicker at the corners. By doing this we have a cell which lends itself to multi-cell construction if desired. At the same time it provides a wall for a second floor of a connecting structure to house laboratories and auxiliary mechanical facilities. These are important adjuncts to high pressure operations. The additional mass of concrete also provides an ideal absorption medium for blast energy.

It will be noted that this cell (Figure 2) has no so-called blowout panel. There is definite reason for this which has been borne out by experimentation and by our own tests of the prototype cell. The reason we desire the blast wave to go instantly out of the cell is to prevent the build-up of pressure from the rebound of detonation waves and after burning effect. A build-up of pressure could have detrimental effect on the cell walls by its quick pressure rise.

While this feature requirement has been recognized before in cell design, it has been always tied in with a detailed description of the blowout panel, termed the venting area. This is a new feature to be pointed to here. There should be no material of rigid stability, even though light in nature and insecurely erected, in the vent space. The forces from the energy release move so fast (a few milliseconds) that the panel hasn't the least conception it had been struck; thus, it contains the force and allows pressure to build up.

The reflecting forces from the detonation wave could move back and forth many times, building up pressure with the hot unburned gases, before the blowout panel moves out.

For an explosion in an enclosed space two mechanisms are important: the initial detonation which gives rise to a shock wave, and after burning of the detonation products in air.

The shock wave reverberates between the walls of the cell transferring energy con-

tinuously to the atmosphere through the irreversible processes occurring in the wave front. Also part of the shock wave energy escapes to the outside through any wall openings or vents which exist. The after burning is a relatively slow process which causes a general rise in pressure in the room or sustains pressure for a longer period of time.

The two processes together result in the transfer of some part of the total heat of combustion to the room atmosphere, the fraction of the total depending upon the percentage completion of the after burning reaction. This energy is in turn dissipated to its surroundings by heat of conduction to the walls, by release of pressure through vents, if any, and also in an important practical sense, by work done in damage to the structure.

Our cells are designed for installation of a plastic curtain which can be rolled down from the arched ceiling. In extremely cold weather the curtain can be dropped while setting up the experimental equipment. When the experiment is under activation and personnel are out of the cell this curtain is to be drawn up to its top rolled position in order to provide clear venting conditions.

Authoritative articles on high pressure cell venting recommend the ratio of vent area to cell volume to be between 1:20 and 1:30 in order to reduce pressure roughly to that obtained from an open air explosion and take care of decreasing the effects of after burning.^{1,2,3,4}

Our small cells have a ratio of 1:16 which is better than recommended. Our larger cells have a ratio of 1:22 which is equivalent to the recommended venting. Dr. W. E. Gordon⁵ considers 1:50 as being sufficient to effectively reduce the pressure.

Having established the shape of the cell, it was necessary to determine the structural material, thickness and reinforcing required. The choice was between using reinforced concrete or double steel plate construction. While there are many proponents in the literature^{6,7} for the use of two steel plates separated by an energy absorbing material it was our conclusion that reinforced concrete would be more advantageous to us for the following reasons:

(1) Multi-cell construction lends itself readily to mass pouring of concrete.

(2) Steel plate construction requires much extensive welding since all joints should be continuous. A preliminary estimate of the cost of each showed no advantage to steel plate even with its thinner walls.

(3) The large mass per unit area of concrete is highly advantageous in energy absorption and ability to resist shock waves.

(4) Anti-missile penetration can be achieved by use of at least 12 inches of concrete for this type enclosure when parts of reactors, rocket bombs, etc. become explosive propelled missiles.

(5) Internal and external maintenance in relation to the two story integral supporting research building definitely favored concrete.

In the preliminary design we determined the thickness of the concrete wall using a nomograph furnished to us by U. S. Army Ordnance. Using the calculated energy release of 25,000 BTU, roughly equivalent to 8-12 pounds of TNT placed 1.5 to 2 feet from any cell wall, the prevention of severe damage by a missile requires 15 inch walls of concrete. Since the exact energy release is indeterminate we added 3 inches more to the wall thickness as a factor of safety and for more mass protection from blast effect.

The additional 3 inches is not very costly, and the potential hazard to life and property would not be worth the insignificant savings in money and space resulting from the construction of 15-inch walls versus 18-inch walls.

The intermediate wall at the center of the cell space over the blast wave vents was made 12 inches thick since it was not a factor in personnel or property safety.

There are two methods of designing the walls to resist the pressure caused by the sudden release of energy. Both are simple design procedures which give reasonably conservative results. A more rigorous detailed method would be difficult to justify since there is seldom sufficient information available to determine the true character of the blast forces which the cell might be required to withstand.

It is extremely difficult to predict a pressure effect from the vast range of

high pressure chemical experiments which could result in blast forces from rupturing of a pressure vessel or a high pressure line, or from the ignition of explosive gases or vapors escaping from an operating system. These methods are equivalent static pressure, and blast resistant design by dynamic response and plastic action. Details of these two design methods are covered in a technical paper presented at the American Chemical Society meeting in September and can be obtained from the authors.

In applying the second method to our design we found the amount of steel required was conservative. Later in this report the results of the field test of the prototype cell show this to be true. Serious wall distress was evident only after energy releases of more than 35,000 BTU.

The 12-inch safe wall, nine feet behind the mouth of the cell, was designed as a cantilever wall by the dynamic response and plastic action method. The test of the prototype cell did not use a concrete safe wall but rather a light wooden wall constructed of the concrete form lumber. Shock wave effect on the weak wood wall confirmed the need of a concrete safe wall which contains mass and resisting strength. It is of interest to note that high speed film of this action proved definitely the fact that a weak fragile wall did not move when first hit by a shock wave of super-sonic velocity. It rebounds a portion of the shock before it knows it has been hit.

Mention should be given to the one-fourth-inch plate on the outside surface of the cell at the operation side, called an anti-spall plate. Its function is to prevent the exterior surface of the concrete cell from spalling off chunks of concrete when the inside cell surface is hit by a high energy missile coming from an explosion. The one-fourth-inch plate, held in place by one-half-inch continuously threaded coil rods nine inches long used in form work. The test of the prototype cell indicated that the studs and plate held firm and performed their function perfectly.

In normal operation it is often necessary to keep cell doors closed for extended periods. Safe operating practices preclude entry to the cell while high pressure experiments are in operation. If leaks should develop

in the operating system at such time, toxic or explosive vapors could be released which would present a hazardous condition unless the cell is well ventilated.

It is not practical to design a cell of sufficient strength to withstand the energy release from the detonation of a cell full of combustible gas mixture. While it is difficult to imagine how this situation could arise in normal operations, the possibility of this happening is guarded against by a forced ventilation of one air change every two minutes.⁶ This is considered as a minimum requirement. Many installations are constructed with one air change per minute. However our cell design makes use of a large direct vent area so the necessity of one air change per minute was dropped to two. Each standard cell has two exhaust fans.

The fans are split between exhausting air at the ceiling and at the floor line. The upper fan handles lighter than air gases and the lower fan the heavier than air gases.

An individual ventilating system is provided for each cell. It is felt that the use of a single fan with a system of ducts to serve more than one cell is less desirable because of the possibility of an explosion in one cell causing the failure of ventilation in other cells at an inopportune time or spreading flame or toxic materials.

At the completion of the cell design considerable research time, money and effort had been expended. It was felt that the only reasonable way to ascertain if the design were adequate, meeting the five basic design premises, was to prove it by building a prototype cell for test purposes. Therefore, Monsanto entered into an agreement with Armour Research, Foundation of the Illinois Institute of Technology, to test a full scale model of the cell.

This organization is experienced in similar explosive-type testing work since it is continuously doing work for government agencies, in the field of nuclear explosives for the AEC, and ballistic missile testing for the U. S. Army Ordnance. The Explosive Research Section of the Fluid Dynamics and Systems Research Division of ARF conducted the tests at the ARF explosives test site, Coal City, Ill., in February and March, 1960.

The test program was intended to determine the effects of 8 to 12 pounds of TNT detonated within the cell. For convenience in charge preparation, handling, and firing, DuPont 50 per cent dithene dynamite was used in place of TNT. The heats of detonation of TNT ($p = 1.59$ gm/cc) and the dithene dynamite are 2010 BTU per pound and 1880 BTU per pound, respectively. The heats of combustion are 6520 BTU per pound for TNT and 2500 BTU per pound for dithene dynamite.

The large heat of combustion of TNT results from an oxygen deficiency. The after-burning of the detonation products does not contribute to the air blast pressure, but it is of importance only in creating rise of static pressure in a completely closed system.

Since the test cell has a large vent area per unit of volume, pressures within the cell are not sustained, and the increases due to afterburning will probably not be of sufficient duration to cause increase in structural damage. For this reason the heat of detonation more truly represents the sudden energy release, and is the better criterion for predicting air blast damage to the cell and its surroundings. Thus, it can be seen that a given weight of dithene dynamite is only slightly less effective in causing damage than an equal weight of TNT.

Electronic and photographic instrumentation were employed to obtain air blast peak pressure measurements in the immediate neighborhood of the cell, shock velocity measurements in the immediate neighborhood of the cell (for pressure and shock position calculations), and air blast pressure measurements at greater distances.

In order to determine directly whether windows in adjacent buildings might be damaged by air blast, three glass windows were mounted in the test area. These windows were located at distances of 280 feet, 500 feet, and 800 feet.

For some of the shots, a 16mm Fastax camera was used to observe shock propagation from the cell, and the response of the cell and the safe wall to the blast. Framing rates were between 725 and 4600 frames per second, depending on the exposure times required for the existing light conditions.

The gauges used for obtaining pressure measurements were of the piezo-electric type employing barium titanate. They were one-fourth-inch in diameter and were flush mounted in the centers of rectangular steel baffle plates having dimensions of three-eighths by four by seven inches.

A foil-break probe system was used to detect the shock front. Holes two inches in diameter were drilled about three-fourths-inch deep at two-foot intervals along a two-by-four. One-half-inch wide aluminum foils, notched down to one-sixteenth-inch in the center, were taped across the openings. Pieces of Saran film were then taped over the foils. The breaking of the foils unshorted resistors, resulting in voltage changes on the output cable. The circuit was balanced, so that an up-and-down step function resulted as various foils were broken by the shock front.

Because only one Tektronix 551 dual beam scope was available for the first few experiments, three of the pressure gauge signals were amplified and recorded on an additional four-channel oscillographic unit. A sequence timer was used to synchronize the recording camera on the four-channel unit, the Fastax camera, and the firing of the charge. Shock arrival probes were used to trigger the sweep of the two Tektronix scopes.

Six one-pound charges were detonated in the cell, followed by one two-pound charge, one four-pound charge, three eight-pound charges, one sixteen-pound TNT charge, and a fifty-pound charge. The charges were all located near the center of the cell floor, and were supported about two feet above the floor by a wood four-by-four. Number 6 electric blasting caps were used to initiate the dynamite charges, and firing voltage was supplied by two six-volt "hot shot" batteries in series.

To permit synchronization with the instrumentation, the firing circuit was closed automatically at the instrumentation trailer. When high speed photography was employed, the firing circuit was closed at the camera remote control unit. The wood wall in front of the cell, simulating the concrete safe wall, did not withstand the effects of charges of two pounds or more. The wall was rebuilt twice, and after the first eight-pound shot it was no longer used.

Except for damage to the side door

mounts (cinch anchors into the concrete), no damage to the cell was detected until after the first eight-pound test. In this shot, some concrete fell from an area across the top of the vent opening or mouth of the cell. The discolorations in the concrete in this area indicated that the concrete had been improperly mixed or settled.

The second and third eight-pound charges caused only slight additional damage to the cell. The 16-pound TNT charge caused several cracks in the side walls and the interior wall, but no significant deformation of the basic cell structure. The 50-pound charge, which was considerably in excess of the energy design limit of the cell, did cause extensive structural damage, however, fragments from steel members placed on the charge were not projected from the cell.

The motion picture records of the TNT test show afterburning of the product gases outside the mouth of the cell. It is also apparent that much unreacted carbon was present. This information supports the opinion that afterburning within the cell does not result in significant additional damage to the cell structure and that the energy release criteria should be the heat of detonation rather than the heat of combustion.

In the experiments involving charges of four-pounds and larger, the pressures recorded from the gauges located near the cell seemed too low, and the shock propagation velocities indicated by the foil break probes were only slightly above sonic. Fastax films of the experiment revealed that the recorded pressures were lower than expected because two shock waves were produced. A weak shock preceded the strong shock from the mouth of the cell. This weak shock apparently is caused by leakage around the edges of the baffle plate on the vent pipe near the bottom of the interior wall.

Pressures of the strong shock were calculated in some cases from measurements of the shock velocity taken from the Fastax film. In the shots for which pressure gauges were located seven feet and eleven feet from the cell mouth, the weak shock signals were recorded, but the strong shock drove the traces off the scope. The time of arrival of each shock at each gauge was known, and therefore, the propagation velocities and shock pressure could be calculated.

SAFE HANDLING OF CRYOGENIC FLUIDS

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What is cryogenics? The word itself is derived from the Greek words meaning "to produce icy cold." In current usage, "cryogenics" generally means the science of producing and utilizing extremely low temperatures. The temperature range involved is usually from about -150°F . down to absolute zero (-459°F), but this is arbitrary, and the recognized groups working in the field have established various other temperatures to define the upper limit of the area of cryogenics.

For the purposes of this paper, we will consider cryogenic temperatures to be those where special cryogenic equipment, such as double-walled vessels, extended stem valves, and related hardware is required. Practically speaking, this is what distinguishes the handling of cryogenic fluids from the handling of ordinary low-temperature fluids.

Cryogenic techniques have been used for many years in the low-temperature separation of air into oxygen, nitrogen, argon, and other gases used throughout industry. In recent years, however, the emergence of new industries and processes has given a tremendous boost to the field of industrial, or applied, cryogenics. The missile and rocket industry, for example, uses large volumes of liquid oxygen, hydrogen, nitrogen, and fluorine. The chemicals industry is making increasing use of cryogenic tech-

niques for purifying methane and other gases, used in producing high-purity chemicals in commercial quantities.

Cryogenics also promises to play a major role in low-temperature physics (particularly in electric computers and microwave communications), in the preservation of biologicals, in the refrigeration of foods, and in many other applications.

The large-scale growth in the use of cryogenic fluids in recent years has been paralleled by a large increase in the number of users of laboratory quantities of these fluids. Since handling small quantities presents some safety considerations different from handling larger volumes, these subjects will be covered in separate sections of this paper.

The Cryogenic Fluids

Handling cryogenic fluids safely is largely a matter of knowing their properties and using common sense to avoid hazards. Potential hazards stem from three important properties:

1. These fluids are extremely cold.
2. Small amounts of these liquids vaporize to form very large volumes of gas.
3. In the case of liquefied hydrogen, the released gas is highly flammable.

Some of the important properties of the most common cryogenic fluids are listed below:

	Bolling Pt. $^{\circ}\text{F}$	Liquid Density lbs./cu. ft.	Conversion: cu. ft. of gas from 1 cu. ft. of liquid at 70 $^{\circ}\text{F}$, 150 psia	Heat of Vaporization Btu/lb.
Ethylene (C_2H_4)	-184.7	35.31	737	207.7
Methane (CH_4)	-258.6	24.48	237	218.2
Oxygen (O_2)	-297.3	71.3	562	91.7
Argon (Ar)	-302.6	87.53	847	70.2
Fluorine (F_2)	-306.8	84.3	869	74.1
Nitrogen (N_2)	-320.3	50.46	656	82.2
Neon (Ne)	-410.6	78.35	1,415	37.1
Hydrogen (H_2)	-422.2	4.42	864	192
Helium (He)	-452.1	7.8	754	8.8

Handling Laboratory Quantities

More accidents, and more potentially serious accidents, have been reported with laboratory quantities of liquefied gases than with large volumes. This makes the proper

handling of small quantities especially important.

Liquid nitrogen, liquid hydrogen, and liquid helium are the cryogenic fluids most widely used in laboratory quantities. Liquid

neon is also coming into the picture, since it provides more than three times as much refrigeration as an equal volume of liquid hydrogen, and more than forty times as much as liquid helium.

Liquid neon, like liquid helium is inert and therefore the same safe practices that apply to handling helium (to be discussed) would apply to neon with due allowance for the higher rate of gas conversion of liquid neon.

Small Containers. The containers usually used for laboratory handling of cryogenic fluids are made from materials which can withstand the rapid changes and extreme differences in temperature encountered in working with these fluids. In a typical container, the inner liquid vessel is supported within the outer casing by the neck tube and, possibly, one other support. The wall of the neck tube is made as thin as practical to minimize heat leak into the inner vessel. Since liquid hydrogen is only about 1/12 as heavy as liquid nitrogen, the neck tube on a liquid hydrogen container may be designed to support the container when it is filled with liquid hydrogen only.

Thus, cryogenic containers are filled only with the liquids for which they are designed, and are handled carefully to prevent damage to the inner container support system. If a container has design limitations affecting the net weight of content, or which otherwise make it unsuitable for use with all cryogenic fluids, suitable warning must be given to the user.

Incidentally, the Compressed Gas Association is considering revisions of Interstate Commerce Commission Specification 4L (the insulated cylinder for pressurized liquid oxygen, nitrogen, and argon) to provide for a cylinder (such as the LSH 150) to transport liquefied hydrogen. The ICC 4L containers suitable for use at liquefied hydrogen temperature (-423°F) will be stamped with the maximum weight of the contents to warn the shipper against filling them with a heavier liquid.

Many cryogenic containers used in laboratories vent to the atmosphere through neck tubes. This type of container has been used successfully with liquid nitrogen for many years with only a couple of incidents reported where the neck tube was plugged. However, several instances have been re-

ported where the neck tubes of liquid hydrogen and helium containers have become plugged.

It has been surmised that, since the boiling points of hydrogen and helium are both well below the freezing point of air, solidified air contributed to this plugging. Thus it is imperative that all containers for liquid helium, hydrogen and neon be protected by a device which permits the escape of vapor, but precludes the diffusion of air back into the cold neck tube.

A relief valve that maintains the contents at 1 to 5 psi is often used and it is installed downstream of a short tube so that it remains at essentially ambient temperature. An inverted "U" tube is not considered adequate to prevent back diffusion of air.

Plugging is particularly critical in air shipments because changes in atmospheric pressure as the plane goes up and down cause erratic boil-off rates. To overcome this problem on liquid helium containers, Linde uses a copper tube heat exchanger ahead of the safety device to warm the released helium gas to ambient temperature before it reaches the relief valve. In laboratories, the tube may be much shorter.

Filling Containers. Before the initial filling of a warm container with liquid helium or hydrogen, it is precooled with liquid nitrogen if possible (contact the container manufacturer for the maximum weight of liquid nitrogen which may be used). Precooling with liquid nitrogen minimizes the volume of flash-off gas when the container is filled with liquid helium or hydrogen. It also purges air from the vessel.

Since the low temperatures of liquid helium or hydrogen can solidify any other gas, it is imperative that all of the nitrogen gas and air be removed from the container before it is filled. Solidified air in liquid hydrogen presents an explosion hazard because of its oxygen content.

Because air will condense into them, liquid hydrogen and helium are always (except in special cases) handled in closed systems and never poured from one open container to another. In addition, all liquid hydrogen equipment is electrically grounded and the operator touches the grounded equipment to eliminate static before making or breaking any connections.

Many cryogenic containers used in laboratories are not equipped with safety relief valves, since the containers normally vent through the neck tube. During filling, a tube is inserted into the container, often leaving only a very small annular space between the fill tube and the neck tube through which the flash-off gas can escape. If transfer is being made from a pressurized container (above 10 psi) through a closed system, a relief valve is installed in the transfer pipe to protect it and the receiving container from excessive pressure.

Design of the Laboratory. A conventional laboratory with good ventilation is suitable for handling non-flammable liquefied helium or neon because a principal hazard is the release of sufficient inert gas to reduce the oxygen concentration in the room below the level necessary to support life.

Laboratories for liquid hydrogen are well ventilated with several (20 to 60) air changes per hour. The density of hydrogen gas escaping from boiling liquid is about the same as air so it tends to spread somewhat. However, it warms and rises rapidly and thus exhaust ducts are provided above the equipment and at the ceiling.

Although the literature assures us that unconfined hydrogen-air mixtures will not detonate, confined mixtures are detonable over a wide range. Spills are avoided by using the proper equipment, including metal dewars rather than glass. All sources of ignition, such as flames and spark-producing electrical equipment are avoided or controlled.

Since hydrogen is odorless, colorless, and tasteless, leaks may not be detected promptly. Therefore, laboratories where liquid hydrogen is handled are equipped with combustible gas monitoring systems, which sound an alarm when a fraction of the lower flammable limit is reached.

Personnel Protection. People, of course, are most important, and their protection is our most important assignment. Since leaks or spills may occur even with well-designed containers and apparatus, the people involved wear personal protective equipment. Cryogenic fluids are extremely cold and contact with the eyes or skin will cause burns similar to thermal burns. Thus eye protection is a must at all times. Gloves are worn when handling anything that is or may recently have been in contact with a

cryogenic fluid. Asbestos is preferred, but leather may be used. The gloves fit loosely so that they can be thrown off if liquid is splashed into them. Cuffless trousers are worn outside shoes.

Since hydrogen is flammable, and the release of any hydrogen within a laboratory creates a hazard, personnel are instructed to leave the laboratory rapidly in the event of a significant spill. At Linde's main hydrogen laboratory the employee can trip an alarm in the hallway, warning all personnel to vacate the building, if it becomes necessary.

Handling Large Volumes

Improved insulation, better materials of construction, and the availability of cryogenic valves, pumps, pipelines and transport equipment, have made it economical to store and handle large volumes of "permanent" gases as cryogenic fluids. With cryogenic fluids, the pressure is low and the volume small. One cubic foot of liquid oxygen, when vaporized and heated to atmospheric temperature, expands to produce 862 cu. ft. of oxygen gas. 0.37 cu. ft. of gaseous methane occupies only 1 cubic foot as a liquid. Cryogenic fluids may be transferred by pressure or pumped in much the same manner as L.P. gas, ammonia, or even water, except that the containers and equipment are well insulated.

Large Vessels. In general, all large volume cryogenic storage is in double-walled vessels with the liquid container supported from the outer casing through long slender tie-rods having low thermal conductivity. Thus, the insulation casing is a part of the liquid container support system. This is the chief difference between cryogenic tankage and conventional tankage, where the liquid container sits directly on the support and the casing merely keeps the insulation in place and dry.

The liquid container or pressure vessel is fabricated of material suitable for use at the boiling point of its contents at 1 atmosphere. Such materials include austenitic stainless steel, aluminum, copper alloys and nine per cent nickel steel (the latter down to -320°F.). Carbon steel and some ferritic stainless steel are brittle at these low temperatures. When applicable, the liquid container is designed and stamped in accordance with the ASME Code, Section VIII for

Unfired Pressure Vessels for use at the proper service temperature, (-320°F. for oxygen and nitrogen, -423°F. for hydrogen, etc.). It also complies with local codes and regulations.

Piping, supports, and other appurtenances likewise are fabricated of materials suitable for use at low temperatures. In addition, all liquid lines from the container are trapped to prevent liquid from continually draining toward a warm surface. This would cause surging and increase heat leak. All lines within the casing have sufficient flexibility to accommodate movement caused by thermal contraction and expansion. Furthermore the outer casing connections to cold lines are designed to prevent the steel in the casing from reaching its brittle range.

The outer casing is usually fabricated of carbon steel and is sealed to positively preclude the entry of atmospheric air. At cryogenic temperatures, frozen water vapor and carbon dioxide would destroy the high efficiency of the insulation. In most cases, the outer casing is designed for 15 psi external pressure because a vacuum is maintained in the insulation space.

Insulation. The space between the outer casing and the liquid tank contains non-combustible insulation and, in most instances, a very high vacuum (1/100,000th of atmospheric pressure) is maintained. Powder insulation, such as perlite, is used in most large tanks, and may be as much as 5 ft. thick, if vacuum is not used. The typical powder-vacuum insulation (6" thick) has a thermal conductivity of about 0.002 Btu per hour, per square foot, per degree F., 35 to 40 times lower than 4" of cork.

Safety Devices. The liquid container is usually protected from overpressure by two safety devices connected to the vapor phase; a relief valve set at or below the design pressure of the container, and a frangible disc set to function at a somewhat higher pressure (but below the test pressure of the container). Although this is very unlikely, if the vessel should be exposed to severe fire or the relief valve should stick, the frangible disc would function and blow the tank down to atmospheric pressure.

The relief valve discharge piping on tanks containing flammables is vented upward away from the tank, at a point at least 5 feet above the tank and unobstructed to the

open air in such a manner as to prevent any impingement of the gas upon the tank; loose fitting rain caps are provided. Also relief valves may be piped to a vent stack.

In sizing the relief devices to prevent overpressure in a vessel subjected to fire, it is assumed that the vacuum is lost and that the insulation space is filled with the contents of the container (gaseous phase) at one atmosphere. Gaseous hydrogen, for example, has about six times the conductivity of air. The insulation space is protected from overpressure by a safety device in the casing usually set to function at a few pounds positive pressure.

Containers are not filled beyond a certain point. If a container were entirely filled with liquid before the pressure reached the setting of the relief valve, the valve would vent liquid instead of gaseous product. Contents of the container are checked either by weight or by means of a full trycock.

Location of Storage Tanks. In determining site locations for cryogenic tanks, the properties of the contents, as well as the construction of the tanks, are considered. As previously mentioned, liquid converts to a large volume of gas. Liquid oxygen, nitrogen and argon, the large volume cryogenic fluids, are all nonflammable, non-toxic and odorless. Thus the primary considerations in locating tanks for these products are to protect them from other fire exposures and provide good ventilation.

The location of liquid oxygen tanks is covered by NFPA Standard 566, "Standard for Bulk Oxygen Systems at Consumer Sites." Among other things, Standard 566 points out that tanks should be located, diked, or graded, so as to prevent any nearby flammable liquids from running under or around the tank. Local building and fire department regulations must also be considered.

Flammable Cryogenic Fluids. Liquefied hydrogen, ethylene and methane, of course, are flammable cryogenic fluids.

The properties of liquefied hydrogen have been thoroughly investigated under an Air Force, Air Research and Development Command contract. After examining all available data, experts have concluded that liquefied hydrogen is not as hazardous to store and handle as corresponding quantities of L.P. gas. Radiation from a hydrogen flame is

only a fraction of that from a propane flame, and the peak emissivity lasts for only a few seconds with hydrogen as compared to minutes with propane.

In view of the above, it appears reasonable to use, with *direction*, industry standards for LP gas and flammable liquids (such as NFPA 58 and 59) as guides. Containers are mounted on concrete pads or saddles. Structural steel supports or legs may be used when they are protected against fire in an approved manner. When the casing is part of the support system for the liquid container, as mentioned above, adequate fire protection (water) is available to keep it cool in the event of fire. The steel casing protects these tanks from "hot spot" failures of the liquid container that occasionally occur in the vapor area of bare liquefied gas tanks in fires.

Low dikes or curbs may be employed to keep traffic away from the tank and contain liquefied gas in the event of a spill. Large dikes do not appear necessary since they are not normally used with tanks of LP gas which is less volatile than liquefied hydrogen. Because of local regulations, however, the authority having jurisdiction may require a dike. Crushed rock may be placed under the tank to supply heat and extra surface area to quickly vaporize spilled liquefied gas, thus reducing the exposure time.

But vaporizing the liquid quickly creates a larger flammable vapor cloud that will travel a longer distance to a potential source of ignition, and there may be situations where slower vaporization would be safer.

Excess flow valves are not used at these low temperatures, so an insulated remote-controlled shutoff valve is located adjacent to the casing to shut off the flow of liquefied gas in the event of damage to the pipeline. A remote controlled internal shutoff valve is also a very effective means of shutting off the flow in the event of a pipeline break.

Electrical Equipment. In locations where the use of explosion-proof equipment is required, the National Electrical Code calls for Group B equipment for hydrogen service. This equipment is often not readily available. However, where (a) there is good ventilation, (b) the possibility of a hydrogen spill is remote, and (c) a flammable mixture would exist for only a short time,

Group C and D equipment is usually adequate. This is checked with the local authority having jurisdiction.

In explosion-proof electrical equipment, a spark-producing element is encased in a steel box with a sealed cover. If a flammable mixture within the box is ignited, the seal will prevent the escape of sufficient fire to ignite a flammable mixture outside of the box. Thus, proper maintenance of the seal is most important.

If the steel electrical box is allowed to reach cryogenic temperatures, it will become brittle, and the cover seal may be damaged, depending upon its design. Under these conditions, conventional explosion-proof equipment may not contain an explosion, but may fly like shrapnel, creating a serious hazard. Inside cold boxes and wherever low temperatures may occur, continuous purging with nitrogen is often used to keep hydrogen out of electrical equipment.

Transportation. The transportation of cryogenic fluids is not new. Regular tank truck shipments of liquid oxygen were begun by Linde in 1932. Total truck mileage since then is estimated at 175 million miles with truck capacities ranging from 5 to 20 tons. Railroad tank car movements started in 1939. Last year Linde tank cars operated in excess of 10 million miles with each car carrying 40 tons of liquid oxygen.

Liquefied hydrogen is being shipped from Florida to California in 30,000-gallon tank cars without loss of product enroute. Liquefied hydrogen is also transported in 8,000-gallon tank trucks capable of going from coast-to-coast without loss of product enroute. Liquefied hydrogen is by far the coldest flammable cryogenic fluid. This indicates that equipment can be designed to transport any cryogenic fluid safely from coast-to-coast.

An amazing fact about these tanks is that the insulation space is only two inches to three inches thick. The insulation is a new, highly efficient aluminum glass-fiber lamination, plus a very high vacuum. The thermal conductivity per inch is about equal to the conductivity through 40 inches of powder-vacuum or 1500 inches of cork.

The ICC Regulations at the present time do not provide for the transportation of liquefied hydrogen, but the ICC has issued special permits to shippers authorizing

its transportation in accordance with the terms of the permits. It is the practice of the ICC to prohibit the venting of a flammable gas from tank cars or tank trucks during normal transportation.

The tank cars described above are equipped with a mixing device. Should the car be delayed so the pressure in the container builds up to the setting of the pressure control device, the released hydrogen is mixed with sufficient air to reduce it to 50 per cent of the lower flammable limit for hydrogen-air mixtures.

The Compressed Gas Association, whose membership includes most of the industrial

producers of cryogenic fluids, is preparing proposed amendments to the ICC Regulations to permit the transportation of liquefied hydrogen in cylinders, tank trucks and tank cars.

Cryogenic fluids have been handled safely by a few companies since the early part of the century. Their use, and the number of people handling them, have increased tremendously in recent years. To ensure safety, old and new users alike require a thorough understanding of the properties of these fluids and a willingness to make use of reasonable safeguards in handling them.

JOINT SESSION WITH OCCUPATIONAL HEALTH NURSING SECTION

PSYCHOLOGICAL ACCIDENTS — THE INDUSTRIAL PHYSICIAN'S VIEWPOINT

By Dr. J. KILIAN, M.D.
Medical Director, Texas Division
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Throughout the years that I have treated occupational injuries it has become increasingly apparent that the vast majority of the accidents were not due to mechanical failure of equipment, or faulty protective devices, but due to the human failure of not doing the proper thing at the proper time. When I was a neophyte in this field, I logically assumed that such was due to day dreaming or perhaps just a chance, but as my appreciation of the human psychological mechanism became more acute I began to realize that here was something far deeper and more basic in many of these accidents. This human understanding has progressed until at the present time I am firmly convinced that a significant number of our occupational injuries are due to basic psychological mechanisms, the patterns of which are just as real as the mechanical equipment that we use.

It is time that the folks who work in the field of safety develop an increased awareness of this and, also, realize that many of these psychological mechanisms must have their protective devices just as certain machinery has to have its protective devices. Today through the presentations on this panel I hope that you will develop this increased awareness of the necessity to understand people and recognize certain emotional danger signals if you expect to make a real impact in the field of safety.

I do not intend to bombard you with a barrage of psychological gobbledegook, but I would like to point out to you some fundamental facts about everyone's personality and illustrate how certain psychological mechanisms may have a bearing upon certain accidents. In all of our minds we have certain areas which we must un-

derstand before we can begin to comprehend this problem of the psychological influence of the human mind on industrial accidents. It is a well recognized fact that the human mind can be divided into three parts: the conscious, the preconscious and the unconscious mind.

The conscious portion is the part that does our everyday thinking. It is the part that I am using at this time in presenting this speech to you.

The preconscious is the area of the mind which we do not ordinarily use, but from which facts can be brought up to the conscious mind rather easily.

On the other hand the unconscious mind is the deeper, inner reserves, which is composed of material not immediately available to our conscious thinking, but is composed of stored experiences and conflicts that have occurred throughout our whole lives. The influence of each of these areas is extremely important to the man on the job, but the thing that should be extremely enlightening to all of you is that fundamentally our lives are governed, moulded and influenced by our unconscious thought processes.

Let me illustrate it in this manner. When one learns to drive a car he consciously thinks about taking his foot from the accelerator and applying the brakes during this training period. After awhile this becomes automatic and now when one approaches the stop sign this particular act does not enter one's conscious mind at all. It is in the preconscious area where it can be easily recalled if one puts his mind to it.

If the brain did not function in this manner, our lives would be completely occupied by all sorts of irrelevant thought

processes everytime we did something. These things must function at a lower level and on an automatic basis in order that we may devote our conscious thinking to the important things. The unconscious mind on the other hand is buried material, deep within the inner recesses of our thought processes and can only be brought out by certain psychiatric techniques that we cannot concern ourselves with today.

There is one fact that I feel is extremely important, that I have discovered from experience. It is that people who work in safety, as well as members of supervision, have a difficult time accepting the concept that the unconscious mind can really influence an individual's actions to the extent that it will produce serious accidents and disabling injuries.

When one mentions psychological causes of accidents most of the people think in terms of the man who is consciously trying to hurt himself to gain a certain advantage, or that a man is preoccupied by his emotional problems and he does not realize that danger is creeping upon him. If one just considers these aspects of psychologically motivated accidents he is indeed missing the boat on the vast majority of cases. Let us take a few examples to try to drive across the point.

Case number one: This case involved a man who was working on an extruder press in which the equipment was well guarded in a manner that made it virtually impossible for the man to get his hand in the extrusion mechanism and throw the switch at the same time. However, early on Monday morning this happened and the man was brought to the medical department with a seriously crushed hand. During his anguish and state of semi-shock he confided in the industrial physician that he really did not much care what happened to him since he had been having marital difficulty and his wife had run away two days before with another man. At no time after this revelation would he again discuss this situation. The wife was located, however, and within a short time she was at the bedside of the victim crying and feeling a great deal of remorse towards the injury.

Now what did this accident accomplish for this man? Obviously it served the purpose of getting his wife back (at least

temporarily), and I think one should really ask himself the question, "Was this really a mechanical accident of a psychologically-induced accident?" When the accident reviewing committee made a study of this particular situation they reported with their analytical, conscious, thinking that they could not understand how this individual could override the guarding mechanism and have this happen.

The question that all of you are probably wondering about is, "Did this man do this deliberately?" To this I would like to add my unqualified "no" he did not! Preservation of life and avoidance of pain and injury is a powerful instinct, and this man's unconscious mind was fundamentally driving him to this solution of his problem. How many times we see highway accidents where there is no logical explanation of why it occurred and it is a matter of statistics that mechanical failure of the equipment plays a minor role in the overall problem. The problem is people and most of these problems involve psychological mechanisms which cannot be understood by the conscious portions of our mind.

Now, let us look at another case and perhaps we can more clearly bring out some other of these unconscious underlying factors that are so important. This man was working in an area where they were temporarily short handed, and his foreman asked him to roll a 400 pound drum out of the aisle. This normally was not the employee's job and he conveniently forgot the order for several hours. Later the foreman again reminded him that the drum in this area was a safety hazard and should be moved. Again the individual chose to ignore this command, and a short while later the foreman became rather disgusted with this turn of events and sternly commanded that the man had better get the drum moved, or else! The employee then went out, seized the drum, and, with a tremendous strain which was conceived in anger and executed with hate, moved the drum out of the aisle and, in the process, produced a severe lumbosacral strain in his lower back.

The man was disabled over a year and intensive investigation revealed no evidence of a ruptured disc or any physical disability which would account for the prolonged loss

of time from the job. Many months after the original injury, I got into the act as his physician and found out that at one time he and his foreman had been hourly employees, vying for the same job as foreman and that the other fellow eventually got. In my discussion with him he literally exploded resentment towards this man when given the opportunity.

This incident that I pointed out to you reminded me of a little child who deliberately threw himself down and tried to sustain an injury and thereby punish his parents who were the symbols of authority to him. This man's back pain (which I am convinced was a simple muscular strain) became a symbol of the festering resentment that he had towards this figure of authority. The eventual outcome was that the more his back could bother and disable him the more he could blame his foreman for what had happened.

This type of thing is happening all the time in industry. Many times the industrial physicians are not treating an organic injury, but are treating a serious inter-personal relationship between a worker and the chain of authority above him. We have to recognize this and do our best to deal with it effectively. I also feel very strongly that you who deal with safety should likewise recognize it and do your best to deal with it effectively.

I have presented this approach of the consideration of the psychologically motivated aspect of occupational injury to many people in management and invariably I have received the same reaction, which I think is a very healthy one, and I am sure all of you in the audience will be asking the same question. "So there are underlying psychological reasons which truly can be on an unconscious basis for many of these things, but just what good is your talk doing? It is one thing to tell you why something happens, but it is a horse of a different color to say what you are going to do about it. After all, we cannot all be psychologists, or psychiatrists, or physicians, and how can we as supervisors and safety people hope to prevent psychologically-motivated accidents?"

My answer to this is, first of all, there needs to be an awareness all the way up and down the line of management that this business of the psychologically-motivated accident is a very real thing. Secondly, there needs to be training so that these people understand how certain emotional conflicts can express themselves in various physical ways of having accidents. With this should come skill in recognition and assigning people to sublimate many of these emotional conflicts into constructive channels.

Let me give you an example. Each of us has the very primitive emotion of aggression and the skillful supervisor should direct the individual who manifests signs of over-aggression into some form of activity which will be useful in allowing that man to work off his aggression. For example, if he is an outside worker he might be given an ax to clear shrubbery from the edge of a road so that he can work off his aggression by wielding the ax against the trees and shrubbery. This will go a long way towards preventing him from wielding a venomous tongue against his fellow employees or his supervisor. It may prevent him from an unsafe act, because his hostility may seek expression in mentally unhealthy channels to punish his boss.

Do not lost time accidents really do a very effective job of punishing the boss? People must be taught that everyone in supervision should be an emotional first aid station and allow the employee to ventilate his problems, and to recognize that when this becomes insufficient he should refer the man on to those who have the special training to deal with these problem cases. The days of the old hard nosed sergeant are over and experience has shown that management gets more productivity, fewer accidents and a healthier and happier worker, when he is dealt with in an environment of understanding, sympathy and genuine concern for the employee. People in safety work can help a great deal by promoting this philosophy and pointing out to management the important factors that we have discussed here.

THE OCCUPATIONAL NURSE'S ROLE IN THE DIRECTION AND REFERRAL OF EMOTIONAL PROBLEMS

By ANNE KLOIBER, R.N.
Supervising Nurse, Pabst Brewing Co., Milwaukee, Wis.

How many times have you heard said, "don't pay any attention to him—he hasn't got all his marbles?" Or, how many times have you discussed an occupational injury or disease with the foreman or supervisor only to have him inject in the conversation somewhere, "that guy's nuts—he doesn't keep his mind on his work—something's bothering him."

Yes, that is precisely the point! SOMETHING is bothering him! And, it's up to us, as occupational nurses, to steer him in the right direction so that he receives proper help.

We nurses in industry, of course, shouldn't have to wait until an injury occurs or until the man's apparent emotional problem is brought to light by the foreman or supervisor. We should, because of our personal knowledge of people at work, be able to detect certain signs and signals which should alert us to action. For this reason, it is vitally important that the nurse maintain a professional, yet warm, relationship with all employees so that they will come to her willingly with their ailments and injuries. Through her adequate medical records, the nurse will then be able to see patterns of behavior which perhaps even medical people outside of the plant could not detect.

It might be well at this time to add that these people with problems—these people who are "different"—not only call attention to themselves in the Medical Department. They are known to Personnel, the Credit Union, and in other areas of the plant as being in one jam after another. It seems almost as if they're enveloped in trouble.

One can't help but wonder if these situations—these difficulties they create, aren't actually S.O.S.—signals for help. What a pity then if, we, who are in a position, at least to, give them some guidance, close our eyes and ears to these situations—perhaps give them something for their nerves, or offer them another job or a few rationed words of reassurance—just to satisfy our conscience.

This problem, as you are all aware, is not confined to industry alone. All one needs is to look about him—be it in a super market, church, school, or what have you. Emotional outbursts of all kinds are visible almost daily in society at large.

Dr. Gerald Gordon of the DuPont Co., in his paper on "Industry's Problem Children," states:

"People are not either sane or insane in the same sense that a woman is or is not pregnant. Whereas it is impossible to be a little bit pregnant, it is quite commonplace to be a little bit crazy. Some degree of mental illness is present in all of us normal people. Inasmuch as we all suffer from it, we find it difficult to see in others, and all but impossible to see in ourselves.

"The diagnosis of mental illness may be made early from apparently trivial and unrelated signs and symptoms if we are willing to be realistic and objective, even about ourselves. Dr. Dershlimer once wrote that industry constitutes one of the most realistic situations existing in our modern world. As such, it is the testing ground on which the strength and weaknesses developed by the early training of individuals become clearly apparent.

"It is, therefore, in industry where many of the earliest signs of failure or mental illness may be seen. This situation gives management and supervision an opportunity, found almost nowhere else, to do a real job of mental hygiene which will benefit the employee no less than industry."

In keeping with the fast pace we have set for ourselves today, with the result, of course, that there is really never enough time for everything we would like to do, I suppose we feel justified in effecting a job transfer for someone who can't get along in a certain department or where a specific problem exists. But we cannot keep shrugging off these responsibilities in this manner—we must face these issues squarely and give them the time that they truly deserve.

Let me tell you of a problem which existed in our plant recently. This problem, I am happy to say, was resolved with the patient coming out as the victor—one of those "happy-ending stories." This young man has no vision in one eye as the result of a childhood injury. Needless to say, he protects his remaining good eye more than one would do normally. Because of his low seniority, he is occasionally placed in a transfer pool to areas where caustic solutions are used for cleaning. Protective equipment is issued this man, as is to all employees. However, when this transfer arrangement first started, this man would be in the Medical Department constantly with one caustic burn after another—his self-diagnosed caustic burns. Actually, most of the time they weren't burns at all.

During every visit he would beg us for a transfer to another department where this hazard was not present, but the doctor and I both felt that we would try to help him face the problem and not run away from it. We knew that if we gave in to him this one time, we would set off a chain of transfer requests. At any rate, the course was slow and at times quite stormy. There were two or three times when the foreman called us and shouted, "get this guy out of my department—he's getting everyone jumpy."

But we hung on a while longer and were victorious. We tried to educate him as to the proper equipment to wear. We tried to instill in him a respect not only for caustic soda, but for all harmful chemicals. We spelled out to him the proper first-aid measures in the event he did come in contact with them in spite of his caution.

Recently, he came in to see us, and thanked us for making a man out of him. His foreman has told us that he has become a more industrious and safe worker. Not only are we thankful that he's not running to the Medical Department three or four times a day with apparent chemical burns, but more important, we are glad that he faced up to the problem and did something about it.

Happy endings such as this are not always possible. We shall continue to have the overly fearful worker or, conversely, the careless worker—the guy who says, "I can take a bath in the stuff," but who continues

to be a threat because of his deep ulcerations from strong solutions. We shall have to realize that lack of attention to the inanimate things about us often involves us in accidents and that this lack of attention is usually conditioned by our mood or preoccupation with other things at that time.

We shall have to stop using that expression, "he's just accident prone," and, instead, learn to appreciate that accidents to a large extent are the result of the person being unable to cope with the situation in which he is placed. We shall have to realize that our physiological well-being can go up or down like a thermometer, that everyone has regular periods of exhilaration and depression—that it's just not women with "estrogen imbalance."

It is suggested that the nurse include in her history, following an occupational injury, the mood the person was in prior to the incident. She might even go a step farther by asking this same question of the foreman or supervisor. At least it might alert him to the fact that maybe this business of emotions isn't just something you read in a book.

In going back over our more serious and disabling injuries of the past year or so, we came up with the following moods or things employees were thinking about just prior to the time of the accident:

One man, who sustained very serious caustic soda burns to 30 per cent of his body, including his eyes, admitted to the doctor that he and his wife were having marital difficulties—that on the morning of the accident, they had an unpleasant scene which was witnessed by their youngest child, who apparently was the apple of his eye. He admitted to the doctor that this argument had left him nervous and jumpy—and that he just wasn't thinking when he dumped the water into the powder instead of vice-versa.

Another man who sustained a traumatic thumb amputation said afterward that he found he was in an ornery mood from the time he got up in the morning—you know, one of those days when everything goes wrong! Still another man claimed the foreman was nagging him constantly on the morning of the accident.

Is there little wonder then that these people become highly vulnerable to accident

proneness? An industrial nurse recognizes the fact that tension and conflict among workers, or between workers and foremen, often causes a rise in accident frequency. Her knowledge of industrial health counseling in such instances can be used most effectively.

While we're touching on the subject of counseling, let me say here that industrial nurses can make themselves responsible to a certain degree for teaching health to the employees. Nothing can replace an intelligently administered health program. Work habits of the employees are influenced by their mental processes and by the help or hindrance offered to them, be it in their homes or at work. It is helpful to the nurse to observe not only how the employee behaves under unusual circumstances but to observe his customary everyday behavior.

Management, of course, also must share in this responsibility. Management should know the physical capacities of the worker, his home situation and his personality traits. Pre-placement physical examinations are a must, as well as routine annual re-examinations. Matching up the job requirements with the individual so that a happy medium is reached is another of management's responsibilities.

I would also like to stress the importance of confidentiality of medical information. While it is generally accepted that management must know of existing physical capacities and limitations so that proper job placement can be effected, there is no special reason why all the details have to be spelled out. If the examining physician interprets his findings into a physical capacities appraisal and sends this to management, this should be sufficient. One of the most tested attributes of the industrial nurse is her ability to maintain confidences. If she is to do well as a counselor, this must continue to be of prime importance.

In summation, then, I would like to offer that nurses, because of their personal knowledge of people at work, because of their background (fortified with courses in psychology and counseling, and because of their thorough medical records, are able to see patterns of behavior and emotional problems which can then be referred to the proper people for care.

Having the psychiatrist in mind, did you hear about the two psychiatrists who met on the street? One said, "Hello, there! And how are you today?" After which they parted and the other one said, "Hmmm, I wonder what he meant by that."

A NEW CONCEPT OF ACCIDENTS

By SANFORD G. ROGG, M.D.

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There can be no questioning of the fact that, as long as we remain human beings, we will become involved in accidents. Obviously the more we understand the multiple factors involved in accidents, the better prepared we will be to prevent the avoidable ones.

There has been an increasing awareness regarding the fact that our continuing nationally high accident rate is a reflection of personal rather than machine failure. Certainly the engineers who design machinery and in particular, those whose task it is to pay attention to safety features

and operational control, have all done an extremely competent job.

As a matter of fact, they have done their work so well, that the continuing high accident rates we see quoted yearly throughout our country, can in no sense be called a responsibility of poor design features. At the same time, it would be foolish to infer by any means that continuing effort on the part of design engineers would be unrewarding. The fact to be emphasized is that even if we designed to theoretical perfection, we undoubtedly would still have well over 80 per cent of our accidents occurring.

TABLE I
Leading Causes of Death by Age Groups
1. Age 14-24 2. Age 25-44 3. Age 45-64 4. Age 65-74 5. Age 75-84 6. Age 85-94 7. Age 95-104

Age Group	Accidents	Heart Disease	Cancer	Stroke	Pneumonia	Cholera	Tuberculosis	Diabetes	Alcoholism	Drugs	Other
1. Age 14-24	100	10	5	5	5	5	5	5	5	5	5
2. Age 25-44	100	10	5	5	5	5	5	5	5	5	5
3. Age 45-64	100	10	5	5	5	5	5	5	5	5	5
4. Age 65-74	100	10	5	5	5	5	5	5	5	5	5
5. Age 75-84	100	10	5	5	5	5	5	5	5	5	5
6. Age 85-94	100	10	5	5	5	5	5	5	5	5	5
7. Age 95-104	100	10	5	5	5	5	5	5	5	5	5

Table I, while contributing no new knowledge on the subject, does emphasize the place that accidents hold as a cause of death in our country.

Without becoming too involved in figures, the National Safety Council's statistics list approximately 40,000 people killed in automobile accidents, 14,000 in industrial accidents, 27,000 in home accidents, and 16,000 public deaths. We can define public deaths to include train accidents, airplane accidents, public fires, etc. or whatever else might happen to a person in a public situation. To this, add an untold number of injuries, possibly running as high as 24 million of the type that brings itself to the attention of a physician or limits a person's activities for at least one day.¹

Perhaps the question arises as to why the medical profession is becoming so concerned about safety. Certainly any condition that kills about 97,000 people a year and leaves over 400,000 with permanent residual injuries, varying from the minor to the most severe type, should of necessity command the attention of the profession that has the responsibility of caring for these people.

In my opinion, most of the problem is to be found in the emotional status or even in its broader aspects, the personality of people who become involved in accidents. And to digress for a moment, we can define personality in the sense that it is being used here by labeling it as consisting of the habitual patterns of temperament, intelligence, desires and behavior that distinguish us as individuals. We can readily appreciate the problem in that it is difficult to delve into and obtain an understanding of these factors. This can be easily understood if we realize that we are dealing with personal motivations and conflicts of thought, wishes and desires of people, combined with all the frustrating situations with which they are confronted.

It should be emphasized that there is no

desire to leave the reader with the implication that the problem of accidents is a narrow concept, a psychiatric one, in that mentally ill people who require treatment are the ones who become involved in accidents. It would be much better and more easily understood, if all of us were to acknowledge that we are liable to accident situations at various times throughout our lives.

What is overlooked in a good deal of the work that is being done, is the fundamental factor that looms as most important in all of our dealings with people. This is, that although we like to think of man as an intelligent, rational, coherently reasoning and consistently logical individual, man in reality is predominantly guided by motives and feelings of which he is most often unaware. These logical powers only serve as a means of allowing the individual to reach goals that are created by more deeply placed emotions. This in turn could lead us to realize how we must look at, and deal with, these feelings if we are to be successful in our safety endeavors.

We must realize that becoming involved in an accident is basically the same as any other condition about which people become involved in difficulties. These individuals could just as well solve their problems by developing stomach ulcers, severe headaches, spastic colitis or the numerous other entities that are diagnosed as psychogenic illnesses. The accident-involved person is, in a very unsuitable, and from the viewpoint of our society, in a totally unsatisfactory way, solving the emotional problem by becoming involved in an accident situation.

It appears suitable and advisable to go a little further at the present time and state that the emotions we are discussing arise from the whole life of the individual, the twenty-four hours of each day that he lives, and by no means only the eight hours that he spends in gainful employment.

We have all heard the expression many times over, that so and so tends to take his work home with him. Well, we can reverse this and state that everybody tends to take his home to work with him.

My interest in the factors producing accidents was aroused while discussing one with a safety engineer. He was describ-

ing an accident that had just occurred and in the course of the conversation said "I just don't know what happened. This man has been doing the job for years and knows it perfectly well. As a matter of fact, in the usual course of events, we checked over everything, the switch controlling the machine, and the machine itself, and they were in perfect operating condition; still, the man became involved in an accident that resulted in the amputation of his finger."

After this discussion my thinking went along the lines of what could have involved the man in this accident, and broadening things a bit, began to wonder what could be going on in the mind of a person just prior to his having an accident.

By accident, we are referring of course to the common garden variety where the individual alone is responsible. Technically we could call this a "personal accident" with the primary cause to be found in the individual in contrast to the "impersonal accident" with the primary cause in the environment. It is possible to be even more precise here and state that this study was not directed towards an exploration of the basic personalities of these individuals, many such studies have been done and the literature is replete with articles describing the personalities of people who become involved in accidents. Attention was focused on the thinking occurring in a person's mind prior to becoming involved in an accident and by prior is meant half an hour, a minute, or even moments before the event happened.

After becoming interested, it was considered advisable to have reference to what had been written by others on this subject and the literature was searched. This led to the conclusion that very little had previously been done where a trained person sat down with someone involved in an accident and tried to find out what thought processes were going on in the mind of this person just prior to the occurrence of the accident. This was somewhat surprising and indicates a field that has been badly neglected. We thing learned, however, was the interesting assurance that we are neglecting a very important phase of accident prevention by limiting the study of the subjective of human behavior and merely measuring a statistic.

Chemical Section

To investigate this matter, a procedure was set up whereby the men who were working in a large plant and had been involved in an accident would be seen by me. The sampling was a non-directed one, the men being picked on a consecutive basis by the receptionist. The attitudes of the men were mainly cooperative. They spoke freely and at times gave more information than was being looked for.

It was felt that to interview someone whose accident had occurred more than three days past would be a useless procedure in that many things would start fading from the individual's mind. Human nature being what it is, when things start to fade from one's mind, the person then tends to supply facts that he actually thinks would fit the situation. It is not meant by this to imply that the individual would deliberately construct misinformation. It is a matter of knowledge that as our memory fades and we are asked to recall an incident that has occurred in the past, a good deal of the information that we bring to recall in information of a type that we ourselves have formulated. The technical term for this would be retrospective falsification.

An excellent article, "Accident Statistics and The Concept of Accident-Proneness," by Arbous and Kerrick,² states that it is conceivable that with our present instruments of analysis, we may yet succeed in pinning down the personal factor in accident-causation in terms of some strict definition, but this may involve so many restrictions in a mathematical sense that the concept will bear little relation to the real factors in everyday industrial life. The above comments do not constitute a denial of the usefulness of statistical procedures in investigations of this type, nor is it suggested that the research worker can ever dispense with them altogether. The conclusions indicate rather the limitations of these techniques and emphasize the fact that statistics can never do your thinking for you.

The above considerations may well lead me into a state of dependency and frustrated resignation, were it not for the fact that a different approach to the problem seems possible. This approach may not enable us to analyze accident liability in terms of universal principles, laws of dis-

tribution, etc. with reference to human behavior in general, but it may well enable us to reduce the incidence of accidents in our community by enhancing our knowledge of the mechanisms at work causing individuals to have accidents. And surely this is the ultimate objective of all this work.

Before getting into the actual cases seen, it appears pertinent to mention the work of Vinales,⁴ who emphasizes the fact that another limitation of the statistical viewpoint in accident prevention is the emphasis upon isolated aspects of the individual personality, in contrast with the concern, in the clinical approach, for the total relationship. The clinical approach recognizes that there are many different causes of accidents and that they may combine in different patterns in different individuals.

Several things became apparent after the procedure of interviewing was started and led to the realization that my thinking was not in agreement with much that had been previously written about accidents.

The first concept with which there was disagreement was that of a man being "an accident-prone individual." The initial studies on which this was formulated were done in England in 1919.⁵ The term itself (i.e., accident-prone) was coined in 1939 by Farnier & Chambers.⁶ For various reasons, one of which undoubtedly was the fact that the concept of "accident-proneness" relieved or lifted the burden of responsibility from where it belonged, this idea immediately attracted attention. Other workers in this field, then began to formulate lists of traits that could be found in these "accident-prone" people. Somehow it was presumed, that armed with such a list of traits, one could then more suitably place or even avoid hiring a person falling into this category.

The obvious fallacy of this type of reasoning is that all of us have accidents, whether at home, at the office, at the plant, on the road, or anywhere, and throughout our lives probably will have many times more than one accident. It seems that there are times when all of us are in a state of increased susceptibility to having an accident without it necessarily being a life-long pattern of behavior. Therefore, the type of personality of the accident involved in-

dividual, is as wide as the range of our entire population.

Of the people seen, only those with sub-major injuries were considered. It was found that the employees having accidents were mainly experienced men. It seems that the younger plant population is helped by the elasticity of youth in dealing with their problems. They also are more attentive to work hazards and still have "open-ears" at safety meetings. Since no control groups on considerations of hazard exposure could be statistically validated, it would be foolish to attempt to read too much into this.

TABLE II
Comparisons Between Injury Group and Plant as a Whole

	Injury Group	Plant
Average Age	45	44
Average Length of Service	16	17
Average No. Dispensary Visits per Year (Excluding Injuries) ..	1.4	2.2
No. Minor Injuries per 100 Person-Years	67	25
No. Previous Major and Sub-Major Injuries per 100 Person-Years	1.6	0.9

From a review of Table II one might be tempted to hypothesize regarding the number of minor injuries in the injury group as compared to the whole plant. Arbous & Kerrick,⁷ in their admirable statistical study, strongly conclude that "minor accidents do not enable us to make any prediction with relation to major accidents."

Many people feel that once the accident train is set in motion, there is no real difference between a major and a minor accident and that the resulting injury was the one chance element in the situation. A mathematical example might demonstrate some of the hazards involved in the deductions obtained from collected statistics.

For example, in studying accidents that result in sub-major injuries (a sub-major injury is one that results in loss of time from one's work) it would seem that there are two liabilities to be considered: (a) the liability of the individual to have an accident, and (b) the liability of this event to cause subsequent injury—resulting in its being recorded. It is conceivable that if the injury were not chance determined, the following results may be obtained as illustrated in Table III.

TABLE III

a—Represents unplanned events without injury.
e—Represents unplanned events with sub-major or major injury.
In the case of two individuals, the results will might be:
Individual X had a, e, e, e, e, e, e = 1 reported sub-major or major accident.
Individual Y had e, (e), (e), (e) = 3 reported sub-major or major accidents.

In the records Y would obviously be considered more accident prone than X, but this would not be a reflection of his proneness to unplanned events (near accidents) since Y has only 4, whereas X has 8. It would rather be a reflection of the liability of such events as he had, to result in injury. This may well be determined by factors beyond his control and the study of (e)'s would give little indication of the individual's susceptibility to (e)'s.⁸

Another deterrent factor bearing on Table III is the inability to equate exposure hazards between the injured group and the plant as a whole.

Referring back to Table II it can be seen that there is a valid statistically significant difference between the average number of dispensary visits per year for the injury group and the rest of the plant. Possibly the people having injuries are settling their emotional problems via this route while the plant group is discharging its emotional problems via psychogenic symptomatology.

TABLE IV
Accidents with Demonstrable Psychological Factors of Recent Origin

Psychological problem of recent origin	Number	Per Cent
No evidence of emotional disturbance	12	44.4
Subtotal	15	55.6
Non-assignable, multi-party responsibility	27	100.0
Not cooperative	8	
Total	35	

Roughly 70 per cent of the psychologically disturbing factors were job-connected, 30 per cent non-job connected.

Table IV might on a clinical basis substantiate my hypothesis. It is, however, a fundamental piece of knowledge that it is never possible in any science to prove a hypothesis.

It may be informative and interesting to transcribe the notes made after interviewing three people who had been involved in accidents.

Case No. 1, a male employee age 21 with two years of employment as a driver for a parcel delivery concern. He sustained a severe twisting injury of his right ankle that required the use of crutches and kept him from regular work for five weeks. The safety bulletin listed the following description.

"This injury was sustained during normal operating conditions. The weather was clear and cold. The concrete surface was level and dry and free of any foreign body. The truck running board was clean and dry, with all door attachments in excellent condition. The injured stated that he looked before stepping down and noticed nothing out of the ordinary." This man in talking to me said that he realized as he was getting off the truck he was headed to go around the front of it. Realizing this, it then became necessary for him to turn so that he would be facing towards the rear and be able to walk around the back of the truck. The sudden shifting of his body after it had already established the direction in which it was going resulted in the accident.

"He went on to talk very freely and stated that he was hit by a truck as a child at about nine years of age and ever since that time he has been afraid to walk in front of any vehicle even to the present moment. Even now if a car or truck is parked at the curb with no one in it, he still will not walk in front of this vehicle but will walk an extra fifty feet if necessary, in order to go behind it. He says at any time he absolutely cannot avoid walking in front of a truck or car, the picture of his being hit by the heavy truck when he was a youngster still comes to mind. "Several times a year," he continued, "I still have nightmares where I wake up screaming and soaked with sweat, dreaming that the truck was coming down the street and about to run over me again. All that I know is that I still can't get over the fear of walking in front of any car or truck."

Case No. 2. This case that I am going to describe, is I feel, an interesting one although it did not actually result in an accident in which somebody was hurt, but very nearly did and would have created an extremely serious situation had the accident itself actually occurred. The man in question was sent to the plant medical building because of an acutely upset condition following the incident. His job is to put an allow-

into a chemical process. He has been doing this for two years and is a first-class operator. In the past four weeks he has had a new helper. This helper and he evidently were extremely incompatible. He feels that this man was negligent and had a careless attitude towards his work. The operator had spoken with his foreman twice asking for a new helper, giving the above reasons for his request. He told his foreman that sooner or later such carelessness would lead to an accident.

No action had been taken up until the day in question. The morning of the incident, he was particularly annoyed by his helper. In violation of all operating rules he dropped his charge of pellets into an agitator following routine procedure except for the very serious omission of not checking to make sure that the agitator was cleared of its previous charge. Fortunately (and in no way could the man know this) the agitator happened to be clear at that time. If not, a violent explosion would have occurred. When the man realized what he had done, he began to suffer an acute panic reaction and his foreman sent him to the medical building. The man was able to pinpoint his thinking when talking to me—"I was so mad with the helper, I knew something would go wrong. I tried to get rid of him but they wouldn't transfer him. I guess the strain was too much for me waiting for him to do something wrong so I went ahead and did it myself."

Case No. 3, a 36 year old man with sixteen years of service fractured a finger while working on a machine. This was the man's first recorded accident in all of his years on the plant. He had worked a double shift the previous day. He said he was asked to do this a few hours before quitting time. He and his wife had made arrangements to go out that evening, this of course entailed the usual difficulties of baby sitters, etc. Although he very much wanted to say "No" to supervision's request, he has always been too compliant an individual to be able to voice his own feelings and therefore, said he would do the extra work. As far as supervision was concerned, their request was routine with this man, since he was usually asked first when there was some extra work available. The next day the man was thinking about the previous evening and was pretty much "burnt up inside" about what

had happened. In addition to his normal resentment he had experienced a difficult situation with his wife when he explained to her that they were not going out. As a matter of fact, he stated his wife was "as boiling mad as he had ever seen her." While dealing with these feelings of extreme resentment, the man suffered an injury.

One of the things that can be seen here is that in the cases quoted we have a fairly clear idea of what was going on in an individual's mind just prior to his becoming involved in an accident. As to how this might be of any benefit in helping us to prevent accidents in the future, several implications can be drawn. First, we should learn all that we possibly can about the fact that such motivations exist in an individual. By this I do not wish to imply that all safety engineers should become amateur psychologists but they must at least have some basic idea of the facts of how human behavior and emotions at times may influence our susceptibility to accidents.

To this end safety educational material could perhaps be reviewed, to emphasize this fact. The advertising industry in the past ten or so years has been doing a good job in some respects with what is called motivation research. Perhaps orienting our safety education somewhat in that direction might be fruitful. In our study of accidents we should try to find out from the people involved how they felt about the accident at that particular time, so that we may learn something about the problems and distractions that have diverted the individual's attention from the safety hazard. By doing this, we may also get some hints about what things distract and disturb people and also some idea of how we may be alert to similar problems in others. Perhaps with a better understanding of the human factors involved in accidents, we can make safety education even more effective.

After a recent talk which I gave to a group of safety men and supervisors, someone in the audience asked me a question—"What would you do with a man who continually and knowingly violates established safety procedures? He insists that he will do the job in the way that he desires." I gave the question back to the audience for an answer and several members stated—"I would fire him." The man who originally raised the question sadly said—"I can't, we both work for the Government."

Another interesting facet of human behavior here is that the employee himself, the individual who stands most to lose through an accident, is the last one to accept the fact that safety is as much a part of doing his job as any other area of performance. Of course, a safe worker will aid management, but openly and directly the safe employee will primarily benefit himself. Be that as it may, and this cannot be too strongly emphasized, we can certainly see that there has been a tendency to be tolerant towards the continued irresponsible actions of people involved in accidents.

We also must realize that stronger demands for an adult standard of behavior will be necessary. Our society as a whole must insist on adherence to effective lines or behavior in regards to safety. Certainly it does not make sense to lightly gloss over the irresponsible, the immature, the careless and negligent individuals who cause accidents. It is a rather grim prospect that the irresponsible actions of people who refuse to follow our rules are yearly causing increases in our national statistics of people who are killed and injured. It appears that the least we should do is to learn more about the factors leading to people becoming involved in accidents, so that we can be in a position to work out ways for lowering the frequency of accidents that can be avoided.

My feeling is that the medical profession must assume more responsibilities in developing these effective ways to help in accident prevention. Since I am firmly convinced and feel that most of us who deal with safety agree that the emotional factors are the cause of the greater part of accidents, our approach must become more meaningful and must consider the emotional life of the people concerned in order to effect any changes.

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EYE SAFETY IN CHEMICAL PROCESSING

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Among those who are wearing glasses there is a good chance that most are safety glasses, with hardened lenses. If you have a small child who wears glasses, these are probably safety glasses. If you have children in chemistry laboratories in high school or college, the schools probably have a rule that the students must wear safety glasses. If you wear glasses and engage in such activities as squash racquets, the chances are that you have equipped yourself with safety glasses.

These are all indications that today there is a clearly discernible trend toward universal eye protection, off the job and on. Of course, you will agree that a complete eye protection program in chemical processing neither begins nor ends with a safety glasses program. We have, you might say, four lines of defense: preventing the accident, preventing the injury, guarding the person, and minimizing the injury.

Preventing the Accident

One of the most familiar examples of preventing the accident is something you learned in high school chemistry, to the effect that sulfuric acid should be added to water and not vice versa. I am sure you can think of other examples.

One user of caustic soda found that he was having trouble in making up caustic solutions by adding solid caustic to water. Despite repeated admonitions, the operator would add the solid caustic too fast and the heat of solution would cause the vessel to spit and boil over.

An acceptable solution was found by replacing purchases of solid caustic with liquid caustic. While there is a hazard from heat of dilution of 73 per cent or 50 per cent liquid caustic, the hazard is not anywhere near so great as the heat of solution produced by suddenly dumping large quantities of solid caustic into water.

In preventing accidents which involve the eyes in chemical processing, one fairly good rule of thumb is that the chemicals you can't see are usually the safest. An example would be in filling containers. If the fill

pipe ends at a point above the top of the container, the liquid is available to the eye—that is, it can splash or bounce or in other ways be diverted from the container to the face. On the other hand, if the fill pipe extends into the container there is considerably less chance that the chemical running out of the pipe can reach the face.

Prevention of eye accidents in chemical processing does not stop at chemicals themselves. Let's take a simple example, that of a pipe rack. Where are you going to put it? If it is in the middle of the yard and open at both ends, pipes sticking past the end of the rack present eye hazards to passersby and to anyone who is getting pipe from the rack. You can automatically reduce this exposure by 50 per cent by the simple expedient of putting one end of the rack up against a building or fence. You can eliminate the hazard to passersby by completely enclosing the rack, so that the exposure is limited to those who actually enter the enclosure for the purpose of obtaining pipe.

You can see that any consideration of new processes or even reviews of present processes can profitably include the query, "What are the potential eye hazards and how can they be reduced or eliminated?"

Preventing the Injury

When you consider the prevention of injury to the eyes you must make the assumption that the accident has occurred or will occur, and that your endeavor is to keep whatever happened out of the faces of your people. In most instances this consists of imposing a barrier between the accident potential and the individual.

A familiar example would be the window in a laboratory hood. Indeed, right here we might discuss the hood window, as it is one of the most abused objects in chemical processing. I am sure that you have all seen hood windows that for all practical purposes were inoperative. Perhaps they were badly etched from months and years of HF determinations. Maybe the glass was old and opaque. Maybe services to the hood,

such as nitrogen, were introduced from outside the hood through lines that entered at mid-hood levels.

All of these things preclude the proper function of the hood window, which is to protect the person and confine the fumes except when an operation is actually being performed in the hood. If you made a study of what this work consists of you would probably find that in an eight-hour day not more than half an hour is spent by the chemist in standing with his hands in the hood. But if the conditions we have just reviewed are present the hood window will remain open the other seven and one-half hours.

Lately there is a new trend in hood design which protects the eyes and indeed all of the body except the forearms during the time the chemist is actually working in the hood. This design consists of transparent panels which slide horizontally on an overhead trolley and overlap in front of the hood. The chemist is able to thrust his arms around the edges of the panels, which are not secured at the bottom, and do his work much as he would in a glove or dry box.

Remembering that we are talking about preventing the injury, which means imposing a barrier, this barrier can very often be simply part of the process equipment itself.

I invite you to consider a gauge glass on a tank. Let us assume that for some reason this is a gauge glass which cannot be quarried, which is fragile, and which is installed at eye level. This clearly constitutes a hazard to the eyes. Now where are we going to put this glass on the tank relative to the area?

Usually one would imagine that the gauge glass would go at a spot most available to the operator who needs it, which would mean at the point of heaviest travel, such as an aisle. If the glass is put in this position it constitutes a potential hazard not only to the operator but to everybody that passes the tank. If we put the gauge glass on the opposite side of the tank it is harder for the operator to read it, but it constitutes practically no hazard to anyone but the operator.

In investigation reports on eye injuries in chemical processing, perhaps one of the commonest phrases is a variation of, "He

turned the wrench and acid squirted out." The chemical industry has learned that this type of accident, which we call a line-breaking accident, is very nearly 100 per cent preventable, because we can impose barriers. A barrier can be as simple as an old vinyl raincoat. You loosen the bolts on the flange a quarter turn or so and then continue your work with a raincoat or rubber sheet between you and the wrench and the flange. If the product in the line squirts out it is going to be deflected by the barrier.

Another barrier can be as primitive as a bucket of water. I wonder how many of you know that something as simple as a plug cock, taken off a process line, can still constitute an eye hazard. If you will examine drawings of plug cocks or many other different types of valves, you will notice that in the closed position in a line considerable product is contained within the valve.

If the line is drained and the plug cock removed, the product goes right along with it. If the valve is subsequently opened, as for example in the act of working on it in the machine shop, the product can squirt out. One simple method of preventing this type of accident can be insisting that the valve be in an open position before it is removed from the line, and that it be immersed in a bucket of water and opened and closed several times before further work is done upon it.

Guarding the Person

Our next line of defense in eye protection to some degree resembles our second, that of imposing a barrier. In guarding a person we provide a barrier on the person himself. This consists of something in front of his eyes such as safety glasses, mono-goggles, face shields or masks.

I would like to tell you about my own company's eye protection program, because I think it works very well and could be easily adopted by almost anyone interested in preventing eye injuries in the chemical processing industry. The program is based on one simple rule, which calls for the wearing of safety glasses by everyone all the time.

These safety glasses are conventional frames without side shields and are plano for those people not requiring prescriptions. For people wearing prescription glasses we provide prescription safety glasses. All these

glasses are provided at no cost and we have no limitations on the number of glasses per person per year.

We think there are some very definite advantages to this program, even though we accept the fact that safety glasses provide only about 90 per cent protection as compared to cup goggles or face shields. We use face shields and cup goggles, and I will mention them a little later. We think that safety glasses when worn all the time dispense with two serious objections to cup goggle programs.

As you know, no workman can be expected to wear cup goggles or mono-goggles or face shields eight hours a day. In plants which rely upon this type of eye protection, some system must be evolved to determine when the workman must wear the goggles. This determination seems to have taken three separate courses: the concept of an eye protection area, the decision of the employee's foreman, or the decision of the workman himself.

In a so-called "goggle area" signs are usually posted to inform that goggles must be worn in this area. However, this does not protect the people working or passing adjacent to this area, and historically people have suffered eye injuries when they have entered the area, as they put it, for a short time.

Programs which depend on the foreman or the worker to determine whether goggles should be worn really place too much responsibility on the foreman or workman. Probably neither of these individuals is competent 100 per cent of the time to say whether a significant eye hazard exists. Furthermore, this type of program leads to arguments between management and the workman, usually with agreements that are only temporary.

I should like to say something about the introduction of a 100 per cent safety glasses program. This is not something which can be installed overnight. One usable method is to begin by announcing to the supervisory staff that at a future date you intend to introduce safety glasses, first on a permissive basis and later on a mandatory basis. At this time you can request the foremen to begin wearing safety glasses and to equip wearers of prescription glasses with prescription safety glasses.

Even at this early stage you will encounter some resistance from the foremen. This resistance can be met in many ways, such as pointing out the frequency of eye accidents in your company and comparing safety glasses with other safety equipment commonly in use, such as rubber gloves and aprons and gas masks.

When you equip your workmen with safety glasses you will initially encounter both resistance and high initial cost. The cost will come from the fact that your people are simply not used to wearing safety glasses and will break them, lose them or leave them at home. You should be prepared to replace these glasses and you will find that initially you will need to carry a comparatively large inventory.

Later on you will find to your satisfaction that your supply problems will diminish considerably, as the employees become accustomed to wearing glasses all the time. Glasses which are worn on the nose don't get lost or broken. The way glasses get lost or broken is by being sat on, falling out of the pocket, or getting knocked about in a tool box.

You will eventually find some unexpected dividends in a 100 per cent safety glasses program. One of them is the psychological reaction of the workman who wears safety glasses. By the very act of his equipping himself with a protection device he becomes more safety conscious and will perhaps unconsciously consider other hazards in the plant more closely. Furthermore, a workman who wears safety glasses is inclined to kid a fellow workman who for some reason has left his glasses off.

Another dividend consists in a reduction of off-the-job eye injuries. As workmen become used to safety glasses and convinced of their value they will wear the glasses off the job when doing things that carry a degree of risk to the eyes. This is particularly true on do-it-yourself projects. In my company we frequently get testimonials from workmen who say that their eyes were saved by their glasses in accidents involving power tools in their own work shops. I personally wish that the Wise Owl Club would include these incidents as qualifications for membership, since at the present time only work-connected accidents are considered.

I said a little while ago that our eye safety program does not stop at safety glasses. Some of our operations require more complete protection. For example, in line breaking operations our minimum requirement is a full face shield. We require that this be worn over safety glasses in order to protect the eyes when the shield is removed or momentarily raised. Chipping, welding and other high-hazard jobs likewise require additional protection such as mono-goggles or cup goggles. These additional requirements are best spelled out in safety manuals or posted in high hazard areas.

I would like to say a word about the future of eye protection programs with relation to safety glasses. We think that better glasses can be made, that they can be better fitted, and that delivery schedules can be improved. It is obvious that some standardization of safety glasses is needed. At the present time not all safety glasses parts are interchangeable. For example, there are J, S, and 7 barrel hinges, and variations in the shape of lenses.

In a large chemical plant there may be two or three different brands of glasses, and the lack of standardization makes it difficult to replace broken parts. As for delivery schedules, these are not much of a problem on plano glasses, but delivery promises, so far as prescription glasses are concerned, have to be taken with a grain of salt. I think we are within our rights to insist upon minimum periods between placement of orders and delivery of prescription glasses.

Concerning the fitting of safety glasses, it is obvious that the better they are fitted to the individual the more likely he will wear the glasses all the time and the more comfort he will enjoy. There is a trend toward initial fittings by oculists or other members of the profession. These services cost money but they increase eye protection and additionally they relieve the busy safety engineer from the purely mechanical job of fitting and dispensing glasses.

Minimizing the Injury

We come at last to the important subject of treating the eye injury after it occurs. In a chemical plant the answer, which is deceptively simple, is water. The first aid measures for a chemical injury to the eye consist solely of the application of water,

lots of water, and for a long time. The best place to administer this water is as near to the scene of the injury as possible.

This calls for lots of hoses as a minimum, many safety showers as a median, and adequate eye wash fountains as an ideal. We personally like home-made eye wash fountains. A simple design consists of three conventional shower heads each mounted 90° apart and at about waist level. Such an eye wash fountain takes care of the entire face and the position of the face relative to the ground is such that it provides for a maximum of dilution and run-off.

I saw an excellent arrangement at an RCA plant recently, which protects bench workers. This consists of nothing more or less than a kitchen type of hose spray on a reel, with a spring loaded nozzle at the end. If materials are accidentally introduced into the eyes the bench worker need only reach for the nozzle, pull it toward him, and direct the stream into his face.

Following the use of water at the point of injury it is usually necessary to continue eye irrigation in the first aid room. Very often other parts of the body are involved, and many first aid rooms use tubs for immersion washing. These tubs should include spray hoses similar to home shampoo hoses so that the eyes and head may be irrigated at the same time.

Some of your workers may be exposed to chemical burns of the eyes away from your plant. Examples would be truck drivers and those performing services at customer locations. Trucks should carry supplies of emergency water, in the glove compartment or in one or five gallon cans kept in the cab of the truck. Lately we have found an ideal place to keep water in acid tank truck transports. These transports are equipped with roll-over bars. The bars are actually hollow compartments, which can be filled with water and fitted with a nozzle.

As for work at customer locations, your people should be instructed to look for emergency sources of water as soon as they enter the location, and to report to you if such sources of water do not exist. We have sometimes found that customers receiving our products do not have safety showers near the point of unloading, and we have also found that uniformly the customer has been cooperative in providing such showers when requested.

Eye wash fountains and showers should be periodically tested and a record of such testing maintained. No valves should be permitted in these lines. Fountains and showers in cold climates can be protected against freezing in various ways, such as using warmed circulating water, installing the piping below the freeze line, or using dry pipes issuing from a warmed building. The showers and fountains should be marked with signs and distinctive painting and it is a good idea to use a green light at each shower.

Some companies are using "drills" for the reason that it is probably against instinct to get under a shower with your clothes on. We have seen many instances in which a man contaminated with a chemical splash would use a hose or even a basin instead of an easily available safety shower. Drills, which might take the form of getting under a shower just before quitting time, will condition the workman to use a shower when he needs it.

A final word is necessary relating to water substitutes and the fight we must make against them. In almost any plant you will find individuals who feel that certain types

of chemical burns are best treated not with water but with special solutions. For example, some people want to treat acid burns with sodium bicarbonate solutions or weak ammonia. There are serious deficiencies in these routines.

For one thing, the so-called special solutions are never as readily available as water nor in the large quantities necessary to flush away the offending chemical. Even more important, the so-called neutralizer very often produces a secondary injury in that in the process of neutralization a new chemical product is formed in the ocular tissue. This not only increases the injury but makes the treatment more complicated as the physician who ultimately sees the patient will find it necessary to remove the chemical which has been formed before he can treat the injury.

To summarize the modern concept of eye protection in chemical processes, we have four lines of defense: to prevent the accident, to prevent the injury, to guard the person, and to minimize the injury. These lines of defense are inter-dependent and each must be carefully planned for maximum eye safety.

FUNDAMENTALS OF PRESSURE-RELIEVING DEVICES FOR UNFIRED PRESSURE VESSELS

By H. V. MODNICK

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I'd like to mention several examples which show abuse and negligence of safety valves and rupture discs:

- 1) A relief valve that couldn't operate if it had to—the spring and frame are corroded, the spring has been repainted several times and the lever arm used for manual testing is inoperative.
- 2) A "pop" valve installed on a 60 psi hydrogen line—the discharge opening with a metal plug installed—in this plant, they were in a hurry to get the hydrogen equipment in operation, so they delayed in install-

ing the discharge line. No, nothing happened.

- 3) A rupture disc installed on an HCl tank, using 60 psi for the acid movement—this rupture disc was a flat sheet of lead, but after four weeks of service it has bulged from the pressure. Four weeks before this, the lead disc ruptured—no one was hurt, but a large amount of HCl was spilled in the area.
- 4) Under two cans are "pop" valves on a steam line. Reason for the cans—the valves were popping off and spraying a large area.

By placing these cans on the valves, the steam was directed downward—a smaller area was involved.

I've seen worse rupture discs and safety valves in my tour of plants, but I'm sure there aren't any scenes like this in your plant—or are there?

This afternoon, I'd like to discuss the fundamentals applicable to pressure-relief devices for unfired pressure vessels. An unfired pressure vessel as you know is a pressure vessel that is not subject to direct application of heat from the products of combustion, i.e. it's the reverse of a boiler, which is an example of a direct fired vessel.

This lecture will not make rupture disc, safety and relief valve engineers out of you, nor will you be able to solve complicated relieving problems, but it should explain the most common types of relieving devices that are used for unfired pressure vessels.

Generally speaking, there are four basic types of safety devices: rupture discs, pop valves or safety valves, relief valves, safety-relief valves, and combinations of safety valves and rupture discs. Each has its purpose, but the pivotal point is cognizance of the fact that every pressure vessel in your plant is a potential bomb.

Before discussing the basic types of valves, I'd like to emphasize one point: all unfired pressure vessels constructed in accordance with the ASME code for unfired pressure vessels and according to paragraph UG-125 shall be provided with pressure-relief devices. In this code, there are five pages of precisely worded rules devoted to pressure-relief devices. These rules state how, when, and where you should install the relief devices, which will be adequate to protect against overpressure, chemical reaction or other abnormal conditions.

If you haven't already done it, it would be to your benefit to obtain a copy of the ASME code for unfired pressure vessels and peruse paragraphs UG-125 through UG-134. These paragraphs relate to pressure-relief devices only.

The simplest safety device is a rupture disc, which is merely a thin metal sheet designed to burst when pressure exceeds a given value. It is held between flanges and is inserted either in the wall of a pressure vessel or in a line connected to the vessel.

Consider a flat disc installed in a flange.

When subjected to pressure, a flat disc starts to take on a bulged shape. When this happens the disc has a tendency to work-harden and as a result, it will fail from shear or fatigue at a pressure lower than would be expected. As a result, frequent maintenance can be expected with flat-type discs.

Experience has shown that for uninterrupted service during normal operations of a pressure system as well as for rupturing within a 3 per cent (plus or minus) range of the marked rating, a pre-bulged disc is most desirable.

Frequently in the chemical industry we have vessels that operate under alternating pressure, i.e. vacuum and positive pressure and this presents a problem. How do we prevent the crumpling of the disc under negative pressure and resultant leakage at the intersection of the creases? This is accomplished by equipping a pre-bulged disc with a vacuum support. Height of the supports corresponds to that of the disc, restricting its movement when negative or backpressure is encountered.

Rupture discs are available in a variety of metals—stainless steel, inconel, monel, nickel, platinum, silver, copper and aluminum. Sizes normally range from 1/4" to 24". What is probably the largest rupture disc ever manufactured was used at the end of a wind tunnel.

Size and temperature are two big factors that effect the rupture pressure of discs. Stainless steel has a rupture pressure of approximately 2700 psi for 1/4 inch disc at 72°F and decreases to 65 psi for a 24 inch disc at 72°F.

Temperature limits have been established on all ductile metals that are used in fabricating pre-bulged rupture discs. For example, for aluminum, copper and silver, the maximum operating temperature is 250°F; for platinum and stainless steel, 600°F; and for monel 800°F.

For use in corrosive atmospheres, various plastic coatings and linings are available for rupture discs.

The rupture pressure of a disc should not be greater than the code rating of the protected vessel. Expressed in other terms, the rupture pressure of a disc should be at least 50 per cent greater than the normal operating pressure of the vessel. Conversely,

the normal operating pressure should not exceed 66 per cent of the rated pressure of the disc. This percentage represents the minimum pressure differential that must exist between disc rated pressure and vessel operating pressure for the disc to give a normal service life. A few examples are in order.

Let's assume that the normal operating pressure is 50 psi, then we should use a disc rated at approximately 75 psi. If you are using a rupture disc rated at 150 psi, then your normal operating pressure should be 100 psi or less. When used in this method, a rupture disc is acceptable on coded unfired pressure vessels as a primary relief device. In addition, if discs are used in this recommended procedure you will receive good service life without frequent replacement and loss of material. Of course, if any wider margin or larger ratio can be allowed between bursting and operating pressures, then the diaphragm life will be considerably increased.

Paragraph UG-129 relative to marking, states: "Every rupture disc shall be plainly marked by the manufacturer in such a way that the marking will not be obliterated in service. The marking may be placed on the flange of the disc or on a metal tab permanently attached." The marking shall include manufacturers' trademark, design and lot number, size in inches, minimum and maximum bursting pressure, coincident disc temperature and capacity, i.e. pounds of steam per hour or cubic feet of air per minute.

How about your plant? Do you buy rupture discs as per code specifications or do you make your own? I know of one large size chemical plant and have heard of others that make their own rupture discs. What they do is this: they buy a sheet of thin gage aluminum or stainless steel—dependent upon relative temperature and pressure requirements and cut their discs upon these sheets. One disc will be tested in a holder of the same relative form and pressure area dimensions as that in which the disc will be used. If the disc will burst at 100 psi, then it is assumed that every disc cut from that sheet of metal will burst at 100 psi. If they need a 300 psi rupture disc, they simply cut out three discs and all three are inserted in the flange or safety head—therefore a 300 psi rupture disc.

These plants conveniently "forget" about the recommendation, i.e. rupture pressure should be at least 50 per cent greater than the normal operating pressure of the vessel, and the effect of temperature on rupturing pressure, etc. The code is very specific on the testing of discs; paragraph UG-127 states: "Every rupture disc shall have a specified bursting pressure at a specified temperature, shall be marked with a lot number, and shall be guaranteed by its manufacturer to burst within 5 per cent (plus or minus) of its specified bursting pressure."

Regardless of what some plants do, I hope that all of you buy your rupture discs from reputable concerns. No, I'm not a stockholder in plants that manufacture rupture discs.

So far, I've made no mention of what size rupture disc we should use, how we determine relieving capacities for pressure vessels and the scope of such calculations. The reason is this: we wouldn't have time this afternoon to discuss this important phase of relieving devices. However, it would make an interesting program for next year's chemical section program.

A cut-away section of a "pop" valve or safety valve—a valve that pops full-open at a preset pressure—would show that this popping action is caused by the huddling chamber. The huddling chamber consists of a disc with two areas, closing on a single seat, and the lower area of the disc protrudes through the seat. Assume the upper part of the disc or huddling chamber is $1\frac{1}{4}$ square inches in area and the lower part or protruding part is 1 square inch in area. Force extended on the disc by the spring is 100 pounds. Assume the vessel is under 90 pounds pressure. We then have 90 pounds per square inch pushing up on the 1 square inch of area and 100 pounds dead weight pushing down.

Now let's raise the pressure to a little over 100 pounds. Then the 100 pound disc will start to rise until the lip clears the edge. When this clears, we have 100 pounds pressure operating on $1\frac{1}{4}$ square inches and the upward thrust is now increased to 125 pounds. The downward thrust is only 100 pounds dead weight, so the valve pops wide open.

Now with the valve wide open, let's drop

the pressure to a little less than 80 pounds. We then have a little less than 100 pounds pushing up, but a full 100 pounds pushing down. The valve starts to close until the lip passes the edge. Then we have 80 pounds per square inch pushing up and 100 pounds pushing down and the valve shuts off with no throttling action.

A "pop" safety valve is recommended only for use on gases, steam, air—not liquids.

A cut-away view of a relief valve shows no huddling chamber and, as a result, the valve will not "pop" open, but only relieve the pressure.

To give a simple explanation of a relief valve, it consists of a flat disc closing an opening in a pressure-containing vessel. This disc is held to its seat by means of a spring. Assume for this discussion that the spring is pressing down with a total load of 100 pounds. Assume the vessel is completely full of water or gasoline at 90 pounds pressure. Then over an area of 1 square inch we have 90 pounds pushing up and 100 pounds pushing down.

When pressure is raised to 100 pounds, everything is in balance. When we raise the pressure to 110 pounds, the spring will compress, permitting the excess liquid to pass through the seat opening in a certain volume. When we raised the pressure to 120 pounds, the valve is discharging its maximum capacity. As the pressure is lowered to 100 pounds the valve closes to the seat and closes.

A relief valve is only designed to be used on liquids. When used for gases, steam, or air, it functions as a relief valve with no popping action.

A few examples of pop and relief valves would show their similarity. It would be rather easy to intermix, especially if the nameplate was missing. Speaking of nameplates or marking, paragraph UG-129 of the ASME code states: "Each safety and relief valve $\frac{1}{2}$ inch pipe size and larger shall be plainly marked by the manufacturer with the required data in such a way that the marking will not be obliterated in service."

Last of the basic relieving devices is a safety-relief valve—this is a type of valve that can be adjusted to give either "pop" or "non-pop" operation and can be used on steam, gas, vapor, and liquid service (with

modifications). The modifications: if used as a safety valve, the huddling chamber must be used; if used as a relief valve, it must be dismantled and the huddling chamber removed.

Let us consider four examples that illustrate diversified usage of rupture discs and safety valves in primary and secondary relieving capacities.

1. A rupture disc, used as a primary relief, installed under a safety valve. It is an accepted practice, when a safety valve is subject to excessive corrosion, jamming, stoppages from material in the system, to install a rupture disc in the pipe ahead of the valve. Avoid loss of valuable material by leakage. Also the rupture disc prevents deleterious materials from entering the valve until relief is necessary.

2. An excess flow valve (actually a ball-check valve). This vents the chamber between the rupture disc and the valve seat, preventing pressure which may leak through a corroded or leaking disc from building up on the top side of the disc and consequently increasing the rupture pressure.

3. A reverse of the last example. The rupture disc is installed downstream from the safety valve. This arrangement is adopted at times when it is necessary to prevent leakage of valuable, noxious or otherwise hazardous materials. In the words of the ASME code on unfired pressure vessels, "Users are warned that an ordinary spring loaded safety or relief valve will not open at its set pressure if back pressure builds up in the space between the valve and the rupture disc." To prevent this a specially designed safety or relief valve is required, such as a diaphragm valve or a valve equipped with a bellows above the disc. A safety valve may also be equipped with bellows.

4. A rupture disc installed in parallel with a safety valve. When equipment is to be operated at more than 66 per cent of its allowable working pressure it is best to place the rupture diaphragm in parallel with a relief valve, the relief valve being used for primary relief and the rupture disc as secondary relief. In this fashion the diaphragm supplements the valve providing emergency relief. Installed in this fashion, the bursting pressure can be at practically any value desired, from 50 per cent above

actual operating pressure up the test pressure for the equipment.

Poor installation of a rupture diaphragm may result in rupture that might endanger personnel in adjacent areas. An exhaust stack higher than the heads of any employees should be installed downstream from such a disc.

A few examples of poorly designed installations that are found in some chemical plants follow, showing rupture disc installation, but the principle is also applicable to safety and relief valves. Naturally, these examples are not indicative of installation practices at your plant.

A valve cannot be installed in a rupture disc or relief valve line unless it is locked open; in the event of a shutdown for repair or replacement, this valve would actually be useless if a rupture disc or valve had to be replaced, and conceivably it might be left closed. The rupture disc or relief valve coming off the end of the tank might vent directly into the path of personnel walking by. It should be vented to the outside or baffled.

While generally not recommended, a valve may be installed in a rupture disc or relief valve line as long as it is locked open, and shut only while supervision is present for replacement of a rupture disc, and then locked open again. By locking, I mean a physical method, such as a seal wire, seal tape, lock and chain, etc.

The relief valve or rupture disc having a vent line with two elbows can lead to disastrous results since every elbow reduces the available capacity of the vent line; if straight, the line might have ample capacity, but with avoidable elbows, the relief capacity can be restricted to the points where after the rupture disc has broken and functioned quite satisfactorily, the flange itself could be torn from the vessel.

In the last example we assume that one rupture disc or relief valve is set at design pressure and the other at test pressure. Actually, this venting of two relief devices into one line is normally expected on two adjacent vessels; in the event that one relief device was called upon to function, it could possibly impose sufficient back pressure on the other to reverse it, even under pressure in the adjacent vessel.

A monograph can be used for the sizing

of safety and relief valves, and is very useful. It not only saves time but insures that all corrections for absolute pressure, temperature and over-pressure have been considered. I'm sorry time does not permit an explanation of the monograph.

How do you treat your pressure-relieving devices? Rupture discs, safety and relief valves should be treated as precision instruments, for basically speaking that's what they are—they are self-actuated and depend on critical dimensions, surface finish, corrosion resistance and adjustments for good performance. Yet on many occasions I've seen them treated as casual pipe fittings and scrap metal, thrown in bins and boxes, mixed with other pipe fittings and left to gather grime and dust.

Inspection, testing and maintenance is an integral phase of a sound pressure-relief device program. Each plant should establish a regular schedule for inspection and testing of relief devices.

Relative to inspections, no general rules can be formulated because of the wide range of conditions and materials encountered. It is suggested that pressure-relief devices be tested quarterly under average conditions, but this should be tempered by consideration of local conditions and service.

Speaking of inspection and testing reminds me of the time I asked the general maintenance foreman of a large size industrial plant how often he inspected and tested the relief devices in his plant. He replied, "I've worked here for 23 years and we have never inspected or tested our safety and relief devices."

After I completed my inspection of the plant, I was forced to agree with him. I saw relief valves with bird's nests in them, wasp nests, metal plugs in the exhaust openings, corroded springs, chews of tobacco in the openings, broken level pins, missing bonnets, lead seals gone and levers blocked open with pieces of wood.

One bad practice I've noticed in plants is the use of safety and relief valves as control valves, i.e., if you want to maintain pressure in a vessel at 100 psi, it is very convenient to adjust a relief valve for 100 psi and let it do the controlling. Another is the installation of safety and relief valves in a horizontal position—they should always be installed in a vertical position.

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SPECIFIC AND UNUSUAL APPLICATIONS OF PRESSURE RELIEF DEVICES

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In the chemical process industry, the proper selection and use of relief devices is well established. Many excellent papers have outlined the fundamentals of relief devices for commercially operated equipment.

The selection and use of safety devices in equipment to be operated under extreme conditions is a great deal more empirical. The term "extreme conditions," as defined by Gaseche and Stjepcevic, covers the range of pressures beyond 2000 psi, or temperatures above 1000°F, and various modifications of these conditions. Presently, only a few commercial processes fall within this category—the manufacture of polyethylene by the high pressure process, the manufacture of ammonia, production of alcohol by the oxo process, and a few others. The greater proportion of work is done in the research laboratory. Therefore, I wish to define the frame of reference of this paper to encompass the work performed in the high pressure research laboratory.

There are many difficulties found in the selection of proper protective devices for this type of activity:

1. Since the work is in the realm of research, conditions to be met are not well defined and may change rapidly.
2. The equipment is usually quite small and normal commercial devices may not fit.
3. Conditions are frequently beyond the

scope of normally available commercial devices.

4. Design protection is extremely difficult because code design practices frequently do not cover the conditions to be met, and sometimes safety factors must, of necessity, be very low.

Therefore, in addition to the relief devices to be discussed, it is felt that additional protection is required, such as extremely well qualified, trained personnel, and well engineered barricade systems.

For just a moment, I should like to discuss the two qualifications mentioned above. By far, the most important is highly qualified operating personnel.

The chemical process industry has recognized the need for barricading systems and has gone to great length and expense to provide them for their research personnel. The high pressure laboratory at Hercules Powder Co. in Wilmington, Del., is an example. From a view of this same laboratory, you could see that other precautions, in addition to relief devices were necessary.

With the thought in mind that the rupture disk is not the only protection given the high pressure research worker, let us examine some of the ways relief devices are used in this work.

With high pressure equipment, it is usually quite important that rupture disks be placed

as close as possible to the interior of the pressure vessels to allow little opportunity for build up of solids, and to ensure that the pressure drop ahead of the rupture disk be as low as possible.

An exploded view of the most common relief device for this type of operation shows that it consists essentially of the rupture disk body, the disk itself, a method of sealing the disk against leakage, and a means for carrying the exhausted products away from the equipment.

Rupture disks have become indispensable to the chemical process industry. There are some cases, however, where the range of work being carried out in research is beyond that covered by commercially available rupture disks. For instance, at extremely high pressures—in the range of 100,000 psi. or above—it is impossible to purchase rupture disks which are reliable.

As a means of solving this problem, the reverse intensifier has been developed. This common piece of equipment is used to raise pressures to high values by means of a differential area piston. In this instance, on a piston, the area on the low pressure side is approximately ten times the area on the other side.

This means that if a low pressure—say 10,000 psi.—is applied to the low pressure area, it is possible to generate 100,000 psi. on the other side. This apparatus is called an intensifier. For extremely high pressure work, it has been found satisfactory to reverse this process and place a rupture disk on the low pressure side of the piston and expose the high pressure side to the process under study.

The intensifier is used as a relief device. As an example, a 100,000 psi. system can receive the protection of a rupture disk normally rated at 10,000 psi. by use of a 10:1 reverse intensifier.

Frequently, high pressure research operations are carried out in the explosive range of certain chemicals. Sometimes, reactions take place which go through the explosive range during the course of reaction. In cases of this type, it is necessary to protect against extremely rapid rises in pressure.

Next consider an autoclave with a rupture disk built as the bottom of the autoclave. With this type of device, the objective is to have a rupture disk with as large an area

as possible. You will note in this figure that since the rupture disk is in the bottom of the autoclave, the possibility exists that the autoclave will become a rocket in the case of explosion. It is necessary, therefore, to mount this equipment with heavy duty reaction springs so that after relief, it will not end up through the roof.

No doubt you have been reading about the chemical "farmers" with their successful method of growing quartz chemically. This synthetic method of growing crystals is a major achievement, and will be of great significance in the field of communication. However, there is one ticklish problem associated with this operation. In a pressure vessel where the object is to grow a solid material, how does one protect the equipment and personnel with a rupture disk which does not become covered by this material. The problem was solved as follows:

In a view of quartz growing equipment you would notice the safety head equipment in the cover. An enlarged section of this portion of the vessel, shows at the upper cover the rupture disk which is made much the same as that discussed earlier.

At the lower section, however, is a small metal disk which is drilled with a single hole of .003-inch diameter. This diameter has been found to be sufficiently small to hold water, due to the surface tension of the water itself. This disk is then placed in the position shown, and the column between the disk and the rupture assembly is filled with pure distilled water. This means, then, that the small perforated disk is exposed on one side to the crystal growing liquor and on the other side to pure water.

This combination assures that the small hole will not become plugged with the crystals, since it is continuously being dissolved at the same rate at which it is formed. The passage below the rupture disk is, therefore, open in the event of failure of the disk.

Another method of attack on a problem of a similar nature is found in polymer chemistry. In this type of reaction, chemicals are allowed to polymerize in a continuous flow reactor. In order to allow for protection of the equipment, it was necessary to introduce the rupture disk into the interior of the reactor. In this way, even

though polymers may form over the rupture disk, protection is still provided. This type of protection has been found useful in such operations as the polyethylene reaction.

In chemical research work, one type of reactor which has frequently been used in the past, and still finds some occasional uses, is the rocking reactor. In this operation, a rocking mechanism is provided to give agitation to the contents of a high pressure reactor. Since the equipment is generally small and is continuously moving, the position of the rupture disk is something of a problem. Such a device has, on the left, the rocking reactor and, on the right, a valve which provides a means of shutting off the flow of gases to the reactor; a pressure gauge to indicate the pressure in the reactor; and a rupture disk to provide relief for the vessel.

Quite frequently, in high pressure research, very expensive or very toxic chemicals are used. It is, therefore, felt that a rupture disk, which is the final safety device, should be supplemented with a primary device which will relieve excess pressure temporarily, but will not empty the contents of a vessel.

In such a device, there is an air-operated valve, which is actuated by air on the valve diaphragm. The air is controlled by a solenoid valve and the solenoid valve is actuated by an electric contact gauge. In this manner, the electric contact gauge can be set to operate at a pressure just slightly above normal operating pressure.

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If pressure reaches this point for any temporary operational reason, the solenoid valve is actuated. This opens the air-operated valve and relieves the pressure. As soon as the pointer falls below the set point, the valve closes and the operation continues. In this manner, relief of a temporary nature only is effected. It is suggested that the exhaust from the valve be carried to a safe area.

We have mentioned many cases of difficult problems in the high pressure field, but have not discussed the other extreme of high temperature conditions. To date, only two methods have been used to solve the problem of relief devices on high temperature equipment:

1. To provide a cooled relief device. Quite often, water circulation around the rupture disk is used.
2. To provide a rupture disk made of a high temperature metal. To date, this is the preferred solution.

One of the most frequently used materials is Inconel. Inconel has a very high strength at high temperature. But perhaps even more important is the fact that the reduction of strength with increase in temperature is very low. A graph of temperature versus pressure on Inconel shows that the strength of the Inconel does not decrease significantly from room temperature to about 1200°F.

As more and more work is done in the high temperature field, other solutions to the safety problem will be forthcoming.

SAFETY IN STORAGE, TRANSPORTATION AND HANDLING OF GUIDED MISSILES AND ROCKETS

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The safety of a plant must be a constant consideration of those in charge of it from the conception of the original idea around which it is designed, and throughout the entire period of its construction and operation. Safety must begin on the drawing board, as otherwise its necessary consideration later becomes a matter of increasing difficulty and cost, and the latter all too often becomes prohibitive.

Safety in the storage, transportation and handling of guided missiles involves several important factors: i.e., (a) the determination of the hazards inherent in the operations, equipment, buildings and areas; (b) the development and adoption of a proper protective procedure to eliminate these hazards, if possible; (c) to reduce their effect in the event of an accident, if they cannot be eliminated; and, (d) the establishment and continued application of methods of inspection to insure the maintenance of these protective measures.

The safety engineering approach to the general problems of guided missile and rocket safety has been a large factor in the remarkable record of the U. S. Army Ordnance Corps establishments that store, transport and handle guided missiles and rockets.

As an example, during World War I, 240 persons were killed for every billion pounds of propellant and explosives processed; whereas in World War II, this figure was reduced to five persons.

These statistics interpreted simply mean that the lives of more than 10,000 persons engaged in these operations during World War II were saved by safety measures that were put into effect.

Without these safety precautions, a billion dollars' worth of plant facilities might have been lost and, what is more important, our combat troops would not have received the

kind and amount of ammunition that they needed when they needed it!

The storage, shipment and handling of packaged missiles, rockets or their components, at present, poses no serious problem. However, the advent of ever-larger missiles and heavy rockets will create correspondingly greater challenges in storing, packaging, transporting and handling.

The type of storage facility provided guided missiles and heavy rockets or their components, is controlled by the hazard, or potential hazard, of the component itself. Explosive components, such as war heads, rocket motors, igniters, etc., require igloo storage. Liquid propellants, including both fuels and oxidizers, may be stored, properly segregated, in liquid propellant storage areas, in properly designed and constructed buildings.

The storage of present and future missiles containing solid propellant rocket motors, however, takes us into an additional problem area—that of explosive safety. The presence of these explosives—loaded rocket motors—demands that the safety of personnel handling, storing and shipping this material, the protection of government property and the safety and protection of the lives and property of surrounding communities will have been carefully pre-planned and is rigidly enforced.

How is this done?

First, safe distances must be provided between locations containing explosive materials. This includes operating buildings, storage magazines, loading docks and any other explosive facility. Inhabited building distance must be maintained between explosives locations and inhabited buildings. Intraline distance is the minimum distance permitted between any two buildings within an operating line. Magazine distance is the mini-

mum distance permitted between any two storage magazines.

Guided missiles and rockets are classified according to the expected damage if they explode or ignite. The maximum amount of explosives permitted in any location is specified in the quantity-distance tables, Section 17, ORL M 7-224. It is mandatory that local limits be established in amounts no greater than those consistent with safe, efficient operations.

Keep in mind that the cardinal principle to be observed in any location or operation involving guided missiles and rockets is to limit the exposure of a minimum number of people, for a minimum time to a minimum amount of hazardous material consistent with safe and efficient operations. All operations should be scrutinized to devise ways and means of reducing the number of people exposed, the time of exposure or the quantity of material subject to a single accident.

Guided missiles, rockets and their components are stored in accordance with applicable Ordnance Corps storage drawings. War heads, motors, igniters and other explosive components require igloo storage. An igloo magazine means an arch-type, earth-covered magazine which may be constructed of concrete, metal or wood. A "standard igloo magazine" means an earth-covered, reinforced concrete, arch-type magazine, with or without a separate door barricade, constructed according to approved standard service drawings.

Liquid propellants (fuels and oxidizers) must be stored in an area separate from all other activities. The facilities must comply with the requirements and standards for various propellants. All buildings, tools and equipment must be compatible with the various chemicals. The propellants will probably either be stored in approved shipping containers or bulk storage tanks meeting all the safety requirements. Among some of the liquid propellants used today are hydrazine, hydrogen peroxide, unsymmetrical dimethylhydrazine, nitrogen tetroxide, liquid oxygen and nitric acid.

At present, the shipment of large guided missiles and rockets, regardless of their hazard classification, is offering no particular problem. Future missiles may reach 15 to 20 feet in diameter and 75 to 100 feet in

length and weigh as much as 100 tons or more. Such dimensions offer not only problems in packaging and handling but also in shipment irrespective of the mode of transportation. The size and weight of these future components will necessitate further revision of the loading and blocking concepts.

The advent of these ever-larger explosives-loaded items will probably cause revision of the ICC Regulations to permit their movement by common carrier. The ICC Regulations are published in the 1949 edition of the Code of Federal Regulations, Title 49, parts 71-90, Transportation. Those regulations are also published in various freight tariffs.

Our present public highways have a maximum height clearance of 13 feet, six inches; yet, as has been pointed out, components of the new large missiles may be as large as 15 to 20 feet in diameter. Not only are our highways as presently constructed inadequate for the transportation of items of this size but the railroads will also have difficulty in handling any item whose loading height, plus the car height, exceed 15 feet, one inch. Such items usually require special handling and special routing.

Present guided missiles, heavy rockets and their associated components are loaded, blocked and braced in accordance with Department of the Army Ordnance Corps drawings. Truck and rail loading drawings have been developed after many tests to insure the best possible protection during shipment of the guided missiles and rockets. All of the Ordnance Corps drawings are approved by the Bureau of Explosives, Association of American Railroads, and are binding upon all shippers of guided missiles and rockets by, for and to the Ordnance Corps.

Shipments of guided missiles, rockets and liquid propellants must comply with the following regulations:

1. Interstate Commerce Commission Tariff Books;
2. Army Regulation 55-355;
3. U. S. Coast Guard Regulations and Instructions;
4. State and Municipal Laws and;
5. Ordnance Safety Manual, ORL M 7-224.

The handling of guided missiles, rockets and liquid propellants involves much more than the mere off-loading and out-loading of these items as packaged. In many cases, special handling equipment must be designed and fabricated for these operations. The handling of any item depends on the hazards involved. The handling of the unpackaged guided missile body, rocket motors and other associated components and/or hazardous material present special problems. In this connection, the size and weight of the component of the new missile, which the future may bring us may exceed the safety limits of the material handling equipment now being used.

It is of utmost importance that the nature and characteristics of the various items be fully understood by all who are required to handle them. Established rules have been developed as needed to fit actual cases. In general, all operating personnel must be taught the nature of the hazards involved in the handling of the guided missiles, rockets and liquid propellants.

The three basic hazards to be dealt with in operations involving the items are:

1. Fire;
2. Explosion and;
3. Toxicity poisoning or chemical burns. Any or a combination of these hazards may be present in a given situation.

Fire protection and prevention are a must at all times. Areas must be kept free of combustible materials. *Fuels and oxidizers must be kept separated.* Fire fighting equipment and extinguishing agents must be suitable to the type of fire which may occur with a particular fuel and oxidizer. Where flammable vapors are present, electrical equipment must be of the approved explosion-proof type, and equipment and containers must be grounded. Non-sparking tools, shoes, and non-static generating apparel should be provided where required.

The principles guiding the elimination and control of fire hazards are generally applicable to explosion hazards as well. Shock-sensitive materials must be handled carefully and protected from vibration, friction and impact.

The protection of personnel from poisoning and chemical burns involves:

1. Engineering prevention to minimize spills and leaks and insure adequate ventilation;
2. Use of appropriate personal protective clothing and equipment and;
3. Conducting of periodical health surveys;
4. Periodic physical examinations;
5. Constant education of supervisors and employees regarding safe procedures and practices.

In summation, the storage, transportation and handling of guided missiles and rockets involves, in general, highly hazardous materials. Consequently, in order to do the job safely the hazardous properties of each item must be fully known, recognized and understood. Specific and detailed safety standards to be followed in all operations involving these materials have been established. These safety standards are outlined in various publications in a manner adapted to the needs of the safety engineer, plant superintendent and operations supervisor.

Supervisors must devise and enforce a system of inspection to ascertain that all operations are being conducted in accordance with the prescribed safety requirements. Unless successful control for the hazards involved in the operations is maintained, sooner or later a fire, explosion, poisoning or chemical burn will occur at the plant. Therefore, during the storage, transportation and handling of guided missiles and rockets close adherence to all safety requirements is a must, and demand constant alertness to every new indication of a need for a change in the safety standards through actual experience.

SAFETY IN ROCKET PROPELLANT MANUFACTURE

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The cardinal principle of hazardous operations; i.e., "In any location or operation involving explosives, ammunition, severe fire hazards or toxic materials, exposure must be limited to the minimum number of people for a minimum time to a minimum amount of hazardous material consistent with safe and efficient operations," must be the basic premise for all propellant manufacturing operations.

The introduction of rockets and guided missiles into the nation's weapons system for defense of our country has raised a question—what changes have resulted in the safety requirements for manufacture, handling, storage, and use. The assumption that the term rocket propellant connotes the unusual; therefore, the hazards must also be unusual, is wrong in most cases. Most often, careful and objective study of the materials discloses the hazardous properties. Thus, there have been few major changes to the basic safety requirements. Specific changes due to chemicals and/or components have resulted. Each of these require individual research in order to formulate the necessary safety requirements.

Rocket propellants are, in general, highly reactive materials designed to deliver large amounts of energy in short periods of time. Fuels and oxidizers, and their reaction products possess hazardous properties which must be fully understood by all who handle them in any manner.

Missile propellants are grouped according to the physical state in which they exist. At present, only two types are in general use—liquid and solid.

The hazards of liquid propellants are fire, explosion and toxicity. In the case of fire and explosion, the principles guiding the elimination and control of each are generally the same. As to toxicity, prevention of poisoning and chemical burns of tissues of the body require (1) proper engineering design of operations, (2) personal protective equipment, periodic health surveillance procedures and (3) trained supervision.

The hazardous properties of liquid fuels, oxidizers and starting mixtures can be easily determined.

The manufacture of solid propellant motors for guided missiles and rockets has introduced many potential hazards. The safety requirements for the manufacture of single, double, triple bases and cast and composite propellant have been developed over many years. Now, however, the ingredients of each are being combined. This has created new safety requirements.

Safety in manufacturing operations must start during the research and development stages of a particular item.

Many of the explosions which have occurred in the manufacture of rocket propellants are a direct result of the lack of complete and adequate research and development.

Solid propellants are basically high-energy mixtures of a fuel and oxidizer which, after certain process steps, are a solid mass possessing properties consistent with the manner in which they will be used. Because of their composition, combustion progresses in the absence of air or other externally supplied oxidizers. The fuel and oxidizer are either chemically bound or in solution as in single and double base propellants, or are chemically separate entities consisting of a generally elastomeric fuel and crystalline inorganic salts. Other ingredients are normally added to impart and control desired physical and ballistic characteristics to the propellant.

The particular chemical and physical differences of the propellants being developed and manufactured require a wide variety of process methods. These methods can be catalogued into major functional processes; i.e., raw material preparation, mixing, casting, curing and motor finishing.

The physical conditions such as increased size, sensitivity of ingredients and ability to detonate are important.

This has meant redesign of present equipment and development of new, unique types of equipment.

No single factor exerts more effect upon a solid propellant operation than the safety procedures under which the work is performed. The objectives of safety are well understood, but the impact of safety measures themselves tends to be underestimated by persons unfamiliar with explosives and industrial operations.

The Ordnance safety manuals are the regulatory explosives safety publications used at Ordnance Corps plants and private plants operating under Ordnance Corps contracts. The rapidly changing nature of solid propellant formulations results in areas for which the safety requirements have not been developed.

The safety manuals in the explosives and chemical field have been written in 'blood.' This was after the fact safety. Now we must, of necessity, build safety into our propellant operations before the fact.

The custom of designing and installing equipment and facilities and then examining it for hazards is obsolete. Consideration of safety after development becomes a matter of increasing difficulty and cost. The cost factor all too often becomes prohibitive.

The mechanization and automation of processing and loading techniques have gone

forward. Many things have been accomplished in the field, but the most important insofar as safety is concerned is the reduction in the amount of explosive materials which might be subjected to a single accident.

Advances in the art have been so rapid in the propellant and explosives field that there are many instances of equipment and processes becoming obsolete before they are actually put into production.

The explosions which have occurred during mixing, curing, finishing and testing of solid propellant motors have been the result of make-shift equipment and lack of complete knowledge. Technical advances have increased the efficiency of our propellants; however, this increase can result in disastrous results because of improper procedures.

Safety involves the determination of the hazards inherent in the processes, equipment, buildings and areas—the development and adoption of proper protective procedures, either to eliminate these hazards or, if they cannot be eliminated to reduce their effect in the event of accidents and to minimize the frequency of such accidents, and last—the establishment and continued application of methods of inspection to insure the maintenance of these protective measures.

SAFETY IN THE ROVER PROJECT

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The Rover Project began in 1955 under the auspices of the United States Atomic Energy Commission to investigate and demonstrate the feasibility of nuclear rocket propulsion. The Los Alamos Scientific Laboratory in Los Alamos, New Mexico, operated by the University of California, does the preliminary research on propulsion reactors and the development and testing of such reactors.

A correlated study of complete nuclear rocket propulsion systems now going on is administered jointly by the National Aeronautics and Space Administration and the AEC through the Space Nuclear Propulsion Office. In recent months engine contractors have been selected and their work will proceed toward the development of a working model of a flight system.

Test reactors designed and constructed at Los Alamos are tested at the Nevada Test Site. To date four models have been statically tested at varying degrees of power and propellant flow rates; about six other models are scheduled for test in the next calendar year. The Nevada Test Site provides a remote area large enough to give the necessary public isolation for this radical development work.

The simplest way to get a nuclear rocket propulsion system is by substituting a fission reactor for the combustion chamber of the chemical rocket engine. All the reactors thus far tested in Nevada and all those scheduled for testing in the Rover program are solid-fuel heat-exchanger reactors using uranium-235. The reactor-coolant and rocket-propellant gas used is hydrogen. We have reached the point where high pressure gas feed systems will not provide sufficient flow rates and so cryogenic systems are being employed.

1. High Pressure Systems.

The first storage system, for Test Cell A, consisted of banks of buried (below grade) high pressure bottles. The original capacity was 2,000,000 standard cubic feet of gas in 140 forged steel bottles. These bottles are two feet in diameter and of

random lengths, approximately 20 feet. Storage pressure is 3400 psi. Storage capacity has recently been increased to 3,300,000 standard cubic feet by the addition of four laminated steel bottles, each five feet in diameter, 96 feet long; these new bottles are above ground. They also are pressurized to 3400 psi. Underground installation proved unsatisfactory at the beginning as leaks developed after the system was pressurized with hydrogen although it had checked out at test overpressures with nitrogen.

In the new Test Cell, Test Cell C, storage capacity is about 5,000,000 standard cubic feet in 12 of the large bottles similar to those added to Test Cell A. Storage is mainly hydrogen although about 10 per cent of the capacity is in helium which is used for purging and 10 per cent in nitrogen which is used for blowdown, purging and inerting requirements which will be discussed later.

The design of the bottles follows generally the standards of the American Society of Mechanical Engineers, Section VIII, Unfired Pressure Vessels. The significant departure from the code was in using a lower factor of safety in yield strength. The usual factor of safety of four was reduced to 2½ for the following reasons:

1. Storage and operating temperatures are substantially below the upper limit of the ASME allowable upper range.
2. The location of the facility is isolated from the public and access is restricted.
3. Only non-corrosive materials will be stored.
4. An automatic deluge system protects the large above-ground bottles.
5. Shell openings are limited to a small drain and a small vent, neither of which is greater than an inch in diameter.

However, fabrication and inspection techniques will follow the usual ASME code requirements. Shop test procedures will follow ASME code standards with hydrostatic testing at 1½ times working pressure; field testing of assembled components is carried

not pneumatically at $1\frac{1}{2}$ times working pressure.

Two years after its installation the compressor station and the manifolds of the Test Cell A tank farm were pressure checked at $1\frac{1}{2}$ times the working pressure using ethyl alcohol as the hydrostatic medium. This testing technique, even with a combustible fluid, was quite satisfactory. The work was controlled remotely; the fire department was on standby at a safe distance.

Gas out-flow rates in the past have been several pounds a second; in the future these out-flow rates will be increased tenfold.

II. Liquefied Hydrogen Systems.

Test Cell A has a storage capacity of liquefied hydrogen totaling 55,000 gallons. This is contained in two 28,000 cylindrical dewars; these dewars are pressurized to 100 pounds. Daily loss of hydrogen is specified as 0.7 per cent of the net contents. The capacity of these dewars almost triples the gas storage capability of Test Cell A facilities.

Test Cell C has a storage capacity of 100,000 gallons of liquefied hydrogen in two 50,000-gallon spherical dewar tanks. These tanks are also pressurized to 100 psi; daily loss is specified at 0.3 per cent of net contents. Liquefied hydrogen storage is protected by deluge sprinkler systems which may be activated automatically or manually; the deluge system can be controlled remotely.

Hydrogen storage spacing is based on configuration and low pressure detonation risk only. Quantities of oxidants are not credibly expected to be in contact with liquefied hydrogen and so high explosive quantity-distance tables are not employed.^{1,2}

III. Safety Standards.

A. Operating Procedures.

Detailed experimental plans, including check lists, are prepared for all reactor runs. Independent of these runs, the filling and flow checks of the gas systems are also carried out with specific plans. Periodic pressure checks are governed by special procedures.

A general safety manual has been prepared for the Rover test work. This manual has been supplemented by the more detailed requirements and standards of specific groups.

B. Safety Administration.

A site safety committee headed by the test director meets monthly. Membership on this committee includes a representative from each technical group and the safety advisor. A safety engineer, responsible to the test director, is in residence during peak program activity.

Technical safety counseling is provided by the home laboratory in such specialized matters as criticality risk and cryogenics.

C. Electrical Safety Standards.

The National Electrical Code³ is the basic reference document in electrical design. In general, Division II conditions prevail so a vigorous application of the code with respect to Class I, Group B fixtures has not been necessary.

Light fixtures are of a sealed type, rather than explosion proof, with switches located in non-hazardous areas or outdoors. Other electrical equipment is specified with one or more of the following conditions:

1. Non-sparking or intrinsically safe.
2. Sealed against gaseous penetration.
3. Continuously purged (this is rather rare).
4. Located close to the floor.
5. Ordinary equipment might be present in a potentially hazardous area with its use precluded during hydrogen flow conditions.

D. Combustible Gas Alarms.

Continuous monitoring is carried out indoors with local alarms. There is also remote read-out during actual flow operations.

E. Inerting Techniques.

In Rover test work hydrogen is present indoors no more than 1 per cent of the time other than in small specialized facilities such as a flow testing laboratory. Nevertheless, during reactor testing operations the hydrogen flow volumes are indeed enormous, many pounds a second. Our test cell building design appears to compromise good combustible gas safety practice by being closed structures. But radiation shielding requirements are such that open-sided rooms cannot be used.

Some explosion venting has been provided in flow rooms but even a modest goal of two square feet vent area per 100 cubic feet of room volume cannot always be met.

Personnel are not normally present during these large flow conditions but protection of facilities is of concern. Design, construction, preparation and checking of facilities are so time-consuming and expensive that the schedule of Rover test work depends on just a couple of test buildings.

It is this overwhelming reliance on a few structures that prompted the capability of inerting some rather large volumes. Rooms with volumes in excess of 100,000 cubic feet will be inerted with nitrogen; a nitrogen capacity for a double purge will be available. Residual oxygen can be monitored with a remote read-out. The return to normal air can be accomplished in about 15 minutes with the ventilation system.

Provision is also made for personnel re-entry for minor adjustments. Self contained breathing equipment and portable oxygen monitors will be available for this purpose.

F. Ignition Control.

Hazardous areas are delineated by fencing and signs; in some cases these areas may be temporary. Permitted smoking areas have been assigned and designated.

Maintenance work and the use of spark producing devices is controlled by requiring specific permission of the responsible group.

No requirements exist for the use of non-ferrous tools.^{1,4,5}

II'. Radiation and Criticality Control.

As the reactor is operated remotely, radiation exposures may be minimized by delayed reentry. A radio-controlled railroad engine moves the test car away from the test cell and into a well shielded disassembly building two miles away. Here disassembly and post-mortem examination is carried out by remote manipulations. On-site radiological safety problems have been readily managed without significant exposures; there have been no off-site problems although backgrounds are surveyed.

Criticality safety problems are localized in the assembly of the reactor and the reactor in the test cart itself. Outside the reactor it would take an unfavorable three dimensional array, fully flooded to cause a critical excursion. In the assembly steps the presence of cadmium absorbing foils in the reactor inhibit the criticality risk. Upon the removal of the foils at the test cell stringent

access and activity controls are instituted. Locked control rod positions and control rod manipulation limitations further enhance the critical safety measures. Continuous neutron monitors with audible signals accompany the test cart when the reactor is present.

1'. Accident Experience.

Only one serious incident has marred our accident experience for two and a half years of Rover field testing. This was the failure of a compression fitting joining a copper tube to a quick disconnect.

A check-out team was in the process of connecting a reserve supply of helium to an inlet manifold at the compressor station to supplement a bank in the tank farm.

The reserve supply consisted of 6 tube trailers containing helium at 3400 psi. The trailers were connected to the closed manifold valve by flexible copper tubing having quick disconnect fittings with the tube ends held to the quick disconnects by compression fittings. The copper tubing was 19 feet long.

The procedure being followed was for the operators to open the tube trailer valves in sequence. A team had opened the valves of trailer #2 and were proceeding to trailer #4. Another person opened valve J2 on trailer #3 when a leak was noticed at the transfer tube connection on this trailer so the valve was shut off. Valve J2 was then opened on trailer #3 and the leak stopped. Just at this time a loud report was heard as the copper tubing had torn loose from its fitting at the quick disconnect and the flailing line struck two men. One received serious head injuries requiring extensive plastic repair and the loss of vision in one eye.

In reviewing the accident, it was obvious that the tube pulled out of the connector while under pressure. The tubing, 0.840" OD, 0.543-0.550 ID, with wall thickness averaging 0.145, was adequate to carry the load. The tubing was held in place with a compression fitting which consists of an assembly body, ferrule, and retaining nut. The assembly body received the tubing in a square shouldered well. At the upper $\frac{1}{4}$ " of the body is a taper. The nut is slipped over the tubing, then the ferrule. As the nut is tightened it forces the ferrule to conform to the taper of the body resulting in the ferrule actually biting into the tubing, thereby making a strong, leak-proof assembly.

bly. Through use and handling, small gas leaks had developed in these connections. It had been standard practice for an operator to tighten the retaining nut approximately $\frac{1}{2}$ turn or whatever was necessary to make a leak-proof fitting. Normally the ferrule "hites" in at about $\frac{1}{2}$ inch from the end of the tube. The end of the tube involved showed that the retaining nut had been tightened as far as it could be and that the ferrule was within $\frac{1}{16}$ " of the end of the tube. Insufficient metal was held by the ferrule to withstand 3400 psi pressure.

In discussing the incident with maintenance people it was brought to light that the plumbers always bulged the ends of the tubes to make them tighter in the fitting. Further investigation demonstrated that the tubing used was too small (in OD) for the compression fitting. Since the tubing was too small for the fitting, this meant that the tubing was not in full contact with the ferrule and retaining nut. This condition makes it highly probable that a tube could be worked loose by continual flexing, such as bending to mate the opposing fitting, whether or not it contained pressure. The only gas involved was that which was compressed in the 19 foot length transfer tube.

The quick lash of the tube can be likened to a bourdon tube—curved tubes under pressure tend to straighten out. If the tube does not rupture and vent, it will whip or uncoil with a straightening tendency when vented at either free end in order to relieve the strain of the metal when the pressure is suddenly released.

The investigation showed the following:

1. The "tubing" supplied was high pressure pipe, $\frac{1}{2}$ nominal (0.840" OD); however, the fittings were designed for tubing, size $\frac{3}{8}$ " (0.875 OD).
2. Originally the make-up of the fittings for the plumbers was supervised by scientific staff employees. The practice was discontinued after hundreds had been prepared and the work was then considered routine.
3. The 0.035 difference in pipe and tube size explains why the plumbers bulged the end of the connectors in order for them to approximate a fit.
4. The assemblies had been used a year.

These compression-type fittings had been used at the site since August, 1958. These

fittings were selected after various other connections, that were recommended by leading high pressure users, failed for one or more causes. Normal tube trailer pressures seldom exceed 240 psi, whereas our specially made trailers handle pressures to 3500 psi. The original coupling was a flex tube, having an accordion-type inner section, woven stainless steel mesh as an outer covering, and having screw fittings welded to the hose. These connections seldom lasted for more than two tube trailer transfers. Gas from the trailer in its initial flow through metal connectors heats the tubing to about 200°F; then as the gas expands the temperature will drop to about 0°F. These temperature fluctuations took place in about 15 seconds. The thermal shock resulted in leaks at the weld. In connecting this type tubing, quite often the tubing was ruptured at the juncture of the weld and hose when the tubing became twisted during a hook-up.

The second flexible connection consisted of stainless steel tubing in four sections connected by fittings. All fittings were loosened, the end sections were connected to the manifolds and then the center fittings were tightened making the assembly rigid. This system failed because of leaks and because of failure of the stainless steel threads.

It is quite apparent that: 1) the fittings should never be tightened, to prevent leaks, without disassembling the fitting and observing where the ferrule is grasping the tubing; 2) it is not good practice to distort high pressure pipe in order to approximate a fit that proper size tubing would make.

In order to prevent a recurrence of an accident previously described, the following changes were made at tube trailer inlet manifold locations.

1. A barricade was erected between the rear of the trailers and the inlet manifold. This barricade was about four feet high and extended the distance necessary to serve the number of trailers to be connected.
2. On the inlet manifold side of the wall was installed a work platform of steel grating about three feet wide and two feet high, extending the length of the wall.
3. Rigid high pressure piping was buried under the work platform extending from the inlet manifold and piercing the barricade to serve the trailers.
4. Short lengths of metallic flex hose (30

inches) connect from the rigid piping to the trailers.

5. Trailer manifold outlets were modified so that an additional connection to the rigid piping is made under the trailer.

For those uses of tube trailers or compressed gas banks at reduced pressures the above modifications were not applied. In some cases, of limited use, where barncoades were not practical, the ends of the flexible hose were chained and long lengths were anchored with sand bags.

VII. Future Test Problems.

To begin an early examination of safety problems in future testing the Los Alamos Scientific Laboratory has recently established a Rover Flight Safety Office; this independent office will be responsible to the laboratory director. Rover Flight Safety will examine the type and extent of all factors concerning the public safety which can arise from the testing or operational use of nuclear rockets.

The ultimate usefulness of nuclear energy for space flight will depend not only on satisfactory performance but of equal importance will be the demonstration that all public safety requirements are met. It is realized that unsolved safety problems can seriously affect the ultimate use of nuclear rockets.

The potential gains from the use of nuclear energy in space must be evaluated in comparison to the risks. While it is the responsibility of government authorities to evaluate and regulate hazards to the public, it must be the responsibility of the technical staff of research organizations to supply the necessary technical data for the proper evaluation of the safety problems in the nuclear rocket program. Now that progress has been demonstrated in the technical feasibility of nuclear rockets, effort must be directed to see that there are no unsolved safety problems for the flight testing inevitably to follow.

While some theoretical and experimental work dealing with Rover flight safety has been done prior to the establishment of the Rover Flight Safety Office, the work was done more on an individual interest basis rather than as part of the over-all necessary responsibility.

The principal flight safety criteria to be

met will require public safety during all launch and flight operations. This will require a reliable safe nuclear rocket disposal plan to be available for all abnormal and reentry conditions. One specific requirement will be the condition that no large fragments reenter or impact on any of the earth's land masses; perhaps this condition can be met for early testing, from coastal launch pads, by the use of a ballistic trajectory where the impact point is known. Nevertheless, such a test requires public safety near the launch area which means that any abort of a booster system or a reactor incident should not produce any safety problems serious enough to be other than those restricted to approximately the launch pad area.

The principal launch pad hazards appear to be first, the release of hazardous particles due to a launch pad fire which might consume the reactor or any part of it, and secondly, the possible oscillating critical excursion from the reactor after immersion in water.

The first look at Rover flight safety problems will involve the determination of some of the basic properties of the reactor core materials under normal conditions. Examples of some of the questions which have already arisen (and are only partially answered so far) are the following:

1. How will a fuel element behave when subject to very high temperature? Of interest here is a gradual temperature rise such as produced by a fast reactor.
2. Are the reactor core materials disposable by post-operational additives? This might employ the use of chemical fuels to burn up the remaining material or the addition of reactive chemicals that might effectively disintegrate the core materials.
3. What will the effect be of water immersion on fuel elements? How will fuel loading and temperature variation affect any water reaction? Will the reactor suffer an oscillating criticality excursion in water and thus produce a much higher fission product inventory than from a single power excursion? Will fission products leach out in ocean-water?
4. What is the nature of the radioactive source produced by the normal and abnormal operation of a nuclear rocket reactor? What is the rate of release of the different fission

products as a function of time, their particle size distribution and fallout pattern—with particular emphasis on those isotopes of higher toxicity such as iodine and strontium?

5. Can the reactor be broken into small enough pieces by chemical or nuclear explosives to assure burn-up on reentry? How small must the pieces be to avoid a criticality incident on a launch pad in case of an abort?

6. Are there any design changes which can enhance launch pad and operational safety?

Thus far a look at future testing safety problems has resulted in generating more questions than answers. Experiments will be done at the Nevada Test Site if needed in order to obtain the information required for sophisticated evaluation of test risks.

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FERTILIZER SECTION

COMMUNICATION AFFECTS SAFETY PERFORMANCE

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Communication consists of more than just talking or writing. Others are constantly interpreting our actions (or lack of actions) into thoughts that suit their purposes. It might be well for safety and supervisory personnel to remember that someone has said, "What you do speak so loudly, I can't hear what you say."

For the purpose of this paper, I would like to define "communication" my own way: "Getting proper information to the right individual at the correct time in such manner that there will be common understanding and/or desired action."

Communication which affects one's attitude toward safe job performance begins during the interview for employment and continues as long as the person remains on the job.

A thorough check into the applicant's injury or accident experience could indicate the need for further safety training. The minimum would be an orientation session on the company policies related to safe job performance. On the other hand, failure to emphasize the importance of safe work practices could be confusing to the new employee in his effort to acclimate himself to the assigned job. This could lead up to an accident since the new employee must make many judgments regarding production vs. safety.

Before considering additional factors that can influence the safe behavior of people, it may be well to take a closer look at some of the weaknesses of oral and written communications or instructions—the communications tools that too often fail to accomplish the results we expect. Too often we erroneously take communication for granted.

At this point, I like to use some sort of demonstration to prove the fallacy of some ideas about "communication" we frequently over-

look. In this situation we will relate some things we have proved with the "Communicometer," a device we developed specifically for demonstrating problems inherent in communicating our ideas to others.

In this demonstration we will ask that one person instruct (communicate with) another on how to set five rotating dials according to a pre-determined pattern. These dials must be described and the desired positions identified. If he does this effectively the green light will turn on, but if done ineffectively the red light will flash and a bell will ring.

To make this part of the program more interesting we will assume that one person is communicating with another to turn valves thereby shutting down a boiler that is about to explode.

(At this point in the program the "Communicometer" experiment was attempted but failed miserably.)

It is not surprising that this communication experiment failed, but it is amazing there were so many communication problems which were obvious. Many of these problems we do not recognize in the work-a-day situation, but they are there just the same. Also keep in mind that any misinterpretation of instruction can cause a hazardous situation.

Here are some of the facts that can be clearly demonstrated with the Communicometer:

1. Few people read instructions and safety manuals as carefully as they should. This means that they have "two strikes" on them before instruction begins.

2. Words or statements have different meanings for different people. No two people have the same culture, background, or experience. For example, the same geometric

is not and should not be considered primarily an occupational disease. There are causes other than injury that bring about back disability.

It is a well-known fact that severe, even disabling back pain, can occur in the course of a simple motion.¹ Cases are frequently seen in which disabling pain occurs while the employee is engaged in motions to which he is accustomed, which are within normal range, and which lack excessive or unusual action. Such a disability obviously does not result from a strain or sprain. The simple act of motion should not be held responsible for the pain. There is usually some other less obvious factor (or factors) which is the real cause of the disability, and which has to be searched for. The simple motion during which the pain arose should be thought of as coincidental rather than as a precipitating factor. The search for the causative factors should be made by both the physician and management. This search begins with a thorough, detailed history, followed by a complete physical examination, including x-rays of the spine taken from more than one view.

A detailed history should be taken of the events which occurred in the precipitating injury. What type of force was involved and how was it applied? Was it a fall, twist, lift, pull, or push? The size and the weight of the object being lifted should be noted. When the pain occurred is important. Did it begin as the person was getting into position, or only after he had exerted some force? What was his position? Was it his normal working position? Was it awkward or in a cramped space? Did he slip?

It is important to know whether the pain and disability occurred immediately or whether there was a latent pain-free period following the injury. If leg pain is present, it should be determined whether it was immediate or delayed. Its exact location should also be determined.

An important source of information as to the severity of the injury and the patient's reaction to pain is what he did immediately following the injury. Did he finish his shift or quit immediately? How long was it before he reported it to his foreman or requested treatment?

If the patient is first seen sometime after the alleged injury, it is important to know

what progress has been made in the interim. Disability from most back injuries either improves or gets worse, and one which remains unchanged for a long period of time is cause for suspicion.

In history-taking it is well to keep in mind that back pain is a common complaint among neurotics. Pain as a subjective complaint is difficult, if not impossible, to disprove, and so back pain is frequently found in malingerers.

The type of work involved has a definite relationship to the incidence of back pain. Prolonged heavy work predisposes to back disability even in those physically fit. Degenerative changes in the spine occur more frequently and earlier in the laborer doing heavy work. New employees unaccustomed to heavy work are prone to develop back pain. Everyone doing heavy work sooner or later reaches the age when he is no longer able to do it. Such a situation may result in a prolonged disability not otherwise explained.

Since many diseases may simulate the picture of low back injury, a systematic review should be made to rule out causative factors other than simple trauma.

The typical acute low back injury occurs most often as a lifting strain. However twisting motions are also frequently responsible for back disability. The pain is usually in the lower lumbar region and is aggravated by any motion of the lower spine and relieved by rest. The physical findings are usually few and include muscle spasm, limitation of motion, tenderness and sometimes a list. X-ray and neurological examinations are negative as a rule. Under conservative treatment, recovery is usually complete (in three to four weeks).²

Clinical Screening of Applicants and Transferees—It becomes obvious then that normal function of the spine is essential for any job assignment which involves heavy labor.

We know very little about the intricate mechanics that cause sudden stress or strain on the structures of the back during the performance of routine work. We cannot determine to what limits each individual can use muscles, ligaments, and joints of his body. All the knowledge concerning the effect of heavy work upon the spine that is shared by medical and non-medical men is

based on experience. Decisions, therefore, greatly depend upon empiricism, common sense and some degree of intuition rather than upon scientific data. Working conditions and working standards for jobs requiring great stress and strain have been established on the basis of time studies, without giving due consideration to the physical capabilities of the individual.

In his studies on the mechanics of the spinal column and the effect of the movements of the spine upon the intervertebral disks with and without carrying weight, Hans-Henning Mattiass³ found that in a 30-year-old man 6 feet tall and weighing 200 pounds the pressure exerted upon the intervertebral disk of the lumbosacral joint in an upright position, not carrying any extra weight at all, is approximately 134 pounds. The pressure is caused by the weight of the trunk, the head, the upper extremities and the tension of the muscles of the back and abdomen. When the same person bends forward 10 degrees without carrying any weight the pressure at the lumbosacral joint increases about 123 per cent the tension of the back muscles being 21 times greater than in the upright position. There is an increase in pressure to 928 pounds during forward bending to an angle of 90 degrees without carrying weight. When lifting 65 pounds, this pressure increases to 1600 pounds.

Therefore it is very important to teach employees proper lifting methods, and at this time I would like to present a few rules for safe lifting.

1. Never try to lift beyond your strength.
2. Get a firm footing.
3. Always crouch down to what you are going to lift.
4. Keep your arms straight and keep your back in as near a straight up-and-down position as possible.
5. Get a firm grip.
6. Lift gradually.
7. Avoid twisting motions.
8. Lift by standing up or by pushing up with the strong leg muscles.
9. Put things down generally reversing the above methods.
10. Learn the trick or knack.

The above illustrates that it is of utmost importance to adopt the most economical

motion for job performance as well as to select, prior to their assignment to a heavy job, employees whose physical conditions signify optimum function of the spine.⁴

What then must industry do to prevent or reduce the frequency and severity of these injuries?

First—The company should hire only those applicants whose medical history and examination indicate that they are competent for heavy labor.

The examination given an employee whose work necessitates heavy lifting begins with his previous history of illnesses, operations, and injuries, especially back ailments. Letters should be posted to former employers for the individual's previous record in safety, absenteeism and back difficulties. A general inspection reveals his body type—normal, slender or stocky. Individuals of different body types show different susceptibility to various injuries. Persons who are very tall or very heavy are poor candidates for heavy work. Anatomical defects and deformities like asymmetry of face, wry neck, deformity of chest, asymmetry of extremities, and poor condition of arches are of great importance. Individuals with definite physical defects or general muscular weakness should not be placed on a job which requires expending great quantities of physical energy.

Age and previous occupation are important factors in this evaluation of the employee's ability to perform his particular assignment. A history of frequent backaches of longer duration excludes an employee from heavy work. Circulatory and genito-urinary disorders which call for restricted work render him unfit for more strenuous work. Subnormal muscular or skeletal development, limited back motion, advanced varicosities are other reasons to declare him physically unfit to do heavy lifting. Individuals with high myopia, persons who are wearing thick concave lenses are not qualified for strenuous labor.⁵

Serious consideration should be given to the inclusion of back x-rays in this program. Certain changes in the anatomical structure of the spine are incompatible with heavy labor. Therefore, x-ray findings are of great importance and may often be the deciding factor in determining the employee's physical ability to perform a given job.

The purpose of this physical examination program is not to deny employment to those with physical impairment. The purpose of this examination is to fit the worker to the job.

The examination is followed by a critical evaluation of all the findings. Such an evaluation must be individualized. Each case may represent a separate problem which has to be studied and judged on its own merits.

Second—A safety program must be developed that stresses the proper methods of material handling.

This requires constant training and education at the foreman level. These men should be trained to recognize faulty work habits especially as regards lifting and to see that corrective action is taken. To succeed, the foreman must be made to recognize the economic implications of back injury to the employee and employer alike, and to take immediate steps to correct faulty work habits. To be successful this training program must be on a continuing basis.

Third—Consideration should be given to new employees and a break in work period be permitted. Also it might be well to consider a warm-up period for all employees prior to heavy physical exertion.

Fourth—The company must develop a treatment program that is decisive and does not give the employee the feeling that he is a "goldbrick" and motivated only by avarice. In the past the company and the doctor both developed an attitude of resistance and distrust since they felt the only cure for these problems was the "greenback poultice." The employee reaction to this attitude was naturally one of resentment and vengeance and interfered with his normal rate of recovery.

The psychological response of the employee to injury must also be considered by the doctor and employer.¹⁴ This response is conditioned by many factors. For example, fear and anxiety for the future, financial problems associated with decrease in income, etc. Therefore, we must assume that the patient's history and findings are credible and proceed with therapy with the idea that the employee wants to get well and is not seeking a settlement.¹⁵

Many patients with back pain, both acute and chronic, will improve and recover even

though they continue working. However, this does not apply to all cases. As long as muscle spasm and limitation of motion of the spine are present, work involving lifting, climbing, pulling, etc., should not be considered. If special work can be provided, which does not require the use of the sore back muscles, the exercise incident to the lighter work will serve to preserve muscle tone and hasten rehabilitation. Such a regimen will have good psychological effect upon the patient and will prevent a prolonged convalescence so common in back cases. The physician must ascertain that the work available is well within the limits of the patient's physical abilities. It is the doctor's responsibility to see that the patient is returned to his usual work as soon as possible, and that the other therapeutic measures are discontinued as the patient improves. (There is no sense in continuing diathermy treatments on a worker who is able to do his regular work.)¹⁶

In summary, I have presented for your consideration a program that is designed to reduce the frequency and severity of back strain and hernia. I want to emphasize that the medical examination alone will not solve the problem. To be effective, the program must be multiphasic and include:

1. A competent pre-placement medical examination.
2. An active campaign of instruction in the techniques of proper lifting.
3. Immediate on the job correction by trained supervisors of poor work habits.
4. Improvement of working methods.
5. Utilization of mechanical equipment where feasible.

When adopted, these factors give us control of the materials used, the machines, the working methods and the man.

The control of accidents falls within the province of industrial medicine because of the role played by the man. An attempt must be made to control the above items on the basis of advanced analysis and continuing inspection. This requires the combined efforts of the personnel department, the safety engineer, the industrial hygienist, the plant nurse, and the industrial physician. Significant results can be obtained only by the integration of these specialists into an effective accident prevention team.

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WHY YOU SHOULD HAVE AN OFF-THE-JOB SAFETY PROGRAM

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In your business is it hard to make a profit? Is the sales-earnings squeeze affecting you? Then you would like to contribute to higher earnings in your company for competition is getting tougher. Don't misunderstand me. I have no secret formula.

I immediately come to the point that you should have an effective off-the-job safety program in your company if you want to help lower costs. I should also say that what I have to suggest is with the presumption that your company is already sold on the value of on-the-job safety and is doing something about it. I will discuss primarily the need for taking action rather than what action to take. There is a big problem nationally to motivate industry to accept the challenge of preventive action to reduce the accident toll daily occurring throughout the country on the highway, at play and at home.

Unless you know, and I presume you don't, off-the-job injuries are costing your company in many different ways. Here are several of the costs which accrue when an employee is hurt off-the-job:

1. Relief personnel is necessary.
2. Training of substitute employees is necessary.

3. Equipment is damaged and product spoiled by replacement personnel.

4. Additional work loads are placed on supervision.

5. Injured employees on return to work are not fully effective for some time.

6. Accident and health insurance payments are increased.

7. Disability wage costs rise.

8. Group life insurance payments may be increased.

9. Medical and hospital insurance payments are increased.

Indirectly, there may be other costs. Community services and facilities are generally taxed to capacity. Hospitals, rehabilitation centers, orphanages, welfare and numerous other agencies are called upon to render aid. Since they are supported by tax dollars or community funds, business becomes involved again.

The du Pont Company is completely sold that promotion of off-the-job safety is good business. Here is the way one of our vice-presidents expressed it to employees:

There are many things which require serious consideration if a business is to be successfully operated. Cost and quality are the matters we most frequently hear about as

every process or action which may in some way be contributory to the end point desired—in the case of our discussion here today—in the accomplishment of an effective, workable accident prevention program.

To the degree that any individual or any group fails to maintain this awareness and interest in his portion or phase of the operation, the accomplishment of that desired end point will fail in direct proportion.

No individual involved in a business operation, be he a top management man, middle management man, supervisor or worker can afford to allow any thought or action to take place which will in any manner result in failure to execute a safe, effective accident prevention program. The stakes are indeed high! Too often we find it necessary to "go for broke" when we fail in our accident prevention program.

At this point, I hope to have established the fact that accident prevention ranks in importance with any and all other phases of a business operation and that it most certainly is one of the areas of responsibility and accountability of management—top management as well as middle management.

If it is agreed at this point that top management has a responsibility, it would appear that agreement could also be reached in the concept that the initiative for recognition of the need for and the establishing of an accident prevention program, with or without the services of a safety department, rests with top management.

This is not to say that the possibility for suggestion or initiative on the part of the line worker or supervisor or plant manager should be prohibited. In fact, it should be encouraged—the line worker is the one who knows best the hazards that exist and steps needed to remove them.

What we mean to say is, in essence, that for a program to be effective, it must be established firmly by management policy and continuously promoted, aided and nurtured by management. Responsibility and authority must be established by those with the power to do so, and assigned to the individual or individuals who are to plan, develop and execute an effective accident prevention program.

It is essential that management provide ample evidence, to those involved in every

phase of the operation, of its policies, its awareness and vital interest in an effective program and its expectation of the whole-hearted cooperation of every group or every individual in the business operation. This evidence must be of a continuous nature—an announcement at the beginning of a program and then silence from management is not enough. Instead, management must take steps necessary frequently to evidence interest in the program, its effectiveness, its shortcomings and the need for everyone, every day, to think positively about the program.

Perhaps at this point we might well consider clarification of the term management. Just who do we mean by management?

My remarks so far have tended to include all people in an organization who have been assigned supervisory positions and who have any voice whatsoever in the planning, development and execution of programs of this nature.

Therefore, while we most definitely feel that top management—from the chairman of the board on down through the ranks—must be keenly aware of the needs of accident prevention, and vitally interested continuously in its effective execution, we must also conclude that you—regardless of whether you are vice president in charge of safety, director of the safety department, a supervisor of a production department with assigned safety responsibilities—you are also included in this terminology of management.

You have been selected by your organization as the one person to eat, sleep, and live accident prevention programs. You are the safety specialist. You may also serve in other areas of responsibility, but, in essence, you are included in the area of responsible management. You must accept your role. You must feel, and give evidence of your feeling that accident prevention is of prime importance and see to it that it is given day-to-day attention.

You must accept the responsibility to spot hazards and remove them when and where possible and practical and also to plan, develop and execute effective programs to create an awareness and a consciousness, on the part of all people involved, of the hazards involved, of the hazards which cannot be removed, and the

best methods of living and working safely while these hazards exist.

You must be able to convince individuals who have been on the job for years and years and who refuse to accept suggestions or safety precautions. You will find it necessary to convince the ones who feel that programs are not for them—that they are accident immune. Ironically, it seems to be characteristic of humans to feel that safety measures, accident prevention programs are designed especially for "the other guy—not for me." To achieve cooperation from individuals such as this requires the utmost in selling skill.

In my estimation this means that management, you, if you please, must be a professional salesman as well as a professional safety man. This also means the ultimate in clear, concise communications to all concerned as to how the program is to work. One technique frequently used by management in this regard is to involve some of these so-called "difficult individuals" in the areas of planning and execution of the program.

Let them feel they are a part of the program. Incorporate their ideas when possible.

In addition to selling the program "down" to the line employee, you will also find it necessary to continuously sell "top management" on the value and accomplishment of your program and secure their vocal blessing of it. The attitude of the chairman of the board or president and vice president seem to be "telegraphed" immediately to all levels of employees throughout the business family.

Selling men in these positions is sometimes difficult—for they spend great portions of their time in areas of product lines, capital requirements, new facilities, plant expansions and similar fields, which all too frequently are considered more important than safety.

Yet, these men must be constantly kept aware of and interested in our accident prevention program. They must be kept informed of the effectiveness of the program—the savings in insurance premiums due to lower accident ratios, the stepped-up production of products due to fewer accidents, the improved quality of products and the many other benefits.

In our company, for example, we operated for a time under the concept that safety was "not for us"—we didn't need it. The situation developed that due to excessive accident and injury losses, we were unable to secure insurance at the standard rates.

This shocked us into action. Our first move was to appoint one of our men as a part-time safety supervisor—in addition to his other previously assigned responsibilities. Our experience was one of almost immediate improvement in our accident and loss record. As a result, the decision was made to establish a safety department and assign full-time responsibilities to a safety director.

This past year our record was one of which we can be proud. Our premium costs were 13 per cent below the national average. Our objective is to be at 50 per cent below the national average by the end of the next fiscal year.

Now, what is your role in accident prevention? What are you doing? What plans do you have? You know by now that you are included in this term, management.

We all want to succeed. We all desire recognition, prestige, and that satisfied feeling that accompanies success.

If we are to succeed, we need to give constant attention to several important areas. Number one—ourselves.

We must give serious, constant attention to ourselves. We need to be certain that we have definite, clear-cut goals established—well-defined, attainable goals. Too many of us want to succeed, but we are unwilling to take the steps necessary, one at a time, to achieve success. Too many of us look at a successful friend or co-worker and immediately rationalize wherein he has succeeded—an easier job, more God-given ability, or some other unrealistic reason as to why he has succeeded.

If we are to succeed, we must recognize that all of us, successful and unsuccessful alike, have the same ability and the same equipment, but the successful people make more and better use of the ability and equipment which they possess.

Too many of us strive to develop a successful personality so that we may be a success. In this situation, it appears to me, we have the cart before the horse.

The first goal, the first objective, should be to succeed and, as a result of succeeding, a successful personality will have been developed.

Through the achievement of success one gains poise and confidence. Confidence comes from competence, and competence comes from knowledge gained through study and applied practices. We need to recognize in our struggle for success that the spectacular comes from many unspectacular attempts. We need to be willing to carry the papers before making the headlines.

As we move forward in trying to convince top management, as well as each and every individual in our business, it is most important that we are always positive and optimistic in our attitudes. In our dealings with our fellow man, we must strive to keep in mind that all of us have the same problems. The only difference between us is the attitude towards the problem that we face. This little poem seems to express the spirit which I have been trying to develop here:

One ship sails west, another east,
By the self-same breeze that blows,
It isn't the gale, 'tis the set of the sail,
That determines the way it goes.

Area number two: We must also give constant attention to our job.

Your job is the vehicle for "going places" in this country. The amazing thing is that most people do not seem to recognize and understand that fact. Everyone, everywhere gives the indication that he would like to "go places," that he would like to succeed, that he would like all the comforts, privileges and prestige which accompanies "going places."

A sad commentary, evident in too many places across this great land of ours, is that in spite of our desire to "go places," the majority of people today discharge their responsibilities in such a manner as to give the impression that this is the "land of the great goof-off." We seem to have lost the desire to do the best we know how and the best we can on the job we have to do. This is a serious—most serious—situation which far surpasses the area of safety, but which also encompasses those of us in the safety area of activity.

Today, our civilization is being challenged. Whether or not it will stand the test will be determined in large measure by whether or not we, the people of this civilization, care enough to do those things required of us to continue to enjoy the benefits we now have. Toynbee, the noted contemporary historian, in analyzing the rise and fall of the many civilizations of the past, tells us that 19 of the last 21 civilizations crumbled because the people just didn't care.

We need ambition. We need a desire to be different. We need the courage to rise above the level of the common man to that of an uncommon man. We need to be willing to sacrifice to learn to improve on our jobs. We need to study and become as knowledgeable in our profession as possible. This requires constant study and open-mindedness to new information, new techniques and procedures.

Yes, you will succeed because you know. It has been stated many times, that knowledge is power. It is indeed a sad sight to see men attempt to live in a profession "camel-like—on the hump of their accumulated knowledge." We must understand that it is impossible to be an effective leader in any field when we are willing to "rest on our laurels." We should be willing continuously to study and learn. For from the accumulation of new knowledge comes a new birth of enthusiasm, a new condition of alertness of mind, a new inspiration to the approach and solution of problems at hand. Yes, to discharge our jobs effectively, we must desire to succeed.

Area number three: We must give constant attention to "the wisdom of the ages."

As safety people, the only product we have to sell is an intangible—one which, if effectively sold, will allow ourselves and our workers to say more frequently, "There, but for the grace of God, go I." It is satisfying to feel that because of our programs, lives are spared, injuries, some which could maim for life, are prevented.

It has been said many times that history repeats itself because man refuses to listen the first time around. It is imperative in safety work, as in any other line of professional activity, that we learn from the experiences of others, not from trial and error.

As we work with people, we must constantly keep in mind that strong fiber which is evident in each and every individual concerning moral responsibilities. We must understand that immorality and success are incompatible. We must obey the Ten Commandments in our dealings with mankind wherever and whenever we meet.

To summarize what I've been trying to say, we could list specifically the following as management's role—your role—in accident prevention:

1. To initiate—motivate—act as catalyst.
2. Plan, develop program.
3. Explain how program is to work.
4. Assist in guiding execution.
5. Follow up.
6. Provide needs for continuity of program.

As we go home from this conference, we are faced with two very definite, very clear alternatives. First, we can go home with the thought that this was a good conference, get up and go back to work following the same old groove—the same old pattern of carrying out our responsibilities. Or, we can follow the other alternative available to us and pick out one idea of the many ideas which were put out at the conference. We can commit ourselves to re-dedication to our jobs, to strive continuously for an open mind, a positive outlook, continuous study and an aggressive approach. We must try to convince top management people of the importance of safety and the vital importance of their support to the success of accident prevention programs throughout the organization.

Remember—you are a part of management.

ELIMINATING THE RISK OF OVERHANGS IN FERTILIZER PILES

By T. A. BAYLEY

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In modern fertilizer manufacturing, the changes in methods of operations which have taken place, have created new and complex safety problems. The problems of armored meters for liquid measurement, pipe lines for corrosive materials, and high temperature reactions, have replaced the problem of the Georgia buggies and the three-wheeled dump trucks. However, all the old problems have not been replaced, and many are with us every day.

Foremost among the carry-overs is the problem of eliminating the risk of overhangs in fertilizer piles. This problem has not been ignored. To the contrary, so many fine analyses have been made, that it raised a question of whether or not there were really any new methods in use. It also raised the question of how diligent have been our efforts in applying the knowledge we already have.

When we speak of the risk of overhangs, we refer to the danger of material falling

or sliding from the height of a bulk storage pile. Everyone is well aware, by experience and by demonstration, of the devastating damages and fatal injuries caused by the falling of overhangs.

A recent fatality, involving a plant superintendent, should serve notice that pile overhangs have no respect for the position held by an individual. Can you picture yourself buried under the massive weight of tons of fertilizer in a desperate, painful struggle for air if not already crushed into unconsciousness? Or envision the tragic vigil and cautious haste of a team, seeking to recover a friend and fellow employee from the tumbled slope of a fallen pile? Certainly these are scenes which we all prefer to avoid.

The goal then is the elimination of risks by overhangs. An understanding of the causes of overhangs is vital in order to affect their removal. The common causes of overhangs can be listed as follows:—

1. Ineffective blasting of piles leaving overhangs at top.
2. Cracks or fractures in piles as loose materials gradually break loose.
3. Large lumps on face of pile often occurring after blasting.
4. Undercutting face of piles by mechanical devices.
5. Building posts holding material from falling.
6. High front bulkheads in entrance to bin, causing material to bridge at a point higher than digging device can reach.

There are variations of the foregoing list which can be made, but the basic causes cited are those which will be subsequently treated.

Although the ultimate goal is elimination of the overhangs by study of the causes, knowledge should be gained in the corrective action necessary, should the presence of an overhang be detected. It is the same old story of struggling for the best—while prepared to handle the worst.

Overhangs caused by ineffective blasting are most often best corrected by blasting the peak of the pile from the top. This avoids working under the overhang which should never be done. The top shot made by the dynamiter working at a safe distance from the brink of the pile is fast and only requires a small quantity of dynamite.

Cracks or fractures in a pile happen frequently after blasting, and are difficult to remove. Latent action of the explosion keeps the pile working for some time. Blasting is still the best way to remove the risk of severe cracks. However, the difficulty of forming a loading hole is greater in the soft material from the previous shot. Inspection of the pile for the best location as to size and drillability should be carefully made. The use of a bar to lever the fertilizer out of its hazardous position should be carefully surveyed.

Many times the brink of a pile is an extremely unsafe area for manually barring down material. Cracks, which appear easily movable with a bar when viewed from the ground, are often very difficult to move. Many a stout bar has been bent in an effort to dislodge material. Another blast in the best possible location is the choice method. Large lumps on the face of a pile present

the risk of potential missiles rolling down on equipment, operators or passersby. Eliminating these large lumps is a matter of reducing them to safe size. A small dynamite charge can shatter a lump effectively. Manual pounding with a maul can break up more modest size lumps.

At times a bar can be used to lever a lump down to ground level where the digging device can cut it down to carrying size. Lumps have been known to roll down the pile and up the bucket and arms of a front end loader, pinning the operator in his seat. Prompt removal of lumps from pile slope will avoid such tragedy.

Overhangs created by undercutting the pile face can be handled in a manner similar to overhangs created by other methods. With pulverized fertilizer in a narrow bin, the use of a top shot with dynamite represents the safe method of restoring a safe pile slope. The warning should be repeated that the loading hole can be drilled from a safe distance from the brink of the pile.

Fall of the overhang could be started by walking on the brink of the pile and result in a quick trip to the ground and the hospital for the dynamiter. In cases where the pile face is in a wide bin, it may be possible to shoot down the overhang by angling a load hole from the side. This would probably call for more explosive and might result in a deeper cavitation of pile face.

Overhangs in granular fertilizer have the same risk but the corrective action can possibly be varied. In areas where clearances will allow, a specially constructed boom may be placed in the bucket of a front-end loader. Then the point of the boom can be thrust upward at an angle to the rear of the pile. The piercing action will loosen the top sufficiently to remove an overhang and start movement of top material. The set in granular materials allows the boom to poke through quite readily.

These booms of 16-foot lengths constructed of 8-inch channel and suitably braced have proven quick and efficient. It is a tool available to the operators and doesn't require a special classification for its use. It is important that the boom be anchored four ways to prevent it from toppling out of control and falling upon the operator or people standing in the vicinity.

Granular material can be blasted from the top if done carefully and with patience. Since it is difficult to form loading holes due to inflow of granules when the drill is withdrawn, it is a slower job. If water is poured down the drill bit and allowed to wet enough material to provide a bonding action, a loading hole can be formed. A small charge will do the task in a well placed location.

Material that hangs up behind posts or in knee braces must be handled to avoid damage to the building. A long bar used from overhead walkways works best on knee braces and sometimes will successfully dislodge material held by posts.

In conditions where ex-drenned superphosphate is dumped across beams, an inverted cone will develop on the beam and should be knocked down before it falls uncontrolled.

There is a peculiar condition which has recently arisen in the storage of granular mixed goods. The front entrance to the storage bin has, in some cases, been bulkheaded to gain maximum storage utilization. These bulkheads usually are constructed so that the lower 10-foot section has removable boards set in at an angle. Above the 10-foot section, bulkhead boards are permanently fixed.

In order to dig material from the bin, as many boards are removed from the bottom as are needed to allow the flow of granules until the entire 10 feet is free of boards. The desired result is for material in the bin to feed downward to a point accessible to the front-end loader, but frequently the material resting against the permanent part of the bulkhead in the upper area does not slide and forms a bridge instead. The front-end loader can not reach this material and a treacherously roofed cavern develops. This overhead roof of fertilizer must be removed before safe entrance to the bin can be made.

Two methods have been used to break the bridge. One method is to use the bucket boom mentioned earlier to poke through the material and break its arch from underneath. Although the major part of the loader is outside the bin, the bridge can break and fall with enough force to cause a downward action on the bucket and

cause an unwary operator an awkward moment.

The second method is to poke the bridged material from the top with a suitable bar. The man using the bar should be provided with a safe platform on which to stand so that a sudden cave-in of the bridged materials would not cause him to fall due to a sudden loss of balance.

The corrective actions described have been used successfully in granular and pulverized fertilizer piles to cope with hazardous situations. The tools required are simple and available to anyone desiring to employ them. There is nothing really new in the methods described. They have been mentioned in other literature and are used throughout the industry.

The successful corrective action would then seem to reduce itself to a matter of execution. Successful execution is in proportion to the practice exercised, whether it be a fundamental play in football or a basic job in a fertilizer plant. Although "practice makes perfect" may be a tired cliché, it has lost none of its truth.

Up to this point, the main points covered were methods of corrective action to handle existing risky overhangs. An examination of the causes of overhangs might reveal some means for preventing the development of overhangs. It is noted that three of the six causes result from ineffective blasting and that one of the six causes is created by equipment operation.

This would indicate that part of the causes are under our control and that there is an opportunity to do something about them.

Blasting results have been vastly improved with the use of long delay caps. I do not intend to represent myself as an expert in this field, but I have seen improvement occur. Explosive suppliers are a good source of advice as is the National Safety Council. A good deal of progress can be made by reviewing blasting methods.

Overhangs caused by building design represent a local problem, which must be reviewed to find the best way to handle materials under the existing conditions.

However, the control of equipment operation is readily observed and corrected. If the cause of overhangs from undercutting

figure calculated from the previous three-year period is shown, as a solid horizontal line on the chart. Control limits also are calculated, using standard statistical formulae. These are shown on the chart as horizontal dotted or dashed lines above and below the mean. The distance between the control limits is the estimated amount of random variation which can be expected to occur without any change in the kind, intensity, or effectiveness of injury prevention activities.

As with any quality control chart, when our serious injury index stays within these control limits, it is considered to be under control.

Or, another way of looking at these variations of the index within the control limits is that the effectiveness of what we are doing in the way of injury prevention is about the same as long as the index is within the control limits. If the index, however, goes above the upper control limit, something has probably gone wrong in our prevention activities, and we should begin to try to find out what did take place so corrective measures can be instituted.

Likewise, if the index goes below the lower control limit something special probably has taken place to give us such a good performance and we should try to find out what it was to continue and expand its use.

Through these control charts then, we should be able to detect when effective or ineffective accident prevention activities are in use or certainly when they remain in use for a short period. This is something we could not detect by the use of disabling injury frequency rate alone. When plants such as ours operate with but one or two disabling injuries in a year, and sometimes without any such injuries, the statistics are just too meager to interpret.

We've been using these charts to keep our manufacturing department management informed month by month of program effectiveness.

We think it has been a useful and effective tool in spurring injury prevention activities.

Looking at a number of different classes of injuries we can see the reductions which have taken place:

	First Aid Cases Per Year	Doctor Cases Per Year	Serious Injuries Per Year	Disabling Cases Per Year
1951-52	7,000	500	275	13
1953-54	6,000	450	240	12
1955-56	4,500	325	200	11.5
1957-58	2,900	270	135	8
1959-60	2,600	240	120	8.5

But aside from control chart techniques, let me urge you to look beyond just disabling injuries. Let's not be satisfied just because many of our injuries don't involve loss of time.

Think of the many times men have fallen at work only to get up, limp a little for a few steps, or rub their arms or hands or shoulders for a few minutes and then go about their work. Or how many times such falls have resulted in strains of the shoulder, or leg or arm muscles which have kept them from doing their full jobs for a few days or even longer. They are the same kinds of falls which sometimes result in broken arms or legs, cracked ribs, fractured skulls—so why not look into them more deeply and intensify your efforts to prevent falls.

Or how about the number of times men have bumped into things or have had parts of their bodies caught between two objects and have sustained lacerations which had to be stitched up (sutured—say the doctors) instead of badly fracturing bones or amputating fingers or hands or toes or otherwise seriously injuring themselves. I can assure you it is very nearly impossible to tell how serious an injury will result once the accident cause has started on its way.

And how much time and effort goes into explaining why a man lost time from work, or even why he doesn't have to lose time because there is work he can do without aggravating his injury. And how much more productive that same time and energy could be when used in preventing more and more accidents and thus preventing more and more injuries of varying degrees of seriousness.

This basically is what is behind our own efforts in promoting the concept of serious injuries, both disabling and non-disabling. We make no claims that our system is the last word but I think we are preventing more injuries than we ever did. Perhaps you don't have the same types of injuries

that we have, but I feel sure that if you looked long and hard at all your injuries you would see a number of recurring types which could be the basis of your own serious injury index.

Of course, your own objectives will determine which way you will go. If you are satisfied with the disabling injury fre-

quency rate as your measuring stick—fine. If you are not, then here is a suggested system.

For ourselves, we think it has helped us to reset our sights on the goal of preventing injuries, rather than largely on the prevention of loss of time from work, as important as that is.

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TO ATTEND THE 1962 NATIONAL SAFETY CONGRESS

Celebrating the 50th Anniversary of the NATIONAL SAFETY COUNCIL

WHEN: October 29 through November 2, 1962

WHERE: Conrad Hilton Hotel, Chicago

The National Safety Congress brings together safety people from all over the country—10,000 of them! By attending the Congress you become part of the largest and most important safety meeting of the year. You meet safety men with the same safety problems and responsibilities you yourself have. You exchange views and ideas on accident prevention, health, hygiene and fire prevention—on safety in industry, in traffic, at school, at home and on the farm. From a program of more than 400 meetings, discussions and demonstrations you select the activities that interest you most and that most closely relate to your safety work. This week-long educational program—planned and presented by the National Safety Council—can be your most inspiring, most thought-provoking safety experience of 1962.

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CIVIC LEADERSHIP SESSIONS

CIVIC LEADERSHIP—THE SAFETY ORGANIZATION AND CIVIC LEADERSHIP (A SYMPOSIUM)

Presiding: DOROTHY DOWNS, Asst. to Dir. of Engineering, Firemen's Mutual Insurance Co., Providence, R. I.; Women's National Safety Conference, N. S. C.
Moderator: MRS. JOHN E. KRUEGER, Milwaukee, Wis.; Member, Board of Directors, Executive Committee of Women's Conference, N. S. C.
 (Mrs. Krueger pitched in for Mrs. Lucille Blakesley, who was unable to attend.)

(A) THE STATE

Mr. James K. Williams, executive dir., Connecticut Safety Commission, gave the purpose of the CSC as being to co-ordinate the activities of groups engaged in traffic safety work with the official program. He mentioned that such so-called do-gooder organizations may be found at all levels of the citizenry: local, city and state.

Mrs. Harry L. Nair, chairman, Advisory Committee of Women's Activities, CSC, discussed the woman's role in traffic safety, and said that women in Connecticut have the opportunity to participate in a program beyond their particular affiliation when, under the aegis of the CSC, they engage in traffic safety work under the official program. She says that the last thirteen years have seen women emerge as the dominant force in traffic safety work. Women's organizations have been persuaded to include a speaker on traffic safety in their programs. She says it took a year to accomplish the objective of introducing instructors in driver education into the schools. Now 77 per cent of Connecticut schools have a full driver education course.

Mrs. Nair then listed several ways that women's organizations can turn to the CSC for safety information: staff assistance in education is available to community organizations, resolutions of the Women's Workshop of the CSC Conference represent the interests of all community clubs (the permanent women's advisory committee having thus been established) and thus serve as a coordinative outlet for official safety policy.

(B) THE CITY — A CHAPTER OF NSC LOOKS AT CIVIC LEADERSHIP

Mr. Ivan A. Martin, mgr., Safety Council, Chamber of Commerce, Fort Wayne,

Ind., said that accomplishment in traffic safety work depended on active interest and constructive work in public safety. He said that the Ft. Wayne chapter of the National Safety Council was mandated to go to work on a safety program under the sponsorship of the Chamber of Commerce. Committees were set up to cover the various regions of safety. He then mentioned the part played by Ft. Wayne as a pilot city for seat belt study.

Mrs. Homer A. Ellison, State Safety Chairman, Indiana Federation of Women's Clubs, spoke of the 35 clubs in Allen County, Ind., each with a safety program. She mentioned the frequent talks given by members of the police and sheriff's departments, and their excellent cooperation in a voluntary safety vehicle check, of which the paper work was done by the women's clubs. In 1956 a well-attended parking clinic was held, with instructors from the police department, and another in the following year that was a great success.

Mrs. Ellison continued that in February, 1960, a steering committee of eight persons set up the present safety organization, which advocated that hardware for seat belt installation be included in 1962 cars.

(C) THE SMALLER COMMUNITY — A VOLUNTEER COUNCIL SPREADS THE SAFETY GOSPEL

Mr. and Mrs. Ralph Eisenschiml represented the volunteer Citizen's Safety Council of Highland Park, Ill., of which Mr. Eisenschiml is president. They mentioned the nine committees into which the safety council is divided: elementary school (the focal point of their program of safety education) and high school (the most people at work here in driver education), police (representative of the council sits

with the chief of police, listens to problems, and uses the material obtained for public relations purposes, making statistics vital), fire, parks and beaches, home, municipal court (the treatment of teenagers of greatest interest here, the seal of the council being the establishment of a student traffic court in the high school), special events, liaison (especially with the activity of civic clubs), and civil defense (the big issue being school versus home in civil defense activities).

Mr. and Mrs. Eisenschiml showed publications sponsored by the council which are designed to get safety across to children who can't read, explained Highland Park's monthly courteous driver award program, and reported that Highland Park had been the winner of the Community Safety Award for 1959.

QUESTIONS AND ANSWERS

Question. In Connecticut, does one women's organization work on a safety project, or do all of them have the opportunity?

Mrs. Nair. Safety projects are limited to the field of traffic safety. On any specifically defined problem, all pertinent traffic legislation and the official program of the CSC is made available at a conference of all women's organizations.

Question. Is Bar Association talent used in safety measures?

Civic Leadership Sessions

Mrs. Nair. The chairman of the CSC is a lawyer, and he works closely with the legislature in the formation of bills, with local and state Bar Association support.

Question. How sensitive are legislators and judges to the press, particularly to news from the traffic courts?

Mrs. Nair. They are sensitive enough so that the court system has recently been reorganized, and the chief justice is a member of the safety commission.

Question. In Connecticut, is there any legislation on reporting deaths and injuries in the home?

Mrs. Nair. There is no statute; it is handled by the vital statistics department. (Mrs. Ellison noted that in Indiana there was the same situation, the board of health supplying a monthly report.)

Question. Is there any NSC pressure for smog control?

Mrs. Ellison. There is in Indiana, especially for the control of back-yard fires.

Mrs. Nair. There is no program in Connecticut.

Question. Do you charge a fee for participation in safety meetings?

Mrs. Nair. The safety program in Connecticut is state-supported.

Mrs. Ellison. In Fort Wayne, the safety program receives budgetary support from the Chamber of Commerce.

REPRESENTING CIVIC ORGANIZATION VIEWPOINT

By MRS. CARRIE NOELLING

Vice President, Kansas City Safety Council, Kansas City, Mo.

Several years ago it was publicly stated by Paul Jones, then director of public information for the National Safety Council, that more women were brought into the safety movement in Kansas City, Mo., than in any other community. I quote from a talk he made the latter part of last year:

"If the whole country could get the leadership and support of safety by women that Kansas City is getting in ever-increasing volume, the accident problem would be nearer a solution."

It is a real pleasure and a special privilege

to tell you briefly what civic groups in the Greater Kansas City area are doing in the field of safety. Following the pattern of the Women's Conference of the National Safety Council, the Women's Activities Division of the Greater Kansas City Area Safety Council is sponsoring a group who, themselves, chose as their name "Safety Conference of Women's Organizations."

This group is made up of approximately 70 representatives of business, professional, religious, civic, school, literary, cultural and service clubs and auxiliaries. "Coffee" meet-

ings are held once a month on Saturday mornings at the home of the vice president of the Council, and qualified speakers present a different phase of safety each time. Literature pertaining to the particular subject is distributed.

At the time this group was being formed, at least one member of each club was given a personal or telephone invitation, explaining the reason for the organization and asking her to realize her civic and personal duty to the cause of safety and, if she attended, always to make a report back to her organization. The response was most gratifying, and at no meeting have we had less than 80,000 individual club members represented. The programs presented stimulate open discussions which usually continue long after the meetings adjourn. This same enthusiastic sharing of ideas and responsibilities has resulted in outstanding safety programs which no one individual or organization could have developed alone.

Realizing the tremendous power that can be created when enthusiastic women join together for any purpose, a speaker said recently, "Every man should get down on his knees every night and thank the good Lord that women don't know the power they really have." Maybe individually they do know, but sometimes we fail to realize all they can do or accomplish when organized for a worthy cause, working together.

The Women's Chamber of Commerce developed a mobile unit to carry their driver testing program to the people, appearing at high schools, colleges, community centers, fairs, shopping centers, national conventions, churches, commercial truck and bus drivers' conferences, in fact, anywhere where there were drivers or an interest in driving, there seemed to be a demand for this program. This project brought to the Women's Chamber the highest 1959 Carol Lane Award for Traffic Safety. Within a 2-year period, more than 167,355 man-hours were spent by volunteer workers in testing alone representing 346 eight-hour days. It was impossible to keep a detailed record of the number of volunteer workers or their organizations. However, it is estimated that over 1,100 three-hour shifts were staffed to carry out this program.

Our Parent-Teacher Association of the public schools has been recognized as conducting the most effective bicycle safety

program in the United States. They have had requests from over 60 major cities, such as New York, Los Angeles and Chicago for copies of their booklet of 20 typewritten pages covering every detail of their important program.

Home safety workshops and baby sitting clinics are conducted every year through our safety council.

Another annual program, the national "Operation Edith," was originated in Kansas City. This means "Exit Drills In The Home," which are featured each year during Fire Prevention Week. In cooperation with the fire department, women's groups have supplied Christmas tree dealers with more than 50,000 combination price tags and holiday safety reminders.

The Railway Business Women in Kansas City carry on a strong safety program, featuring speakers on various safety subjects at their regular meetings several times a year and distributing safety information. Reports of their activities are made at their national meetings.

Through the Women's Conference, information regarding a revised traffic code in our city was passed directly to other organizations by officials of the municipal courts, police department and City Engineer's office.

When in 1960, Kansas City's traffic toll rose at an alarming rate, at the mayor's request we participated in an all-out traffic safety program, and a marked decrease in the number of fatal accidents is shown in this year's record. From January through September last year, there were 50 fatalities; but for the same period this year there were only 29.

In conjunction with the American Red Cross, a water safety carnival was held at one of the nearby lakes, where marine operating regulations were explained and boat safety demonstrations were conducted.

A series of 39 original safety cartoons were published locally and through inquiries, went into every state in the Union and several foreign countries.

After working with one of our women's groups on a "Safety Fair," the Association of Community Councils has established a Traffic Safety Committee, comprised of representatives from each of the more than 13 community councils.

Three thousand of the familiar yellow and green school safety patrol flags were made by members of women's organizations this year at a saving of over \$1,700 to our area safety council. Also the local chapter of the National Secretaries Association has given many hours of secretarial work in the safety council office.

A leading member of our group was appointed by Governor Faillon of Missouri to serve in this area to carry out an educational campaign regarding needed traffic safety legislation. This campaign was aimed particularly at civic, church and women's organizations. She spoke at countless meetings explaining the pending traffic legislation, and handed the voters explanatory leaflets and maps showing the legislative districts and mailing addresses of their legislators. The flood of correspondence from their constituents caused Missouri legislators to bring about the greatest strides in traffic safety laws in the state's history.

At the time of the Central States Safety Congress which meets in Kansas City bi-annually, the women have always helped with the plans and have always had a women's session. This year, we are told, the women's session had the best attendance of any at the Congress, regardless of a deluge of rain that day.

On January 1st of this year, our safety council added a new division known as Religious and Church Activities, which will stress the moral aspect of safety. They had an interesting session at the Central States Congress, where a talk was given by Harold Holmes, director of this division for the National Safety Council. They participated in an area "Safety Sunday" in May, by furnishing material for sermons, house organs and bulletins. Churches of all denominations cooperated in this program. The council and church leaders are now working on a Christmas safety program for the coming holiday season.

We know that women have proven their leadership in spiritual guidance as well as alleviating suffering.

One of the leaders in our women's group

Time Leadership Sessions

was instrumental in getting Kansas City, St. Joseph Diocesan Council of Catholic Women, representing 30,000 women in our area, to set up a safety committee and for the past 3 years a report of their activities has been read at their monthly board meetings. At their annual conventions safety displays have been prepared and literature of all phases of safety are made available.

A Sunday School teacher of a large religious organization with headquarters near Kansas City contained a Ten-Point Creed for Teen-Age Drivers. It was later printed on cards and our women's organizations distributed them to teen-age drivers throughout the area, and they have become a part of the driver education kits used in our public schools. The first National Student Traffic Safety Conference was held in Kansas City in 1959, and again in 1960. Delegates from all the states and Alaska came, and these creeds were distributed at that time. Since then, requests came from all over the United States for supplies of these cards to be used in other driver education programs.

If I were not, as the Egyptian mummy said, "pressed for time," there are many other worthwhile safety projects I would just love to tell you about. But now, I must close, and I would like to share with you the safety prayer that we use to close every meeting of the Safety Conference of Women's Organizations:

"Father-God, we thank you for this safe place in which we dwell and work: For the life-saving bond that unites us; for the hope of greater accomplishments with which we expect the tomorrow; for the health, soundness of limb and general well-being that makes life worth living, and for our friends and co-workers in all parts of the earth. Give us and them courage to continue the life-saving and accident-prevention efforts that must be so pleasing to You. Bless us in all our safety endeavors. Give us the strength to meet the day-to-day problems of discouragement, antipathy and apathy. Give Your own special blessings to all who in the spirit of good will, take up that most humane cause: Safety."

REPRESENTING THE VOLUNTEER

By MRS. HENRY S. PIERSON

Chairman, Greater Chicago Women's Safety Conference, Des Plaines, Ill.

The role of a volunteer is the most exciting and rewarding experience in a lifetime—especially in the field of safety. All the hurry, worry, tears, and sweat make sense for you are doing something for some one else.

My experiences have been thrilling and varied with one thing leading to another. One experience that was different was a blood typing program which started in Evanston, Ill. The object was to record all persons having type O blood for use in case of disaster.

The remaining experiences have taken place and are taking place in Des Plaines, Ill., where I have lived for the last five years. To move into a strange area makes it easy to break ties so I thought I was out of safety forever—my children grown and away and I thought that at last I would have time to learn to cook and darn the socks. For two years this is what I did.

Then I read in the local newspaper that the Des Plaines Safety Council would welcome anyone interested in safety. That did it—I sent in my name and have been hooked ever since. I attended the general meetings but came away disappointed. People brought in their neighborhood problems and gripes but we got no safety education. There seemed to be a need for good safety information.

So I offered to organize a Home and School Safety Committee, such as Evanston has had for thirty-five years. The Safety Council, as well as the public and parochial schools, the police and fire departments all agreed it was an excellent idea and there was a need but they didn't think it could be done. However, they were all willing to help if I got the thing organized.

Letters were written to P.T.A. and parent groups of all schools asking that they send a woman representative to the newly organized Home and School Safety Committee of the Des Plaines Safety Council which would meet one morning a month. The letters included accident facts on the national level as well as on the local. The

object of the committee stated to be that of safety education at the adult level as the schools already had an excellent program.

We divided the school year into a different type of safety each month, covering back-to-school safety and the "Safest Route to School;" fire prevention and Halloween; pedestrian and firearms; holiday and Drink, Don't Drive; winter driving hazards; poisons; Spring clean-up; civil defense; bike safety; vacation etc.

The police and fire departments sent a representative who reported on all local accidents and fires. The fire department issued a special bulletin on fire prevention each month. At each meeting we recorded these reports on special sheets so a continuous record was kept and at the end of the year we had a true picture of our own community.

The Home and School Safety Committee is in its fourth year and now includes representatives from the Woman's Club and neighborhood civic groups.

Next was a baby sitting course open to the public. The Interdenominational Church Youth Group were looking for a civic project and at the time the city officials had nothing to offer. However, the *Home Safety Review* published a splendid baby sitting program and we presented it to the group. They became most enthusiastic and decided to undertake it. With the cooperation of the Des Plaines Safety Council a seven week course was outlined with meeting on Saturday mornings. A different speaker and subject for each meeting. We had a pediatrician, a nurse, fireman, policeman and meeting on home safety, child safety and first aid. Teen-age boys and girls as well as adults regularly attended. Each was required to pass a written examination in order to graduate and receive a card showing them as qualified sitters.

The course was successful and was repeated the following year.

This Fall we offered the "Safest Route To School" on a city-wide basis. We just made use of all the information available

the Safety Council, Board of Education, the parochial schools and the Police Department all cooperated. We obtained a list from each principal of the intersections guarded by patrols and adult guards with the hours they are on duty. The newspapers printed this information and included a map of city blocks on which the parents were to mark the school and guarded intersections—then to draw a line from school to home following the safest route for their child to follow. This was accompanied by an "Open Letter to Parents" by the safety council making a plea to all parents to establish with their child the safest route and to walk with his child over this route until he knew it by heart and then to insist that his child use only this route to and from school each day.

This is the first time a city-wide effort has been made to show how the schools and the police department work together to provide the school children with the greatest protection possible.

The latest project is in the final planning stage. We are planning a clinic on winter driving hazards which will take place early

Civic Leadership Sessions

in January through the cooperation of the safety council, the Driver Education department at Maine Township High School West and the Park District.

The clinic will be held in a field house on a Saturday morning where drivers young and old can see a movie, hear a chalk talk by the driver education teacher and an explanation of charts showing the stopping distances under various road conditions. This will be followed by a demonstration outside on the ice skating rink of the right and wrong way to handle your car on ice and snow.

We have found that there is a tragic lack of actual knowledge as to how to handle your car under adverse conditions so we are offering to the driving citizens of Des Plaines the opportunity to learn what to do and when to do it as an experienced teacher.

You can see that there is no limit to the opportunities awaiting an enthusiastic volunteer. I hope you will join the ranks and experience this exciting and rewarding service.

PUBLIC SAFETY SESSIONS

LOCAL COOPERATION FOR SAFE OUTDOOR RECREATION

By AL MCGEE

Dir., Home and Public Safety, Seattle-King County Safety Council, Seattle 4, Wash.

The Federal Charter of the National Safety Council provides that one of the Council's objectives is "cooperation with all existing agencies and individuals concerned with Safety." I suppose this wording implies that there are some agencies and individuals who are not concerned with safety, but I must confess that I have never yet encountered one. There are many individuals and agencies which think they are not concerned with safety, because they have not yet discovered how safety affects their interests.

When we set out to organize local cooperation for safe outdoor recreation, we have a primary duty to show those who are oblivious to the impact of accidents, just how they are personally affected. Let me give you a couple of concrete illustrations.

Out in the Pacific Northwest, some 200 boat builders, boat sellers and marine supply firms have organized a trade association called Northwest Marine Industries, Inc. The principal purpose of this association is to encourage the sale of marine products and services. This it does in admirable fashion by sponsoring each year the Seattle National Boat Show. But Northwest Marine Industries has no direct humanitarian responsibilities, it is not a "Safety" organization.

However, this "non-safety" organization puts more money into the annual operating budget of the Seattle-King County Chapter of the National Safety Council than any of the rest of nearly 500 firms, agencies and individuals who hold annual memberships. Why? Because someone pointed out that each serious boating accident is followed by a wave of cancelled orders.

Junior high schools are not "safety organizations" either. Their principal purpose, since the Russians fired the first Sputnik into orbit in 1957, has been to turn out

junior grade scientists. Yet, despite the pressures put on school curriculums by the international missile race, South Mercer Island Junior High School in King County Washington recently installed a required course in boating safety which all eighth graders must take. Why? Because someone reminded the members of the school board that youngsters who drown now won't be around to sh. rockets later. And in a school district where some of the larger families own as many as a dozen boats, this is a pretty potent argument.

Let me go back now and tie these two examples together. South Mercer Island School District had no teachers who were boat safety experts, but the Seattle-King County Safety Council had access to the best brains in the business through Northwest Marine Industries. South Mercer had few text materials; we were able to offer them such a wide variety, all furnished by the boating industry, that they had trouble choosing between them. Four untrained instructors put 270 students through the first course last year and told us afterward that the help we gave them enabled them to do a good job despite the lack of previous experience.

The same "help" — including guest lecturers, the loan of films and wide variety of printed text materials—are now available to all 25 King County High Schools and Junior High Schools without charge. This "without charge" feature is important. School budgets always seem to be overstrained.

The point I want to make here is that every one of us in this room lives in a community where there are organizations which have not yet discovered just how they are "concerned with safety." We often can aid them to full awareness and enlist their aid in solving community problems. Let me give you some more examples:

The primary concern of newspapers is news rather than safety education, and for weekly newspapers this means *neighborhood* news. Yet when we staged our Free Family Boating Festival this year, 30 newspapers and a couple of magazines gave us free advertising that would have cost nearly \$2,000 if paid for at their regular rates. Why? We gave it to them as hard news. There were 34 weeklies involved and in almost every case we were able to find a volunteer who lived practically next door to the editor. These volunteers carried our handouts to the editor personally and said:

"Mr. Editor, I live in your circulation area and I'm serving on a countywide committee which is putting on the Free Family Boating Festival. We are giving the people of our county five hours of free life saving demonstrations and marine entertainment. I hope you will find room for our copy." More often than not he did, because now he had a perfectly legitimate reason for doing so. "Mr. John Smith, prominent district business man, is serving on a countywide committee which will put on the 1961 Free Family Boating Festival." And having said that much, the editor could hardly stop without saying a lot more.

Radio stations have a present concern with safety education either. They are permitted to fulfill their public service obligations by giving you weather reports, the time of day, religious programs, or "great debates." Your spot announcements on safety compete with the March of Dimes, The United Fund, Heart Fund, Milk Fund, Muscular Dystrophy and Cystic Fibrosis. But despite this hectic competition for a limited amount of public service time, the Seattle-King County Safety Council has done very well in its efforts to use radio for safety education.

The biggest single attraction of our Free Family Boating Festival this year was a rowboat race for disc jockies — for a "Blistered Palm Trophy." Nine jockies from eight stations competed, and our "race announcer" was a prominent local television star. For a week before the festival, these fellows talked it up on the air, giving us publicity that we were completely unable to measure, but which was certainly welcome. Why were all of these stations so good to us? Because we do something practically no other public service organization seems to

do — we write letters to the Federal Communications Commission praising the licensees whenever they help us! Our letters go directly into the official files, and when the license renewal date rolls around, the station has our written endorsement in the field of public service.

Television stations don't really owe us anything either, but they are usually willing to give us a bit of time for safety projects. The trick here is to avoid accepting an expensive gift that really isn't worth anything. Television time sells for \$100 a minute and isn't worth taking unless properly used.

If we get our safety message on the air at 8:00 a.m. on Sunday morning who's watching? Usually, nobody. Anyone up at that time is either getting ready for church or too sick to care whether he's safe or not.

How about those local versions of *Today*? Those nine a.m. week-day shows with news, interviews and exercises? Well, they are fine for the light, bright type of message or interview. But what housewife wants disaster with her second cup of coffee? And disaster is usually what we are peddling.

How about the cookbook shows? Usually very good, if your safety message is directed at young mothers. We ran the GEMS baby-sitter training course on one of these mixmaster marathons in ten-minute sections, one each week for six weeks. It turned out great for both us and the station. Poison-control doctors, pediatricians and orthopedists work fine on these, but traffic safety experts get nowhere.

Documentary or panel discussion programs can sometimes be "put in the can" for future use, now that most stations have video tape machines. You "tape" a half-hour documentary on some controversial subject like driver training in public schools, and the station will slip it into the schedule when the ball game ends early or a can of film fails to arrive on schedule. These programs are tricky to put together, but they work hard for you when you get them right.

The most desirable spot on the daily telecast schedule is the evening newscast, but you can't get on this with platitudes and poetry. You need the news-connected interview with the victim—the kid with the eye just blinded by the firecracker, the pretty

girl who had 184 stitches after running through a glass door. We ask insurance adjusters and firemen to tip us to unusual accidents which might not otherwise be reported. One TV station gives us half-a-dozen two to three minute newscast interviews a month. Each of these is worth as much as an hour of "dog time."

If you're any good at scouting talent at all, you'll have to work hard to avoid becoming a talent scout instead of a safety peddler. Some of the most charming people in the world work in TV and if you're not careful, they'll charm you right out of your mission. I've carried boxes of pickles up and down stairs, helped build sets and carried messages for the producers while shows were going on. Sometimes my little buddies forget to toss in the safety plug which was my sole reason for being at the station. Sometimes my boss is watching and notices it, too.

So much for television, and I will return to it only briefly in connection with my next example of agencies who suddenly discover out of a clear blue sky that they are, indeed, concerned with safety.

Early in 1960, we were contacted by the sales manager of a firm which manufactures power lawn mowers. He said his product, which has many built-in safety features, had been taking an awful beating, sales-wise, from cut-price, inferior, unsafe mowers. We checked the reputation of his firm and his product and discovered that here indeed was a company whose product reflected the company's sincere desire to perform a public service. It was a company which had budgeted funds for safety education. We said we would try to help. But if anyone had told us then that we would be able to help as much as we finally did, we would certainly not have believed it.

This sales manager had the friendless, wistful look of a cocker spaniel about to be spanked. So we persuaded television interviewers at all four stations to give him a rough time—a real Mike Wallace treatment. And the sales manager had his audience nearly in tears. They were so sorry for him, as he gave his little pitch on power lawn mower safety. He didn't once mention the name of his company, but four of its shiniest products were on camera with him most of the time. The commercial

value of the free time on the four stations was \$3,000.00. Viewers began to call up and ask where they could buy this "safe" mower. And we were able to book the sales manager into high schools for demonstrations and distribute thousands of Power Mower Safety Leaflets to students.

When safety supervisors and engineers begin to feel their way cautiously into an off-the-job safety program for employees, they would do well to re-evaluate the firms from whom they buy supplies for their on-the-job safety programs. You will find that some firms deal on the basis of price alone, with little thought to quality and none at all to public service. You will also find firms like Johnson & Johnson who not only sell high quality first aid supplies at a fair price but who have as a public service conducted a nation-wide "Emergencies Don't Wait Week" each year for the past 13 years.

The Resuscitube, an aid to artificial respiration which has saved hundreds of lives in industrial accidents, is a Johnson & Johnson development. It is now included in marine first aid kits, and available separately for use in plants and factories.

A working arrangement with one good firm like Johnson & Johnson can help your off-the-job safety program immensely. You can pick the best brains of a national organization which has been making mistakes and then correcting them for many years. Their advice on off-the-job safety has now reached a high degree of refinement. You can tie new efforts to their established ones and get the benefit of nationwide publicity. And it often turns out that this sort of cooperation is more valuable than saving a few cents on a case of inferior adhesive bandages.

In summary, let me say that I have been talking to you as public safety director for a chapter of the National Safety Council and I have assumed that most of you are safety supervisors for industrial firms. I have attempted to show you how one safety council has worked to organize local cooperation for safe outdoor recreation in the Pacific Northwest. Of course I have only scratched the surface of this important subject. You can get other ideas by writing to managers of safety councils anywhere, or by studying carefully the summaries prepared by NSC.

SURGEONS AND SAFETY—THE JOINT ACTION PROGRAM

By DR. PRESTON A. WADE

American Association for the Surgery of Trauma and American College of Surgeons
New York City

Surgeons are interested primarily in treating the sick and injured. The prevention of injury and safety problems have traditionally been left to other agencies. However, in the last few years, the physician has made prevention one of his major interests.

The American Association for the Surgery of Trauma and the American College of Surgeons have joined with the National Safety Council to develop a joint action program in which an effort is being made to improve the prevention of injuries and also help in the treatment of the injured. The history of the Joint Action Program began in 1956 when Dr. Charles G. Johnston, president of the American Association for the Surgery of Trauma, wrote a letter to the National Safety Council pointing out the necessity for those concerned with the prevention of accidents to work with those concerned with the treatment of the accident victims. The first formal meeting of the top level representatives of the three co-operative organizations was held in October, 1957.

This group decided upon a joint action program and formed itself into the policy committee and directed Dr. Paul R. Hawley, the director of the American College of Surgeons, and General G. C. Stewart, executive vice-president of the National Safety Council, to have prepared a basic document outlining the program. This document was prepared by Dr. James B. Mason and Mr. Ralph Kuhl and was published jointly in May, 1958 entitled, "The Joint Action Program." The objective of the program was the approach on a solid front to prevent accidents and minimize the serious effects of trauma.

The National Safety Council is concerned with the prevention of accidents and the two other agencies are primarily concerned with salvage after accidents occurred but, actually, the two aspects of the trauma problem cannot be separated and the pre-

vention of accidents and restoration are interlocking.

As a result of this effort, all of the safety council managers and the local trauma committees of various states and localities were asked to co-operate and to serve as co-ordinators and to promote the program.

There were several projects in which all of the interested groups could co-operate. One of these was concerned with the transportation of the injured in which ambulance attendants would be properly trained and qualified. Secondly, the communitywide promotion of attendance at courses of instruction in accident prevention and first aid and, thirdly, an effective, vigorous support at the state and local levels of the objectives of the President's Committee for Traffic Safety. Later, in July of 1959, planning memorandum No. 2 added new projects for the promotion of seat belts and for safety in sports.

The policy committee for the combined program plans and allocates projects and programs. The chairman is Dr. George M. Wheatley, a member of the executive committee of the board of directors of the National Safety Council. I am the vice-chairman and other members are the top representatives of the three sponsoring organizations.

We, the surgeons of America, are extremely interested in the prevention of accidents and have entered into this association with great enthusiasm. We have found in our efforts to help the injured, that, on many occasions, proper preventive measures might have obviated the serious injuries which we encounter.

Automobile Crash Injuries—One of the most important efforts in which we have been involved has to do with the prevention of injuries in automobile crashes. We have not, of course, had a great part in the prevention of accidents except insofar as we have supported the governmental and

local agencies in proper screening of applicants for driving licenses and helping in the usual traffic control discipline. We have, however, taken a great interest in the prevention of injuries in inevitable automobile crashes. Speed has become so vital in our national economy that we must accept the inevitable price of injury and death.

The Cornell University Medical College was a pioneer in the effort to investigate the cause of death and injury in automobile accidents. Hugh DeHaven, in 1940, first became interested in the factors involved in *break survivals* of free-falls and suicide attempts. He applied these factors to the designing of cockpits of fighter planes during World War II and as a result of his recommendations, the cockpits of fighter planes were constructed so as to package the pilot in the plane. The improvement in mortality and injury rate was so effectual as to cause the armed services to ask him to continue his investigation. It was only natural that his discoveries would be applied to automobile crash injuries after the war.

The American College of Surgeons became very much interested in the results of preliminary studies in which he found certain major causes of death in automobile accidents. The first was the finding that passengers ejected from an automobile, at the time of the crash, were apt to sustain severe to fatal injuries five times more often than the passengers confined within the vehicle. This led him to suggest the possibility of a confining seat belt.

The other findings of the Cornell Automobile Auto-Crash Injury Program showed that there were certain areas within the interior of the automobile that caused serious injury. Usually these were the protruberant areas on the dashboard as well as the conventional steering wheel. He made several suggestions, five of which were: 1. improving the design of the steering wheel so as to catch the driver when the crash occurred, cradling him in the steering wheel so as to protect him from the force of the driving rod; 2. padding the dashboard and removing the protruberant objects from it; 3. improving the design of the car door so as to prevent it from opening at the time of the crash; 4. adding seat belts; 5. fixing the seat to the chassis of the car so as to prevent the extra weight of the seat with

the passenger's body from being propelled against the front part of the car.

These suggestions were considered by the American College of Surgeons Trauma Committee and transmitted by resolutions through the Regents of the College of Surgeons to the five major automobile manufacturers in 1955. It is to their credit that they took cognizance of these suggestions and all complied in one way or another. One automobile manufacturer included all of these five improvements in the 1956 model and centered its advertising campaign on safety during that year. Unfortunately, there was a severe drop in that company's sales for that year and this was thought to be due entirely to the accent on safety. Apparently, safety is not popular to the automobile buyer so this had to be dropped in their future advertising campaigns. Nevertheless, all of the automobile manufacturers have continued to add these safety features in their automobiles.

The Cornell Auto-Crash Injury Research Department made a study of the results of these improvements. It was quite interesting to note that the study of the 1956 cars indicated that there was considerable less danger in injury and death in those cars which had been fitted with the new design car door. The incidence of ejection from the car was considerably less as was the injury and fatality rate as the result of being ejected from the car. A further investigation of the use of seat belts indicated that there was a remarkable decrease in the incidence of death and injury as the result of the use of seat belts.

There is no question about it that the seat belts do not prevent death or injury when automobiles hit, head-on, in crashes at high speed. But for the usual accident the seat belt has proved to be a life saving device.

The surgeon has also interested himself in the pedestrian problem and, recently, the Cornell University Trauma Research Department has made a study of 200 consecutive pedestrian deaths, the study being undertaken with the co-operation of the police department and the medical examiner of the City of New York. This study will show that there are a few improvements that can be made in the design of the automobile to prevent death but, most certainly,

the pedestrian's disregard of the law of traffic lights is probably the most consistent cause of death.

Surgeons are also interested in the injuries sustained on the farm and as a result of their studies of the injuries treated have made certain suggestions as to improvement in farm machinery.

The medical profession has also interested itself in such things as the serious injuries resulting from rotary lawn mowers and gas and oil heaters and has made suggestions that may be helpful in the manufacture and sale of these products.

For many years, physicians have taken the lead in the effort to control the injuries that result from sports, particularly in football injuries. The advice and counsel of those surgeons interested in the sport have helped to prevent serious injuries and death. Particularly in the treatment of the injured football player on the field, the proper transportation and care of the patient has helped a great deal in the prevention of the worsening of his injury. It has been as the result of the physician's insistence that the practice of sending a player back into the game after he has been injured has been abolished. Many of the serious knee injuries which are often the result of a secondary injury on what might have been a simple knee strain have been prevented by proper investigation and control. Also, the surgeon has helped in great measure to help design the helmets and face guards which, in the past, have been more harmful than helpful.

Ambulances and Speed—One of the most important contributions a surgeon can make to safety is the control of the speeding ambulance. The excitement and hysteria engendered by an accident usually stimulates all concerned to use great speed in everything they do. As a result, ambulances are usually driven at an unnecessary rapid rate. It is very unusual for one to see an ambulance traveling the streets of any city at a reasonable rate, obeying traffic laws. Yet, we in the medical profession, know that there is rarely a need for speed in an ambulance call.

Furthermore, Curry and Lytle have shown in a study of 2500 cases at Flint, Mich., that in only one case was speed necessary to prevent serious difficulties in the treatment of the patient while, in some nine cases, a rough and rapid ride might very well have caused an aggravation of the injuries and even a fatality. We, therefore, feel that we have sufficient evidence to indicate that speed is unnecessary in the transportation of the injured and that careful transportation and obeying speed laws is not only helpful to the patient being transported but also will prevent injury and death to the unwary pedestrian and motorist. In my opinion, the speeding ambulance causes death to more people than it saves. I believe there should come a time when all ambulances should be made to travel at normal speeds and obey all traffic regulations. This concept of ambulance control is resented by ambulance companies and volunteer ambulance units and many will give examples of how speed of the ambulances saved a life but these claims are all speculative and depend upon the opinion of an interested bystander. However, the death caused by the speeding ambulance is not a speculation but is a true statistic. It was found that in one large American city ambulances were used to transport radio stars from one studio to another so that they would not have to be delayed by usual traffic regulations. Ambulances should be required to obey all traffic laws and the surgeons of this country will, some day, give evidence that speed is not necessary in ambulances and strongly support their control.

Civilian Defense—There is one further effort in which the surgeons of this country are interested and this has to do with civilian defense. With international difficulties being such as they are, it is our solemn duty to take cognizance of the danger and prepare for our national survival. This means that the medical profession must take steps to assist the government in teaching the public as well as the medical profession and paramedical personnel to treat and take care of those who are injured in a mass catastrophe.

SHOOTING SAFETY IN OUTDOOR EDUCATION

By JULIAN W. SMITH

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One of the significant developments in education during the past several decades is the concern for the wise use of man's leisure time—that increasingly large portion of waking hours when he can participate in activities of his own choice. Due to the influence of industrialization and the expanding role of the school, the curriculum now includes a wide variety of offerings which help equip children and youth with the skills, attitudes, and appreciations which contribute to good living. In a volume entitled *Leisure and the Schools*, the following statement is made:

The entire school curriculum must be conceived as a tool for developing attitudes, understandings, knowledges and skills required for leisure literacy.

The most recent announcement from the Educational Policies Commission of the National Education Association has this to say about education for leisure:

The worthy use of leisure is related to the individual's knowledge, understanding, and capacity to choose, from among all the activities to which his time can be devoted, those which contribute to the achievement of his purposes and to the satisfaction of his needs. On these bases, the individual can become aware of the external pressures which compete for his attention, moderate the influence of these pressures, and make wise choice for himself. His recreation, ranging from hobbies to sports to intellectual activity pursued for its own sake, can conform to his own concepts of constructive use of time.

An examination of the current scene indicates that the outdoors is occupying an increasingly important place in man's life as he seeks to find good and wholesome adventure and relaxation in this complex urban society. This is reflected in the emphasis in education known as outdoor education which helps develop concepts and insights about the natural environment and man's relationship to it; provides laboratory experiences for more effective learning in

some of the essential subject matter areas; enables one to acquire skills with which to enjoy a lifetime of creative living; and gets us back in touch with those aspects of living where our roots were once firmly established.

Learning in the outdoors applies to the educational activities that take place in outdoor settings; while education for the outdoors encompasses the skills and knowledge necessary for satisfying participation in outdoor pursuits.

Learning through the use of the outdoors as a laboratory contributes to the phase of outdoor education which might be termed the appreciation arts. Education for the outdoors consists of the development of the manipulative and creative skills which are expressed in the more active types of outdoor recreation activities such as shooting and hunting.

Historically, shooting and hunting have been favorite activities for generations. But only in recent years have schools and other educational agencies recognized the need for teaching the basic skills for these significant activities which have lifelong values and in which so many people can participate. Shooting and hunting are among the important activities in the phase of outdoor education which may be called the manipulative skills or education for the outdoors. While shooting has been regarded as a desirable activity in a broad program of physical education and recreation in schools, colleges, and agencies for some time, it was not until the National Rifle Association initiated its excellent program of hunter safety that the need for systematic teaching of safe shooting and hunting came to the attention of the public.

In the mid 1940's, the National Rifle Association enlisted the cooperation of the National Education Association in setting up a broader hunter safety course which could be conducted in cooperation with the school and community. Hundreds of thousands of youth have participated through community sponsored hunter safety courses

under the leadership of N.R.A. instructors. It became increasingly evident that the basic skills for a wide variety of sports and activities in which large numbers of children, youth and adults can participate should be a part of the curriculum of schools and colleges and that broad opportunities for participation in these activities should be provided by community agencies and organizations. Ideally, the home should provide early instruction in the care and use of sporting arms, but as in many other activities, the conditions of modern living have deprived many children from the opportunity for participation with their parents in shooting and hunting.

Prompted by the need for leadership in schools, colleges, and community agencies for teaching the skills, appreciations and attitudes through outdoor education, the American Association for Health, Physical Education and Recreation initiated the Outdoor Education Project in 1953. Following the effective pattern in a cooperative program by business, industry, and education, the Project was developed with the financial support of the American Fishing Tackle Manufacturers Association, the Sporting Arms and Ammunition Manufacturers' Institute, and the Daisy Manufacturing Company, and in cooperation with the National Rifle Association, departments of the National Education Association, and the American Casting Association. The Project, now in its seventh year of operation, has given impetus to the initiation of many new programs of shooting and firearms safety.

Over 50 state and regional workshops involving school and college administrators and teachers, recreation and conservation personnel, and outdoor education leaders have been conducted. In each of these, shooting clinics were provided, with the leadership of nationally known instructors from the N.R.A., S.A.A.M.I., the Daisy Manufacturing Company, departments of conservation, and industry. Shooting clinics have also been included in many other state and national workshops, conferences and conventions. Two publications of the A.A.H.P.E.R., entitled *Shooting and Hunting and Marksmanship for Young Shooters*, have wide distribution. Thousands of other publications from the N.R.A., S.A.A.M.I., and Daisy have been distributed.

An important phase of shooting safety in the Outdoor Education Project is the program involving the use of the air rifle as an instructional tool. Many elementary and secondary schools now include marksmanship and gun safety activities for young shooters. A survey conducted by the A.A.H.P.E.R., after the Project had been under way for three years, indicated that the number of shooting programs in schools and colleges had increased from 12 per cent to 28 per cent.

Safety is recognized as an important phase of hunter training. Operating on the basis that a good sport is a safe activity, safety techniques and procedures are included in the instruction about guns, in the demonstrations of the use of guns, and in the actual participation. It should be pointed out that shooting in an educational program is considered a sport and is taught according to the same principles that are used in other sports and games that are part of the school and college curricula.

Shooting and Hunting Instruction — In schools and colleges, shooting and hunting fit logically into physical education and recreation. They are included with other activities in the regular physical education class period or through school clubs, intramural sports, after-school programs, and in special activity periods. Rifle shooting, especially, has often been administered as a club activity, but in order to provide more basic instruction for all who need it, the physical education class is more inclusive.

Clubs provide excellent outlets for field experiences and competitive events. Many schools offer concentrated instruction in hunting and correct gun handling in activity periods and after school hours. This kind of instruction often is conducted prior to the opening of the hunting season. In elementary schools, shooting through the use of the air rifle is often included in physical education classes, clubs, after-school programs, and in school recreation departments and school camping. In colleges and universities shooting may be offered as a service course or as a part of the professional classes in physical education. A portion of a report on the Outdoor Education Project prepared in June 1961 will illustrate the development of shooting programs.

Program developments in shooting: Students learn casting and angling, shooting and hunting education, boating and water safety, archery, winter sports and other outdoor activities in school, college, and agency programs.

Percentage increase in shooting and casting programs:

In 1955—12 per cent + of the schools surveyed reported programs

Now—28 per cent + have programs (reported in survey of 1958)

Programs listed in schools and colleges that were surveyed, most of which were represented in the Outdoor Education Workshops:

1958 survey—Casting: 358

Shooting: 528

1961 projection—Casting: 1000+

Shooting: 1056

Note: More than a million youth are enrolled in the schools reporting these programs.

Hundreds of other programs are under way in schools and colleges which were not surveyed.

In colleges and universities—

3,000 prospective physical education teachers and recreation leaders receive instruction in shooting and casting in physical education and recreation courses and activities each year

Total for five-year period: over 15,000—approximately 5,000 of this number are certified American Casting Association and National Rifle Association instructors

Examples: Pennsylvania State University—900 students receive shooting instruction each year

Michigan State University—150 students receive shooting instruction each year

"Outdoor schools": Entire classrooms of students and teachers spend one week periods in camps, on school time and as part of the school program.

In 1956—300 school districts in the United States

In 1961—750 school districts in the United States

250,000 children in elementary and secondary schools learn science and outdoor skills (including casting, shooting, archery, and woods survival) in these outdoor schools as part of the school program.

Resources—There are many resources for teaching shooting in the curriculum of schools and colleges and in the programs of community agencies. The National Rifle Association with its certified hunter safety instructors reaches into nearly every community to assist in the initiation and development of the instructional programs. Many physical education and recreation leaders now have had instruction in college or through in-service education and are competent to teach shooting. In most instances, conservation departments have personnel available to assist in the preparation of local instructors and in some instances work directly with schools and colleges. The Sportsmen's Service Bureau of the Sporting Arms and Ammunition Manufacturers' Institute has excellent publications and provides some field service. The Daisy Manufacturing Company, through its Training Services Division, offers leadership and materials in the use of the air rifle. Other leaders are often available from sportsmen's clubs and industry.

Because of the extensive participation in shooting and hunting in the United States and since there are firearms in upwards of 25 million homes, shooting safety should be a part of the basic instruction in the public schools and opportunities for participation for those interested should be provided by the community. Like other community activities, this can be a cooperative venture between the school and other education and recreation agencies. Local safety councils, sportsmen's clubs, parent-teacher associations, and other civic organizations can do much to make shooting a safe and satisfying sport. It should be pointed out that the sport of shooting, through participation in shooting games, constitutes an activity which has great appeal and extensive participation for a wide range of age groups. The number of hunters each year constitutes another large group of citizens who seek wholesome outdoor recreation, many of whom need more instruction in shooting safety.

Since shooting is a legitimate and recog-

nized sport, and because of its opportunities for lifelong participation, shooting safety is finding its place in outdoor education. It is estimated by Marion Clawson that as the year 2000 approaches, ten times as many people will be participating in outdoor activities. Many millions of these outdoorsmen will use sporting arms for recreation. It is a challenge to the nation's educational system to develop outdoor minded citizens

who will find wholesome recreation and devote their efforts to the care and preservation of our natural resources which make outdoor recreation possible. Shooting, like many other activities, is an avenue to the out-of-door and outdoor education needs to provide the appreciation arts along with the skills in order that those who seek the open spaces may find maximum satisfactions in their endeavors.

SHOOTING SAFETY IN ORGANIZED YOUTH GROUPS

By FRANK L. WYMAN

Dir., Program Div., National Rifle Association of America, Washington, D. C.

Shooting safety in organized youth groups doesn't just happen—it's safety ever day. It is planned for and is the end product of continuous and constant effort. Some of this planning and effort is shown in the Outdoor Education Workshop project. It is through this type of educational work that we can reach the largest number of people at an impressionable age.

Undoubtedly, there were youth shooting groups many years prior to the 1920's, but it was at that time that the first major safety effort was made in such groups on a national scale. It was at that time that the well known Winchester Repeating Arms Co. organized the Winchester Junior Rifle Corps. As can well be imagined the response from young people was immediate, as it always is when the words "gun" or "shoot" are voiced around youngsters. In fact, the response was so great and in a field rather far removed from the actual manufacture of rifles and ammunition that the originator of the idea offered to turn the entire project over to the National Rifle Association, at that time a small organization.

The NRA accepted enthusiastically and set to work to teach both firearms marksmanship and safety to boys and girls. The Association's records were not too complete in those days, but reports indicate that it was not until 1931 that these youth shooting groups totaled over 200. Today there are 5,000 Junior NRA Rifle Clubs actively

engaged in a safety training and competition program.

These clubs have a membership of approximately 250,000 young men and women under 19 years of age. During the average 12 month period they will earn about 100,000 pieces of shooting qualification insignia, such as medals and brassards which are offered as an incentive to develop and to maintain the young person's interest through the program, as well as to attest to the winners shooting prowess.

This program has become popularly known as the NRA Junior Shooting Program and is conducted by volunteer leaders, and instructors in local communities. Frankly, the National Rifle Association is not financially able to furnish paid employees for a project with 250,000 eager participants and 53,000 trained instructors. This program to be successful relies on municipalities, schools, churches, business firms, luncheon clubs and adult shooting clubs to become group sponsors. Dedicated men and women are required to become the trained instructors. Without these sponsors and instructors this safety project could not carry on in the successful manner in which it is operating.

Many firms and individuals who are members of the National Safety Council are already actively engaged in shooting safety work. Every member can take part in some helpful manner. The town or city where

you live can assist with facilities through its park or recreation Department. Your business or employer can do likewise and hundreds have done so already, either because someone in management had a personal interest in shooting or because an employee or business associate called attention to the need. Your schools, churches and clubs all should have this good work called to their attention, not only from the safety training aspect, but also as a recreation which appeals to all boys and to many girls.

Shooting occupies an enviable position in the safety training field because it is an enjoyable sport which can be, and is, participated in on an equal level by both sexes and most age groups. Furthermore, it can be enjoyed as a family recreation feature to a degree seldom found in an active outdoor sport. The family recreation feature has been attractive to many industrial recreation departments as an assist to them in their personnel relations. The National Industrial Recreation Association membership is active in support of a marksmanship and safety training program.

I have spoken previously of the need for range facilities which many municipalities, business firms and clubs are helping to solve. Shooting to many of us brings up visions of large areas being required for one sole purpose—to be closed for everything except use as a shooting area. True, some types of shooting do require extensive real estate, but I am happy to say that the types we are concerned with today do not.

The youth shooting program concerns itself with nothing larger than 22 caliber and usually the firing is indoors, or on outdoor ranges confined to comparable distances to those used indoors which is 50 feet from shooter to target. Sometimes even this short distance may not be available in a convenient, comfortable location and when that occurs there are parallel programs at 25 feet with low-power CO₂ gas rifles and at 15 feet with spring type air guns. The same safety training can be accomplished at 25 and 15 feet with the appropriate guns as is accomplished at 50 feet with the more familiar and commonly known 22s.

More about range locations. Many ranges for the types of firing we have mentioned are so located that they use an area for

shooting which at other times is actively used for an entirely different purpose. For instance, a school gym is a desirable spot. A club auditorium can quickly be made into a satisfactory, safe range, and as quickly returned to its status as an auditorium. This comes about through using the available space for 25 or 15 foot shooting or by building the backstop for 22 caliber firing on a platform, which is equipped with catters. Thus, the backstop is pushed into position for range use and easily moved into its storage space when the area is not being devoted to shooting. Many such ranges are in daily use and more are being built.

Outdoor ranges are frequently equipped with a low shelf under which the rifles remain at all times, even while being fired. Due to the low shelf the rare bullet which would not hit the backstop will be contained in the wood from which the shelf is made. A range such as this is well adapted to park areas and has been used during the last two Boy Scout National Jamborees, which by the way presented the opportunity to give firearms safety instruction to 53,000 Scouts who chose rifle instruction as one of the elective sports they wished to take part in.

As you have no doubt gathered rifle shooting as a sport and safety training project is very much of a group activity. This is most desirable for our purpose of safety training. An instructor can supervise several young people while they shoot with little more work than required to supervise a single boy or girl. Competitive shooting is an ideal sport where those taking part learn much beside how to shoot safely and well. Through observing others a youngster learns many correct shooting habits. They learn cooperation with their teammates, how to observe the habits of others and correct faults quickly and efficiently. They learn that careful and precise handling of equipment is necessary for good work to result—and all the while they learn more about "Safety."

In order to spread safety instruction among organized youth groups to the greatest extent close work is carried on with many other national associations. A natural bond exists between the NRA and the Boy Scouts of America. One of their merit badges is for rifle shooting and here

the safe handling of firearms is a very large and important part of the work each Scout completes to earn this award.

A series of annual postal type competitions is conducted in cooperation with several national associations, including the Boy Scouts, the Veterans of Foreign Wars, the American Legion, the YMCA, and the DeMolay. Several of these names may come as a surprise, but through them shooting safety instruction reaches a new audience, one of youngsters who might not otherwise have been exposed to firearms safety training.

Each Fall season is heralded by both the beautiful autumn leaves and a rash of newspaper stories on accidents to hunters. Close scrutiny of these articles may disclose that the unfortunate victim died from a cause far removed from a firearm, but the fact does remain that there are too many unsafe hunters going into the fields and woods.

A little more than ten years ago the State of New York, through its conservation department, came to the NRA for help in connection with its problem of too many hunting accidents. That state had already used its splendid corps of game wardens in an effort to give safe hunting instruction to young people who were applying for their first hunting license. Their game wardens were literally swamped with applicants for instruction and many more trained, qualified instructors were needed, and the instruction material for this special work was also needed. NRA contacted its affiliated clubs in New York who furnished hundreds of instructors the first year and thousands later. In cooperation with our good friends in the National Education Association the needed material was prepared, both to teach proper instruction techniques to instructors and to teach the hunters themselves. From a small beginning with only one state in the program, the now nationally known and accepted NRA Hunter Safety Training Program has expanded until at present 31 states are using it, plus one Canadian

province, and more are being added each year. There is not a state in the nation where hunter safety instruction is not available, either as a state project or by individuals dedicated to the work. Millions of pieces of literature, such as manuals, examinations, safe hunter identification cards and insignia, and safety posters have been distributed in this campaign for safety. The effectiveness of the campaign, in face of a major increase each year in the number of hunters going into the field, is shown by the many words of praise received from conservation departments. For example, the Washington State Fish and Game Department recently stated "In Washington it is very apparent that the activities in the field of hunting safety have accomplished their primary purpose . . . there has been a definite reduction of fatal accidents . . ." Other states have made similar statements in their official reports.

Many times this afternoon you must have noticed that I mention marksmanship training either with or closely akin to safety training. I assure you this was not a mistake. When either a young person or adult is instructed in rifle marksmanship a large part of that instruction deals directly with safety. An expert marksman is usually a safe person with a firearm for he, or she, has handled firearms sufficiently to almost subconsciously take safety precautions which have been learned through hours spent in instruction, practice and competition. Therefore, it is not a mistake to mix marksmanship and safety instruction—they go together naturally. An expert driver usually is a safe car handler and an expert swimmer usually is super safety conscious for both himself and others.

As said before, each of you, each of your business firms, your churches, lodges, luncheon clubs and kindred groups, as individuals and as organizations can take an active part in the program to offer even more education on shooting safety through organized youth groups—the National Rifle Association of America will be glad to tell you how.

CAMPING AND SURVIVAL

By FRANK MENTZER

Editor & Publisher, Family Camping Magazine, Philadelphia, Pa.

For a good many years, our family has enjoyed living during our vacations under what many people might consider to be hardship conditions. We have enjoyed living under canvas, without all the niceties of home. We find it a pleasure to be without television. There is a relief to be away from the jangling of the telephone. And there are many compensations for the inconvenience of a pit toilet, for the trouble of having to tote your water from a central supply.

Over the years we have discovered that no matter where we go we always arrange our gear in just about the same way. Thus, everywhere we go our camp has a feeling of sameness, of being at home.

The gear that has given us so many pleasant vacation trips and happy weekends, receives loving care. We have developed the habit of maintaining and storing it so that it is always ready for an unexpected opportunity to go camping.

Packing the family station wagon has fallen into a routine; each item has its place, predetermined by experience.

Now, suppose war does come again into our lives. Suppose the order is given to evacuate that section of Pennsylvania in which we live. As a typical camping family, just how are we better trained and equipped for survival?

First, because we have been training to operate under "adverse conditions", we could pack our gear into our wagon and be on our way in 30 minutes. Upon arrival at the evacuation zone, we could set-up in less than an hour—completely prepared, equipped and trained to live under these conditions for an indefinite period of time.

In contrast, can you imagine the pandemonium that would reign in the homes of my neighbors, none of whom are campers? For that matter, how long would it take your family to evacuate? When you arrived at the safety zone, what would you do?

One of the many conditions that are mentioned in every discussion of civil defense is the probability that the family will be

separated at the time an unexpected attack occurs.

Here again, the camping family is better equipped and trained for survival. Because of the teamwork involved in setting-up and breaking camp, every member of the family knows not only what he or she is expected to do, but could also take over for a missing or disabled member.

We are hearing and reading a great deal about fallout shelters these anxious days. Concrete shelters, steel shelters, indoor shelters, outdoor shelters. What to put in them; what to leave out.

But have you read one word about how to live together in such a confined space?

Last August we camped with three days of continuous rain. We learned that two adults and two active children can live together in confined quarters and under adverse conditions. It is possible, we admit, that we did not learn this lesson as well as we could have, for by the end of the third day we were all a little edgy.

If we are ever forced to seek refuge in a fallout shelter, we will be better prepared to survive because we know what many of the pitfalls are and, I hope, how to avoid them.

What I have just said about the ability of the camping family to survive is based on my own family. I know our own situation best. But what I have said is just as true of most every other camping family. We will all differ in degrees—but we are all trained and equipped for survival as family groups.

None of us kid ourselves into thinking that life under emergency conditions will be anything like vacation camping. But the transition will be easier for us than for our non-camping neighbors.

I am not "some kind of a nut, or something." I do not preach the gospel of doom and gloom. On the contrary, I am the eternal optimist. I honestly do not believe that I will ever load my camping gear into my

station wagon for any reason other than a pleasure trip.

But if I am wrong, our family will move out with the efficiency and confidence learned through camping for the fun of it.

And we will be able to lend help and guidance to a mass of people who will be floundering in a sea of confusion.

Today, survival is mentioned primarily in connection with nuclear blasts. But there are other catastrophes—that families, communities and a nation—must be prepared to survive. In all of these, I believe, the family that camps together has the best chance for survival, and makes the greater contribution to the future of our nation.

SAFEGUARDS FOR BIG CROWDS AT AMUSEMENT PARKS AND FAIRS

By AULTON D. MULLENDORE

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The subject of public safety, as it relates to crowds at amusement parks and fairs, is something I am sure many of you have not thought much about. This lack of interest may be explained by the fact few of you are directly responsible for safety of persons gathered at amusement parks and fairs.

How long has it been since you attended an amusement park or a fair? I am sure it has not been very long; most of us have either had a personal urge or have been urged to attend such events by members of our families. If you have not attended such an event, it probably will not be long until you will have had the opportunity to do so.

If you have attended such an event, you should have been concerned with this aspect of public safety. I believe that any person, in any crowd, should be alert to any conditions which might conceivably produce an emergency and a resulting panic.

Think with me for just a moment about this problem in order that we may put it into proper perspective. I have tried to estimate the number of persons annually exposed in crowds, at amusement parks, beaches and fairs throughout this country. The only conclusion I can reach is that the total annual attendance far exceeds the total population of the United States. This is certainly an astounding figure and it is a foregone conclusion that, if this be the case, such crowds pose one of the greatest public safety problems we have in these United

States. We must be alert to the fact that crowds in amusement centers are becoming larger. As more leisure time is developed, more of it will be spent at amusement centers. People will seek out such places of amusement as a means of relaxation and escape from the routines of work and normal living.

To help get this problem into perspective, let me elaborate. There are approximately 300 cities with a population of more than 100,000, and there are over 3,000 counties in the 50 states, all of which are constantly promoting, arranging and causing crowds to gather at public places.

All of the major, and many of the minor, cities in the United States boast of having one or more amusement centers, either privately or publicly owned. Each year the season usually begins with Memorial Day and runs for at least three months, ending with Labor Day, so you can see most of these places of amusement operate at least one quarter of the year on a seven day per week basis. Many of them, in areas of moderate climate, are open on a longer schedule. Places like Disneyland, and the state fair grounds in Dallas are open for longer operating seasons. Furthermore, keep in mind that practically all of our states hold some kind of state fair, and a large majority of the counties within these states conduct fairs.

You may be saying that these are not crowd exposures because people are not grouped in confined areas, but let me re-

mind you that at all of these amusement parks and fairs, there are special events which are repeated, sometimes nightly. I refer to events such as rodeos, horse races, stock car races, fireworks exhibitions, prize fights, ice shows, horse shows, ball games, political rallies, dance halls, roller skating rinks, restaurants, boat races and excursions, musical concerts and drama programs. Also, there are many amusement devices which carry dozens, and sometimes hundreds, such as roller coasters, miniature trains, ferris wheels, and the like. Readily, we see that the problem of group exposure at such events in the United States is something for us to be concerned about. So let us become aware of this exposure and properly control such crowds in order to prevent catastrophes.

Many companies annually plan group picnics and excursions which crowd employees into places of amusement in numbers sometimes in excess of the building or area capacity. They crowd into amusement devices to the point of overloading. A few years ago, at a mid-western park, a miniature train was upset when a rowdy group of picnickers over-loaded and began swaying and rocking the ride excessively. Dozens of riders were injured. Let us be aware of this type of exposure, and continue to set up controls in accordance with the purpose of our profession as safety engineers, police, security officials, etc.

Let me pause here to pay tribute to the individual owners and operators of amusement parks, pools and beaches. This group of responsible businessmen and women have long been concerned with the safety of their patrons, and with few exceptions, have provided adequately for the public's safety. The National Association of Amusement Parks, Pools and Beaches, with headquarters here in Chicago, is doing an outstanding job of promoting safety among its many hundreds of members throughout the United States. In spite of the fact that each year, millions upon millions of persons assemble in groups at amusement parks and fairs on an almost daily schedule, none of our country's major catastrophes or holocausts have occurred at such places. This segment of American amusement industry is indeed to be commended for this accomplishment.

You may ask then, why should crowds

at amusement parks and fairs be considered a special problem? Why separate these from crowds at professional football and basketball games? Isn't the hazard the same? The difference is that crowds at major ball games are generally larger and of necessity require and get special handling. Millions of dollars have been spent, in a well planned program of permanent buildings designed and constructed to provide safety for these groups.

Crowds at amusement parks and fairs often gather in buildings which were not originally designed for public occupancy. Sometimes these buildings are conversions and do not possess the same safety standard which would be required today for new construction. Building and electrical codes were not in existence or were not enforced when these structures were built. The original design and construction might not have contemplated their use as a place for public assembly. Some of these buildings may have inadequate exits, sub-standard lighting, and in many cases no emergency ventilation, may be built of combustible materials, and may have weak foundation structures susceptible to collapse under heavy loads.

I might add that all too often these combustible materials are made more hazardous because of the addition of non-flameproofed drapes, bunting, billboards, and other decorative or advertising materials. Oftentimes, the addition of such materials cuts down and reduces the number of exit units. The famous Coconut Grove Night Club fire in Boston in 1942, where 492 persons were burned to death is an example which illustrates this point.

In speaking of collapse, I am sure that you have seen a parade, a political rally, or a sports event, which called for the erection of temporary stands or bleachers. All too often, these stands or bleachers, because they are temporary, are not properly constructed. Footings are not secure, bracing may be inadequate and the quality of materials used is not commensurate with load requirements. There have been repeated instances of catastrophes where grandstands have collapsed, seriously injuring dozens of people. The best example of this was the collapse of stands at Baltimore Regiment Army in March, 1952, in

which 29 persons were injured while watching an ice show. A more recent incident was the collapse of a viewer's stand at the Indianapolis auto races in May of last year. Two died and scores were injured.

A few moments ago I mentioned non-flameproofed materials. This brings to mind one of the greatest catastrophes in the country's history. It did not involve an amusement park or fair, but it was a place of amusement. I refer to the circus fire which occurred in Hartford, Conn., in 1944 in which 168 persons were burned to death when a big-top tent was completely destroyed by fire.

Tents are a continuing problem at places of amusement, especially fairs, because smaller tents are often used as a temporary structure to house crowds. Occasionally, we find them at amusement parks. Tents are always a fire hazard unless they have been properly flameproofed, and occasionally, they pose a problem from the standpoint of collapse due to sudden wind gusts.

I also referred, a few minutes ago, to buildings not having proper ventilation. I am sure you are wondering why this should be a concern of ours when thinking about the public's safety. Over-crowded, poorly ventilated buildings, or areas can conceivably cause panic, and panic as you know, often causes injury. Let me cite you a couple of instances; one back in 1936, and another one within the last year or so.

In 1936 when Texas was celebrating its centennial, thousands of public school children were transported and gathered at the Cotton Bowl to witness and participate in the celebration. They were gathered to sing patriotic songs commemorating this great event. It was a hot, still, sunny day when these thousands of children were gathered on the playing field and in the stands. The stated objective was to crowd as many persons as possible into this place because great numbers would be impressive. You know, they like to do things big in Texas.

Suddenly, without any forwarning, dozens and dozens of these children began to faint, collapse, and fall because of extreme heat, excitement, and the crowded condition. The shape of the Cotton Bowl, together with the existing weather conditions and the immense crowd brought about a situa-

tion which caused the children to lose consciousness and you can well imagine how serious such an emergency could become, as panic ensued.

One would think that such a place, would have natural ventilation at all times, because it is open. Here was an emergency created because of the lack of proper ventilation, even in an outdoor area. Properly ventilating the Cotton Bowl, under similar conditions, would have been almost an impossibility. The control of such situations obviously is in proper planning and supervision for such large crowds. Potential emergencies must be anticipated and planned for; in so doing, they are prevented.

I should like to bring another incident to your attention. It occurred a couple of years ago in a mid-western state and received a considerable amount of national publicity. At a basketball game, in a public school gymnasium, the school buses were parked near the building air intake vent; during the course of the game, the engines of the buses were permitted to run in order to keep the buses warm. The exhaust from the buses was drawn inside the ventilating system. Many people inside the Gymnasium were overcome by carbon monoxide. Naturally, confusion and near panic ensued. I cite these instances to show you how remote the cause of a catastrophe or panic can be. I cite them also to emphasize the point that any time you have a crowd of people together, you have a problem with reference to public safety.

We usually think in terms of Public Safety as it relates to fires. As we all know, it is certainly one of the primary factors to be considered when crowds of people are assembled; but, as you can see, these are not the only factors to be considered. Any conceivable emergency which might cause panic, should be anticipated and procedures put in force to deal with it, just in case it develops. Panic, which develops within a crowd of people, is a horrible and often a catastrophic experience. Therefore, panic control is fundamental and basic in handling crowds.

Whether the location is owned by an individual, a municipality, county or state, it is always important to see that one person, or better still, a committee of persons is assigned and given the responsibility

for public safety. All too often, events are planned, publicity arranged, and large crowds are expected to gather without anyone in particular giving thought, or being concerned about the safety of the people. You may say, well, that is everybody's business. I agree with you, and I am one who believes that everyone should be concerned, not only with his own safety, but the safety of all the members of the public.

However, being concerned is not like being responsible. There must be someone, or some committee, assigned and held responsible for the public's safety. Even though we'd like for everyone to be concerned, we cannot escape the fact that the nation, "that which is everybody's business, is nobody's business," still applies. Someone must be in charge of safety and be held responsible.

Your local police and firemen are always available to consult with you and help you plan such events. Building inspectors, employed by municipalities, can advise you concerning exit codes, building floor load requirements, wiring, and ventilating requirements. Your fire marshal or chief can give you advice on flame-proofing materials, and setting up permanent as well as emergency fire fighting equipment.

He will assist you in training your employees in handling emergency situations. For most events, local and state police are available for on duty assistance if they are called upon. Stand-by firemen are likewise available and often render valuable service. If public police and firemen are unavailable in your area, you can designate and train your own employees to carry out certain functions in the event of an emergency.

Advanced safety planning is absolutely essential where crowds gather. Days before the crowd assembles, those responsible should inspect the area, checking exits, using the national building exits code as a guide, because this is generally the accepted standard throughout the country. Any de-

fective wiring should be removed and any new wiring needed for the performance should conform with the local and national electric codes. It is important to see that emergency lighting is installed to take care of any kind of temporary disablement of the regular system.

This inspection should involve all of the seating arrangements, making certain there is no collapse hazard and that there will be no overcrowding in the event it becomes necessary to evacuate the place. Competent technicians should check out the heating and ventilating systems for defects and adequacy. Adequate fire extinguishers should be available and those responsible should be familiar with their location and method of use.

Finally, management should review what has been done by the safety committee, making sure that there is nothing in existence which is likely to cause an emergency. These plans should involve details of what each usher, watchman or other employee will do in the event an emergency develops.

So, in summary, I might point out that there are several major causes for catastrophes and panic when you have crowds gathered. They are fire, collapse of structures, poor ventilation, and overcrowding of places of assembly and amusement devices. The three points I want to give you for control of these hazards are:

1. Place the responsibility for public safety upon an individual or a committee.
2. Secure the help of all public agencies such as police and firemen; appoint or hire additional help to handle the crowd if needed.
3. Days before the crowd assembles, management should make a complete inspection of the premises, checking lighting, structure of buildings, heating, ventilating, and fire hazards; make sure there are adequate controls established to take care of any emergency; check also to see that all known hazards have been removed.

I conclude with this admonition, plan *not* to have an emergency, but also plan to have one.

WHEN INDUSTRY HAS A SERIOUS EMERGENCY, WHAT IS THE PUBLIC'S JOB?

By HENRY E. WEBB, JR.

Safety Dir., Nitro Plant, Monsanto Chemical Corp., Nitro, W. Va.

The public's job is to assist in the containment of an emergency and in an orderly return to normal operations. To understand this job, we must have the answers to several questions.

1. Who is industry?
2. Who is the public?
3. What is a serious emergency?
4. How does industry plan for the containment of an emergency?
5. How is the public included in such plans?
6. Who is responsible for coordinating the public's effort?

Who is industry? Industry is a plant or a group of plants. Within the term "plant" we have first of all the people that are engaged in the operation of the plant, whether they are on the actual property or away from the plant, so long as they owe their livelihood to the proper operation of the specific plant. The real estate enclosed by a fence is a part of the plant. The buildings and the equipment therein are parts of the plant. A particular plant may be a portion of a totally industrial community or it may be a part of an industrial-business community or it may be a part of an industrial, business, or residential community.

Who is the public? The public is composed of people, property and equipment within a given area. There may be an overlapping as in the first instance where the public may comprise a community which has a plant or business or residential area, any one of which may be an exclusive member of a public community. In addition, we will certainly find other elements of community life such as organizations whose purpose is to protect the common good, the fire department and the police department. Educational institutions, churches, hospitals, libraries and other plants whose purpose is to assure community members of a well-rounded life, generally, complete the total community.

There is considerable overlap in the terms industry and public. If we consider our people, we find that they are of one industrial community and may be a member of still another "public" community. A person's allegiance and interest most certainly are governed by his own residence. His reactions to a situation which will involve his family will be more acute than to a situation that is remote to the well being of his own family.

For the family of the individual in the plant, their concern about the safety of other individuals in a plant where their breadwinner is not a member is of a lesser degree than the plant where he spends his working day. The whole of a specific community whether it be totally industrial, residential, business, or if it be any combination of these, must be examined very closely to determine where one ends and the other one begins.

Now let us examine question three. What is a serious emergency? In our industrial environment almost routine plans for the handling of an emergency are developed. In the chemical industry for example, one must assume that certain things may go wrong with an operation. Therefore, means are provided to care for an unusual occurrence. A sudden pressure rise in a reaction may be compensated for by an over-pressure device on the reactor or by cooling or by a combination of the two.

One step further, if a reactor's contents exceeds these control measures and a material is released which is flammable and which catches fire, an emergency beyond the initial scope of the safeguard is encountered. This emergency may be countered by sprinkler systems or by other methods to extinguish the fire.

Suppose a fire which exceeds the ability of the extinguishing agents occurs, then there are measures such as diking and hold-up ponds as another line of defense. If the entire reaction occurred in such a rapid fashion as to spread large amounts

of flammable materials over a wide area completely beyond the scope of sprinklers and ponds, there is the plant fire organization which becomes effective, and we border on a serious emergency.

This emergency may or may not be within the ability of the plant to contain. It may endanger adjacent operations which in turn can create even more serious problems. If the material which is burning and which has threatened the surrounding plant area also gives off toxic vapors, the entire plant is then threatened and if the plant is adjacent to a residential or business community we have a threat to the "public." Since there is a threat to the "public" and it has been recognized, most plants have plans for the containment of serious emergencies.

In one area it may involve only the operation of adjacent industrial organizations. In another it may involve a total industrial-business-residential area. The Kanawha Valley may be considered as an example of such a heterogeneous community and an example of how industry plans for the containment of an emergency. So, question four is best answered by a description of the Kanawha Valley Industrial Emergency Planning Council.

The KVIEPC includes the area along the Kanawha River from Gaudy Bridge to Nitro, a distance of about 60 miles, and from Charleston north along the Elk River to Clay, a distance of about 43 miles. High hills border these rivers and limit the size and number of ways in and out of the greater Kanawha Valley. These limiting factors were emphasized during a serious plant emergency when aid to the stricken plant was delayed because of heavy traffic that included many sightseers.

Following this incident members of industry met and developed the Kanawha Valley Industrial Emergency Plan which was approved on May 21, 1952. Refinements of the Traffic Diversion Plan and expansion of the Emergency Plan's scope followed. The name of the mutual aid group was changed to the present one but the objectives remained as they are today. The valley is particularly heavily industrialized from Belle to Nitro. In the KVIEPC we have 34 members and 31 associate members, 100 per cent of the eligible groups.

The objectives of the KVIEPC are eight-fold:

(1) To establish a well-coordinated and practical long range plan for handling industrial emergencies in the Kanawha Valley.

(2) To build public confidence in and understanding of how to cooperate with established industrial and utility emergency procedures.

(3) To insure cooperation with municipal, county and state agencies to the same extent that the public may be involved or affected by industrial emergencies.

(4) To encourage self-sufficiency in each industrial plant and utility installation with material assistance from others within set limits.

(5) To establish an organization of Kanawha Valley industries and utilities in order to facilitate cooperative action to any degree in event of an all-out emergency (conflagration, sabotage or enemy action).

(6) To set the stage for appropriate evaluation of potential industrial emergencies and appraisal of the adequacy of available materials and manpower to cope with foreseeable emergencies.

(7) To improve techniques and facilities for emergency control through:

a. Application of available manpower and facilities more effectively, and

b. Supplementing protection within practical limitations.

(8) To cooperate fully with national efforts to safeguard industrial plants and their utilities in order to insure continuity of production in peace and war.

Each organization sends to the council at least one official representative and one alternate. The council is responsible to the managements of the participating industries and utilities. The council elects a president, vice-president, and board-of-directors all of whom serve for one year. The president and vice-president serve as chairman and vice-chairman, respectively, of the board of directors. All past chairmen of the board will serve as ex-officio members to the board.

Board-of-director members serve as chairmen of the standing committees of KVIEPC. These committees are: communications, fire protection, materials assistance, medical and welfare, membership and by-laws, program,

public relations, risk evaluation, security and traffic.

Other officers of the council are secretary and treasurer.

The "grits" of KVIEPC is our traffic diversion plan. Zones have been established and all police agencies in each zone have cooperated to work out methods of diverting traffic from the disaster scene and at the same time pass through roadblocks the aid needed at the stricken area. This plan is tested continually by dry runs and revised as the need is observed.

Frequently one or more plants in a given zone will simulate a serious emergency in order to test other facets of the mutual aid plan.

It is well to emphasize that there is no magic number that activates KVIEPC. KVIEPC is a method of operation, a way of cooperation, a simple policy of good neighborliness. When a plant has an emergency that threatens to become serious, an authorized representative of management will call that state police nearest their plant. He will state that an emergency exists and request that the traffic diversion plan for his area be activated.

If assistance in the form of material, manpower or a combination of these is required, it is requested by the involved plant who calls direct to a member organization for the aid needed. (Our KVIEPC has been alerted and has rendered assistance in the "natural" disasters that have afflicted the communities within the scope of our operations since the inception of the plan.)

Question five. Within the KVIEPC the total public is included. The plan as outlined has as members all of the individuals who either manufacture or handle dangerous materials or who find themselves giving service to such industry or who are themselves concerned with the preservation of life and property.

Civil defense plays an increasing part in the containment of emergencies whether they be natural, industrial or caused by enemy action. Civil defense in a well-organized sense is largely accomplished by existing officers of a community who simply swap hats when the need arises. Possibly the largest segment of the non-industrial public finds its place in industry's plans for the containment of an emergency in or-

ganizations such as the Red Cross, Salvation Army, civil defense auxiliaries, and fire and police auxiliaries.

The responsibility for coordinating the public's effort, in answer to question six, is the responsibility of the duly elected public servants, whether the public consists totally of a residential community, or of a residential, business community, or even if industry is included within the boundaries of such community. It is his job to make certain that through all avenues of communication, people are advised of the emergency that exists and are instructed as to how they might best aid in returning the situation to normal.

It is his responsibility through his department of public safety to see that committees and sub-committees in whatever degree necessary are formed and that the work of traffic control, of the control of people in and out of the area in private and other vehicles is determined; that evacuation routes for the general public have been established; that emergency supplies in the kind and amount needed as dictated by the community's character have been established; and that his plans have been tested through dry runs to a point where he can expect that the general reaction, when the emergency alarm is given, will be carried out along pre-determined lines.

Since industrial emergencies can involve a total community and because such events may be caused by natural forces and considering that the total community may have developed after the industrial start, we must concern ourselves with moral rather than legalistic values.

In an area where a mutual aid plan exists, is tested and working, the public job is largely one of considered cooperation. Where no plan exists the previously outlined one can be made to work.

First, a traffic plan must be developed. It must be tested to detect and eliminate the bugs in it. The best plan in the world is no good if shelved after its conception. Some communities have developed wonderfully comprehensive plans but have done nothing to implement them and when disaster has hit a tremendous loss of life and property has occurred.

Second, a risk evaluation group must be organized to assess the needs of a particu-

lar area. From this group will be developed lines of communication and other functions necessary for the preservation of life and property.

Third, the plan must be widely publicized. Everyone in the community must know that a plan exists. Everyone must know the responsibility that he has to the community in which he resides. Everyone must cooperate in the plans and tests to the degree that he is involved, be it to stay at home and listen to the radio or for a phone call, or to follow a diverted traffic, or to come to an assembly area for assignment.

The "five knows" of emergency planning that have been developed by KVIEPC apply to any mutual aid effort. They indicate again, public's part in planning and aiding to restore normal operations after an emergency has been dealt with.

(1) Know Your Hazards

To prevent an accident, to avoid an emergency, requires that one must recognize a hazard. Whether we are part of an industrial plant or a "communal plant" we must be able to pinpoint the type of emergency that we might encounter. The range of emergencies is wide. It might be something as personal as a heart attack, insulin shock, heat stroke and the like. It may be something as unexpected as the flash flood that claimed twelve lives this past July in our Kanawha Valley.

It might be fire, explosion, mechanical failure, inadvertent release of air or water contaminants, even toxic gas or radiological exposure.

Hurricane, tornado, earthquake or war-time are but a few more of the problems that confront one who is "hazard hunting."

It is a tribute to man that he can handle hazardous materials safely; that he can perform hazardous tasks safely. We seldom hear of an electrician being electrocuted, or a trained deep-sea diver drowning, or a "powder man" blowing himself up. The outstanding record of the Atomic Energy Commission and the various space age agencies is example enough that knowing your hazards will minimize the potential for accidents and the development of emergencies.

(2) Know Your Facilities

As a member of the chemical industry, I can vouch for the need for good plant layout, proper arrangement and specifica-

tions for equipment and machinery, prescription of adequate protective equipment with full recognition of hazards inherent in the process. We must know the limitation of our facilities if we are to combat accidents. We must be aware of the consequences of the loss of our protection devices and instrumentation, loss of control and loss of manpower who are in position to take emergency action.

(3) Know Your People

Risk evaluation such as those made by insurance engineers involve pinpointing of hazards and their potential to inflict harm to people and damage to facilities. The estimates of these hazards and their effect determines premium rates. This illustrates that no matter what we do, how we do it or where we do it, the common denominator in all of our thoughts and calculations is people. The insurance engineer's evaluation; the research engineer's project; the chemical engineer's pilot plant.

We depend upon the manufacturer of railway tank cars, of pressure vessels, or an atomic reactor to make these items with "built-in" safety factors. We have to depend upon the pilot of an airplane, the driver of a car or a chemical plant operator to take the prompt, proper action when danger appears.

We can develop, communicate and completely understand information concerning potential hazards and limitations of facilities, but if we have no plan of action, very little will be accomplished. Knowing our people means knowledge of ability to apply the emergency plan. People must have a willingness to cooperate and be motivated by opportunities to drill and test themselves.

We possess five senses: seeing, smelling, tasting, hearing and feeling. Every one is essential to accident prevention and disaster control. Even these will not produce the results we want and need if attitude is wrong. If mutual aid is to work, then the attitude of the managements concerned must exemplify the willingness to cooperate as a good neighbor. The plant or community that seeks help through mutual aid must be willing to give help in return. The principle of self-sufficiency must prevail to the maximum.

Government agencies and authorities and private agencies concerned with the protection of life and property must eliminate

political bias and genuinely cooperate to seek a common plan for emergency action.

(4) Know Your Community

In an industrial sense community relations are affected by an industrial emergency. In a "communal" sense industry is affected by a "public" emergency. For instance, an auto smashes a power line and shuts down the community including industrial operations. A train derailed and spills flammable, toxic material into a tank farm. A large supermarket is closed, a leak in a gas main occurs, an explosion throws flaming debris throughout the "communal" and industrial community.

From past experience we can predict what an uninformed "public" will do in each specific emergency situation. If you don't believe me, read Donald Robinson's *The Face of Disaster*. He has compiled an excellent bibliography of re-search in "disaster behavior."

An informed "public," a "public" with a tested mutual aid plan that carries assurance for those who might panic and discipline for the curiosity seekers is the sort of "public" that we are discussing today and working toward achieving tomorrow.

Knowing your community means fulfilling a moral responsibility to do one's part in a community concept of emergency planning and disaster control. The introduction of the fire chief to the plant emergency on the evening of a fire makes no sense. The change in a traffic pattern that might affect emergency mutual aid to a plant will not be recognized as a hazard unless police authorities are aware of their part in the overall plan. The Salvation Army, Red Cross, members of the press cannot be expected to perform their services without guidance of those who know conditions and potential dangers. The director of civil defense should not have to dictate emergency orders involving hazardous conditions beyond his technical abilities to recognize and control.

(5) Know Your Plan

Howard Minckler, director of manufacturing of the Organic Chemicals Div., Monsanto Chemical Co., speaking at the Fourth Annual Industrial Mutual Aid and Disaster Control Conference at Cincinnati, May, 1960, said while discussing mutual aid, "The point I want to make is that the road to

preparedness begins at home. We have to make the effort to stand on our own two feet before we can expect others to join us. . . . We must make detailed plans to avoid the risk of being unprepared to meet these responsibilities."

Your plan has to be designed to meet the specific and unique needs of your industry, your community, your topography, your people. A single point of authority is desirable for planning and must be strived towards in serious emergency though the pitfalls to such an achievement are many.

In the Kanawha Valley, we speak of a cooperative authority and a procedure that brings together the leadership necessary to cope with a given set of conditions.

You have heard of the title "Emergency Director." It has been used many times. I tell you there ain't no such animal. We do not direct emergencies or disasters. The chaos resulting from an emergency dictates the requirements for control.

If your house is on fire, you have called the fire department and you direct the chief to the scene of the fire and give him information about what's burning, location, etc. The fire chief determines what sort of equipment is necessary to extinguish the fire and to protect adjacent structures from exposure. Prompt-arriving police determine who comes into the fire area and is available to obtain aid such as medical or additional fire equipment. The need dictates and directs the action.

A traffic diversion and control plan is of the utmost importance. We must be assured that emergency aid in any form can be called for and can get to a stricken plant, quickly. Also, the problem of evacuation, clearance of the injured to hospitals is of equal importance. A master plan for cooperative action between fire departments in a specific area is fundamental.

At one plant in the Kanawha Valley eight fire companies from six municipalities worked successfully in a team operation to provide water for fire fighting at a chemical plant which lost its own protection because of an explosion. Now the fire services are in the best position to solve their own problems but it is up to those depending on the fire service to let them know what these potential problems might be.

A good basic medical plan including rescue and first aid at the scene in cooperation with fire and police services and planned usage of local hospitals are practical parts of any plan for disaster control.

Material assistance is a well-understood term in mutual aid circles. But unless there is a registry and procedure to ask for specific assistance in an emergency there will be no guarantee that the mutual aid will be efficient or effective.

Your plan should start with your personal

I. Who is industry?

II. Who is the public?

III. What is a serious emergency?

IV. How does industry plan for the containment of an emergency?

V. How is the public included in such plans?

VI. Who is responsible for coordinating the public?

Appendix

Emergency exercises are practiced in earnest. Our folks know that an incident could occur which would call upon all their skills. That might sorely tax their ability to act reflexively—to do the right thing at the proper time. There is a minimum of joking and kidding during these tests. Occasionally, someone is doused by a water hose or showered with foam as the simulated fire fighting activities are carried out. Such things are accepted with good grace. Once in a while a really hefty "victim" is chosen and then we have many comments from the litter bearers.

In 1957, the National Association of Manufacturers visited Charleston, West Virginia, and made a film about the Kanawha Valley Industrial Emergency Planning Council. A copy of this film may be borrowed from the NVEPC, or from the West Virginia Safety Council, 808 Nelson Building, Charleston, W. Va.

Last year Monsanto was the scene of one of the many drills that are conducted to test in-plant plans as well as several facets of the mutual aid plan.

Community Mutual Aid

The Five "Knows"

- I. Hazards—Fire, Explosion, Electric Shock, Toxic gas
 1. Gas lines (other buried pipelines)
 2. Electric service (transmission lines, distribution systems)
 3. Transportation through city (Train, truck, pipe lines, air lines, boat)
 4. Flammables stored in area (Gasoline in service stations, autos, trucks, HOMES, stores)
 5. Adjacent industry (its threat potential)
- II. Facilities
 1. Homes and materials stored therein
 2. Business's such as Grocery, General Mer-

knowledge of "What you would do in case of fire." What is your building plan, area plan, plant-wide plan, the plan to seek outside aid? What are your ties with Civil Defense and the Red Cross?

In closing may I stress that people cause disasters and people restore conditions to normal. We can each do our part insofar as each of us knows his job and participates fully. To sum up, let's look once again at the original six questions and their answers as to what part the public plays when industry has a serious emergency.

People Property Equipment	Industrial Plant	Total Community	Industrial Residential Business Plant
People Property Equipment	Communal Plant		
One that threatens to involve a total industrial or communal plant.			
Plant emergency plans and mutual aid organization.			

Thru mutual aid, CD and/or other emergency service organizations.
Duly elected public officers with aid from business and industry management. A cooperative authority.

chandise, Dry, Exterminators, Hardware, etc.
other public buildings

III. People

Housewives, children at home, infirm and ill at home
School children
Business people
Professional persons
Artisans and craftsmen, etc.

IV. Community

Street layout: dead-end streets, width of streets, surface.
Business and residential distribution throughout community.
Building's size, type, construction, heating, ventilation access.
Schools, churches and other public building.

How protected when empty.

Police and Fire Protection

Mutual Aid

Civil Defense

V. Emergency Plan

Fire Drills—Evacuation Drills—RESCUE

DRILLS

Home

Schools, churches

Hospitals

Business buildings

Other public buildings

Methods of inspection—checking for flammable or toxic vapors—gas leaks (natural gas—oxygen—CO—CO—cleaning fluids, etc.)

Power failure—who affected, how.

Fuel supply failure—Protection, how.

WEATHER FORECASTING FOR BOATING SAFETY

By PAUL H. KUTSCHENREUTER

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THREE DROWN IN SUDDEN SQUALL—HEAVY SEAS CAPTIVE PLEASURE BOAT—COAST GUARD RESCUES SIX

How often have you seen similar headlines? What can be done—or could have been done—to prevent, or at least to lessen the number of such accidents? Know the weather!

The June 1961 issue of the *Ensign* includes a summary of the Coast Guard's tabulation of 3,790 recreational boating accidents reported in 1960. Of the 739 deaths resulting from accidents in pleasure craft, seven and one-half per cent were attributed directly to either weather or sea conditions. Of the 926 injuries, four per cent were attributed to weather and sea conditions.

Inadequate weather safety precautions, presumably by less experienced boatmen, during the calendar year 1960, then, resulted in nearly twice as many deaths as it did in injuries. It is extremely likely, also, that weather and sea conditions were contributing factors in an important percentage of the other causes such as excessive speed, unsafe loading, over-powering of the hull, inexperience, inattention, forgetfulness, and poor judgment.

Recognition of the importance of weather forecasting for safety of life at sea dates back to the very beginning of the United States Weather Bureau. A joint Congressional Resolution, HR 143, signed on February 9, 1870, created the first U. S. Government weather service. By this Resolution the Secretary of War was required to provide for taking meteorological observations and to provide information on the approach of storms on the northern lakes. These functions were assigned to the Signal Service of the U. S. Army, predecessor to the present U. S. Department of Commerce Weather Bureau.

Although the intent of this initial Resolution was to provide weather information for the safety of shipping on the Great Lakes, recreational boating has developed and grown to such an extent that the provision of information and warnings for

light pleasure boating is an important aspect of the Weather Bureau's service.

According to estimates made by the Outboard Boating Club of America and the National Association of Engine and Boat Manufacturers, in 1960 there were over eight million pleasure boats, including cabin cruisers, in operation throughout the U. S. seacoasts, Great Lakes and inland waterways. This is an increase of over a million pleasure boats since 1957. These organizations estimate that the number of individuals making at least two or more boating pleasure trips during 1960 is approximately 40,125,000. This large increase in the popularity of pleasure boating has created a problem of familiarizing the large number of new skippers with weather safety rules.

Weather Hazards

Of the weather factors affecting boating safety, the most important are: wind and waves, fog, lightning and heavy rain. Of these, wind and waves are by far of major importance. Fog and heavy rain are important primarily from the standpoint of reduced visibility which, in turn, makes navigation difficult. Except for fog, these weather hazards result mainly from thunderstorms, squalls, strong cold fronts, tornadoes over inland areas, deep mid-latitude storms, and tropical storms and hurricanes. In addition, there are the relatively infrequent but none the less very damaging seiches on the Great Lakes.

From the standpoint of weather-caused fatalities among pleasure boat enthusiasts, the sudden squall or thunderstorm tops the list. These frequently develop and move quite rapidly in otherwise fair weather conditions; their exact path and time of occurrence usually cannot be forecast very far in advance. The unwary skipper can thus easily be caught off guard and away from safe mooring.

Dollar-wise, the pleasure boat owner sustains the greatest loss from major mid-latitude storms, tropical storms and hurricanes. These are usually well-developed before

reaching our coastal sections, however, and it is generally possible for the Weather Bureau to issue warnings at least 16 to 24 hours in advance of their approach. Advisories in connection with such storms invariably include advice to small boat skippers not to venture too far from shore during the early stages of the storm; later, to seek shelter and safe mooring as the storm approaches.

For example, the advice issued in connection with Hurricane Carla, whose center passed over Port O'Connor on the Texas Coast on the late afternoon and evening of September 11, 1961, are an excellent example. As Carla moved through the Yucatan Channel on September 7, the Weather Bureau advisory broadcast shortly after 1:00 p.m. stated that Carla was a dangerous hurricane and that its force would soon be felt over most of the Gulf of Mexico. The same advisory also cautioned small craft from Sabine Pass, Texas, to the Florida Keys not to venture too far from port. This cautionary advice was later extended to include all Texas ports. As Carla approached the coast, boatmen were advised to seek shelter and safe mooring.

In many cases there isn't a really safe mooring in low lying coastal sections to the immediate right of the path of the hurricane center. Wind, tides and waves combine to tear boats loose from their moorings and convert them into veritable battering rams to destroy any structures in their path. The weather-wary skipper is well advised to complete precautionary mooring for maximum security well in advance of the onset of hurricane waves and tides and not to attempt to change moorings once hurricane waves and winds have set in.

While the experienced pleasure boat skipper generally recognizes and usually appreciates the importance of winds, waves and reduced visibility, the hazards of lightning are frequently overlooked. Actually, danger from lightning at sea has been recognized ever since the days of Ulysses. The English Navy lost many ships because lightning ran down the masts, caused fires aboard and sometimes punched holes in the hull. The use of a chain as a grounding device dates back to Captain Cook's Pacific expedition in 1768.

During a thunderstorm the operator of an outboard motor boat alone in open waters

is almost as inviting a target as a sailboat with its masts. This is equally true also for larger power boats with non-metallic hulls and especially for those with inadequately grounded electronic equipment. Especially vulnerable is the radio antenna; unless it is grounded directly to the water, this is a particularly lethal instrument in an electric storm. Without adequate grounding, the antenna should be lowered whenever a thunderstorm is encountered.

An equally good target for lightning is the fisherman who keeps right on fishing in spite of a thundersquall. A wet, metal-tipped pole is as dangerous as an ungrounded antenna.

What the Pleasure Boat Skipper Needs to Know

How can the pleasure boat skipper keep from becoming another statistic in the log of weather-caused boating casualties? The first requirement is to observe three weather safety rules:

Weather Safety Rule No. 1: Check weather and sea conditions before setting out.

Weather Safety Rule No. 2: Keep your weather eye "peeled" while out.

Weather Safety Rule No. 3: Keep checking on weather forecasts and warnings until you return to your mooring.

These three rules could readily be combined into one simple statement: Keep up to date on the weather.

What the Weather Bureau is Doing to Meet the Need

The vast majority of pleasure boat cruises cover periods of from two to twelve hours. All of the weather information needed in order to observe these safety rules is readily obtainable from the United States Weather Bureau. Forecasts especially prepared for the purpose are readily available in frequent radio broadcasts. A corollary safety rule therefore is: *Keep a good radio receiver aboard.* The forecasts are also available by telephone from your local Weather Bureau office—if you can get through his usually busy telephone.

The Weather Bureau issues annually a series of coastal warning facilities charts covering all areas of the U. S. seacoasts, including the Great Lakes and Puerto Rico.

These charts contain explanations of warning displays made by the Weather Bureau at over 500 seacoast points in the U. S., voice weather broadcast schedules of commercial and government radio stations operating on standard bands, as well as those on the 2.3 mc. frequencies. These charts are available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for ten cents each. Those for your own area are usually available also at yacht clubs, power squadrons and elsewhere in the area.

Marine forecasts and warnings covering the following 36 to 48 hours are issued every six hours. These now cover much smaller areas than they did a few years ago. As a result, the forecasts contain much more detail and are of greater use in planning boating operations. For example, years ago only a single forecast was issued for the stretch of coastal waters from Eastport, Maine, to Block Island, Rhode Island. Separate special forecasts for boating interests are now issued four times daily covering the area 15 miles seaward and extending from Eastport, Maine, to Portsmouth, N. H.; Portsmouth to Chatham, Mass. and Chatham to Block Island, R. I., as well as separate advices from Boston Harbor, Buzzards Bay and Narragansett Bay. Special boating forecasts are also issued for comparable small areas along the rest of the U. S. seacoasts and for a number of inland lakes, dams and reservoirs.

Weather observing stations have been established at a number of seacoast and inlet points to furnish reports which include not only wind, weather and visibility but wave heights as well. Bulletins containing forecasts, advices and reports of current weather to boatmen are broadcast by AM and FM radio and TV stations and also by marine radiotelephone stations on regular daily schedules.

To increase the small boat skipper's appreciation of weather safety factors, the Weather Bureau arranges weather exhibits at a number of the larger motor boat shows which are usually held throughout the country in the late winter and early spring months each year. The theme of these exhibits has been "Boating Safety through Weather Knowledge." Valuable assistance has been received from the U. S. Power Squadrons and numerous other organiza-

tions as well as boating enthusiasts. All of these have been very helpful to us in making improvements in weather service to promote the safety of navigation among small craft operators.

To improve the short range forecast accuracy of hurricanes and severe local storms, the Weather Bureau has installed modern weather observing radars at a network of stations. Our eventual goal is to have every square mile of the U. S. and immediately adjacent waters under constant weather radar surveillance. Information from these radars is included in regular and special forecasts on AM radio stations, in the special short range forecasts broadcast especially for boating interests in some areas and in the automatic telephone forecast service in many areas. By keeping in touch with any of these, pleasure boat skippers are less likely than ever to encounter sudden or unexpected local squalls and thunderstorms.

An amazing recent addition to the forecasters' weather observing tools is the weather satellite Tiros III is still in orbit and has been instrumental in pin-pointing several hurricanes and typhoons. It gave the first indication of the formation of Hurricane Esther. Tiros I showed a unique square cloud formation at 2:00 p.m. on May 19, 1960, approximately 50 miles west northwest of Wichita Falls, Texas. This cloud formation moved northeastward and later spawned tornadoes and hail.

Future satellites are planned to help maintain a constant broad-scale weather surveillance of the entire globe. Radar, then, will give a "close-up" picture of important segments of the broad-scale weather patterns detected by the satellites. Study and correlation of these will further improve the forecaster's knowledge and understanding of the various physical factors at work in the atmosphere and hence his ability to further improve his forecasts.

How to Get Boating Weather Information

Insuring that weather information and advice are readily accessible to the ever-increasing number of small boat skippers still poses a problem. This becomes particularly acute during summer weekends and holidays and especially in many of our large metropolitan areas. In earlier years, one could easily telephone the Weather Bureau and talk to the forecaster. As with boat-

ing, however, requirements in other areas for up-to-date weather reports and forecasts have also expanded. The busy-telephone has become a serious problem. There have been instances where people have tried in vain for as much as two to three hours to telephone a Weather Bureau office.

More telephones and more people to answer them is not the solution. The Weather Bureau began looking around for automatic devices capable of bringing especially tailored forecasts to large segments of the population. In eleven of our larger cities the telephone company has cooperated by installing automatic telephone forecast service. A twelfth installation will be added early next year. Information available by this facility includes local weather and forecast information which the small boat skipper can use to good advantage in planning his outing. More important: since local forecast demands of most of the public are satisfied by this means, it improves the odds that the pleasure boat skipper will not encounter a busy telephone when he seeks specific boating weather information directly from the Weather Bureau.

To provide special boating weather and forecasting information in areas where this demand is particularly heavy, the Weather Bureau has been experimenting with the installation of special broadcast equipment. Continuous FM marine weather broadcasts for harbor and boating operations are now made in the New York and Chicago areas. Both transmitters (KWO-35 in New York City and KWO-39 in Chicago) operate on a frequency of 162.55 MC, each year from May through October. A number of surplus receivers have been made available to yacht clubs and other marine interests in these areas in order to help evaluate the programs.

In Washington, D. C., special boating forecasts for the Chesapeake Bay area are transcribed by the Weather Bureau forecasters and are available by dialing NATIONAL 8-4100. In Baltimore, upper Chesapeake Bay area forecasts are similarly available by dialing SO 6-3382; in Los Angeles, ORchard 0-0234 is the marine weather forecast number.

In Providence, still another pilot project in rapid dissemination of forecasts directly to the public is underway. FM multiplex

is used for continuous broadcasts which currently cover the hours from 6:30 a.m. to 2:30 p.m. on Mondays, 6:30 a.m. to 7:30 p.m. Tuesday through Saturday, and 7:30 a.m. to 2:30 p.m. on Sundays. These broadcasts include boating forecasts as well as spot weather reports from Coast Guard stations and other short points. Here, too, in order to evaluate the service, receivers have been installed at several yacht clubs, docks, and other places where the recipients have agreed to give us the benefits of their comments and suggestions.

Scheduled marine weather forecasts and warnings are broadcast on regular schedules by marine radiotelephone stations; special warnings are broadcast on receipt. Hourly and special aviation weather reports and aviation advice are broadcast by air navigation radio stations at 15 and 45 minutes past each hour; some, such as at Andrews Air Force Base in Maryland, have continuous broadcasts. These broadcasts include wind, weather and temperature and are of use to the small boat skipper. Schedules and frequencies for these as well as other weather broadcasts of interest or use to the pleasure boat enthusiast are listed on the Coastal Warning Facilities Chart mentioned earlier.

Finally, what aids are available to help "keep your weather eye peeled" while out? The careful skipper is well advised to take advantage of available weather courses such as those offered in many localities by the U. S. Power Squadrons. In most instances he will find that his local Weather Bureau forecasters conduct these courses during their off-duty hours and that they provide much in the way of specific information on how to obtain and to make the most of the weather and the forecasts available in the local area and vicinity.

In summary: Helping to promote boating safety is an important function of the U. S. Weather Bureau. In effect, it is a part of our organic legislation. The Weather Bureau makes special weather observations, prepares forecasts and warnings for increased boating comfort and safety. In cooperation with the Coast Guard, Coast Guard auxiliaries, power squadrons, yacht clubs, government and commercial radio stations and any other means available, it does its utmost to see that this information

reaches all marine interests. Intelligent and effective application of available weather information in promoting boating safety is,

in the final analysis, up to the skipper. Even here, the Weather Bureau helps provide guidance and suggestions.

ENGINEERING SMALL BOATS FOR SAFETY

By GORDON H. MILLAR

Chief Eng., McCulloch Corp., Scott Div., Minneapolis, Minn.

Over the past ten years an increasing number of people have adopted boating as a means of recreation and a hobby. This trend, and the ability to participate in this wonderful sport, has been made possible primarily through the availability of outboard motors and boats. It is possible for almost anyone to buy a boat and an outboard motor, and with little or no training and completely unaware of whether or not the boat and engine combination is a safe marine vehicle, take his family out for a weekend or an afternoon on the water.

In the past two or three years it has become more and more understood that safety problems involving boats and motors are related to several primary factors. First, boats must be made sufficiently safe so that even in the hands of the inexperienced the boat does not become dangerous. Secondly, the combination of the boat and engine must be rated in a way and sold under circumstances which make a satisfactory boat-engine combination.

Most people have had the opportunity, I am sure, to observe, in populated boating areas, boats which are both underpowered and overpowered and which are dangerous in the hands of the inexperienced boat operator.

With rare exception, engines and automobiles are not sold separately. It is allowable that boats and motors are a completely different breed than land transportation vehicles; however, the combination of a boat and motor still represents the marine vehicle and there is no reason to expect the average uninitiated consumer to possess the knowledge necessary for making the best selection.

A partial step in the direction of boat and motor combination selection exists in the ratings which are provided by the O.B.C.

Although there is no law governing the size of an engine a person can put on a given hull, boats rated by the Outboard Boating Club state specifically on the boat name plate the size of engine for which the boat is rated and the number of people the boat can carry.

From a corporate point of view, however, we at McCulloch Corp. feel that the responsibility of a manufacturer goes much further than a rather loose attempt at wedding the boats and motors. It is our basic philosophy that boats, motors, and the marine vehicle, should be designed to be completely compatible with each other; individually designed to be safe in the hands of the inexperienced and that these combinations should not allow optional selections of engine power and boat performance which would produce an unsafe marine vehicle.

From the engine point of view, safety consists primarily of operating reliability and freedom from failure of rotating parts which may cause human injury due to fragmentation. In this regard, engines today are the most reliable, the safest, and best performing power plants ever made available to the consumer.

The boat problem is not as clear cut. It is impossible in the short time available to cover all the problems which the average boat builder and manufacturer must face. In the design of a small boat, however, consideration must be given to stability, performance, construction, ability to install accepted auxiliary safety equipment, load carrying ability, and safety with and without power under all conditions of weather the boat will encounter.

With the introduction a number of years ago of the fiberglass method of construction, tremendous latitude was made avail-

able to the small boat designer with regard to hull shape, structure and appearance. I believe it is adequate to state that from the standpoint of performance, the lines of the bottom of small boats must be laid out in the manner which will produce smooth performance in turns, level riding capability, and freedom from abrupt boat reactions which can occur with the inexperienced operator. Part of the solution to the boat handling problem is a knowledge of the hydrodynamics of boat bottoms and the positioning of the keel and planing surfaces in a way which will produce an accepted performance standard.

In order to do this with some reasonable assurance that a workable combination will result, the small boat designer must know from the very beginning the weight and performance of the power plant. When boats are designed to accept any and all engines, compromises in performance result which detract from the safety of the boat combination. The manufacturing solution to the problem of small boat performance is in our judgment the integration of the boat and motor package so that the small boat designer eliminates the need for compromise and produces a small boat and maximum performance for the power plant available and with the maximum degree of safety which can be built in a given hull design.

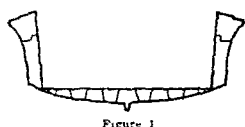


Figure 1

To illustrate this point, I would like to refer to Figure 1. This figure is a diagram of a cross section of a small boat where consideration has been given to a hull structure rigidity, flotation, sheer line configuration for splash control, boat configuration for ride control, and designed with the basic thought that the passenger compartment will hold people. This can be seen in the cross section; tremendous rigidity in the beam strength is achieved through the use of controlled bottom sections which are channelled to give a very high section modulus.

lus. The sides of the hull are formed in a manner which provides both longitudinal and lateral rigidity and provides space for permanent flotation.

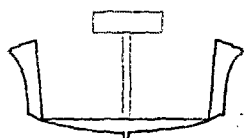


Figure 2

The next series of figures show a model of this hull cross section in various conditions of flotation. Figure 2 shows the condition when both the side tanks and the bottom tanks formed by the hull structure are used for flotation and the passenger compartment is punctured in a manner which would simulate a free flow of water into this part of the boat. The center of gravity has been adjusted in the model to the same height as produced by the outboard motor and hull combination. As can be seen in



Figure 3

Figure 3 this condition is a safe condition and although the boat is lowered in the water it remains upright and does not capsize.

Figure 4 shows the same model in a condition of submersion which punctures both the passenger compartment and the double bottom flotation tank. Once again, in this condition the boat will float in an upright

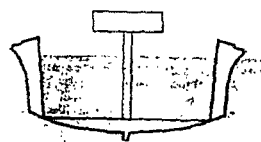


Figure 4

fashion although it will be lower in the water. Again, this is considered a reasonably safe method of flotation as the passengers will remain contained in the hull and stand a more reasonable chance of rescue.

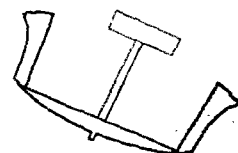


Figure 5

Figure 5 shows a situation where the bottom flotation tank remains unpunctured and the side flotation tanks are punctured as well as the passenger compartment. Figure 6

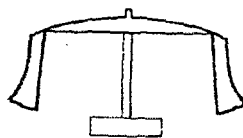


Figure 6

ure 6 shows what happens under these circumstances as the relationship of the center of gravity of the hull with regard to positioning of the flotation in the hull structure produces an unsafe condition and the hull no longer remains upright but turns upside down.

The distribution of flotation is tremendously important in any small boat design. It is not adequate to provide only vacant space for flotation as flotation tanks themselves can be eventually punctured and as was shown, under certain conditions, can result in a dangerous flotation system. It is also not necessary to fill all compartments with foam as certain conditions of tank flotation are completely adequate for both flotation and stability. It is, however, tremendously important to fill the key flotation compartments with foam material which will remain buoyant even though the compartment is punctured.

In the hull used for the model from which the film was made, and referring again to Figure 1, it is technically obvious, that foam must be used to completely fill the side tanks so that the dangerous condition of upsetting the craft during a swamping condition is effectively avoided through proper design of the hull structure.

To reiterate again, the possibility of utilizing to the maximum the fundamentals of boat design can only occur when the engine, boat and passenger carrying ability is designed as an integrated package. When a hull is designed for a wide selection of engines, large compromises must be made in the location of the center of gravity both vertically and longitudinally as well as dimensional compromises which will alter boat performance and the ability of the boat to resist swamping.

There are, of course, many other factors affecting the safety of small boats. The ability of the boat to resist fire and the proper location of fire fighting equipment is of great importance. It is further of importance to provide proper venting of fuel tanks, proper venting of confined areas in the bilges and to minimize during the design and manufacture the chance that fuel vapors will be trapped and a fire result from a spark or open flame.

All problems related to safety, however, are more susceptible to solution when the engine and boat combination is manufactured as a marine vehicle rather than separate add-on packages. Above and beyond the manufacturing responsibility, however, continues to loom the necessity for the exercise of judgment on the part of the user. No matter how thoroughly a small boat is designed and no matter how skilled an

operator is employed, in the last analysis, certain boating accidents result exclusively from the lack of judgment with regard to weather, loading capabilities, availability of fuel, knowledge of safety devices, and the exercise of simple precautions if in trouble. It is our job as a manufacturer of marine vehicles to minimize the exposure of the user to danger when trouble does

occur and this has been done to a great degree through boat and engine integration. The ultimate responsibility for safety in performance must still rest with the user and this judgment can only be altered or improved through education. In the long run, it is education which will minimize that small portion of boating accidents which cannot be solved by intelligent boat design.

UNIFORM MARKERS FOR RECREATIONAL WATERWAYS

By KEITH WILSON

Dir., Michigan State Waterways Commission, Detroit

I have been invited to address you today to outline the recommendations that a committee of state officials on uniform markers is making to the Council of State Governments relative to the national adoption of a system of uniform navigational and regulatory markers. These recommendations are to be submitted to the advisory panel of the Merchant Marine Council, U. S. Coast Guard, at a meeting scheduled for October 31, in San Francisco, Calif. Representatives from all 50 states have been invited and, if these recommendations are adopted by that body, they will be submitted to the Council of State Governments for submission to the individual states.

To give you a brief background on this matter, and to acquaint you with some of the governmental organizations active in this field, I would like to outline to you the manner in which this study was initiated. A group called the North Central States Boating Law Administrators, which consists of officials charged with administration and/or enforcement of the boat registration and boat safety laws of the states of Kentucky, Indiana, Ohio, Michigan, Illinois, Iowa, Wisconsin, and Minnesota, first determined the need for a uniform marker system and created a special committee to investigate this matter.

This Committee came up with recommendations which were accepted by the parent organization and were then referred

to the advisory panel of the Merchant Marine Council, U. S. Coast Guard. This group recognized the desirability of action in this area and appointed its own committee which included two members from the north-central states organization and it is this committee which is making the recommendations that I am here repeating upon.

The general problem was to develop a system of uniform navigational aids suitable for all water areas and types of watercraft to supplement the Coast Guard system, and still be compatible with it. Specifically, there existed a need for water signs or markers which would convey to the small-craft operator information which under the Coast Guard system is normally found on navigational charts or in published regulations. Small-craft operators, often without experience and without navigational charts, need markers on the water itself or on the adjacent land to indicate presence of natural hazards, zoned areas, and directions and distances.

The committee divided the problem into two general areas, the first being to develop a system of regulatory markers to indicate to the watercraft operator the existence of regulatory areas, speed zones, restricted areas, etc., and the second being to develop a system of navigational aids to supplement the U. S. Coast Guard system.

In attempting to evolve a satisfactory buoy, careful consideration had to be given

to the colors of the buoy and its markings, since the Coast Guard has almost completely pre-empted this field and, unless our regulatory marker was in a design acceptable to the Coast Guard, it could not be used on federal waters. Therefore, the colors international orange and white were selected, since these colors have been designated by the Coast Guard for use on special purpose buoys. To avoid confusion with other special purpose buoys, it was agreed that the buoy would be painted white with an orange band at the top and an orange band at the bottom of the buoy. The white area between the bands would be used to place any special symbols or lettering to indicate the purpose of the buoy.

The committee, after further deliberation, decided that it was desirable to standardize the markings which would be used on the white portion of the buoy, and, after experimenting with a multitude of markings, settled upon the use of three distinct designators for this purpose. The first designator consists of a diamond shape which is to represent danger outside the diamond, in letters of black, will appear an explanation of the specific danger involved. In cases where boats are to be absolutely prohibited, a diamond shape with a cross will be used and any explanation given will be given outside of the diamond itself.

The diamond alone would be used when you wished to warn the boatman of some danger ahead, especially to himself, such as a submerged obstacle or a dam or something similar. The diamond with a cross would be used when you wished to absolutely prohibit boat operation within an area and would be used to mark swimming beaches, wildfowl preserves, waterfalls, and similar areas.

Where a regulation has been established, the same buoy with a round designator would be used, with the nature of the regulation indicated in black letters within the designator itself. This designator indicates prohibited or controlled activities and would be used to warn of speed limits, no wake areas, and similar prohibitions.

For informational purposes only, a rectangular shape is provided and the purpose of this designator is to inform boatmen of distances, directions, and the availability of services. It is considered likely that this

type of information will generally be provided on shore signs because of the limited surface of a buoy, but a buoy can be used if desired.

For navigational buoys to supplement the Coast Guard system, the committee attempted to follow the federal system to the greatest extent possible. However, certain problems are faced on inland lakes that do not exist on navigable waters of the United States to any great degree. This required the adoption of a special system of markers for this purpose.

The Coast Guard system is called a "lateral" system of markers and depends upon a given body of water having a definite inlet or outlet or, where such does not exist, presumes the inlet to be to the north and the outlet to the south of the given water area. However, many inland lakes have a multitude of inlets and outlets and also have sufficient obstructions and islands to preclude the use of the lateral system of buoys.

On these waters, a "cardinal" system of buoys is more effective and this system depends upon the use of buoys which permit travel to the south or west or to the north or east of a specific type of buoy. The committee found it necessary to adopt both systems in order to adequately deal with the varying conditions found on interior waters of the various states.

The committee therefore recommends that the lateral system be used on well-defined channels, including rivers, which would require the use of the all red and all black buoys used by the Coast Guard. In these situations, a red and a black buoy will be installed at both ends of the channel so that there shall be no question as to the fact that boats should pass between solid red and solid black buoys. Any staggering of the black and red buoys should be limited to instances where they are close enough together to eliminate any possible confusion, and they should then be installed in conformity with the buoys at the beginning of the channel. The use of numbers on these buoys is discretionary, but if used, the numbers should be colored white and may be reflectorized. Odd numbers should be used on black buoys and even numbers on red buoys.

In those instances where there is no well

defined channel, or the obstruction is of such nature or in such a location that it can be approached from more than one direction, a cardinal system will be used, by using a white colored buoy with a red top or a white buoy with a black top, the width of the top color to be approximately one-third of the portion of the buoy showing above the water level. Navigation will be to the south or west of the red-topped buoys and to the north or east of the black-topped buoys. The use of numbers on these buoys is also discretionary, but, if used, the numbers should be colored white and may be reflectorized, and shall be placed on the top portion of the buoy. Odd numbers should be used on black-topped buoys and even numbers on red-topped buoys.

In cases where the obstruction is of such a nature that boats should go outside, that is away from the shore around the end of a reef, a buoy striped vertically with red and white stripes, the white stripe to be twice the width of the red stripe, shall be used. The significance of this buoy is that boats should not pass between it and the nearest shore.

Use of this system will require only that a boatman have a reasonable idea of the direction of north and, thereafter, he can proceed throughout any body of water marked under this system without reference to charts or other material. Of course, this assumes a working knowledge of the buoyage system, and each of the states is expected to give wide publicity to this system when putting it into operation.

The committee has also adopted a standardized color for use on a mooring buoy, the buoy to be white with a blue band through the center. The Committee adopted the color white for use on all other water structures, such as ski jumps, diving rafts, etc., as the principal designating color.

Because many of these aids will be used at night, the committee has also made recommendations relative to the use of reflectorized materials or lights. If reflectors are used, a red reflector will be used on a solid red buoy, a green reflector on a solid

black buoy, while all other buoys will have a silver or white reflector.

Whenever navigational lights are used, they shall be flashing and the color of the light lens will be as outlined for reflectors. That is, all red buoys will have red colored lenses, black buoys will have green colored lenses, and all other lights will be white. Whenever lights are desired on bridges, they shall be fixed red lights marking the edges of the safe channel with a single fixed green light to be placed over the center of the safe channel so as to indicate the maximum vertical clearance at that point.

The Committee made one final recommendation, and that is that the flag prescribed by the Underwater Society of America for use during diving purposes be adopted and recognized by the individual states. This flag is red with a white diagonal stripe running from the upper left hand corner to the lower right hand corner.

The committee has spent a good deal of time and research in arriving at these recommendations and we believe that we instituted this study at a propitious time in that most states are just now beginning to recognize the need for such a system. We feel that this system will provide for every reasonable need of any body of water and that through use of a standardized system on a nation-wide basis, confusion and the likelihood of misinterpretation of the meaning of these buoys will be greatly reduced. However, to be effective, it will be necessary to secure the affirmative action of each of the individual states and it is in this area that individual boatmen, boating organizations, and boating groups can be of great assistance both to themselves and to the Council of State Governments.

I urge each of you to encourage boating officials in your state to adopt this system when the day arrives that such markers are required on waters of your state. If we can begin on a uniform basis before various states have an opportunity to institute their own special programs, the problem should be greatly reduced and it should be much easier to maintain uniformity in future years.

THE MOBILE BOARDING UNIT IN LAW ENFORCEMENT AND BOATING SAFETY

By CAPT. J. J. HUTSON, JR.

Chief, Port Security and Law Enforcement Div. United States Coast Guard
Washington, D. C.

It often comes as a surprise to many of our citizens to find that the Coast Guard functions as a water-borne law enforcement body, since most people, when recalling this service to mind, think only of the search and rescue functions which our forces perform. However, the law which states that Coast Guard "may make inquiries, examinations, inspections, searches, seizures, and arrests upon the high seas and waters over which the United States has jurisdiction, for the prevention, detection, and suppression of violations of laws of the United States" is not really new.

When originally established in 1790, the Coast Guard, then called the Revenue Marine, was primarily concerned with law enforcement, in particular the apprehension of smugglers who were evading the payment of custom's duties. The young nation could no more countenance the loss of this revenue than the federal government can allow evasion of income taxes today. A small fleet of sailing cutters effectively reduced smuggling to a tolerable degree and thereby began our now traditional responsibility for law enforcement on the federal waters.

Over the years there have been continuing changes in this responsibility until today the Coast Guard's enforcement job has taken a very different aspect. Rather than pursuing the smuggler intent on violating revenue laws, our forces are now busy enforcing the laws and regulations concerning safety of life and property on the navigable waters of the United States. These laws and regulations are numerous.

There is the Federal Boating Act of 1938, with which most of you are conversant, which requires the numbering of boats and the reporting of boating accidents. The Motorboat Act of 1940 specifies certain lifesaving equipment requirements and provides for the assessment of monetary penalties for reckless and negligent operation. There are others covering water pollution

by oil or refuse and of course, those which concern merchant vessels. For today, I shall confine myself to those laws which concern the smaller watercraft, in particular the pleasure boats, and to their enforcement.

New advances in boat building technology, safe modern propulsion equipment and the advent of the mass-produced popular outboard motorboat, have made their contributions to the explosive expansion of recreational boating. In 1947 there were approximately two and one-half million boats used for recreation; today there are over eight million boats.

The mobility of the average boatman who owns an outboard motorboat transported on a trailer creates many problems, such as what is his state of principal use required for numbering his boat, overcrowding of popular water areas from time to time, and last but not least the overtaking of the capabilities of law enforcement officials to give proper coverage to given areas for the safety of the boating public. Our Coast Guard law enforcement capabilities have not kept pace with the increase in the boating population.

Perhaps here would be an appropriate spot to explain how the Coast Guard law enforcement program operates in the recreational boating field and what it attempts to accomplish. The two primary Federal boating laws, which I mentioned earlier, were established as aids in the promotion of boating safety. The Federal Boating Act of 1938 provides for numbering boats for identification (perhaps to identify a reckless operator) and to provide a system for reporting of boating accidents, while the Motorboat Act of 1940 requires that boats carry such lifesaving devices as life jackets, fire extinguishers and carburetor flame arrestors and provides, under a 1958 amendment, certain administrative monetary penalties which a proved reckless or negligent operator may be required to pay.

The enforcement of these laws is accomplished basically by boarding motorboats on the navigable waters of the United States and examining their equipment to insure compliance with legal requirements. Additionally, Coast Guard craft frequently patrol federal water areas, apprehending the overtly reckless or negligent operator. These two types of operation are the basics of the Coast Guard program. As you can see, it is a program slanted towards assistance to the average pleasure boatman, towards making his water-borne recreation safe and sane. The boarding operations are conducted in a courteous way and in a very short period of time—usually less than 15 minutes per boat. Our boarding officers have always been considered as "friends of the boatman" and we wish to have this thought continued.

Until very recently all boarding and water safety patrols were conducted by regular Coast Guard facilities such as our major cutters, patrol craft and small craft attached to shore stations. These facilities include 140 shore stations operating 300 small boats and 300 patrol craft and larger cutters. The primary mission of these units is not law enforcement patrols or boarding but rather includes such duties as search and rescue, ocean station patrols or servicing aids to navigation. Boarding and safety patrols can only be accomplished by these units when they are not engaged in their primary duties.

Also, these units are, in nearly every instance, located only along the sea-coasts, the Great Lakes or in a few instances on the major river systems. The great number of recreational water areas which are of a lesser degree of importance commercially, but which are navigable waters of the United States and therefore subject to Coast Guard jurisdiction, are not covered by these existing forces.

The vastly increased number of boats and the increased use of these more remote inland waters subject to federal jurisdiction and the increases in these areas through flood control and irrigation projects require additional Coast Guard facilities. Because of seasonal use of many of these inland areas and because of the great expense in building and maintaining permanent stations, new methods had to be investigated, looking toward an effective solution at reasonable cost to the taxpayer.

From this new thinking was developed the mobile boarding unit concept. This new type unit was to consist of a small number of fully qualified boarding petty officers, equipped with a small outboard motorboat and trailer and towed by a truck. Being completely mobile, it could travel from place to place without any difficulty whatsoever, spending as much time as needed in an area boarding boats, instructing fledgling boaters in the rudiments of boating safety and carrying out water safety patrols.

The first mobile boarding units were placed in operation for a few months during 1957 but due to a budgetary crisis, had to be suspended. Because other Coast Guard programs of national importance took precedence, the mobile boarding units remained out of commission until last year when, on July 1, Congress authorized the Coast Guard to re-establish twenty units. This fiscal year we have been authorized an additional 15 units so that, by the beginning of the boating season next spring, the Coast Guard will have 35 operational mobile boarding units, with more planned.

Geographically the units are located from Maine to Hawaii and from Washington state to the Florida Everglades. Most often the mobile boarding unit is based at a large Coast Guard installation and operates on the inland waters remote from regular service facilities.

As now organized, the mobile boarding unit consists of four petty officers: a chief boatswain mate, first class boatswain mate, second class engineman and a third class boatswain mate. The equipment consists of a 16-foot modern design, rugged, fiberglass boat built by the Coast Guard, a 40 H.P. outboard motor, a heavy-duty boat trailer and either a carryall or panel truck. A complete set of equipment is provided including such items as samples of approved life-saving equipment and safety handout pamphlets. Both the boat and vehicle are equipped with two-way transistorized radios which enhance both their law enforcement and rescue capabilities.

I hesitate to quote dry statistics, but in the case of the mobile boarding unit program, they may help me to show their effectiveness.

During fiscal year 1961, that is, from 1 July 1960 to 30 June 1961, mobile boarding

units boarded and examined 41,169 motorboats and issued 12,377 reports of violation on these boats. It should be noted that although the units were authorized on 1 July 1960, it took some time to detail personnel and collect the required equipment. Most of the units were operational by late July; a few did not begin operating until the start of the boating season, around 1 April 1961. Therefore, the statistics quoted earlier are not entirely representative of their potential.

However, when you consider that the total motorboat boardings for fiscal year 1961 by all Coast Guard units were 152,441 and violations totaled 25,125, it can be clearly seen that the mobile boarding units were performing their mission very well, despite the organizing difficulties encountered.

I would like to pursue these statistical records just a bit more, citing the operations of one mobile boarding unit which operates in this area. Mobile boarding unit 09-1, under the operational control of Commander, Ninth Coast Guard District, Cleveland, Ohio, was assigned to the Fox Chain of Lakes, located in Illinois near the Illinois-Wisconsin boundary. Being a large water area located near Chicago and other metropolitan areas, it receives tremendous usage during the boating season. During the period of 1 April to 30 June 1961 this four-man unit boarded 2,647 boats and issued 363 reports of violation.

This unit thus boarded and examined in excess of 29 boats every single day during this three-month period and cited approximately one in seven of these boat's operators for some violation of the boating safety laws. I had not as yet received a report for the three-month summer period when I left Washington yesterday, but it can be assumed that the statistics for that period will be even more impressive.

The record of all the mobile boarding units closely parallels that of the unit at Fox Lakes, although certain of them are more affected by seasonal closings than others.

It had been considered that because of the seasonal nature of some areas, the personnel attached to the mobile boarding units would be idle during the inclement fall and winter months. However, we have

found that because of the experience gained by these men, they make excellent instructors for our regular established unit personnel in boating law enforcement duties.

Therefore, regular training programs have been instituted in every Coast Guard district covering the very complicated duties of a boarding officer. These courses cover such subjects as "Boating Laws and Regulations," "Reckless and Negligent Operation Cases," "Numbering Boats Under the Federal Boating Act of 1958," "Lifesaving Devices," "Documents, Papers and Inspection Requirements," "State Boating Laws," and many more.

Men of the mobile boarding unit travel from one Coast Guard unit to another during the late fall and winter months, conducting classes for periods of three to five days duration. Whenever the weather permits, actual boarding duties are performed under the watchful eye of the instructor, and when the weather is such that actual boardings cannot be made, they are simulated in the classroom. By such training our regular forces become more competent boarding officers and our mobile boarding unit personnel keep from becoming rusty in their regular work through forced inactivity.

It is well worth noting that persons other than regular Coast Guard personnel are also instructed at these training classes. In the last year and a half, forty states have adopted approved motorboat numbering systems, and thereby accepted the responsibility for enforcement of their boating laws on their own state waters. The Coast Guard accepts that the states also have concurrent jurisdiction with this service on the navigable waters of the United States within the state.

Now, only a very few of these 40 states had any conception of the problems involved in maritime law enforcement nor did they have trained boating law enforcement officers. In many states the responsibility devolved upon the county sheriffs, in others on state game wardens. The Coast Guard volunteered to include a limited number of these state and local enforcement officers in our regular training sessions conducted by the mobile boarding unit personnel.

During one three-month period early this year, 138 civilian enforcement officials were

recipients of Coast Guard training. In every case, these officers have expressed their sincere thanks to our personnel for the training received. A side effect of such training is that the federal and state or local enforcement officers better understand each other's problems, which has resulted in increased cooperation between the two forces.

Another important aspect of the mobile boarding unit program is the public education work carried out by the personnel at each area that they visit. The men call on the local civic organizations and boat or yacht clubs, show water safety movies and give lectures on boating safety and the Coast Guard function in this field. During the period of 1 April to 30 June of this year, mobile boarding unit personnel were engaged in such endeavors 3,771 hours. No similar program of public education at the more remote water areas had been possible prior to the inception of this new type program.

Before closing, I would like to comment that these mobile boarding units are en-

thusiastically received at each place they call. State enforcement authorities, local residents, and the visiting boatmen have all indicated their appreciation for the services rendered by the units and more often than not have requested that they make more frequent visits to an area. Insofar as possible, these requests are met. Schedules for their operations are planned well in advance and are often submitted to state boating law officials for their comments and recommendations. Such scheduling permits more efficient utilization of both our Coast Guard mobile boarding units and of state and local enforcement forces.

The Coast Guard has ample reason, through long and trying experience, to know that the traffic slogan "where traffic laws are enforced, deaths go down," is equally true on the water. Through our mobile boarding unit concept, as well as by optimum use of our regular forces, we believe that enforcement of the various boat safety laws and regulations will result in lower accident statistics and more real pleasure to the boating public.

HUMAN FACTORS IN LIGHT PLANE SAFETY

By B. DIXON HOLLAND, "D."

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There is a total of about 114 thousand planes aloft, of which fewer than 2 thousand are commercial airliners, 42 thousand are military planes and over 70 thousand are private and business aircraft (general aviation).

In 1959, certified air carriers flew 1.15 billion plane miles, general aviation planes almost 1.65 billion plane miles.

In 1959 the number of private pilots and commercial pilots (most of whom are involved in private aviation) exceeded the number of airline pilots by a vast majority, these numbers being respectively around 464 thousand, 255 thousand and 19 thousand.

Marring this picture that looks so pretty for general aviation, however, are the following stark statistics (those for 1957 are cited):

There occurred in general aviation over 420 accidents, one for every 16 active aircraft. About a tenth, that is 42 of these accidents, were fatal accidents, costing a total of 560 lives. There was one fatal accident for every 187 active aircraft, contrasted with the occurrence of one fatal accident for every 2,000 motor vehicles.

Investigations have shown the pilots to have been at fault in most of these accidents. This fact accounts for the interest and intercession of physicians in this situation. Physicians are rightfully concerned not only that flying be safe but that it be pleasurable, its pleasure not marred by the discomfort and pain that could accompany a disregard of certain health rules.

There are certain inherent limitations, physiological and psychological, built into the human machine that have to be reckoned with, disregard of which can lead to an accident. These limitations are found in so-

called normal, healthy, able-bodied persons—and this is the type of person we are talking about, one medically certified to fly a plane.

Some have despaired of insuring proper regard for these built-in human limitations except through legislation. For instance, the need for oxygen at a certain altitude is one of these built-in limitations of the human machine. Some have advocated strict governmental regulations to require that planes lacking oxygen equipment be prohibited from flying even momentarily at such an altitude.

Our program is planned to revolve around two subjects. Since there has been recent publicity suggesting the possibility of Federal legislation relative to oxygen use, we thought this would be a topic of interest. As weather is the major cause of death in private aviation, it was felt that a medical explanation for pilots as to why the following two statements are factual was appropriate.

I. You cannot always avoid clouds at your option (because of the visual limitations of the human eyes).

II. You cannot maintain control of an aircraft under instrument conditions without training because of the limitations of the positional and motion senses of humans.

Though the minimal instrument requirement for new private pilots has been in effect for the past year or so the vast majority of general aviation pilots flying today have little or no instrument training. Based on letters to the editors and other articles in some of our national flying magazines, it appears that many pilots are not conscious of the above two facts. Explanation and repetition of explanation of why adequate instrument training is a must, cannot be overdone if the vast majority of fatal general aviation aircraft accidents are to be avoided.

HUMAN FACTORS IN LIGHT PLANE SAFETY

By HAROLD N. BROWN, M.D.

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The following is extracted from the presentation on "Human Factors in Light Plane Safety" given to the National Safety Council, General Aviation Safety Meeting.

This paper is limited to a discussion of what the writer is convinced is a major cause of death in general aviation. It refutes the concept that cautiousness alone will always permit a pilot to avoid clouds. Pilots frequently enter clouds inadvertently. This is because of the limitations of their eyes in determining distance when familiar ground objects are absent. This writer, whose concept is supported by the Flying Physicians Association through their teaching and self imposed instrument requirements (in effect since 1958), is anxious to promote instrument training for all pilots, at least, sufficient in amount to permit them to extricate themselves calmly and with full control from instrument conditions inadvertently entered.

The Federal Aviation Agency has devised an excellent stimulus by placing a blue seal on licenses of those pilots demonstrating adequate proficiency. Since June 1960, the Federal Aviation Agency has required such proficiency prior to issuing a new pilot's license. The Aircraft Owners and Pilots Association is effectively promoting its "360" rating which incidentally qualifies any pilot so rated for the Federal Aviation Agency's Blue Seal. The publicity associated with the Aircraft Owners and Pilots Association's rating is extremely effective in promoting consciousness of the necessity for adequate instrument training. It is generally conceded that 5 to 10 hours of proper instrument training with occasional refreshing serves the purpose.

In spite of these efforts, many pilots not inclined to avail themselves of this training, state that sufficient knowledge of weather together with caution, would prevent a large

number of fatal accidents caused by lack of instrument training. Others state that this minimal knowledge may tempt pilots to enter clouds when they are not fully qualified for the entire instrument system. It is our contention that until a pilot has some instrument training, he has inadequate basis for judging the dangers. These pilots have a right to know the facts so that the basis for their judgment is through knowledge rather than supposition.

We should no longer accept the concept that clouds can always be avoided at the pilot's option for the medical reasons discussing vision which follow.

Once inadvertent cloud entry occurs, the untrained pilot can expect a "graveyard spiral" for the reasons outlined following the discussion of inadvertent cloud entry.

This is a typical story of what happens to the uninitiated.

This pilot is flying along anxious to get to his destination, knowing there is some haziness or clouds about, but feeling that he can stay out of the clouds if he is careful. He does not realize how limited his depth perception is and does not have the benefit of experience which helps the trained pilot use whatever few clues there are to best advantage.

Unintentionally, and suddenly, he enters the clouds. The aircraft starts to roll slowly but the pilot's semi-circular canals do not perceive this slow roll. Because the nose drops in a turn, speed is built up. This, the pilot detects either by noise or his air speed indicator. He assumes he is descending straight ahead, as the buttocks pressures are equal. He pulls back on the wheel. Though he is tightening the turn and probably losing altitude, the increased pressure on his buttocks tells him he is climbing.

He knows something is wrong because his airspeed is still high. Eventually he catches a glimpse of a toppled artificial horizon or a markedly offset needle. He will then suspect he is banked, but because of the lack of training and resultant panic he will not know in what direction. He will also not know to what extent. He may get another try at it if his guess is correct. In this instance, a newspaper account by a non-pilot observer will read "Airplane must have had engine trouble as I heard it zoom twice before it came out of the clouds in pieces."

If the pilot guesses wrong as to the direction of bank, the newspaper article will be identical except for one word instead of two. If the airplane disintegrates before striking the ground, it usually occurs when the ground is first seen in a dive. Extreme sudden back pressure on the wheel, at this time, pulls the airplane apart. In this instance newspaper articles will be similar except that included in the comments will be something to the effect that the airplane must have exploded.

Let us discuss the human mechanisms which permit the above to occur:

Depth Perception Mechanisms

Binocular Vision—Convergence—Within 20 feet of the viewer, the closer an object is, the more the eyes turn toward each other. The brain interprets this change of the muscles which control eyeball movement, in terms of distance. It is upon this single principle that a photographic range finder is based. Using mirrors, two images of the same object are superimposed by varying the angle of the mirrors. The distance is evaluated from this angle. Between about 20 feet and infinity this angle is almost constant as the rays from the object approach parallel in both instances.

The range finder is more sensitive than the eyes (can differentiate up to as high as even one hundred feet and infinity) because it amplifies the angular change by internal projection of one image. Without transplanting the eyes farther apart, the same limitations apply to convergence depth perception in humans.

Stereopsis—This is another depth perception mechanism requiring both eyes. It also applies within 20 feet, having almost no value beyond that. It can be thought of in two ways. Within 20 feet, each eye sees a different view of the same object. The brain interprets these different views in terms of distance. Stereopsis is also used for comparing the relative distance of objects. If we look at an object 20 feet away, with a pencil at arm's length along the line of sight of the left eye, both images will fall on the same spot of the left retina (the film of the eye), but the image from the pencil will be displaced toward the outside of the right retina. This difference informs you of the relative distance of the pencil and distance object. Use a pencil and try it, closing one

eye at a time. Remember that the lens of the eye inverts and reverses the image.

These above mechanisms, which are not usable beyond about 20 feet, can not help us avoid clouds. It can be said then, that aside from a larger field of vision which two eyes provide, depth perception beyond 20 feet is achieved as well with one eye as with two.

Monocular Mechanisms

The following mechanisms can be thought of as monocular (one eye). They give depth perception information at all distances. However, you will see that for the most part they use ground objects for interpretation and thus are frequently useless in determining distances to clouds.

Known Size—A man, whom we assume is five or six feet tall, is at an unknown distance. If the image he creates on our retina (the recording film of the eye) is small, we assume he is at a great distance. If a cat's image is the same size, that is, takes up the same space on our retina, we would conclude he is much closer than the man, because we know a cat is less than one fifth the height of a man. Approaching a cloud in the air, we frequently can not tell if it is small and close or large and far. This is because clouds can have the same shape and appearance, and be vastly different in size. Thus, the known size mechanism frequently does not help us.

Geometric Perspective—If we look along a railroad track upon which is lying a steel rod, we know the distance to this rod because the rails appear to converge proportionate to the distance from the viewer. In flight, this type of perspective is frequently unavailable because of no markings for reference. This would apply in the following circumstances; over water, especially if the surface is smooth; over dense forests which have an even appearance; above a solid cloud blanket or fog; at night when there are no ground lights, as over unpopulated areas.

Overlapping Contours—When one object is seen to overlap another, the overlapped object is most distant. If a DC-6 is seen to move within the line of sight of a cloud and remains visible, we know the cloud is farther away than the airplane. If the airplane disappears, we know it is farther away than the cloud. Without the airplane as

reference, clouds may be separate and at different distances and yet appear to be one cloud. Thus in flight, with no distinct object for comparison, availability of this mechanism can not be relied on.

Light and Shadow—The way in which shadows separate objects gives us clues as to their relative closeness. If a lamp casts the shadow of a man toward us, we know the lamp is farther away than the man. Because clouds are frequently illuminated through other clouds, as with a high overcast, the light is often diffuse and gives us no shadow clues. Also, since the sun is at relative infinity, all primary shadows are cast in the same direction. We get no clue as we would if we were observing our changing shadow while walking under a street lamp. This mechanism then, is also frequently unusable.

Terrestrial Association—We see an isolated thunderhead while flying above an overcast, and radio reports this thunder-shower over "X" city. If we know our present position we know the distance to the cloud; if we do not know our present position, as is usually the case without instrument training, this mechanism is lost.

Aerial Perspective—We have learned that the more distant objects are, the more they appear indistinct. If a cloud is seen through haze, the thicker the haze, the farther away we tend to assume the cloud to be. It can be seen then, that "aerial perspective" is more apt to lure us into clouds than to help us avoid them.

Motion Parallax—Looking at a distant mountain while riding on a train, nearby telephone poles appear to be moving behind, while the mountain appears to be moving in the same direction as the train. As we gaze at the mountain, any object closer will appear to be falling behind at a rate depending upon its distance. In flight, we get similar information from distinctly outlined clouds; but if we are near large clouds, or if their outline is indistinct as in haze, they appear to melt together, frequently giving us no clues of motion parallax.

In concluding this summary of depth perception mechanism, it should be said that when one or more of these mechanisms are available, they are available not so much in proportion to our visual acuity as in proportion to our accumulated experience of

cloud forms from previous flying. As an example, an experienced pilot on the ground can determine the height of cloud bases with extreme accuracy; a beginning pilot with no accuracy. Both can have perfect vision. Frequently, circumstances are such that none of these mechanisms are available to help us avoid entry into clouds. Without instrument training we can expect a graveyard spiral for the reasons we will consider next.

An untrained pilot has thus entered clouds and not illogically assumed that he will know the earth's whereabouts without vision. Can he not tell the earth's whereabouts when standing on the ground and his eyes closed? This conclusion is dead wrong for the following reasons.

Positional Mechanisms

Position and direction of motion are relayed to the brain in three ways: the eyes, the proprioceptive senses, and the vestibular apparatus of the inner ears. Ignore the eyes for now, as we assume we have entered the clouds. We will discuss the remaining two positional mechanisms.

Proprioceptive Sense — This deals with those sensations sent to the brain as a result of forces which arise from pressure on, or from movement of, a joint or muscle. Because of this a man on the ground with his eyes closed can sit, walk or point. He can do this because the earth's gravitational forces are perpendicular to the earth's surface, and therefore tell him where the earth is. In the air, G forces happen to be perpendicular to the earth's surface only in straight and level flight, and in constant climbs and descents. Only in these attitudes, by coincidence, is the pilot's proprioceptive sense (buttocks) a guide to his position relative to the earth's surface.

In other coordinated flight maneuvers, the aircraft's G forces, rarely and then only momentarily, coincide in direction with gravitational pull, such as the bottom of a loop, thus our usual guide towards the earth's center is gone. Pressure on the buttocks increases during entry into a climb, and thus any other maneuver which also produces pressure against the buttocks, as a coordinated turn, will be interpreted wrongly as climbing. In entry to a descent the seat is pressed less firmly and any maneuver causing a similar sensation, such

as leveling out after a turn, will be interpreted wrongly as a descent.

The student instrument pilot tends to climb when rolling out of a turn and tends to lose altitude when he has rolled into a turn. He believes that if his buttocks pressure is constant his altitude will remain constant. Because of this he wrongly holds the amount of elevator necessary to maintain this buttocks pressure. Greater lift is necessary to hold altitude in a turn than in level flight. As the lift increases, more buttocks pressure must be accepted proportionate to the rate of turn.

The student VFR pilot does not grasp the necessary pressure changes until he learns to use the horizon as reference. The student IFR pilot has to reaccept this changing sensation. In a slip or skid the pilot is forced sideways on his buttocks and because of this he will have the impression that he is tilting. This feeling of tilt will be in the direction opposite from the slip or skid. It can be said then that while flying, the proprioceptive senses do not substitute for our eyes. They give us no usable indication of the earth's whereabouts. In fact, because of our ground experiences, they tend to mislead us.

A vestibular apparatus is located in each inner ear. It has two basic parts: the semicircular canals and the utricle.

Semicircular Canals can be thought of as three small doughnut shaped tubes lying in three different planes; horizontally, vertically side to side, and vertically front to back. These canals are joined together at one point and contain fluid that circulates freely within and between them. Where the three joint, hairlike cells project into the fluid, and as this fluid moves these cells are bent toward the direction of flow. Nerves from the cells' base relay the direction of flow to the brain.

These semicircular canals are affected only by rotation of the head in any plane. They work in this manner. Let us visualize a glass doughnut containing fluid with floating particles as the horizontal semicircular canal. This tube is placed on a table, and suddenly rotated counterclockwise. Initially, because of inertia, the water stands still relative to the table. As the tube is continually rotated at a constant speed, the water catches up to

the tube because of friction, and there is no relative motion.

If we suddenly stop the motion of this tube the water continues to move until stopped by friction, and the relative motion is then in the opposite direction. If a sensory antenna were projecting into the canal of the tube, it wouldn't know if the tube or the water were moving, unless there were a connection to the table beneath.

Similarly, but in all three planes, the semicircular canals tell a pilot in the air only that he is rotating in a certain direction. They do not tell him from what position he starts or stops. In fact, as the rotation of his head stops he believes he is starting to rotate in the opposite direction unless his eyes give him information to the contrary. This conflict between the eyes and semicircular canals is the main cause of vertigo during instrument maneuvers.

Vertigo can also occur if the head is suddenly tilted or turned during a turn of the aircraft. This activates a different plane of the semicircular canals and deactivates or even reverses the flow of fluid in the plane that was originally active. Turning your head sideways to look at a map while in a turn can do this. Vertigo under these circumstances is normal. Thus, during instrument flight one should not turn his head more than a few degrees except in level flight or in constant climbs or descents.

If the rotation of the head is accelerating at less than three degrees per second, there is no sensation of rotation. Less than this does not overcome friction between the fluid and canals. This adds to the problem of knowing when rotation has started or

stopped. For this we need our eyes. In the air, as a demonstration of this friction problem, have a friend in the right seat close his eyes. Ask him to tell you whether you have turned left or right, after the following maneuver. Roll the aircraft very slowly to the left (at a rate of roll less than three degrees per second) until the bank is quite steep; then quickly rotate to level flight. He will say he is turning to the right at this moment and will be surprised, when opening his eyes, to find himself level. The untal roll did not overcome the friction of the semicircular canals but the second roll did. It should be evident then, that the semicircular canals give no indication of the earth's whereabouts.

The Utricle—The other part of the vestibular apparatus, the utricle, is adjacent to the semicircular canals. It is, in essence, a small sac containing erect hair cells, upon which rest tiny particles similar to grains of sand. These hairs are displaced by gravitational pull or G forces, and nerves signal the brain of this change. If the head is tilted towards the left, the weighted cells are bent towards the left, signaling the brain that the head is tilted left relative to the earth. In an airplane it would tell the position of the head relative to G forces. In a level skid to the left, these hair cells bend to the right, causing a wrong sensation of tilting to the right. This organ then, has approximately the same limitations as does the proprioceptive sense, and thus gives us no usable guide to the aircraft's altitude.

Adequate instrument training must be continuously promoted to decrease the major cause of death in general aviation.

LESSONS LEARNED FROM AVIATION CRASH INJURY RESEARCH

By VICTOR E. ROTHE

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Each year, more and more people are traveling by air. More commercial aircraft are being used, and private and business flying has increased beyond all expectations. New aircraft types are being continually

developed with emphasis on speed, range and all-weather capability. Better environmental facilities are being provided, new flying aids are being introduced and operational limits are being strictly defined in

the requirements for airworthiness certification.

With all of the steps being taken to prevent the occurrence of accidents, the present accident rate will undoubtedly be improved. Really striking reductions cannot be achieved, however, without disproportionate increases in the cost of aircraft and aircraft components. Further, there is the unpredictable human error, which is the chief causation factor in some accidents. Based upon the foregoing, it is reasonable to assume that we can expect occasional accidents and, since some of the newer aircraft types are carrying greater numbers of people, we can also expect more casualties per accident.

Accepting the inevitability of an occasional accident, it then becomes the joint responsibility of certain medical, engineering and research groups to strive to minimize the consequent injury to the occupants by drawing attention to measures which may reduce unnecessary death and injuries in aircraft accidents. The aim must be to provide the safest possible design within the limits imposed by operational and economic considerations.

There is a reason for every injury, and if all the facts are known, each injury can be related to forces with or without contact between the site of the injury and some part of the accident. A knowledge of the relations between injury, force and aircraft structure will serve as a source of ideas concerning prevention, diagnosis and treatment of certain injuries—all of which will improve the rate of survival.

This brief introduction suggests that crashworthiness, or crash safety, is a subject as worthy of comprehensive study as is airworthiness.

The work presently being done by the Aviation Crash Injury Research Division of the Flight Safety Foundation is to conduct research involving the relationships between injury, force and aircraft structure for the purpose of increasing our knowledge in this area with the hope of improving the survival rate in aircraft accidents. The research conducted by AvCIR involves aircraft of all types—fixed wing as well as rotary wing, civilian as well as military, transport as well as lightplane. Many of the research findings are of such a broad nature that they are applicable to

most different aircraft types. For example, most Army aircraft have their civilian counterparts. The findings under the research conducted for the Army are, therefore, applicable to light or business type aircraft. The reverse also holds true. Likewise, knowledge gained from investigation and study of survivability in transport accidents is translated into both military and private plane applications. Consequently, the collective research of the entire project has broad direct value to all interested agencies. The research conducted by AvCIR is performed by the following branches:

Accident Investigation Branch—This branch conducts on-the-scene accident investigations on military and civilian, fixed wing and rotary wing accidents. The military accidents investigated are limited to Army aircraft which fall into both the lightplane and helicopter categories. Civilian accidents investigated include both transport and private aircraft. When investigating civilian accidents, the investigators of this branch serve as members of the CAB or FAA investigation teams.

In addition to on-the-scene investigations, this branch also conducts evaluations of preliminary designs, mockups, prototypes and operational aircraft from a crash safety point of view. This work is done for the military under the terms of our military contract and for civilian companies on a request basis.

As a result of the investigations and evaluations conducted, appropriate reports are prepared on the findings for distribution to interested agencies. These reports include recommendations which form the basis for new, improved designs and modifications to existing designs from a crash safety standpoint. The information compiled by this branch also becomes a part of the mass data compiled by the organization for statistical studies.

Statistical Analysis Branch—The function of this branch involves collection, coding, and analysis of accident data. The data are forwarded to the organization on AvCIR accident and medical report forms by the FAA, CAB, Army, state aviation groups, and state police forces.

The data are analyzed for the purpose of determining injury causal factors out of the complex and otherwise indeterminate

events. The branch also observes and measures trends of a general nature in, for example, accident rates, injury severity rates, installation and utilization of safety equipment and structural and design features relating to injuries. Special studies are also conducted which deal with the frequency and pattern of injuries experienced in specific areas of the body.

Training Branch—This branch maintains and operates the crash injury investigator's school. It conducts five two-week training courses annually for military and civilian design engineers, flight surgeons, aviators, safety officers, etc. The operation of this branch permits direct dissemination and interchange of the data and findings of AvCIR and other agencies as a result of research and investigation.

Human Factors Branch—The basic activity of this branch is the study of the correlation of injuries to causative agents in aircraft accidents with emphasis on occupant restraint, occupant environment, protective equipment and emergency evacuation.

Experimental Research Branch—This branch is responsible for the design and execution of experiments which will provide increased knowledge of the dynamic behavior of aircraft and their components under actual crash conditions. The experiments include testing of full-scale aircraft under fully-instrumented controlled conditions and the dynamic testing of aircraft components. The design of each experiment is built upon the problems brought into focus by the other elements of the organization, wherein the indications are that answers to certain key questions can be found only by simulating certain crash situations under dynamic conditions.

Before discussing some of the detailed findings resulting from research conducted by AvCIR, it might be well to dwell on two points which we feel require some clarification.

The first point for clarification is the question: "What is a survivable accident?" Almost everyone involved in aviation safety today has at one time or another used the expression "a survivable accident." Numerous attempts have been made to define a survivable accident without success. The difficulty in attempting such a definition stems from the fact that there are no present

or foreseeable means to accurately determine the crash force factors such as: peak magnitude, duration, rate of onset, direction, and frequency through post-crash calculation. This, in combination with the lack of reliable data on tolerance levels and survivable limits of the human body when supported by standard restraint systems makes it doubtful whether such a definition is feasible.

If it is assumed, however, that the crash resistance of modern pressurized fuselage structures are within the survivable limits of human G tolerance, a more practical criterion can be based upon the post impact condition of the fuselage structures. In that case, a relatively intact fuselage structure or portions thereof would imply survivable conditions, which in turn would justify survival expectancy for the occupants of those areas.

The second of these points is the definition of the term "crash safety," as we see it. A number of terms have been used by various agencies and individuals involved in aviation safety to express the overall degree of safety built into an aircraft. A term which has been used by many people is "crashworthiness." We don't feel this term is as meaningful, nor can it be as well defined as the term "crash safety." We therefore, have adopted the expression "crash safety" as an all-encompassing expression which lends itself to definition. "Crash safety," as we see it, is the result of the following factors:

A. **Crashworthiness.** We see crashworthiness as the ability of the basic aircraft structure to resist deformation, disintegration, or collapse into areas normally occupied by vital body areas during an impact in which survivable crash force conditions existed. This feature in itself, however, does not assure survival.

B. **Adequate Tie-Down.** Assuming crashworthiness of an aircraft design, our next problem is to keep the occupants and loose equipment anchored in their respective positions during a crash. This requires that the floor structure does not disintegrate, the seat anchors not fail, the seat structure remain intact, and that the restraint system for both occupants and loose equipment be adequate to retain the occupants and loose equipment in their respective positions under survivable crash force conditions.

C. *Elimination of Injurious Environment.* If we now have a crashworthy aircraft structure which incorporates adequate tie-down features, the next problem is to eliminate items within the immediate environment of the occupants which are potentially injurious such as non-yielding seat backs, food trays, arm rests, etc.

D. *Crash Force/Energy Absorption.* If an aircraft is provided with the desirable features set forth above, there is then the possibility that the structure of the aircraft has become rigid at the point where the crash force energy is transmitted directly to the occupant and in some instances, may even be magnified during the crash deceleration. Crash safety design should include provisions for absorbing energy either in the basic aircraft structure or through the use of suitable energy absorbing materials or devices without compromising crashworthiness or any of the other features cited above.

E. *Elimination of Post-Crash Hazards.*

If the above factors are properly incorporated in the design of an aircraft, then the survival rate in aircraft accidents should be substantially increased. There are, however, still the post crash hazards to contend with such as post crash fire and drowning in ditching accidents. Crash safety design should include proper emergency placarding, proper emergency lighting, adequate emergency exits, and methods for reducing the possibility of post crash fire.

In summary: crashworthiness, adequate tie-down, elimination of injurious environment, crash force/energy absorption, elimination of post-crash hazards equals crash safety.

In conclusion, we feel that the following deficiencies represent the most significant findings resulting from aviation crash injury research:

(1) The lack of sufficient medical data, particularly autopsy data from fatalities associated with aircraft accidents. More information of this type would permit better correlation between injuries and their causes, particularly internal injuries. Such information would also be extremely valuable in determining the causes of accidents in some cases, especially where alcohol or drugs are involved. It is hoped that someday a way may be found whereby complete autopsies could be performed on all fatalities experienced in aircraft accidents.

(2) The present load factors governing the tie-down chain are inadequate. These load factors were developed at a time when very little was known about the actual loads experienced in aircraft accidents and they have been improved very little during the intervening years. During the past decade, however, through experimental research in improving the crash testing of full scale aircraft, considerable knowledge has been gained with regard to the loads experienced in actual aircraft accidents for both fixed and rotary wing aircraft types.

The information gained through this research has indicated that deficiencies exist in the present standards with regard to magnitude of the loads, direction of application, duration, and frequency. It also indicates that there are significant differences between the loads experienced in fixed wing and rotary wing aircraft which leads us to believe that the same standards are not applicable to both types. Further, deficiencies exist in the present requirements for meeting the standards and specifications now in existence. The present requirements are for static testing of the various components involved whereas the environment in which these components function is dynamic and the testing procedures used should closely simulate the conditions in which these components function; that is, they should be dynamically tested.

ORGANIZING FOR SAFE WATER SKIING

By JAMES R. LAUZON

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Picture, if you will, a high powered water ski tow boat. The boat is streaking toward a water ski jump at 35 miles per hour. The boat is pulling a highly trained, extremely competent skier. The skier angles toward the jumping ramp at a speed in excess of 48 miles per hour. He miscalculates his timing. At the last fraction of a second he futilely attempts to swerve away from the jumping ramp. There is a resounding thud, then silence.

The time and place of this actual incident was August 20, 1961 in Austin, Tex. The occasion was the National Water Ski Championships and the skier was Chuck Stearns, former national and world champion.

You are probably asking yourselves, will this boy ever ski again? He skied again ten minutes after this hair-raising incident. Had it not been for safety precautions conceived and insisted upon by organized water ski groups, this skier might have been severely or even fatally injured.

Statistics—There are an estimated 12 million water skiers. However, water skiing has an exceptional safety record in comparison with other water sports. This statement is backed by the fact that of all the boating fatalities studied by the Outboard Boating Club of America in 1959, only 3.9 per cent of those fatalities occurred while the victims were engaged in the sport of water skiing. These figures represent a drop of 0.6 per cent from the 1958 study which had a 4.5 per cent fatality ratio.

The 1960 report by OBC is even more encouraging. Of all the boating fatalities studied, water skiing fatalities comprised only 1.8 per cent of the total. This is a drop over 1959 of 2.1 per cent. This safety record is not only amazing but certainly gratifying to both OBC and AWSA. Both organizations have carried on extensive campaigns to educate the boating and water skiing public in matters of safety and common sense.

Safety Precautions—Several safety devices have become commonplace in organized water skiing. Some states now have laws making the use of some of these devices mandatory. In water skiing, life belts are the most commonly used flotation device. Through the efforts of many manufacturers, life belts have become less bulky and less obtrusive. In some cases they are even attractive.

The second item is a life vest or jacket. These jackets are manufactured in different sizes ranging from large all the way to extra small. Some jackets are designed to be more than just flotation devices. In tournament competition skiers attain speeds in excess of 45 miles per hour and a fall at these speeds could certainly injure a skier internally. These jackets cover the chest and back protecting the skier's rib cage, chest cavity and such vital organs as the heart and lungs.

In all AWSA sanctioned tournaments, it is mandatory for all skiers to wear a life jacket during jumping events. Just as a football player wears a helmet and a hockey player wears shin guards for protection, so should water ski jumpers wear a life jacket for protection.

The third item is a wet suit. These suits are made of rubber comparable to those worn by skin and scuba divers. In many cases, the skier uses a wet suit to keep warm while skiing. A wet suit is considered a flotation device, but the suit must meet the same requirements as any other flotation device. It must float the skier. The wet suit, however, cannot be used as a flotation device in jumping because it does not afford the skier the protection from injury that the jacket does.

When it comes to a flotation device, I am a believer! I never ski without a belt, jacket or wet suit. It's just good common sense. Not too long ago, those of us who considered ourselves "hot shot" skiers thought that anyone wearing a life belt was a "sissy." Now we realize how wrong we were. As a matter of fact, the Illinois Water Ski Association, of which I am a member, has a standing rule that no one

skis without a flotation device. This also applies to our ski shows. Not a single act leaves the dock without a flotation device.

Some local ski clubs have adopted the slogan: "If you see anyone skiing in our area without a flotation device, he is not a member of our ski club." This type of thinking and action can only help to promote safety on the water.

This next item of ski equipment is a ski hitch. This ski hitch is manufactured by the Futurity Company of Joliet, Ill. The ski hitch is designed to attach to the transom of an outboard motor boat. It holds the ski line high above the water so that the line will not become entangled in the propeller. This hitch also tilts forward so that the observer, or line handler, does not have to reach down behind the motor near the propeller to retrieve the line.

The increasing use of these safety devices will certainly make the sport of water skiing an even safer water sport.

Rather than reading a long list of "do's" and "don't's," I refer you to the "Signals to Boat Drivers" and "Guideposts to Safe Skiing." All of these "do's" and "don't's" are certainly important and we encourage their observance by skiers and boat drivers. I would like to comment on just a few of these rules.

One of the most important signals used in water skiing is the one signifying "I'm O.K." This signal consists of clasping both hands overhead after a fall. This signal should be automatic to water skiers. Its use is not only encouraged but insisted upon in all American Water Ski Association sanctioned tournaments.

Another extremely important rule concerns a skier's landing. Never, but never attempt to land directly toward shore.

The American Water Ski Association Official Tournament Rule Book specifies the rules to be followed at all sanctioned tournaments. Safety is strongly emphasized in this rule book. There are eight sections in different parts of the rule book devoted to safety.

One section in particular specifies that a safety director be appointed for all sanctioned tournaments.

Section 6.09 states: "At least two weeks before a tournament, the sponsoring affiliated

club, with the approval of the chief judge, shall appoint a safety director, who will appoint such assistants as appear necessary. The safety director shall be responsible for the safe condition of all equipment, facilities, and operation of the tournament. He shall have the authority to take whatever action is necessary, including stopping the tournament whenever he observes a condition he believes unsafe."

We, of the American Water Ski Association, feel that the safety director of a tournament is a very responsible position. We, therefore, feel that this position should be assigned to a competent, responsible individual. The safety director must see that safety boats are in position before a skier leaves the starting dock. Two safety boats are required for jumping and slalom. This means for both practice and competitive sessions of a tournament.

The requirements for safety boats are as follows:

1. The boat must have sufficient length and be powered by appropriate horsepower motor, or motors, which will enable the boat to quickly reach a fallen skier.
2. There must be a driver and a rider. The rider should be a good swimmer and must wear a flotation device.
3. Ring buoy and line.
4. Boarding ladder.
5. Water stretcher (can be an inflatable air mattress).

The safety director must also check the safety sides on the jumping ramp to see that they are in a safe condition. The safety sides just mentioned are plywood enclosures which cover the sides of the ramp. They are attached to the ramp surface and jut outward at an angle to below the water line. If a skier strikes this slanted safety side, it is not like running into the proverbial brick wall. The skier is merely deflected away with little or no injury.

Had it not been for these previously mentioned safety precautions, Chuck Stevens, whom I mentioned earlier, might have been seriously injured.

It is interesting to note that in 22 years of water ski tournaments with 65 tournaments sanctioned by the American Water Ski Association this year, there has never been a fatality in a sanctioned tournament.

American Water Ski Association—The American Water Ski Association (AWSA) is comprised not only of single memberships but also of affiliated clubs. Local clubs find it advantageous to be affiliated with AWSA. Information not readily available to others is available to them. Publications such as the "Water Ski Club Manual" and the "Tournament Manual" are sent upon request. These publications contain specific sections on safety.

People often ask me, "Why should I join a club?" One of the basic reasons for joining a club is the availability of equipment which of course includes safety equipment. Many ski clubs have safety rules formulated by their own committees to suit the needs of their specific area. For example, a certain area might require a definite pattern for boat traffic. Our local club has a safety director and a safety committee. They have drafted rules for our ski area which, incidentally, include all of the local laws as well as existing state laws pertaining to water skiing and boating. By joining a club a skier may enjoy the protection of regulated, safe organized water ski activity. The new club member will also benefit from the background and knowledge of safe skiing procedures acquired by the older members of the club.

In a great many instances, local ski clubs have worked hand in hand with marine manufacturers in the development of their products. The manufacturer gains the much needed testing his product requires and the ski club gains the use of the equipment. The recommendations of seasoned skiers is invaluable and the final product is always a safer, more durable product.

The Mid-West Region of AWSA is deeply indebted to many marine manufacturers for the consignment of their products to the region for use in tournaments and ski shows. The Jones and Yandell Company and Billy Boy Products have donated life belts and jackets. The Kaar Engineering Corporation consigned two-way radios to be used in tow and safety boats. The major motor manufacturers, Scott McCulloch, Johnson, and Evinrude have made boats and motors available. The use of this equipment by the region certainly helps to make our tournaments and water ski activities more proficient and thereby, safer.

These manufacturers have also co-operated with AWSA, by including membership applications and safety literature and safety pamphlets with their products. Scott McCulloch co-operated again with AWSA to prepare and produce a booklet called "Trick Riding Made Easy." This booklet, incidentally, also includes a section on safety. Evinrude Motors has produced and distributed a booklet on water skiing stressing safety. Johnson Motors has produced a complete library of water skiing films and has made them available to clubs throughout the country. Kiekhaefer Corporation has also produced films in water skiing.

These manufacturers have done much to foster and further the cause of safety and certainly deserve a commendation for their efforts.

Cowboys—As in any way of life, or in any sport, there are always a few bad apples who can spoil the barrel. We of the water ski world are also plagued with this problem. The cowboy, or renegade, as we often call them, are the guys who buy or borrow their first boat, borrow a pair of skis and a tow line, grab a friend by the neck and hit the waves. They have had no previous instruction or indoctrination. They do not know, nor do they care to know the local or state regulations on boating or water skiing. They run their boats and ski with little or no common sense, and very little regard for other water enthusiasts. The comments made by fishermen and land owners alike naturally are, "there goes another blankety, blank water skier." These comments are justified, but certainly place a stigma on water skiing in general.

We feel that the most practical method in which to corral these cowboys is to encourage them to join an organized ski club. There are well over 800 water ski clubs throughout the country, which should provide plenty of corral space. Recently, there has been the development of statewide water ski associations, or federations, who are organizing the water ski clubs in their states. Much is being done through these state water ski federations to promote safety and common sense.

The primary lesson taught by organized water ski groups is as follows: "When water skiing, give a wide berth to all other boats, swimming areas, and objects on the

water. Give particular regard to fishermen, canoes and sailboats so that a healthy situation will prevail on the water. Water skiers and other boaters, who use our waterways, will then be able to live together and enjoy their respective water sports in harmony."

Legislation—Many states throughout the country have enacted or have attempted to enact legislation which we feel is restrictive to water skiing. Some examples of this type of legislation are as follows: "Restricting water skiing to only certain hours of the day. (This would certainly impose a hardship on a person who has unusual working hours.) Restricting horsepower or even eliminating boats from lakes of certain acreage. (This can cause a hardship on a person who has purchased property on these lakes.) No double skiing. (This could put show skiing out of business.)"

Organized water skiing groups not only warrant favorable legislation, they unequivocally endorse it. Organized groups, by example, have shown that they are not

afraid of legislation that requires flotation devices, or requires an observer, or a wide-angle rear view mirror. Our local ski club has had these regulations for years. If, by example, we can show others that this is what an organized group does, perhaps they will emulate us, or even join us.

Summary—Safety devices and safety rules are useless unless the skiing and boating public are educated as to their existence and usefulness.

The American Water Ski Association, in co-operation with the Outboard Boating Club of America and marine manufacturers, is actively engaged in furthering safety in water skiing. The AWSA is constantly in contact with affiliated ski clubs, working with them and sending them safety and technical information. The AWSA has been represented at boat and sport shows throughout the country. The message being relayed is 'ski safely, join a local ski club and the AWSA.' Then enjoy the fastest growing all family and competitive sport, but enjoy it safely.

HOW TO USE LOCAL PUBLICITY IN PROMOTING WATER SAFETY

By PHILIP LESLY
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Educating people for safety is an anomaly. It is an axiom that "Self preservation is the first law of nature," and yet everyone associated with safety education knows how difficult and frustrating it is to get people to heed messages that can save their lives. This is not unique in America, because in this country, admired all over the world for creating the highest standards of living based on selling products and services, we are strangely inept at getting across ideas.

We have the best economic system ever devised by mankind, yet we have done such a poor job of getting it understood and appreciated that we must constantly be beating off efforts to destroy it. We have the best social system for the total of the people in the history of mankind—yet most

of the time in most parts of the world Russian communism is much more effectively projected than American freedom.

Behind these difficulties is one key rule of communication that too few people understand: You can't *sell* ideas the way you sell products. You can't *sell* safety by driving messages at people, trying to impose what you have to say on people's minds. Ideas are accepted by people who come to feel they are their own ideas as a result of exposures that are meaningful to them.

So, to educate people for safety—on the highway or on the water—safety must be made meaningful to them, at the local level, and in their individual lives.

We have seen that safety programs do not succeed on slogans only, on emotional

appeals, or on vague calls for safe action. They must be as specific in concept as possible, and identified as closely as possible with the individual *personally*. People must absorb the safety message out of exposures and activities that they voluntarily encounter because of benefits they themselves seek.

Safety education programs should be simple, easy to understand, and easy—even enjoyable—for people to engage in.

Here is another important principle: Convey the message of safety in terms of the wife, the children and other loved ones, rather than the person himself. It's a basic psychological fact that many people consider it a sign of weakness to admit, even to themselves, a concern for their safety; but it is a sign of strength and admirable to be concerned about one's family.

Tell a man how he can help protect the life and health of his wife and children and you will be educating him in safety without his acknowledging the fact.

Now let's look at how we might go about organizing and conducting a local publicity program for water safety.

First of all, let's recognize that as in all fields where ideas are the primary ingredient, the best publicity cannot be done by committee. No matter how many people may be involved or delegated to carry out assignments, the program will be successful in direct relation to the availability of some one dedicated person with imagination, creative ability and energy.

The media for reaching the public include all of the mass outlets—newspapers, magazines, radio, television and public meetings. These can be utilized in a variety of ways: interviews in newspapers or magazines with local safety council members or Coast Guard personnel; an insurance man who points up the dollar losses incurred in boating mishaps; soliciting the services of boating editors to comment editorially on how water activities can be best carried out with safety and security for one's loved ones. Radio and television interviews can be arranged with local marine dealers, Red Cross, safety council or Coast Guard personnel, newspaper or magazine boating editors or outdoor editors, or with police officials.

Wherever possible, the information about safety should be couched in material about

water sports in general—boating, swimming, water skiing—and treated as proper procedure, rather than as lectures on avoiding accidents.

People who can speak authoritatively on water safety almost always are glad to cooperate in a program that holds real promise for making the public more alert to proper practices on the water. These include local safety council members, Coast Guard or power squadron personnel, police officials, local Red Cross representatives, or personnel from the Outboard Industry Association, formerly the Outboard Boating Club of America.

Materials to help get across the message of proper procedures on the water are readily available. Pamphlets, booklets, photographs and films can be obtained usually by written request to the National Safety Council, commandant of the Coast Guard District in which you live, your area Red Cross director or the Outboard Industry Association or the National Association of Engine and Boat Manufacturers.

Now, here are a few specific suggested activities in which a local organization might engage to foster safety on the water:

1. Stage a public on-the-water demonstration of proper and improper practices. Urge that wives and children be brought as observers so that they will learn. Cooperation can be solicited from the Red Cross, local dealers, the Coast Guard, Sea Scouts and similar groups. Ski clubs can provide attractive entertainment, at the same time pointing out the proper ways to water ski. Free rides can be offered at another inducement to get people to come out and to absorb proper procedures. So can free engine checkups be offered by dealers.

2. A talk before a civic club or service organization by an authority on water activities or a safety expert can provide an immediate outlet for information on proper procedures and techniques. It also provides very important means for reaching thousands of people in addition to those who attend the talk. It is always important to remember that any meeting represents only a portion of the impact that can be derived if it is properly planned and handled; the publicity that appears as a result of the meeting in various kinds of media can frequently be much more effective in total results.

3. Marine dealers can be interested in holding on-the-water demonstrations at which experts would be local Red Cross and/or Coast Guard personnel. The demonstrations could include illustrations of good boating techniques, engine care, rescue practices, etc.

4. Arrangements can be made for police, Red Cross or Coast Guard personnel to talk before school assemblies on water activities, proper procedures, and getting the most out of fun on the water. Films can be shown that illustrate these points. Such appearances also provide an opportunity for publicity in local newspapers, radio or television.

5. A newspaper interview can be set up between a local insurance man who specializes in marine coverage on the dollar losses in water mishaps, caused by improper practices, and the savings that can be effected by good boating habits. In many cases the fear of financial loss can be made more graphic to people than the always-unreal likelihood of their being killed or injured.

6. An interview can be arranged between a boat racer or water ski champion and a newspaper boating editor on techniques to be used at high speeds, under trying conditions, etc.

7. A local marine dealer can be urged to sponsor one-minute suggestions on proper boating techniques, over radio or television.

8. Other interviews can be arranged for local Red Cross or Coast Guard personnel; the president of the local outboard boating club; a marine dealer or a local garage man on how to hitch and pull a boat trailer with a car.

9. Films available from the various outboard motor manufacturers, the Outboard Industry Association, the Red Cross and other sources can be shown to many organizations such as women's clubs that are not directly interested now in boating. The big problem in water safety is not the veteran so much as the beginner who ventures too soon, with too little information. The new boaters and water skiers and swimmers each year are most in need of education. The future water sportsmen—those not already aware that they will be interested in water sports—need to be reached before they venture out onto the water.

Reducing the accident toll on the water is a challenge worthy of the best abilities and the most humane instincts of the American people. It is not an easy assignment, but one that can be most gratifying in its results if imaginative and energetic efforts are applied.

WATER SURVIVAL COURSES

By ROBERT W. BUCKLEY

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Few water safety instructors have understood the value of teaching their students safe methods of swimming while clothed. It can be shown that more than 80 per cent of all people who lose their lives in the water are fully dressed at the time of the accident. It is common knowledge that most people believe that clothing will drag them down with its weight and therefore, must be discarded before they can swim to safety.

Swimming instructors have attempted to cover this important subject matter by teaching their students to disrobe while swimming in deep water. In most cases,

the swimmer does not have sufficient clothing to give him a true test of his ability to disrobe. He does not have, for example, shoes that lace above the ankles; he does not have the multiple layers of clothing a sportsman is likely to wear when on or around the water, such as a T-shirt, a wool shirt, a sweater and a windbreak, a parka or a rain jacket. Each of these must be systematically removed one at a time; or there is great danger in becoming entangled, thus making swimming almost impossible.

Swimming instructors should quickly recognize this fact: only the smallest percent-

age of their pupils will ever be able to swim well enough to disrobe properly.

Under actual conditions, people around the water participating in boating, sailing, hunting and fishing are usually heavily dressed for protection against the cold. The water is often rough or choppy, and sometimes distances to safety are great.

There is a definite need for standardizing instruction in "clothing swimming." Most text books teach clothing inflation, outlining only procedures for disrobing and inflating garments that have been removed from the body. It has been proven that students can be taught to inflate the clothing that they wear while on the body. Without removing a single object, students very low in swimming proficiency can be taught to splash air into their shirt or jacket while being worn. They can be taught to keep air in their trouser legs by falling or jumping into the deep water, bending their knees slightly and coming up, and rising their knees to the surface about the same time their head breaks the surface. This should be done face up, hips low, and feet remaining underwater.

Let us look at some of the advantages of keeping the clothes on the body instead of disrobing.

1. Clothing protects the body from the initial shock of hitting cold water and allows the swimmer to adjust to the cold a little more gradually in order to get his breath.
2. It offers support for the first few critical moments when panic is likely to strike the swimmer. He may be able to calm down and more rationally plan his course to safety.
3. Clothing protects the body from prolonged exposure. Sometimes rescue is many minutes, if not hours away. In many places cold is a cruel enemy and causes loss of life to even the strongest swimmer. Water, trapped within successive layers of clothing acts as an insulator against the outside cold. Water coming in contact with the skin warms up, thus cutting down exposure to cold. Alert instructors in the military service taught men for survival in South Pacific waters the advantages of keeping their clothing

on for protection against the sun, predatory marine life, and rocks and reefs when swimming to safety.

1. Remaining dressed eliminates dangers of becoming entangled in the clothes. Clothing is not damaged as a result of inflating it on the body. Clothing can be inflated in much less time than it takes to disrobe.
5. It takes less time to teach inflation than to teach disrobing.

Inflation of Upper Garments—By holding a shirt tail or the lower front of a jacket or any other upper garment out and away from the belt, air can be pulled into the water by the free hand. This is accomplished by cupping the hand and delivering a striking blow downward, thus splashing the air into the front of the jacket. By assuming a semi-vertical position in the water, belly slightly downward, back arched, face out of the water, as in the head high breast stroke, the air splashed into the jacket inflates the area over the upper back and shoulders. This support is vital for keeping a person afloat in a desirable position for swimming breaststroke, side stroke or dog paddle. Air can be replaced when needed with little difficulty.

Inflation of Trousers—By turning up on the back, flexing one knee and holding the cuff away from the shin at the ankle, air can be splashed down and under the holding hand. This air becomes locked in the trouser leg over the knee. Each trouser leg should be inflated a little at a time. The position maintained on the back should allow the belt and trouser fly or feet to remain lower than the rest of the inflated trousers. Of the two methods of inflation, the one most useful under most conditions is the inflation of the upper garments. Usually support from the upper garment is lost when attempts are made to inflate the trousers. The position on the back allows air to escape through the open front of a jacket or shirt.

Suggested Inflation Test—Simplicity should be stressed in testing. Keep in mind that poor swimmers need inflation techniques requiring little skill. The good swimmers can usually survive their mistakes. *Test No. 1.* Students dressed in cotton shirt and trousers. Completely button shirt, including collar button; roll down sleeves and button. Jump

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into water, feet first, pull out front shirt tail, splash air into shirt. Time limit 10 seconds. Remain air-borne, re-inflating from time to time when necessary for support. Test No. 2. Students jump into water feet first, bringing knees to surface just a little ahead of their feet and head. Air is trapped

in trousers above the knees. Students are to remain motionless and air-borne within ten seconds after hitting the water.

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FARM SAFETY SESSIONS

OUR STAKE IN A HEALTHY AGRICULTURE

By PAUL C. JOHNSON
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American agriculture has been at some kind of a crossroads for as long as I can remember. Nevertheless the situation today has many aspects which cry for understanding and articulation. We are here primarily to talk about a specific farm problem, namely that of safety in farm operations, but I think it would be well first to do some broad thinking about the place of the farmer in our society. This thinking might well explore his state of mind and his relations to the rest of society.

They say a disturbed man is accident prone. It makes sense then that leaders in the safety field should make a real project of understanding the mental and occupational climate in which the farmer works. This is an important step toward achieving our goal of inducing farm people to analyze their safety problems and attack them systematically.

There's an old saying that you should learn to love and understand your neighbor before you set out to improve him. So that is my task in opening this conference.

Those of us directly involved in farming and agribusiness have been worrying a good deal lately about the public relations of agriculture, that is the image of farmers and farm business that is being impressed on the minds of American people. The public distaste and "bad press" that have grown up around a succession of government farm programs are largely responsible. Friends of agriculture who have been deeply concerned about this governmental involvement have sometimes worsened the situation by dwelling on the evils of dependence to the extent that the success stories of agriculture are overshadowed or overlooked.

We all suspect that a bad public image may have serious consequences in misdirecting public attitudes on such things as cost of living, or indeed safety, and may encourage anti-farm legislation that will not serve the national welfare.

I am even more concerned about the effect of the deteriorating public relations climate on the farmer and his family. I have detected a growing tendency on the part of farmers to be apologetic about their work. There has been loss of pride in their vocation, evidenced by dropping enrollments in agricultural colleges and lack of enthusiasm about the future of farming.

This adds up to a situation which might best be described as "unnatural." City people want to think well of farmers and will do so if given half a chance. They may be far behind in their understanding of modern farm practices, but they like to think farmers are the salt of the earth. Many non-farm people have a background of farm experience. There is deeply rooted in man a desire to own land and a feeling that in land there is both romance and security.

I believe this relations problem can be attacked by working diligently at developing four lines of public understanding: (1) tell the truth about present-day farming; (2) explore the future of farming with optimism; (3) bring the needs and priorities of land use into perspective; and (4) set up national goals for farming and farm people.

The nature and extent of the revolution in agriculture is not well understood, even by farm experts and farmers themselves. It is not surprising that non-farm people fail to grasp what has been going on. Yet the magnitude of the change explains why we have many tensions, plus farm programs to treat the problems of adjustment. The consumer has fared very well indeed and it is not necessary to point the finger of blame at anyone. Just tell the truth.

The fact is that modern farming methods have made the farmer a bigger man. With his new tools and his new knowledge, he can do three to ten times more than his grandfather, depending on the type of farming.

I do not believe, as some do, that the farmer was pushed into technological and business farming. He chose the new methods eagerly, even though the rapidity of the change has at times caused much economic anxiety. He chose the tractor in preference to the horse, then bigger and better tractors and auxiliary machines. He hired the electric motor because the motor can duplicate the muscle work of a man for a tenth the cost. He took readily to the new chemicals that transformed agronomy, and the new science of breeding and feeding his animals for higher production. Incidentally, you safety experts know these improvements have also spawned a whole new set of working hazards.

The speed with which this transformation has taken place is a tribute to the farmer's own ingenuity and enterprise, and to the vast forces of institutional and commercial invention which were unleashed by this enterprise.

Changes in farming have been complicated by changes in patterns of supplying farmers and processing the products of the farm. Farm suppliers must produce in quantity to survive, so they advertise diligently and put forced draft behind educational and research programs, their own as well as those of the colleges.

Processors have found their business changed radically by the advent of the supermarket. This institution has brought low-cost merchandising, standardization, and convenience packaging. The processor had to look to his sources of raw material to meet this new demand and was forced to change his buying habits to suit the somewhat cumbersome organization of the large food chains.

The tremendous productivity of farmers has made food steadily cheaper. City folks may find this hard to believe when they check out a grocery order. They need to be reminded that the higher costs they pay are the costs of the packaging and processing that have been added to the food since it left the farm.

Less than a tenth of the people in this country are now farmers. As a matter of fact, more than 90 per cent of all our food is grown by approximately one-twentieth of our people. A hundred years ago it was the other way around. This change

has given us the highest standard of living in the world, but it also has given us some persistent headaches, because many people have to leave the farm to find other work and it is necessary to reduce the amount of land which is being farmed.

It is this adjustment that has brought the long succession of experiments we call government farm programs. These programs have not all been successful, but it is only fair to say that they have been mostly honest attempts to save us from depression, and to save a lot of people on small farms and on poor land from becoming a burden on the nation.

The cost of farm programs has been relatively small when you keep in mind the magnitude of this judgment. The experiments will continue until we get more nearly the right number of people living decently on more nearly the right amount of land.

It's up to us to call forth the kind of citizenship that will direct the adjustment wisely, and to have wisdom we must have understanding.

A lot of people, both on and off the farm, carry in their hearts a deep concern for the future of farming. After all, haven't we drawn from our farms, generation after generation, young people of good work habits, stable outlook, and honest ambition? Hasn't the family farm stood us in good stead throughout our history? Do we want to trade it in for some kind of agricultural factory system which might grow out of present trends toward big business farming? Can our traditional family-farm system meet the new demands and continue to survive?

I believe the answer to this last question is yes. There have been many experiments in vertical integration as well as industrialized farming. There will be more as we probe the future, but as of now farming still belongs solidly to the individual operating his own business. Except in a few fields, the industrial type corporation seems to be out of its element in farming. I do not believe that processors or grocery chains want to farm. They will go into it only if they must, to procure the kind of raw material they need, when they need it. Its investment cost is too high by industrial standards. There are too many variables, too much grief.

I believe the independent farmer is in business to stay, *provided he recognizes the importance of keeping himself fully employed and the necessity of turning out a good product at a cost in keeping with his tools and his capacity.*

This calls for a farm of considerable size, a \$100,000 investment in land and capital, perhaps more. It means outside financing of one kind or another, probably some separation between ownership of the land and the ownership of the other means of production, because the investment load is likely to be too big for one family.

There's a lot to be said for the two-family farm, giving full employment to two able-bodied men, father and son, two brothers, or an operator and an able hired man. The two-family farm makes better use of land and machinery, and it makes farming much more compatible with modern standards of living. Can this size economic unit compete successfully with the really big ones? It will depend, of course, on the type of farming and on the organizational aids farmers can muster. By the standards we now recognize in the midwest, I would say that this bigger family farm can still run corporation farming off its legs. This means that in safety and other programs of betterment we can still address ourselves to the farm family as an independent operating unit.

The larger family farm has an economic resiliency hard to match. This accrues from such things as personal interest in the business, willingness to put in overtime at half rather than double pay, willingness to build up capital rapidly in a good year and to live on it when the going is hard.

I believe the farm as an independent economic unit of moderate size can hold its own as the prevailing pattern of American agriculture if we can give some help in bringing the amount of land and resources in farming into better balance with the needs. It is hard to understand that we now need less land to feed more people.

This points to another line of understanding that we must diligently pursue if the public image of agriculture is to be an honest one. It is really a wonderful thing that at a time when the population is growing we still have surplus land for highways, industrial expansion, airfields, parks, and other very important non-farm uses.

Somehow we as a nation have gotten ourselves into a predicament where we are farming some 70 or 80 million acres of land which should be shifted to other uses. One time-honored method of adjustment, letting the price drop so far that this land will go back to the county for taxes, is no longer socially acceptable. We just don't believe in putting anybody through this kind of a wringer any more if we can possibly help it.

Modern farming demands optimum use of the best land, so the acres to be shifted should be the acres least suited to farming. This is hard for the individual farmer to do. Goaled by fixed overhead costs and fired by ambition to succeed, using the land he happens to have, he produces for whatever market there is. If the market is phony and the price bears little relation to honest need or true demand, farming is thrown even more out of kilter.

Use of public funds to develop new agricultural land or subsidize the improvement of unsuitable land aggravates the problem further. Our government does have a responsibility in dealing with this overexpansion in agriculture. Present programs for idling acres tend to treat symptoms rather than causes. They are unacceptable as long-term solutions.

I've been plugging for some time for something I call a Federal Land Reserve Board which might be given the responsibility of planning and implementing long-time adjustment in the use of land. We need a sounder approach than that we have been using. *Over and beyond his own ability, nothing will do more to assure the farmer of success than bringing the total capacity of the nation's agricultural plant into reasonable line with the total need. This is the way to make the free market effective.*

There is a fourth area of concern which I recommend to the attention of all leaders in farming and agribusiness. If we are to entrust our food-growing function and our best land to one-twentieth of our people, they should be among our finest citizens—strong, competent, well-educated, proud of their work. This means more than just earning a living. It means taking a responsibility for conservation of the soil and the countryside, dealing intelligently and confidently with the economic and sociological

problems of the changing rural community, building their own safety and improvement programs, and impressing the viewpoint of the grower on our national and international leadership.

A good many farmers I know are living up pretty well to this ideal, but it certainly is not the usage being held before the American public today.

The entire nation should re-examine the new role of the farmer in the light of the public welfare and America's future, divest it of some of the romantic and nostalgic notions that have come down out of the past, take a hard look at the facts of adjustment, and in general put the food industry into more realistic focus.

It is tragic that the American housewife, whose family has been emancipated from the historic fear of famine, should wheel her cart down the wondrous aisles of the supermarket, utterly oblivious to how this great treasure was assembled, often contemptuous of the farmer and his carping problems.

Fifty years ago an American Country Life Commission, headed by Liberty Hyde Bailey and utilizing many of the best brains of the time, presented to President Theodore Roosevelt a commission report in which they evaluated the needs of the country at the turn of the century, when we were much younger. They wrote a credo for American agriculture that is well worth

reading today, and they drew in surprising detail the blueprint that has made possible the success story of American agriculture unfolded in the past half century.

I think this job should be done again. As an editor I have confidence in the written word. If it is well considered and carries the force of insight and sincerity, it can go far to elevate our purposes and unite our efforts.

What do we want from the American farmer in the future? Continued abundance, yes, but this is only a part. The nation should speak out on this subject.

Is the farmer merely a cog in an economic machine? Is he a cow to be kept happy and well-fed so he will give much milk? Or is he a free man doing important work and having an important part in the great decisions of his time? What we really want him to be may affect the way we tackle the host of perplexing problems that have grown up around today's agriculture.

I have sketched this background of modern farming because it needs to be understood by all who work in farm programs. If we are to be effective leaders, we have to believe in farming as a vocation and farmers as good and useful citizens. I urge you to familiarize yourself further with the truths about farming and enlist in a crusade to make them widely known. If you do this your work in farm safety is sure to be blessed with success.

THE ACCIDENT SYNDROME

By MORRIS S. SCHULZINGER, M.D.
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Practical considerations as well as the complexity and enormity of the accident problem have made it advisable to attack the accident problem piece-meal. Hence, the division of accidents into home accidents, automobile, aviation, recreation, farm accidents, etc.

Basically, however, all accidents, no matter where they occur, have more things in common than what sets them apart. I would know of no group who could ap-

preciate this truism better than the farm group.

For many years a dissertation on accidents frequently began with a statistical recitation of the horrible annual accident toll. The figures seldom varied:—accidents are the first cause of death under the age of 35 and the fourth cause of death for all ages. One hundred thousand deaths are caused by accidents annually, 400,000 are injured with permanent disabilities, 10,000-

000 are injured with one or more days of disability and the cost of accidents is \$10,000,000,000 annually. In recent years, the cost has risen to some \$15,000,000,000 and by means of some statistical magic, the annual casualty figures were raised to 50,000,000 injured, with one or more days of disability.

When the impact of these figures began to wane, the astonishing fact was brought out that in terms of productive years lost, automobile casualties alone are responsible for one and a half million years lost annually. While counting all accident fatalities, nearly 5,000,000 productive years are lost annually in the U.S., and these figures do not include the losses due to partial-and-permanent-disability accidents.

If a disease was to threaten continually with incapacity or extinction any large or small segment of the population, particularly among the young, the medical profession, the public health services and an aroused public would promptly shoulder the responsibility of studying its cause and checking its havoc. The seeming public indifference to the annual accident holocaust and the innumerable personal tragedies that follow suggests that accidents may serve some deep inner needs of the individual, or that the overwhelming nature of the problem evokes a measure of fatalism and resignation in face of the inevitable, reminiscent of parts of the Orient, where every new calamity denotes little more than a break in the monotony of suffering. Yet progress in accident prevention has and is being made as is evidenced by the proceedings of the current National Safety Congress, and the increasing number of reports from research laboratories throughout the country.

Some 30 years ago when the author entered the practice of medicine, there was no accident literature to speak of, accidents were considered fortuitous experiences or an act of God, and accident prevention was largely unknown outside of major industry. Soon after World War II, accident prevention bloomed forth as a new and exciting field due to the introduction of the magic concept of "Accident Proneness." You will recall the erstwhile chorus of many loud and booming voices pronouncing, that 85 per cent of all accidents were caused by 15 per cent of the people and that all we

needed to do to solve the accident problem was to find, train, isolate or remove the 15 per cent of the culprits who caused most of the accidents.

By 1947 this author had treated some 35,000 accidents in his private practice and on the basis of experience the new concept of accident proneness, as the cause of most accidents, did not ring true. The challenge was great and thus the author began an intensive study of his case records, which among other things showed: that when the period of observation was sufficiently long, i.e. one or more years, the 15 per cent of the population who suffered 85 per cent of the accidents were not the same people, but were in reality a changing or shifting group, with new persons constantly entering and leaving the group.

It is now generally agreed that the vast majority of all accidents are preceded by personal acts which, in a manner, pave the way for the accident and in fact, make its occurrence almost inevitable. The personal acts described as precursors of accidents are usually in the nature of physiological, psychological, or physical aberrations, subject to detection by clinical means. Yet, accident prevention is still largely directed at manipulating the environment while clinical efforts aimed at manipulating the individual are relatively rare.

In the past, major gains in accident prevention were truly achieved by all of those measures commonly known as "safety." Our hope in stressing a change of emphasis, from the environmental to the personal and clinical aspects of the problem is to engender the overall conclusion, that future major gains in accident prevention devolve upon a comprehensive clinical approach of which "safety" is an integral part.

Various studies suggest that an accident in itself is merely a culmination, and often times an inevitable culmination, of single or multiple factors which temporarily or more or less permanently are in the background of life. Given a set of circumstances of unfavorable nature, with fair fidelity, it is possible to predict the coming of an accident, but the background is more important than the culminating final event. The accident itself chiefly serves as a trigger mechanism for the impending disaster.

Clinically speaking, there are three factors underlying most accidents: an environmental hazard; a temporary or a prolonged personal impairment, or maladjustment; and faulty behavior under stress. It can also be shown that preceding most accidents, there is a combination of signs, symptoms, and circumstances which together determine or influence its occurrence. These signs, symptoms and circumstances, though numerous, follow a pattern and lend themselves to the formulation of a syndrome—the accident syndrome.

The Accident Syndrome is thus a combination of signs, symptoms and circumstances which together determine or influence the occurrence of an accident.

Susceptibility or proneness to accidents is largely a passing phenomenon, shifting from group to group; with age, with experience, with the degree of hazard, the intake of alcohol or drugs and a host of other transitory or more or less permanent situational, personality and health factors. In the course of a lifetime nearly everyone can and does become temporarily accident prone. Most persons, consciously or sub-consciously, rapidly adjust to their unsafe or accident prone state and an accident is avoided. It is when the individual fails to recognize his accident prone state, or when he is unable to adjust to it, that an accident is liable to occur.

Susceptibility to accidents varies in degree and duration, and fluctuates with personal and situational factors. Susceptibility to accidents may be divided into personal and situational proneness, and these may be subdivided into mild, moderate, and severe, and again, into temporary, long-term and permanent accident-proneness.

Freedom from accidents depends on physical and mental health, on an integrated harmonious functioning of the sensory-motor and psychomotor systems, and on conditioned safe behavior, or the ability to react in a safe manner under stress. The adequacy of adjustment of the individual to himself and to his environment, and his ability to adapt to sudden change, is a measure of his non-susceptibility to accidents at any given time. An individual's accident potential may thus be said to vary with current stresses and strains, superimposed on basic or long-term personality trends.

For maximum effectiveness, accident prevention should begin in early childhood with a careful indoctrination in safety habits and the art of safe living. The home is the place where susceptibility to accidents and immunity to accidents are born and bred. The family and the home are the ideal units for favorably affecting accident susceptibility and accident experience. The schools, industry, and the community also may admirably serve these aims.

Essential to the success of the clinical method in accident prevention is a working familiarity with the accident syndrome and with the physical, physiological, and psychological factors which determine accident causation. Another pre-requisite is a systematic effort to check out predisposition to accidents, and the pre-accident state, in all routine medical examinations and screening procedures. More intensive examinations and appropriate therapy may be necessary in individuals with a high accident potential, in accident repeaters, in persons under severe emotional strain, and in those engaged in hazardous pursuits. Careful clinical examination and treatment are especially indicated in the three main accident-producing groups: the young, the male and the maladjusted; as well as in the permanently or acutely accident-prone.

Viewed as a clinical entity it becomes incumbent upon physicians, in their examinations of patients, to determine the possible presence of accident-producing abnormalities, or factors and to forewarn their patients accordingly. Of special concern in the clinical prevention of accidents are the patient's current illness or state of health, their past medical history, their current life situations, emotional stability, motivation, developmental and family backgrounds; history of adjustments on the various levels; current and long-term stresses, behavior under stress, physical and mental disabilities, smoking and drinking habits, the use of drugs, the frequency of accidents, occupational and situational hazards, etc.

To diagnose the accident syndrome or the pre-accident state, the properly trained physician would begin with a careful history and physical examination of the patient. Psychological and physiological tests may provide additional aid. The accumulated information then has to be evaluated on the basis of clinical experience, and the study

of the patient. In diagnosing the accident syndrome, as in other complex clinical entities, diagnostic acumen is sharpened by a state of alertness, diagnostic receptiveness, and a heightened index of suspicion.

Suppose the physician does diagnose a pre-accident or accident-bound state in one of his patients, what could he do about it? The physician's first task is to protect the patient against the impending accident. With this in view, pre-accident patients should be divided into three groups, those who are safe for exposure to hazards; those who are unsafe; and those who are safe for limited exposure.

Where treatment is indicated, pre-accident clinical therapy should attempt to prevent an accident thru the control or cure of the known accident-producing personal impairments and maladjustments, discovered in the examination of the patient. Of lesser importance, but never to be neglected, are the situational or environmental hazards of the individual which are to be controlled with the aid of safety specialists. Every physician's office thus can and should become a source of accident prevention information and treatment.

In clear-cut cases, treatment of the accident syndrome should begin as soon as a working diagnosis has been established and the treatment should be as all-inclusive as possible. In border-line cases, the need for appropriate treatment arises whenever pertinent accident-producing physical, physiological or psychological abnormalities are discovered, and whenever the loss of emotional, psychological, or physiological equilibrium is threatened. The aim of treatment should always be to eliminate, modify, or neutralize the accident-producing factors discovered in the examination of the patients.

What about the vast majority of accident casualties who do not happen to see a doctor before the accident? Here undoubtedly preventive therapy would meet its greatest challenge. To prevent most accidents, emphasis should be placed on: educating the entire population to recognize common, recurring and other important accident-producing factors. Emphasis should also be placed on the importance of adequate and speedy adjustment to impairments; and on developing a conditioned pattern of safe

behavior and safety awareness. Highly susceptible or "unsafe" individuals and those exposed to hazardous pursuits should receive more intensive preventive treatment.

In order to reach every segment of the population and still remain within realistic bounds, prophylactic therapy should attempt to make use of seminars, workshops, and educational literature, as well as visits to the home and periodic re-examinations. Preventive therapy should stress accident prevention in personal health education, with emphasis on the role of the individual's deficiencies, abnormalities, capacities and skills in accident causation and prevention.

Guidance should be provided on: vocational placement and training; on general and specific situational hazards; on the role of the home and the family; on the need for adjustments on the various levels; the importance of youth, inexperience, alcohol, speed, fatigue, and stress; on the role of such factors as aggressiveness, frustration, lust and guilt and the role of extremes of temperature, humidity, seasons, weather, time of day, drugs, smoking, CO, noise, vibration, high altitude, transient factors, etc.

From the above listing it can be readily seen that the clinical and "safety" approaches to accident prevention overlap in many respects. The need for cooperative effort and teamwork by many disciplines cannot be stressed too often.

Important therapeutic goals in treating pre-accident patients are to help them achieve and maintain emotional equilibrium, to help them diffuse their uncontrolled aggressiveness with appropriate action, to help them develop a proper sense of respect for minor temporary impairments, and to help them adjust to their permanent impairments. In their unique position of trusted advisers in matters of health, physicians have the opportunity and the responsibility to educate their predisposed patients in the clinical principles of accident prevention. Such an effort should be no more difficult nor less rewarding than the education of pre-cancerous, pre-cardiac, pre-hypertensive, diabetic, and other patients whose continued well-being depends on an acquired ability to recognize pertinent signs and symptoms and to adjust to their impairments.

In the final analysis, true accident prevention rests with each individual citizen, and education in the basic principles of the accident syndrome as part of an individual's personal hygiene education, could go a long way to prevent accidents by way of a safer pattern of behavior and living.

Will the clinical approach to the prevention of accidents place an undue burden on the medical profession? Probably not. In the vast majority of instances simple non-medical measures will suffice. Where a physician's attention is called for, a considerable number of the patients are likely to derive therapeutic benefits from the mere evaluation of their accident potential by the physician, and the insight gained therefrom. Some may require superficial psychotherapy, correction of specific physical or physiological impairments and maladjustments, a course of training in safe practices, or a change of employment. Relatively few patients will require prolonged medical treatment or deep psychotherapy. The relatively small percentage of accidents which are due to specific psychological conflicts, or to a compulsive need for self-punishment through injury, may require specialized psychiatric help. The treatment of physical and physiological impairments and superficial psychological abnormalities is, in the main, along straight medical lines.

By the very nature of the accident syndrome, preventive and therapeutic efforts must deal not only with the individual but also with his family, the community, and with the patient's social, economic and physical environment. In modern urban society, this calls for a community-wide multidisciplinary approach with the personal physician in a position of leadership. The clinical opportunity to prevent an accident before it occurs, through the identification

and treatment of the pre-accident patient, should provide the necessary diagnostic and therapeutic challenge, which has hitherto kept physicians from playing their proper role in accident prevention. Widespread public participation and approval would be of considerable help.

In major industry and in other controlled environments, the clinical method of accident prevention can be applied even now. In other areas of activity a successful application of the clinical method would be facilitated by an enlightened and aroused public participation, the development of a solid body of validated clinical facts, thru research and an active participation of the medical profession. The establishment of special departments by medical schools for the study and teaching of accident causation and prevention would be a welcome step in the right direction.

To advance and test the limits of usefulness of the clinical methods in accident prevention, the author proposed several years ago the establishment of community accident prevention and diagnostic clinics. Such clinics would be exceedingly useful in the practical daily task of diagnosing and treating pre-accident patients. They could also serve research goals by enabling a systematic study of the health, behavior and adjustment of pre-accident and post-accident patients. Well staffed and equipped accident prevention and diagnostic clinics would also serve the needs of undergraduate and graduate medical teaching and as centers for public education in the hygiene of accident prevention.

Unless vigorous application of the clinical approach be espoused, or others of equal or greater promise, if there be such, then the present appalling accident frequency will continue.

WORKMEN'S COMPENSATION IN AGRICULTURE

by E. W. FOSS
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Since the 1930's, in many of the States, there has been a marked increase in the number of farm accidents. The most serious of these have

been able injured workers in getting adequate for injuries without the delays present under common law or employer's

liability laws. The damages include payment for lost time, medical and hospital bills, and reimbursement for permanent injuries.

Until recently, agriculture was not included in compulsory coverage. At present eight states; Alaska, California, Connecticut, Hawaii, Massachusetts, Ohio, Vermont, and Puerto Rico, cover agriculture the same as other workers. Ten other states have some types of compulsory agricultural workers coverages—most of them machine operations. These additional states are Arizona, Kentucky, Louisiana, Minnesota, New Jersey, New York, Oklahoma, South Dakota, Wisconsin, and Wyoming.

From an occupational hazard standpoint, agriculture has the highest death rate of all industry groups. It rates third from the top in total injuries and also third in deaths per 100,000 workers—exceeded only by the extractive industries and construction.

From a social standpoint, there is a need for workmen's compensation benefits by all workers including agricultural. With all other major industry groups covered, and with agriculture moving steadily toward almost complete mechanization, including more hazards, whatever major difference in "mode of life" of farming compared to other industry is fast disappearing.

Because workmen's compensation laws remove much of the risk of civil suit or injured employee against the employer, and workers prefer to be employed by farm operators extending such coverage, there is also a large amount of voluntary agricultural workmen's compensation insurance.

To summarize the workmen's compensation table, some 22½ thousand farm operators in 38 states paid over 10 million dollars of premium based upon some 300 million of payroll. Thirty-six deaths were recorded as part of the 28 thousand "large" claims, amounting to nearly 9 million dollars. This is big business as well as a tremendous waste!

Employer's liability for farm employees shows one and one-half millions of premium based on 66 millions of payroll paid by farm employers in 43 States. Approximately

three thousand medical claims came to over a quarter of a million dollars and 1500 liability claims came to a third of a million dollars—also big business and big waste!

From a safety standpoint, such records of work injuries in agriculture would be a powerful ally. In education we would have exact goals toward which we can aim our publications, our demonstrations, and all other efforts. In engineering we can likewise turn our energies toward improvement in machine guarding, safety interlocks, housing structures, electrical hazards, etc. Enforcement can likewise—through insurance inspection and state regulations—bring about many improvements, based upon facts. Unfortunately, these workmen's compensation records can be summarized only in dollars—no injury summary is available or even possible under the present system of workmen's compensation records! The employer's liability records are likewise useless from an injury summary standpoint.

Recommendation

1st. Recognize the potential value of both workmen's compensation and employer's liability records to aid in agricultural safety work—both research and education.

2nd. Develop a system of record keeping, in cooperation with and the sanction of the insurance industry, that will provide satisfactory information on injuries.

3. We need the assistance of the Farm Conference Board of the National Safety Council on a national level to expedite work with the National Bureau of Casualty Underwriters and with the National Council on Compensation Insurance.

4. We need every state's rural safety council to back this program—particularly to point out the needs to the respective state insurance organizations.

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WHY A SUMMARY OF BASIC AND APPLIED RESEARCH IN THE FIELD OF FARM AND HOME SAFETY?

By L. W. KNAPP

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For years we have all been aware of the enormous numbers of farm and home accidents. Best efforts to date, although great, have not solved this problem. My premise is that one of the major elements missing in our efforts is the lack of general recognition of the usefulness of safety research and a definition of needed research.

One of the first principles in problem solving in any field of endeavor, including safety, is the identification of that which needs to be done. It is imperative that all the elements be correctly identified if any logical order is to be found for their assembly and the solution of the problem. Differentiation must be made between basic (underlying factors) and applied (problem solving) research and evaluation (surveys and studies). Programs and future research, if they are to be effective, must be developed upon fact and not hypothesis, personal opinion or speculation.

A logical step to a breakthrough in farm and home safety is the classification in summary form of all research, either safety or safety-related, listing that which has been done or is presently being undertaken. Any work under wraps or unintentionally left hidden will only delay the establishment of a sound basis for farm and home accident prevention. Too much time has already been lost in duplication of efforts or running down trails already proven unfruitful. Such detours frustrate the strong and discourage the weak, arousing a feeling that such work is useless and wasteful of men and money.

The summary will provide a number of needed links for a well thought out, organized effort toward developing an effective accident prevention program for the farm and home.

1. It will recognize work under way for improved communication between interested investigators.

2. It will provide a resource platform from which to launch new research efforts.

3. It will be a source of basic factors upon which educational programs can be developed.

4. It will provide a measuring stick for the progress made by those involved in safety research.

5. It will create enthusiasm in those doing such work and stimulate interest in those presently uninvolved but receptive to new ideas.

Each of us must in his own way stimulate those agriculturally oriented organizations, societies, manufacturers of machinery, land-grant institutions, and safety organizations to delay no longer. We must raise questions, suggest needs and show personal desires in such quantity that this summary of basic and applied research will be forthcoming immediately.

However, having shown such desire, the work is still not finished, for the compilation of this information again needs the same sort of support from you to assure its distribution and use as did its inception.

Lastly, I personally feel that this summary would provide you with a mirror, which, if we have the courage to look into with truth, would shock us with its emptiness. However, on the other hand, and far more important, is the possibility of setting in motion the creative thinking which will find a solution to the problem of reducing the number of farm and home accidents about which all of us are concerned.

There may be a wide difference between the mechanisms of a modern rocket and farm and home safety, but each needs an adequate launching platform if it is to perform successfully. There are visible signs of sputtering safety rockets all over the nation. The need has never been greater for this summary of basic and applied research than now. Let's set up an adequate launching platform for once and adjust the gyros for a true course.

WHAT DO WE NEED TO MAKE FALLS AN EFFECTIVE AREA OF EMPHASIS FOR AGRICULTURAL SAFETY?

By HERBERT T. BOGERT

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Div. of Safety and Hygiene, Batavia, O.

I will attempt to cover the findings and recommendations of the 1961 National Institute For Farm Safety, and other additional points for reducing the occurrence of falls in the agricultural industry.

Injuries and deaths from falls affect persons of all ages, and are usually caused by a "loss of control," in some way. To help to eliminate or reduce the injuries from falls:

We need to develop a greater understanding of the exact causes of falls.

We need to develop the ability to recognize the causes of falls, on the part of all persons with whom we work.

We need to develop an increased awareness of the various injurious effects of falls.

And finally as a result, we need to thus reduce the causes of falls.

Stateways and steps are recognized among the leading sources of falls — around the home, the farm, and around farm machinery. To help more effectively reduce the causes of falls from this source, we need:

More adequate lighting.
Better conditions of construction, repair, and maintenance.

Removal or elimination of the practice of storing items (of clutter) on steps.

More adequate handrailings and handholds.

More suitable and solid step coverings.

Ladders are another important source of serious falls. In this relation, we need:

A more adequate awareness of what really constitutes a "good ladder."

More understanding about how to correctly take care of a ladder, to preserve its quality.

Better awareness of how to correctly use a ladder.

Floors in themselves are the source of many other falls; as a result, we need:

To motivate people to eliminate the loss of rugs—scatter rugs, etc., by use of the various recommended methods.

To eliminate highly waxed slippery floors, and to popularize the use of non-slip floor waxes instead.

To improve housekeeping, to remove obstructions, etc., in passage ways.

Better maintenance of floors in barns, on porches, in attics, etc.

Permanent openings in floors of homes, of hay mows and other parts of farm buildings, etc., need to be more adequately protected with railings, etc.

Clothing is a cause of some falls. We need to develop a respect for the fact that bad shoes, high heels, loose and long shoe laces, cuffs on trousers, ragged trouser cuffs or bottoms, etc., must be eliminated to effectively reduce this cause of falls.

Farm machinery is involved as a source of many very serious falls. Many things have been done in recent years to eliminate the falling hazards connected with machinery. However, with the increasing size and height of much of our modern farm machinery, it is evident that we need further effort in eliminating fall causes.

We need more usage of non-skid platform and step materials, of the expanded metal grating types, carbonium surfaced metals, non-skid coatings, etc.

We need more adequate and solid hand rails and hand holds.

We need continued effort toward the designing of farm machines so that those parts which are now tripping and falling hazards, (such as levers, bars, rods, cables, etc.) will not obstruct the safe mounting, riding, or dis-mounting of farm machines.

We need a continual effort toward developing a respect for the hazard involved with extra riders on farm equipment.

If additional riders are needed in the operation from time to time, then we need to have provisions designed into the equipment, for the safety of such additional persons.

Recently, one possible cause for many falls, which has become recognized and has been discussed, is the problem of "inadequate vision" (the inability of the individual to see clearly and adequately).

We need an increased study and understanding of the inter-related factors involved in the subject of human "vision" as it applies to our personal safety.

Finally, in order for the overall emphasis on "fall safety" to become most effective, we

all need to give our co-operative assistance in developing a bibliography of presently available materials and information which could apply to the subject of fall safety, and which could in turn then be used by all safety promoters.

We need to compile a "catalogue" of all applicable program materials and information, films, slides, bulletins, demonstrations, visual aids, etc. The National Safety Council—Farm Division, in cooperation with appointed members of the National Institute For Farm Safety, has been suggested as the logical "clearing house" and compiling agency for this overall project, to help make fall safety an effective area of emphasis for agricultural safety.

RURAL YOUNG PEOPLE SAFETY PROGRAM PLANNING

Session number one was "Techniques of Initiating Safety into the Home," and was illustrated by a film on handling and controlling poisons in the home. Nadine Elder was speaker at this gathering. A very good film on poisonings is available for only five dollars. To promote safety at the local level, a poster contest on safety could be used.

At number two, Frank R. Burrows, Jr., presented a new approach to safety by the use of comical gimmicks and novelties. "Reaping the Harvest of Your Farm Safety Program," was his topic. If each person would carry a kernel of corn with his change, he would have a reminder of safety every time he saw his change.

In the third group session, Mr. Grice Sexton led the group discussion on "Setting up the Theme for Safety Programs." Traffic signs were discussed. Four things can be done to help with traffic safety. They are:

1. Correctional signs can be observed.
2. The law can be strictly enforced.
3. Roadsides can be kept free of weeds and obstructions.
4. Coffee stands can be set up along the road to help keep drivers alert and awake.

Number four, "The Importance and Value

of Accident Reporting," with Rollin Schneider as speaker was interesting. Portable flares, fire extinguishers and first aid kits are some safety ideas that would help on a car if there were an accident. Prizes for safety plays and exhibits could help create interest. The seven to thirteen age group could be given a small prize such as a ball point pen. In the fourteen year old and up age group, they can win the big prize—an expenses-paid trip to the National Safety Congress.

The meeting Wednesday morning was, "Tools in Home Accident Prevention." Jon F. Greenstein gave us ideas on using them effectively. Visual aids as well as communication can be used to promote safety. Some examples of this would be a flannel graph with cut-out pictures to incorporate safety. Slides can also be used to create an interest in safety as James T. Wadkins proved. Some of these were pictures which had been enlarged and were projected overhead. Drawings can be used as a basis for these slides. Robert E. Whalen explained and illustrated how low-cost exhibits can be made and used effectively. A "do-it-day," was an idea which could apply to any type of safety and would mean—"Do it today, not tomorrow"—when it may be too late.

REAPING THE HARVEST OF YOUR FARM SAFETY PROGRAM

By FRANK BURROWS
Field Service Dir., Citizens Traffic Safety Board, Chicago

I wish to create an enthusiasm within you so that you will reap a better harvest from your safety program. By using some of what I call "advertising gimmicks"—may I refer to them as enjoyable methods of "fertilizing" a program—your harvest should reap dividends in your community.

I hope to impart to you a variety of ideas

to advertise good safety tips. This collection of ideas first began to accumulate when I was asked to lecture at Northwestern University Traffic Institute. Since a large part of my work consists of lecturing before all kinds of groups, old and young, large and small, a need to do something other than just talk safety arose.

I discovered, as I am sure you have be-

cause it has happened to you, that part of the audience does not receive the safety message. So I began to incorporate little attention getters to hold interest. In other words, I improved upon my fertilizer. The audience seemed to receive the safety messages more strongly, especially if they were down wind, and in a sense I became a better harvester for safety.

To understand how an idea, or "gimmick," should be used, one must keep in mind three definitions which when used through all your safety planning will enable you to attain the maximum results. The three definitions are:

1. **Safety**—Doing the "job" the right way. Job is anything a person undertakes to do—standing, sitting in a chair, crossing the street, driving a car, running a machine, peeling potatoes, shucking corn, milking a cow, etc.

2. **Safety Education**—The art of making a man want to do what he ought to do.

3. **Safety Program**—To create an appetite in people who are not hungry.

Keep these definitions in mind. I am going to demonstrate how I sell safety. (Here the audience viewed a short part of a traffic safety lecture in which several visual aids, gimmicks, magic and humorous stories were used as an example of what adding a touch of glamour to a safety message means) . . . and that is the way I attempt to present the safety message to the people here in our area.

You know, sometimes those of us who have a safety message to sell overlook the obvious. Sometimes we create our own illusions. Our own most trying problems are often the result of self-deception. And too many people selling an intangible safety message are prone to assume that the doors are locked against them when the difficulty is actually a mental block. Remember Harry Houdini? He was an ingenious entertainer.

Behind Houdini's skill as an illusionist was a profoundly scientific mind and a keen grasp of the application of modern mechanics to intricate physical problems. He matched wits with locksmiths and prison wardens, and never failed to escape within the time limit. But he almost failed on one occasion by overlooking the obvious.

The warden who nearly outwitted Houdini

used a simple artifice. He placed Houdini in an "escape-proof" cell and closed the door. Houdini tried all his ingenuity on the lock but could get no action from the mechanism. A few minutes before the deadline, in desperation, he tried the knob of the ponderous door. Presto! It opened. It hadn't been locked in the first place.

I want you to use gimmicks, humor, or anything else you can think of to enrich the mixture of your fertilizer to reap a better safety message harvest. Let's stop overlooking the obvious. Let's use proven advertising principles. Let's encourage people to at least look at or want to hear what we have to offer.

Let me encourage you to use some of these ideas so that you will not only be doing a good deed, selling safety, but you will enjoy it more and you will be creating an appetite in people who are not hungry by making them want to do what they ought to do—that is, to do every job the right way.

Here are some of my ideas. You could build a whole routine around gimmick types of glasses. "Goo-goo" glasses—funny to look at, aren't they. Goggle glasses—make me look side. Open and shut glasses make me look as if I'm popeyed. When I'm wearing these I could tell you that I want to see what's actually causing accidents. While you're laughing at my glasses, you're listening to my message. This is what you have to do with your safety program. People will enjoy it more, and they will receive more from it.

Here are some other articles. I have a little police badge, a little boy's police cap, his gun, his whistle and his handcuffs. Any one of these items can be tied into a safety message. You can tell the audience while twirling the handcuffs that with their cooperation you can "handcuff" a certain cause of accidents. With the gun you could pretend that you are out "gunning" for crime and that it is the thing that causes accidents in a specific field. Blowing your whistle can be tied in with blowing the whistle to stop accidents, and so forth.

You could build a whole safety message around dollar bills that come in many shapes and forms—large comic bills, little dollar bills, rubber dollar bills. With a little bit of imagination you could tie in the cause

of accidents or stretching your money, stretching money through the prevention of accidents. See what I mean. Let's enrich the fertilizer and reap a better harvest!

I have developed a little **safety six pack** in order to help you plant a safety message in everyone's mind. This six pack contains six items which have retention value and are very inexpensive. The six items are:

1. A piece of string—"string along with our message of safety."

2. A kernel of corn—a pocket or change purse reminder of the need for cooperation of the individual in the safety program.

3. A safety pin—to be pinned on one's clothing as a reminder to keep one's guard up against accidents and be safe at all times.

4. A band-aid—to be placed on the back of the hand or dashboard of a car as a reminder that traffic laws or good safety rules practiced will hardly ever result in an injury serious enough to need more than a band-aid for repair.

5. A rubber band—"you must stretch your efforts for safety."

6. A lollipop—"don't let accidents make a 'sucker' out of you." "Work hard to 'lick' the problem of accidents."

Let me give you an idea of how to think about enriching your safety message. I have what's called a "Hypo-Pony." It looks like a regular doctor's syringe, and it looks as if I am drawing blood right out of the air. I saw this article in a drug store. It cost a buck and a half. I felt I could use it in a safety message, so I purchased it.

Shortly thereafter, I received a telephone call asking me what the title of my lecture to be presented before the Woman's Auxiliary to the American Medical Association would be. I looked at this toy on my desk

and told the caller that the title would be "You Can Get Blood Out of a Turnip." I made the turnip resemble their impossible task of selling safety. I then proceeded to tell them how to use good programming to sell safety, and I concluded my speech by saying that if you use the right tools, the right safety programs, etc., you can do the impossible.

Of course, the right tool for extracting blood is a doctor's syringe. I inject my syringe into this bloodless turnip and extract blood. This is the only time in my life that I ever received a standing ovation for a lecture, and it cost me a buck and a half.

If any of you are interested in enriching your mixture, if you want some additional ideas, please drop me a card or contact me by phone.

Use one or all of the ideas, enough so that the audience will receive your safety message. Remember, the purposes of these ideas are to add color, humor and enjoyment to your safety talk. So often selling safety is a thankless part of your program because the recipient knows it all and he mentally tunes you out.

The ideas expressed here and the ones I'd be happy to send you are audience tested. If used as suggested, or as you see fit, they will make your safety lecture a little unusual. This alone will create an interest in the audience. Some of these ideas, by nature, will bring a chuckle or smile to the faces of those who observe them. This tells you that they are listening. Please do not be mistaken by the laughter—it is not directed at you but at the "gimmick" which emphasizes your point.

Do enrich your fertilizer with these ideas and see how the audience's attention will improve. Remember, you can reap a better harvest from your farm safety program.

THE IMPORTANCE AND VALUE OF ACCIDENT REPORTING

By ROLLIN SCHNEIDER

Safety Specialist, University of Nebraska, Lincoln, Neb.

An accident is considered reportable when it requires professional medical attention, results in permanent disability, or when the accident victim is unable to return to his job or resume all normal activities on the succeeding day. Personal property when incident to an accident should also be reported.

What value do we receive from accident reports?

1. Gives an indication of the accidents that are taking the greatest toll in human suffering.
2. Gives an indication of what accidents are causing the greatest economic loss in an area.
3. Gives some indication of what accidents can be eliminated or controlled.
4. Shows up some of the danger areas.
5. Points up accident ratios.
6. Makes people more aware of their local problems.
7. Promotes safety on a National, State, or Local level.

What are the requirements of a good accident reporting program? It is essential that groups cooperate in acquiring accurate accident records. Careless work by any member of an accident reporting team can nullify the effectiveness of the project.

Perhaps the most important thing to consider in respect to an accident survey is its validity. The question we may ask is: "Does the survey test what it purports to test? (Or what it claims to be).

Another requirement is the reliability. The survey should be trustworthy or fit to be relied on.

Criteria for selecting a problem:

1. Try to avoid duplication of some other work.
2. Should be interesting. (There are no uninteresting subjects, only uninterested persons).

3. Should have practical value.
4. Data should be accessible.
5. Cost.
6. Time.

Characteristics that must be possessed by your accident survey.

1. Accuracy—The dissemination of correct information is very desirable, but the dissemination of erroneous information is unforgivable.

2. Objectivity—Survey should be based upon facts with verifiable evidence. If opinions must be used, use only those of qualified persons.

3. Impartiality—Only the truth is wanted. It should be impartially sought and recorded even though it be against your feelings.

4. Verification—The survey should be so reported that it may be readily duplicated and verified by some other person or persons.

5. Readability—If survey is to be read and used by other persons, it must be written in a readable and attractive style.

What methods may be used for collecting data for the survey?

1. Personal investigation method

- (a) Personal correspondence is used
- (b) More accurate data is usually procured
- (c) First hand information is received

2. Questionnaire method

- (a) This method is widely used and often abused
- (b) Questionnaire must be easily filled out
- (c) Questions must be clear
- (d) Questions must not be leading questions
- (e) Must be ample space for answers

What will you do when you get the information? Data may be put on a reporting

form. Prior to making the survey, you should set up a procedure for getting the information and analyzing it once you have it. To do this, the survey may be broken down into divisions. Such divisions might be:

1. Statement of survey (A study of all farm accidents in the State of Nebraska from January 1, 1960 through December 31, 1960).

2. Purpose of survey (To determine the agency most responsible for farm deaths for the period).

3. Limitations of the study (Time, who is concerned, what constitutes an accident, sex, etc.).

4. Procedure for collecting data (Questionnaire method or personal interview method may be used).

5. Analysis of data (Reporting form may be quite helpful).

6. Summary (Main points of survey).

7. Conclusions (Must be as a result of findings).

8. Recommendations (As a result of your survey, you may have ideas on how accidents can be reduced).

Accuracy & clarity of your survey. Any statement should be written so that it cannot be misunderstood. The basis for accuracy and clarity rests largely upon mutually understood definitions. It is impossible to make our write-up too clear.

Von Moltke, a general in the German army in the Franco-Prussian War told his officers, "Remember gentlemen, any order that can be misunderstood, will be misunderstood."

YOUTH SERVICE TO SAFETY

ATTITUDES ESSENTIAL TO THE SAFETY MOVEMENT

By WALTER A. CUTTER
Director, Center for Safety Education, Division of General Education
New York University

To someone approaching the "golden years," the youth picture is somewhat confusing. We are removed from youth—if not in space, then in time. There is a definite time lag even between the time most youth leaders have the youth and the time they reach the university.

Basically, the threats facing our generation today are not too different from those of previous generations, but how well are we measuring up as youth leaders? Do we ever tell exactly what is expected of young citizens by the state—by the community?

We hear of delinquencies. We read of Fort Lauderdale. We read of thrill crimes among middle and upper class youth. The "beat" generation.

Then we see, hear and read of unnumbered deencies, accomplishments, achievements, progress—in the ranks of youth!

We reach a preliminary conclusion: "... nothing is completely true about youth, yet there is an element of truth in all of it."

We hear much today of images. How do we, our organizations, our country look to others? What is our national image? Needless to say, it is a confused image.

To what heights, to what dimensions, to what levels of achievement do we want our young people to come? Who is the good citizen who exemplifies the best national traits?

Here again we run into an age-old problem. We find adults often want youth to do both more and better than the adults have done or are doing!

Spiritually, we have lost much. The gap between precept and practice becomes increasingly confusing to youth. This factor, added to the obvious confusions of our era, often puts us in a very weak position to issue appeals, mandates, challenges.

Before we can ask others to be better, we must be better. We must create and reflect a better image.

This difference between precept and practice is very important. A child—or a dog—can tell so easily whether a precept is from the heart, or if it is just words coming from the front of the mouth.

Urbanization has created a climate in which there is nothing for young people to do. Young people today do have chores, as was customary in the past. Many parents want to do more for their children than they had for themselves, but keep in mind that you can't give anyone more than he can take.

We are living in a soft age. This lack of sharing in responsibilities has caused many young people to develop a feeling of being "not needed" and "not wanted."

Any youth will respond to some motivation, so we must hold up higher standards. There must be a public and private morality to which people can be attracted.

One of the most powerful motivations in the world is to show our young people that they are needed.

Safety, we can agree, is not an electrifying concept for youth. Adventure, chance-taking, breaking new paths, and old prohibitions make much more appeal.

So, our approach to a philosophy of safety must play down the static connotations of safety, and place more emphasis on doing—doing whatever we do, better.

A good saying is: "What we want to do in safety is to teach people to do better what they are going to do anyhow!"

But, we must provide a basic, unarguable reason which will have oomph—and appeal—and compulsion!

All philosophies begin with basic premises and presuppositions. Are we interested in

such a basic and comprehensive premise? We have tried sportsmanship, maturity, as impulses. We have cajoled, criticized, praised, condemned. Perhaps we have not held up a high enough standard and held it up consistently.

Let us consider: *Your moral obligation for survival for service.*

Integrity. In today's world, we are quite literally "struggling for our lives," for our way of life, our freedom. We need the contribution of all to preserve our system. Have we made this clear and compulsive to youth?

Have we convinced them that they are needed for a big cause?

"What are you dying for—in an accident?" one might ask.

Look at the response to the announcement of the Peace Corps. Admitting the romance,

the adventurous challenge, the rampant idealism, and all, does this not suggest that *large goals breed large efforts?*

What you can do?

Illustrate in your own lives, and practice survival for service. Practice. Teach. Inspire.

Illustrate it to your own generation. Safe habits and attitudes spring from character. We need better men and women. Work to show youth that it is needed, and needed desperately.

Youth needs to be needed—by his family—by his community—by his state—by his country—by his world!

Survival for Service—a clarion call to youth!

Can we measure up to worthiness in issuing such a call—for such a philosophy?

Youth Service to Safety

YOUTH INVOLVEMENT IN ACCIDENT PREVENTION PROGRAMS TRAFFIC SAFETY — "SIGNS OF LIFE"

Illinois Assn., Future Farmers of America

Kenny Mc Millan, Pres., Illinois F. F. A.
Don Gillespie, Central of Clifton F. F. A.
Chapter

I. National level

- A. Chapter safety award program
- B. Each chapter applies; state winner selected from applicants; Central of Clifton selected state winner
- C. Winner selected on point system of different aspects of safety
- D. State winner submitted for national awards sponsored by National F. F. A. Foundation

II. State activities

- A. Through program of work
 1. State program of work—each chapter assigned to certain convention committees, one is program of work, another is a specially planned state committee on safety

2. Chapter program of work—definition: planned program of year's activities; the real accomplishments come through chapter programs; chapters have special safety committees, community service committees and other committees where safety is stressed; safety is a major project in most chapter's programs of work

- B. Through Illinois Foundation F. F. A.
 1. The Ill. Foundation F. F. A. was organized 14 years ago for the purpose of encouraging farm boys to develop characteristics essential for good citizenship and successful farming
 2. Safety is one of the Foundation's major award programs
 3. A special cumulative four-year record book is provided for students in safety activities

4. Awards—chapter winner's medal (provided by national foundation), sectional winner's plaques, district and state winners' plaques
5. Foundation brochure: published account of award winners, including safety
- C. Safe Corn Harvest
 1. Old stand-by looked forward to each year by farmers
 2. Sponsored by National Safety Council and Farm Equipment Institute
 3. Unique feature—safety six-pack
- D. Safe Farm Power (sponsored by Safe Corn Harvest)
 1. Kit in Corn Harvest
 2. Contains—newspaper mats, radio programs and releases, news releases, stickers, pamphlets and reminders
- E. Signs of Life program
 1. Sponsored jointly by N. S. C. and Illinois Agricultural Association
 2. Just in infancy with plans for increased usage
 3. Summary of statistics available
 4. Further Signs of Life discussion by Don Gillespie
- F. Additional programs and uses
 1. Safety used as topic for—public extemporaneous speaking contests, parliamentary procedure demonstrations and contests, school assemblies, radio programs, state and national convention exhibits
 2. State is sponsoring civil defense program later this year
 3. State officers stressing enlargement of safety programs
 4. "Gimmick" for state officer safety—picked up from last year's safety congress, kernels of corn, to remind one of safety, put in change pocket

FIRST AID AT THE ACCIDENT

Chicago Chapter, American Junior Red Cross, Chicago

The Chicago Chapter of the American National Junior Red Cross demonstrates first aid techniques used at the scene of an accident.

The members of the group are: Frances Losselyoung, Patricia Skora, James Cocomas, Robert Glenn, Claude Pickens, Sylvan Schwab, and George Reaves.

This summer at Lake Forest Academy, we participated in a Junior Red Cross Training Center. At the Center, we were trained in first aid and what to do at the scene of an accident. Of course, the primary purpose of first aid training is prevention of accidents. If, in our training we become aware of causes of accidents, we can prevent most of them and have less use for our first aid training. But no matter how careful we are—accidents do happen and we must be prepared to cope with them and take care of the injured party.

We are going to show some typical ac-

cident scenes—caused by carelessness, and follow this by the proper first aid techniques used in taking care of an accident victim.

Bob is tackling a very difficult problem—how to take this plain piece of wood and turn it into a decorative wall plaque. By the look of great concentration on his face, he is really struggling—but look out for that knife; it's very close to your hand.

Ooops! Well, it was bound to happen—that's a pretty nasty looking cut on your hand.

Now Jim comes to the rescue. With his first aid training, he is able to cope with the problem.

The objective in treating a wound is to protect it from contamination and control the bleeding.

First, Jim applies direct pressure on the cut, to stop the bleeding. If the bleeding is still severe he applies digital pressure.

He uses his finger to press the brachial artery against the bone to stop the blood supply. In extreme cases, such as a severed limb, a tourniquet is applied. Once applied, it is not loosened until the victim is in a physician's care. Once the bleeding has stopped, the wound is wrapped with a sterile dressing and bandage and the victim is told to see a doctor.

For minor wounds the steps are as follows:

1. The first aider washes his hands.
 2. He washes the wound with plain white soap and water.
 3. He applies a dry, sterile dressing and bandages it snugly in place.
 4. He tells the patient to see his doctor.
- The next accident is one that could happen to any of you girls in your own home. Frances is busy doing some ironing. Her friend Pat comes in to chat awhile and because the gossip seems so very interesting, Frances forgets about her work. Her hand is dangerously close to the hot iron.

Just as we expected—the hot iron topples over on her hand. It is a lucky thing that Pat is trained in first aid and will be able to treat the burn.

The objective in treating a burn is to relieve pain, prevent contamination, and treat for shock. The bandage used in treating the burn relieves pain because it excludes air, and prevents contamination. It is fitted snugly in place and tied securely. Always remember that a sterile dressing is placed next to the burn and any thick clean material such as a towel can be used to hold it in place.

The patient should see a physician.

To treat sunburn with which we are probably all familiar, sunburn lotion, cold cream, salad oil or shortening may relieve pain. Butter or oleomargarine should not be applied. A dressing should be used if blisters appear.

Our next accident can happen easily when you don't take the time to read labels. Sylvan has a severe headache. He knows that there is a good headache remedy in tablet form in one of those bottles on the medicine shelf.

That bottle looks right, so he takes a couple of the tablets. Too late, he realizes that the bottle contains a poison. Claude knows what to do, though. First he checks

the label on the bottle to see if the antidote is listed. If not, he remembers three words in treating poison cases: fill, draw, refill.

He quickly administers fluids in large amounts. Four or more glasses for adults. Water is most readily available. Milk protects the digestive tract and slows the absorption of poison. Baking Soda in water will induce vomiting. The Universal antidote will help in most poison cases. It consists of two parts burnt toast, which absorbs the poison, one part strong tea, which neutralizes alkali poisons, and one part milk of magnesia, an alkali that neutralizes acids.

In prepackaged form, it can be purchased at your drugstore and stored at home.

The next situation can be found where amateur electricians and "Mr. Fixits" are found. Claude has decided that he will fix some faulty wiring in his home. As you can see, he is an expert since, he's jamming the fuse box with a screwdriver.

Next we see what is inevitable—an electrical shock! Electrical shock paralyzes the body and the victim cannot breathe for himself.

But the rescuer, George, arrives.

George positions his victim for the most effective form of artificial respiration—mouth-to-mouth resuscitation. Notice how he extends the head back to get a clear passageway for the air. He can do this in several different ways. He can press down on the forehead and up on the back of the neck—or place an object under the shoulders and drop the head back—or he can hook his finger in the jaw and pull up. His action has another effect—it gets the tongue out of the way of the air passage. He can also do this by pushing on the jaw from the side.

George seals his mouth over the victim's, pinches off the victim's nose, and breathes into his mouth—then he turns his head to one side and watches to see if the chest is rising and falling. If it is not, it is obvious that the air passage is blocked. He turns the victim on his side and raps him sharply between the shoulder blades to dislodge any foreign matter. He then wipes out his mouth and proceeds with Mouth-to-Mouth resuscitation. He does this until

the victim is breathing comfortably to himself or until a physician pronounces the victim dead.

How many of you have ever ignored a "DON'T WALK" sign? These signs are put there for our convenience and safety but if you stand on one of our busy street corners for awhile, you will see many offenders.

Here is "non-reader" in action. She ignores the sign and pays no attention to the incoming automobile. As the driver rushes over to offer his assistance, she finds that her leg hurts badly from the collision. Many Red Cross Mobile Unit Operators have splints and equipment in their cars but this fellow must improvise with what he has.

He remembers that he has a blanket in his car and with a belt, a necktie and some cloth he can improvise a splint that will give support to the injured leg until help can be obtained. Notice how the thickness of the folded, over blanket is tied around the leg and foot to keep it immobile.

For our last accident, we see a tree

limber. He is waving to some friends and maybe cleaning a little. Well, there he goes!—and it's a long way down. Glowing is a major cause of accidents. A show-off forgets about his safety when he's trying to get attention.

He is on the ground and unconscious. His friends see that he has to be carried to safety since an ambulance can come into the woods. We show how to place a blanket under a victim without disturbing him too much and then how to lift him enough to slide a stretcher under him.

As Frances builds his head for support, a folded blanket is placed around his head. As two helpers lift his shoulders slightly, the other two pull the blanket under him as far as they can. Then they roll the blanket up to his body and grasp it firmly. They lean back to pull the blanket tight and lift his body. This enables George to slide the stretcher underneath. After this is completed we wrap the blanket around him and he is ready for transportation.

This completes the Junior Red Cross presentation on "First Aid at the Accident."

TEEN-AGE ACCIDENTS

By DONALD DUNCAN

De Kalb Agricultural Assn., De Kalb, Ill.

Bringing a greater realization of the principles of safety to the attention of the younger generation is surely a worthy enterprise. If you ask me, they need it.

The DeKalb Agricultural Association, Inc. is a formidable name, but in the town of DeKalb, Illinois, it is usually called the "Ag." Our company started as an outgrowth of one of the oldest Farm Bureaus in America—the DeKalb County Farm Bureau. After its incorporation in 1917 as an organization to conduct the financial affairs of the Farm Bureau, it first dealt in limestone, legume seed and open pollinated corn. As hybrid corn was developed, the Ag early became identified with its production and soon began to expand to nearby states. Later in the early 1940's, hybrid chickens were added and in the late 1940's hybrid sorghums were

developed with a large research center near Lubbock, Tex. Right now, we are engaged in producing a sort of hybrid cotton with research headquarters near Athens, Ga. We are the biggest producers of the hybrid type of seed crops in the world, but the various lines are quite competitive with half a dozen major producers in each. Our trade mark is the "Winged Ear" which you have surely seen in driving about the country.

Since most of the products from our seed stocks—corn, sorghum, and cotton—are now harvested mechanically, we feel that we have some obligation to help protect our customers against the mechanical monsters which can overcome them unless they are careful and your organization is doing much in such protective work.

I am not a safety expert—I can think

of no special qualifications, except that I have all of my fingers and toes intact, have never had a broken bone, never been in the hospital, and have driven a car a million miles with never an accident of any consequence. I am better qualified than the prospective speaker on safety of a recent FFA meeting I attended. He failed to appear because as the chairman announced with embarrassment he had gotten his toes in the power lawn mower.

The types of accidents change, but the general reasons behind them remain the same. When I was a boy on the farm, accidents were caused by bulls, runaways with horses, involvements with threshing machines, silo fillers and other stationary power equipment. There were no safety councils to point out precautions, or there would probably be more older farmers living or ones with a full quota of fingers or hands. It was not an uncommon occurrence not long ago when shaking hands with an older farmer to find missing fingers or a misshapen hand.

Now, accidents primarily involve automobiles and moving power machinery. This means accidents of much greater severity involving much loss of life and property damage.

When you are making a talk and are at a loss as to how to proceed, a standard device is to say, "I thought I'd consult Webster to see what he has to say." Noah Webster, of course, was always looking for exact meanings. Webster says an accident is "undesirable, unfortunate, unexpected and unintentional." I like his succinct definition of safety "Making harm unlikely." That sounds like a good slogan.

If I asked you who said, "We have met the enemy and they are ours" I have no doubt that you could immediately as loyal Americans who have been exposed to history identify the speaker as Oliver Hazard Perry.

A paraphrase on this statement was made recently by Pogo of the well known Walt Kelley comics, who said "We have met the enemy and they is us."

We certainly have to agree that most accidents are caused by our own carelessness. A recent advertisement for automobile insurance suggested protection against

the "If, only" driver. "If only I'd been driving slower." "If only I'd had the windshield wiper fixed." "If only I'd bought that new tire yesterday." After the accident is too late—forethought prevents the difficulties.

Knowing how accidents can happen, can prevent us from doing the things which cause them. Presumably this is the work of your organization.

As representatives of youth, you should have fewer accidents than anyone else. You can see better, hear better, think faster and have quicker reflexes. But what is the disgraceful record of the younger generation—more automobile accidents, more deaths, more property damage, more cars turned over, more trees hit, more of every kind of accident. When you look at a record of accidents in your local paper, most involve boys of from 17 to 22. Insurance companies recognize this fact by exorbitantly high rates to anyone who insures a car with a boy in that age bracket. This is certainly a tremendous field for safety improvement where the most progress should be made.

When Jack Kennedy was elected president, his success was ascribed to his greater effort in the metropolitan areas where most of the votes were. Safety success among a junior organization could similarly be aimed at the young driver menace who is responsible for a disproportionate share of accidents. These accidents go far toward developing an adult concept of teen age irresponsibility.

Why does youth have more accidents? Is it a natural recklessness? A desire to show off? A desire to impress friends with fast driving and shrieking turns? An inferiority complex? These reasons are a science in themselves and deserve much study.

Trying to impress others is a cause of much of our conduct and many of our problems and frustrations. Someone said, "You wouldn't worry so much about what other people think, if you know how seldom they do." A good illustration is in golf. A player works long and hard to improve his game to impress his friends. But they couldn't care less—they're thinking mostly about their own good shots. When you can get away from the necessity of

trying to impress somebody, you're growing up. Developing such an attitude might help prevent a lot of accidents.

What have I tried to say here—accidents are largely our own fault and as such are highly preventable. Greatest safety emphasis should be placed where accidents are worst

—teen age automobile accidents. A young group should be particularly able to fathom the psychology of this group with an opportunity to cutting down the accident rate. Your organization is performing a worthwhile service and certainly receives our commendation.

SENTINELS OF SAFETY

By FRANK E. LADERER

Dir. of Safety, Nationwide Insurance Co., Columbus, Ohio

We live in the finest country on earth. We have more things (material possessions) than any other people. It seems we should be a healthy, happy lot. Yet we live—it seems—in a crazy mixed-up world. But is it the world—or the people? When you fellows were little, you couldn't wait for your first pair of long pants. Now you men rush home from work, jump into your shorts and potter around the yard showing your shapely legs to the neighborhood.

Don't laugh, girls. Remember when your crowning ambition was to get into a pair of high heels, no matter how oversized the shoes were, and strut about. Now the high heels must be undersized and you can't wait to sit down at the table, slip them off—then hope you can get 'em back on again.

Yes, we have a mixed-up world. We, with all our many blessings, should be an alert, helpful people. But too many of us are worry warts:

Worry about the Russians, then get run over by a neighbor.

Worry about radioactive fallout, then get poisoned spraying flowers.

Worry about the kids getting in front of cars, then drag them across the street on a red light.

Worry about crashing in an airplane, then fall off a ladder painting a house.

Worry about getting enough exercise, then drive two blocks for cigarettes.

Worry about getting the car greased every thousand miles — then never get a medical checkup.

Worry about the kids getting proper

nourishment, then leave household poisons around for them to snack on.

Worry about retirement, then do everything we can to keep from lasting that long.

Worry about H-bombs, then blow our heads off lighting a stove.

Worry about polio, then get crippled by a power lawn-mower or a home-shop power tool.

Worry about tornadoes, then get liquidated in an auto collision.

But our subject is "Sentinels of Safety." We would challenge each of you here attending the National Safety Congress to become a "Sentinel of Safety." How—your ask.

First, let's consider "sentinel." *Sentire*—from Latin, to perceive by the senses. Webster says, "One who watches—guards; to watch over."

How about safety? There are many definitions. Sidney Williams, one of the founders of the safety movement has said:

- (1) Safety or accident prevention is in the main a problem of organization and education
Or
- (2) Safety is efficiency, but it is more than efficiency because it is human
Or
- (3) Safety is applied Christianity stated in terms any child can understand, any adult can practice
Or
- (4) Safety is a great social force worth the best any of us can give.

Webster defines safety as: "A keeping of oneself or others safe." So, "Sentinels of Safety" becomes, by definition, "One who watches over or guards against danger, keeping himself and others safe."

Briefly then, how can you and I translate into action and results the safety lessons we learn here at the Congress, in the days ahead as we return to home and loved ones?

We talk a lot about safety education. Too often our solution is to "pass a law." Harry Emerson Fosdick, New York Pastor, has said, "Religion is something we catch rather than learn." He says that "right attitudes"—so important to safety—may be quite similar. We learn by precept and example. Most safety is caught not taught. If we learn from the examples of others, then as sentinels of safety you and I must continually ask ourselves, "What kind of an example am I setting?"

For example, a grade school boy who was very good in mathematics was frequently asked by his teacher to work out problems on the blackboard. In doing this he made his figure 2's with a real flourish. Many of the class learned to make 2's just like his—but still couldn't work problems! So even as we attempt to set good examples let's be sure we do not mislead others.

I am reminded of the story of the driver who was caught out in a very dense fog. So dense that it was impossible for him to see the road ahead of him. He could, however, see the tail lights of a car ahead of him and decided to follow it. A sudden stop by the driver of the lead car resulted in a collision. As each of the drivers got out of their cars, the man who had been following demanded to know why the first driver had not signalled before stopping, and received the reply: "What—signal in my own garage?"

So, as Sentinels of Safety, let's be sure our examples are clear, that they are good, that they will be understood—and followed.

Spiritually we have lost much as a nation. The gap between precept and practice becomes increasingly confusing to youth. Parents, teachers and youth leaders too often say one thing but do another. Before we can ask others to be better—we must be better. We must be real sentinels of safety if we are to help reduce accidents. Let's not be excuse makers.

I'll go where you want me to go, dear Lord.

Real service is what I desire;
I'll sing a solo any time, dear Lord,
But don't ask me to sing in the choir.
I'll go where you want me to go, dear Lord.

I like to see things come to pass;
Don't ask me to teach boys and girls,
dear Lord,
I would rather just sit in a class.

I'll go where you want me to go, dear Lord.
I yearn for the Kingdom to thrive,
I'll give you my nickles and dimes, dear Lord.

But don't, please don't ask me to tithe
I'll go where you want me to go, dear Lord.

I'll say what you want me to say
But I'm pretty busy myself just now,
dear Lord.

So I'll help you some other day.

Many ask, "Why is youth so reckless?"
My answer is, "They are not, generally."

There are many reasons why some youth are frequently involved: Untold thousands do not have "good" homes, chores to do (no purpose in life), loving parents, a sense of belonging. Many feel they are not needed—not wanted.

Those of us who have good homes (not just houses), who have good understanding parents, who have close friends or buddies, who have a real feeling of purpose in life—should be eternally grateful. What if we were unwanted, shunned, made fun of?

That many young people have to live with these situations may be hard for us to realize, but we must try to understand the problem youth—or youths—in our community. Any youth will respond to some motivation, so we must hold up higher standards. There must be a public and private morality to which he can be attracted. You may be the beacon or lighthouse that keeps such a youth from going on the rocks. One of the most powerful motivations in the world is to show these youth that they are needed and wanted—not just shoved about or ignored. As sentinels of safety, you can help this youth become a part of the group.

Safety, we can agree, is not an electrifying concept for youth. Adventure, chance-taking, breaking new paths and old prohibitions, make much more appeal, have more glamour. Drag racing, chicken, and similar "games" are prime examples of chance taking. High diving, speed boating, dreaming of rocket ships, blast-off to the moon, all are thrilling prospects to many youths. So, our approach to a philosophy of safety

must play down the static connotations of safety, and place more emphasis on doing whatever we do—better.

What we want to do in safety is to teach people to do better what they are going to do anyhow. If we will drive a car—let's help 'em drive well and safely. If we swim or dive—let's do it skillfully, in a safe place and not alone. But we must provide a basic, unarguable reason which will have compulsion, appeal and compulsion! Make it extremely unpopular to be a speed demon—a slow-off—a big shot—a bully.

Sentinels for safety can be a major force for good, as we help control behavior of our own age group. Dr. Cutter of New York University Center for Safety has said: "We have cajoled, criticized, praised, condemned, perhaps we have not held up a high enough standard and held it up consistently." We let our halo slip frequently, and somehow people remember these slips but forget the many good things youth does.

Dr. Cutter proposes a new challenge, "Your moral obligation for survival for service." In today's world, we are quite literally "struggling for our lives"—for our way of life, our freedom. We need the contribution of all to preserve our system of government, of democracy, of freedom. I'm sure we have all known lads who seemed to be "me-er-do-well," but after a hitch in the Armed Services they found themselves and became outstanding citizens. What if we rule out some "bad actor" and he never finds himself? Or is killed or severely maimed? As sentinels of safety we have a Christian responsibility to be our brother's keeper. Let's help others to be someone that counts, who are part of the answer, not part of the problem.

Ambitions are many—we all have our ambitions—a goal for which we strive. What constitutes one person's failure may make another thrive. Some seek for higher learning—while others are content. Some seek to spend their lives by doing good—for those who know torment. The clown is happy when he makes a tear turn into laughter.

The poet gains a thrill when hearts are happy ever after. A doctor's job is greatest when he lessens someone's pain. A teacher is rewarded by the knowledge pupils gain. Men of God are joyful when their congregation prays. Mom and Dad live for their young—and dream of future days.

That's how it goes in this world—ambitions are so many. I don't believe you'll ever find a person without any! What is your ambition? To get ahead no matter what the cost, or who is pushed aside, or will you help others become sentinels of safety?

Why do some become real sentinels of safety while so many others do little or nothing? I'm sure we all think of qualities like dedication, vision, concern for others, unselfishness and perseverance.

Let's be sure, as sentinels of safety, that we take time to recognize and give credit to others "round about us. Don't just take people for granted. I'm reminded of the experience of Dr. Arthur Secord—who was the principal speaker at a large company's service awards banquet one night.

During the program "They brought two men up to the dais and presented them with lapel buttons and certificates signifying membership in the Wise Owl Club. Many of you know what that meant. It meant that during the past year each of these men had had the sight of one or both eyes saved because he was wearing eye protection. The safety glasses were on display—one with a completely shattered right lens, the other with both lenses shattered.

"After these men had been honored and returned to their tables, I heard a man at the head table turn to a neighbor of his; only the three of us, I believe, heard him. I quote: 'That's the silliest darn thing I ever heard of. Why honor a man for doing what he should do?' Now, think that one over. Why honor a man for doing what he should do? So they were supposed to wear eye protection, so they had it on, so they saved their eyes, so what?"

"That night I wondered how that fellow would like to live in a world where God operated on that basis. It seems to me there would be just one adjustment—there would be no heaven, no reward for doing what you should do. Just hell for the boys who didn't do what they should do. And I wonder in how many of our industrial establishments—our mines, and factories, and plants, and offices—and in our religious organizations, and schools, and homes we operate on that basis.

"We're awful quick to jump somebody when he's not doing it right. We're awful slow to pat someone on the back simply because he is doing what he should do."

So far we have touched upon: (1) state of mind (worry, etc.), (2) right attitudes, (3) setting good examples, (4) doing what we say, not making excuses, (5) understanding problem youth, (6) doing whatever we do better, and (7) the importance of recognition.

But there is more. Without a deep and abiding faith in God, good works will not prevail. And now in closing, let us look to God in prayer.

Forbid it, Lord, that our roots become too firmly attached to this earth, that we should fall in love with things.

Help us to understand that the pilgrimage of this life is but an introduction, a preface, a training school for what is to come.

Then shall we see all of life in its true perspective. Then shall we not fall in love with the things of time, but come to love

the things that endure. Then shall we be saved from the tyranny of possessions which we have no leisure to enjoy, of property whose care becomes a burden. Give us, we pray, the courage to simplify our lives.

So may we be mature in our faith, childlike but never childish, humble but never cringing, understanding but never conceited. For what profits a man who gains the whole world but looses his life?

So help us, O God, to live and not merely to exist, that we may have joy in our work—becoming true sentinels of safety. Amen.

YOUTH IN COMMUNITY SAFETY PROGRAMS

Presiding: CALVIN SCOTT, Pres., National Junior Achievers Conference, Ypsilanti, Mich.

Moderator: ALEX MALESKI, Boys Clubs of America, New York City

Panel: CATHERINE A. CARTER, State Advisor, F.H.A., Springfield, Ill.; GEORGE E. TEWKSBARY, Supervisor of Youth Programs, Nationwide Insurance Co., Ohio; MIKE RAPP, Key Club International; ROBERT McALLISTER, Key Club International

A panel consisting of three youths and two adults discussed the role of youth in community safety programs. To do this, the following areas of concern were considered:

1. Does youth have a place in community safety programs?

2. If so, what is its role?

3. If roles are identifiable, how do we as youths work with adults in order to make our communities a safer place in which to live?

4. What are some of the stumbling blocks our youths and adults working together on community safety programs?

5. How may we work around these stumbling blocks?

It would seem logical that the adults working with the panel of youth would want to find out what youth thinks; the adults would be the catalyst so that the ideas of youth would be foremost. Such a panel discussion clearly points out that youth has a place and can contribute to community safety programs.

The moderator and the two adults serv-

ing on the panel were named ahead of time; the three youths were picked from the delegates after they arrived in Chicago.

Notes taken from this panel discussion.

Adults and youth—work closer for better safety. They should work as one cooperative group for a common goal.

Youth—its effect on other youth. Youth most definitely has effect on other youth, they look to each other for leadership, inspiration and as models.

Example of adults and youth working together for safety (effectively). An insurance club in Ohio high school is most productive today. Safety posters, programs in school safety worked out with teachers and students, high school auto driving courses, with results in reduced auto insurance for the graduate.

Illinois has community groups that meet regularly with their youth on local community projects that are of interest or concern to youth.

Youth rejects the fact that adults will take over a youth project when it is not satisfactory to adults, thus completion of

the project is by adults and youth is left out.

Youth needs encouragement in projects in local communities. Youth feels adults lack confidence in them. Adults want the credit for themselves, rather than wanting to just help youth with their projects.

Youth speaks on panels. Adults with titles or specialists in youth fields cause youth to be shy and reserved in talking and discussing their problems, because youth gets the feeling that the experts know all there is to know in their particular field, thus they are not interested in listening to youth's ideas and problems. Youth prefers to talk with an average adult, who will inform the expert on youth's problems. This gives youth an easier feeling for expression of their thoughts.

Youth wants adults to act as council for their activities. Titled adults can help carry

out youth's projects, where youth would not have the connections.

Summary

Youth in safety.

Youth is active in community and school safety projects.

Youth's thoughts on working projects with adults.

Adults should guide youth, not try to run activities for youth.

Adults feel youth is not capable on their own, youth wish more confidence in them from adults.

Youth on panels.

Youth is shy when on panels with professionals on youth—rather discuss with an average adult panel. Must not be outnumbered by adults on panel, wish equal number in audience also.

HOME SAFETY SESSIONS THE IMPACT OF HOME ACCIDENTS

(a) ON THE FAMILY

By LEONA BAUMGARTNER, M.D.
Commissioner of Health, New York City

I was asked to speak today and set the stage for this session. This is the second time in a few months I've been asked to set the stage for a meeting and I'm not sure it isn't a sign of approaching something or other, like middle-aged spread. The person who sets the stage is essentially a harmless and amiable type who utters fuzzy generalities while late-comers creek into their chairs . . . who is considered serviceable for holding the floor pending the appearance of more important participants, and who, under no conditions, is to be used for ringing down the curtain.

Well, I set a messy stage, and I hope you will let me wander a little as we open this meeting on the subject of Home. Sister Home.

I suppose the problem we are dealing with began tens of thousands of years ago when some early and primitive man stubbed a toe on a stalagmite in his cave. And then, later, I suppose he tripped on an adze or a stone knife, marking the beginning of his experience with man-made hazards.

The toll of accidents has grown since then and homes have changed, and we are now dealing with a problem so serious that if it were considered a disease the clamor for correction and control would be deafening.

In the 1 to 14-year age group, accidents kill more than 11,000 children a year. They are the leading cause of death in this age group and kill more than the next four causes (cancer, congenital malformations, pneumonia and heart disease) put together. While I am talking to you, if the average holds, two youngsters in this age group will die somewhere in this nation due to accidents. By the time we finish lunch, almost a dozen will have been wiped out.

This is only in this one age group. If

you count everybody, of all ages, more than 50 people will die as a result of accidents in this land between now and the time we finish lunch.

Today we are talking about the home—man's perilous castle—and there is good reason for it. Among all age groups we expect about 27,000 deaths from home accidents this year.

As you know, statistics on deaths are misleading and only part of the picture. If we maintain a level rate of deaths from home accidents we can delude ourselves into thinking that we are at least not losing ground, but this is not so. Modern methods of treatment are saving many more injured persons than a few decades ago—the role of antibiotics in the treatment of infections is only one obvious example—so that an even home accident death rate really means a rising number of accidents.

Our information on numbers of accidents, as you know, is much less solid than our information on accidental deaths, but we believe that the deaths are only the tip of what might be called a very black iceberg.

For instance, a recent report of the National Health Education Committee quoted the National Safety Council as estimating that in 1955 there were more than nine million persons in this country to some degree handicapped as a result of accidents. The National Health Survey found that in one year there were 19 million home accident injuries serious enough to require medical attention or to restrict the victim's activities, and some years ago the Metropolitan Life Insurance Co. estimated that every four minutes some one in this land receives a permanent disability as a result of a home accident. This is about 130,000 a year and is generally in line with a number of similar informed estimates.

I won't go deeply into the economic cost of accident—it is huge, probably more than 11 billion dollars a year, of which I believe more than half is due to home accidents. It is hard to imagine 11 billion dollars. I don't know if you find it any easier to imagine two million dollars, but that is what the State of California recently discovered it was paying annually to care for needy children whose parents had been incapacitated by home accidents. Two million in one state for one year for just one piece of this tragic picture.

Statistics are awfully dull to talk about—and awfully inadequate in the field of accidents—but it is clear that we are dealing with a major cause of death, far more important than many diseases, and an appalling cause of crippling and disability. We are faced with a serious situation and ought to act accordingly.

In many ways the impact of home accidents on the family is like the impact of disease and illness. Most people still do not realize that even a family that is hard working, self supporting, with money in the bank plus health insurance, can be brought to indigence by a single protracted illness, especially when the bread winner is involved. Take a woman with four children whose husband is injured so that he must be bedridden for a year. The woman can't work because she has to care for the children and her husband (unless she's lucky enough to be able to earn enough to support the family, *Mrs.* a housekeeper), and the husband's income sooner or later stops.

One important difference between the impact of accidents and illness lies in the emotional field. People feel guilty about many accidents while, in most instances, they believe that contracting an illness is no one's fault. This only adds to the problem. Take a family where mother's momentary carelessness in the kitchen is held responsible for a child's being horribly burned, and you have a tremendous emotional burden piled on top of all the other problems. It may take months or years of psychiatric care to help such a family.

Most of us have dramatized accidents at one time or another, because we are so desperately eager to make people do something about them. But I thought this morn-

ing I would give you just a few reports on accidents in New York City, in the cold and unemotional language of our official reports. Just let me say that in New York we go into these things, we follow them up, we try to find reasons. These are exactly as reported, except that I've shortened some of them a little.

Report No. 1: "Substance: benzene. Place of occurrence: kitchen. Accident: Father had been painting and left some benzene in a Pepsi-Cola bottle in back of a washing machine to be used for cleaning up; machine was subsequently moved away; child found uncorked bottle and drank one to two ounces. After hospital treatment, this child recovered.

Report No. 2: "According to the grant-mother the family members were having wine with their noon meal. The patient (a four year old child) went to the refrigerator where the wine bottle was kept and drank some of its contents. She went to the living room to watch television and soon had convulsions. She was taken to the hospital where her stomach was lavaged; she apparently made a complete recovery. There is a further note in this case: 'The general accessibility of alcoholic beverages to children constitutes a major hazard.'

Report No. 3: "While the father and grandfather were building a closet in the cellar of their new home, the child was riding on his bicycle and playing around in the cellar. The patient became thirsty, and since there was no water in the cellar, he obtained a can filled with fluid. It was an orange juice can filled with turpentine. . . . This child was also lucky, and recovered.

Report No. 4: "Baby (was) seated on high chair near gas stove where mother had placed rice to boil. Mother turned her back for a moment, baby reached for handle of hot on stove and tilted entire contents over himself. This baby died. There was a note on the report: 'Pot handle should have been turned away from child.'

Report No. 5: This child was a little over five and a half years old. This is the report: 'Fracture of the skull—shock. Child was flying a kite on the roof of another building and fell off as he tried to follow the kite. This was a fatal accident. There was a note on this report, too: 'Child should never have been permitted to play on a roof.'

Report No. 6: "Child climbed on a chair and took bottle of baby aspirin out of kitchen cupboard while mother was working washing machine in an adjacent bathroom. . . . Mother is a good housekeeper and takes excellent care of two young children. She did not know that aspirin was poisonous since there is nothing on label to indicate that it was."

Report No. 7: This is the last one. "Both parents were away at the time of accident. Uncle visiting from South Carolina was at home with three children. The uncle lit kerosene stove to warm room. It exploded instantly. One child died and a three-months old baby was burned but survived.

We all are gratified that medical care techniques for treating accident victims have improved and are still improving, but what we are interested in is preventing accidents before they happen. To do this we naturally

want to find out what causes them, and here we get into trouble. For years we took a rather simple view of things. We said people slipped and fell because the floors were slippery, and they cut themselves because knives were sharp.

Then we began to talk about accident proneness, since it was found that some people had more accidents than others. This concept came into being at about the time of World War I, largely in connection with industrial accidents. It was seized upon for use in personnel work, and was used as a predictive instrument—a reason for not hiring people. It was thought of as something inherent, something constitutional, rather like an intelligence quotient. Subsequent studies have thoroughly discredited the idea of accident proneness. Dr. Jacobson, for example, in his research on child accidents in New York City, has shown that "repeaters" are a very small percentage of the total, and certainly not an important factor. And we know that some of the people who were formerly considered accident prone had more accidents because they were in hazardous occupations and situations.

Perhaps accident proneness served some purpose as a concept, but it also did harm because it helped reinforce the already prevalent idea that accidents are things that don't happen to us, but to other people—people who are somehow faulty by nature. It is time now to lay accident proneness quietly to rest and get to specific factors.

Today we think more and more about behavioral factors, which may vary from day to day, or even from minute to minute, and are not inherent as accident proneness was supposed to be. Does the child have an accident partly because he is trying to attract attention? After all, children do many bad things to attract attention. Or is the child trying to punish himself, or his parents? Or do the parents have aggressions against the children, so that they may push the child away so sharply that it has an accident?

We find ourselves with a complicated problem. It is pretty obvious that razor blades, sharp knives, poisons, are dangerous, but it is equally clear that this is not the whole story. Many people handle razor blades, sharp knives and poisons without injury.

We begin to think more and more of a complex situation involving risk-taking and good and poor decision making and of safe and unsafe environment. Dr. Edward Suchman, of the New York City Health Department, has written extensively on this. For example, take a person whose judgment is awful and decision-making poor and put him in a very safe environment—a padded cell, for instance, and he is extremely unlikely to hurt himself because there's nothing for him to have an accident with. His environment is so safe that he is safe.

On the other hand, take a person with extremely good judgment and decision-making and put him in a chemical laboratory filled with poisons, and possibly sharp knives and other potential dangers, and he is not likely to injure himself because he is experienced and careful.

But take the person with bad judgment and poor decision-making and place him in the extremely unsafe environment and there is likely to be trouble.

In the home we generally fall between the two extremes. We have a safer environment than the chemical laboratory, and we have decision making that ranges in quality between bad and good. There are different people in the household, from the infant, whose responsibility, judgment and decision-making are very poor—close to zero—to the well trained, alert adult, whose decision-making may be quite good, to the older person, whose alertness and decision-making ability are declining. So we have peaks of home accidents among children and older people—at the ends of the seven ages of man. I was amazed to find that in one recent year 46 persons were killed in falls who were 100 years old or older.

Then we have the problem of risk-taking. We live in a risk-taking society, a society where taking a chance is equated with manliness. The boy who climbs the tree is admired above the one who does not. Children drive cars at one another, calling "chicken" at the one who turns off first.

We also live in a society where risks are not always made clear to the growing individual. We give children plastic guns, which they shoot at each other safely, and are shocked when they get hold of a real gun and behave the same way with it.

killing or injuring somebody. We expose youngsters to television programs in which extremely unsafe risks are made to appear worth taking, where the act of shooting fire arms is dramatically shown, but the after-effects played down, or not shown at all.

A friend of mine was saying the other day that he sees a television program in which the detective is always being hit on the head with a bottle or other blunt instrument. This stuns the detective briefly, but in a very few minutes he is back at the chase, bright-eyed and alert. In actuality, judging from the force of the blows, he'd have been buried with full honors long ago, or at minimum have suffered horrible brain injury. But suffering a crushing blow on the head is made to seem only an incident. Obviously if a child isn't made to learn what he may suffer as a result of taking a certain risk, he cannot very well judge whether it is worth taking or not.

We cannot seek to avoid risk-taking altogether, nor will we ever completely eliminate accidents. Without risks we would have no space men, no exploration of the depths of the sea, no progress, probably. But there is a difference between taking a risk just for the sake of the risk and taking a calculated risk for the sake of accomplishing something.

Paraphrasing, in situations where we have control of the environment, as in factories, we are able to encourage a certain pride in safety and the use of safety techniques. We have scarcely done this at all in the home, or, I might add, on the highway, where safety belts could probably save 5,000 lives a year, and are almost universally sneered at.

In any event, we have finally learned that the causes of accidents are many and complicated. They involve the state of the environment, the condition, the abilities and judgments of the individuals concerned, and they involve transient conditions such as anger and sudden illness.

There are a lot of things we don't know about accidents, and if we don't know what we don't know we are in bad shape. We don't know how many accidents there are, we don't know if accidents do occur deliberately, we are not really sure what should be called accidents and what should

not. We do not know in detail the effect of different mores on accidents and why.

We do know, from studies in this country, that there are more home accidents in low socio-economic groups, but we only partly know why. Even on this point there is some dispute, since the National Health Survey showed a high reporting of accidents from higher income families. Yet, from our experience in New York City and many studies elsewhere, we would conclude that low socio-economic groups do have a higher rate of serious, non-fatal home accidents, as well as fatal home accidents.

In other words, those least able to afford accidents have more of them. We conjecture that these people may be too overburdened with other things to keep a good household. They are often overcrowded in poor housing. We know they are more apt to leave poisonous chemicals around, that their environment has more hazards, but we have not yet a clear picture.

A recent very interesting study investigated home accidents among families connected with a U. S. military establishment in Japan. Thirty per cent of the mothers involved were Japanese, but the husbands were American and the living conditions predominantly American. Yet there were significantly fewer accidents in the homes with the Japanese wives. Why? We should like to know.

How do you train children to avoid accidents? Some people think if the child is burned just a little bit this is his best education about fire. Is this true? What is the difference between children brought up in strict and permissive families? We don't know.

We have tremendous problems in communication. One of my people, helping recently to gather materials on home safety, went through the files and when he finished he said: "Boy, am I going to clean up the cellar steps." He'd been reading pamphlets, which were in our files. But these pamphlets had never reached him before—at least they had never reached his consciousness. We tend to be pamphlet-happy and in our pleasure at seeing a nicely designed pamphlet we tend to forget whether we are going to be able to get it into the consciousness of the people who need it.

I guess you can lead a man to a pamphlet but you can't make him read.

We know that homes can be made much safer through safety engineering—through the inclusion of such sensible things as handrails in tubs and showers. With an aging population these are increasingly important. There are scores of other safety measures that can be taken. It has been estimated that the average house can be reasonably equipped with safety features for less than the cost of a picture window. But builders are selling glamour and invincibility and don't include these things. And they don't include them because the public doesn't demand them. And the public doesn't demand them because we have not convinced the public that it is important to demand them.

In the automotive field, of course, manufacturers have done much laudable research, but are not generally selling features designed to protect lives. I'm sure many of you saw the cartoon not long ago. I forgot the exact words, but a man was about to buy a car and he was saying to the salesman, "Will you go over once again the part about how the 200 horsepower engine makes it safer?"

People who would drive 100 miles to avoid exposure to an infectious disease are quite content to expose themselves to accidental hazards far more likely to cause serious injury or death. If we were to predict that there would be an epidemic over a weekend that would result in 400 deaths and maimed crippling, I can well imagine the rush by people to stuff themselves with penicillin, and to do almost anything to escape. But when this toll is caused by automobile accidents over a holiday it is almost impossible to get people to do anything about it, to drive with care.

I think we have to admit that in home accidents we are doing a generally poor job. There are a few sparks here and there, but this is a generally unattended, neglected field. There is agreement, I think, that by and large the research that is being done is not first rate, that there is not enough of it, and that able young people are simply not being attracted to the field in sufficient quality or quantity.

It seems to me the worst obstacle in this field is the word "accidents" and its con-

notations. Many accidents, we like to think, are things that happen to the other fellow. They are unpredictable. They are acts of God. They don't really have causes. They just happen. How can you get hold of them?

What we are dealing with is not accidents in the traditional sense. If you eliminate accidents that produce no injury you are left with a large group of incidents which I would prefer to call injuries, frequently fatal, of complex and not wholly understood etiology. There are more similarities between these injuries and disease than might at first be apparent.

Let us consider, for example, a child in an environment that includes polio virus. We know some children, if they get this virus inside of them will get paralytic polio. Others will be saved by their natural bodily defenses. Some will not take in the virus at all, even though it is present in the environment.

Now let us consider a child in an environment in his home that includes a poison in a cabinet under the sink. We know that if the child eats or drinks this poison he may be killed or made terribly sick. We know that some children will not get the poison at all. But we know that a substantial hazard exists.

In polio we developed a vaccine which prevents the virus from reaching the central nervous system. We have protected the sensitive part of the child from the danger, and if the vaccine is used we are able to control the problem.

In home accidents, it seems to me we are trying to do much the same thing. As in the conquest of a disease, the problem is complex, but not necessarily insoluble.

There are a lot of things we can do. We can put a lock on the cabinet. Or we can transfer the poison to a cabinet out of reach of the child. We can put a big poison label on the chemical, so that the mother and eventually the child will be warned. We can educate the mother, and eventually the child, to the meaning of the label, and to safe methods of handling the poison.

In both cases we have a hazard and a child, and we develop means of preventing one from harming the other. A vaccine seems nice and neat as a solution, while a combination of safety engineering and

education seems fuzzier and less easy to grasp.

I think the development of the germ theory has tended to make us oversimplify—or want to oversimplify—the causes of human ailments. We like to think that a single disease is, or ought to be, caused by a single bug. Simple cause and effect. But even in disease we are learning that this is not the whole truth. If it was simple cause and effect, every one getting the bug would suffer the disease. This does not happen and we realize that matters of resistance, stress and other factors are also involved. We tend to be annoyed by these more complex explanations, although we must accept the fact that most human ills are brought about by a combination of factors.

It was hard for us to accept the idea that accidents have causes in the first place, and having accepted it we are distressed to find that accidents have a whole variety of causes, some of them extremely subtle, many still unknown or not fully understood. The problem seems so complicated, so lacking in handles to hold it by, that we tend to lose heart.

We ought to realize that our problem is not as peculiar as we think it is, and in many ways not so different from disease problems we tend to think of as much simpler.

Let's take an example from the infectious diseases. In 1938, for example, when the medical advisory committee of the National Foundation for Infantile Paralysis met for the first time it developed over a dozen points that would have to be covered before polio could be brought under control. Dr. Thomas Rivers was a member of that group, and he emphasized again and again at that meeting that man did not really know what polio was.

It is hard to believe in retrospect, but it wasn't until 1950 that scientists definitely nailed down the crucial point that polio was due not to one but to three different kinds of virus. All the earlier research went on without that vital piece of knowledge, and it wasn't until even later that some of the basic mechanisms of the virus transmission in the host were illuminated. In fact, we still don't know about all of them.

I think that in home accidents we are about where polio was in 1938, or perhaps

some years earlier. It might be argued that we have less understanding of our problem, but it is certainly true that even without a full understanding of causes, we have more that we can do now than the polio people had for their disease in 1938. Safety engineering and education can save tremendous numbers of lives and injuries in one field now, while we seek more knowledge for the future. There was much less that could be done in these areas in polio in 1938.

Our uncertainty about causes is shared by those in the field of cancer. No one knows the cause of most cancers, and there is increasing evidence that multiple factors are involved. We know that cigarette smoking is an important factor in lung cancer, but I don't know any one who thinks it is the only one. So the cancer people have a tremendous quest to find the full picture of the cause of their disease. In the meantime, they are saving lives with what they have.

I mention all these things because I think we ought to stop feeling sorry for ourselves and to point out some of the similarities between accidents and disease. We aren't the only people with a difficult problem on our hands. In fact, I suspect that the answers which will provide reasonable control of home accidents may be somewhat easier to come by than some of the answers which have been and will be dug out in the field of disease. We must not let ourselves move from considering our problem difficult, which it is, to considering it insoluble, which it is not.

Here are some points that seem to be important:

1. We must wipe out the idea that accidents are accidents. They are not. They are injuries and deaths of multiple cause. But caused they are, every one of them. Is it an accident when you put a child on a dangerous roof and provide him with a kite that will attract him over the edge so he kills himself? I hardly think so. Is it an accident when a child picks up a Pepsi-Cola bottle, which he thinks of in a friendly way, and drinks poison? I think not. I think if it is an accident it is one prepared in advance. After all, what would you do if you wanted to poison some one? I think you would put the poison in some-

thing he might be expected to eat or drink. Is it an accident when we allow a child to see us drinking cocktails over and over again, and the child empties the remains in our glasses and kills himself? It is no such thing. Is it an accident when we provide an older person with a tub made slippery with soap, and with no handrails and he falls and hurts himself. Of course not. It is a prepared and predictable result.

2. We must make accident research more appealing. It isn't essentially a question of money. Able young people need to be informed about this problem to an extent commensurate with its size. Medical schools especially need men on their staffs who are concerned with the home accident problem and who can act as catalysts to interest first-rate minds in research on it.

3. We must accept the fact that we will have to use what we know until better methods become available. Public health progress, over the years, has come about largely through the application of knowledge we already had. We know we need to improve the safety of man's environment in the home, and at the same time improve his decision-making ability in this area. We will need education and plenty of it, and greatly increased research toward better means of communication. We are not getting through to the public—not even to ourselves, very often, and we must realize this and do something about it. Communication in this field is as important as penicillin. At the moment we are very poor at it. We must recognize this and move forward.

4. We must realize what we know and don't know, and act accordingly. We must look at our situation coldly and then move. We must examine the areas where we are

failing and work to make our performance better.

5. We must realize that home safety is everybody's business. It is the business of the schools, of families, of safety engineers, of doctors, of social scientists. It is a health problem. The doctor who learns to treat children, for example, in a variety of disease situations, finds that they are being destroyed by accidents, over which he feels but little control. A multi-disciplinary, multi-faceted approach is essential. Nothing can kill off our effort more surely than for any one group to think this problem is its personal property. It isn't.

In my city we have worked long and hard on accidents. No one could feel more keenly than I do the complexity of the problem, and the frustration that comes from tangling with it. We have worked with paint manufacturers to keep lead out of interior paints to cut down lead poisoning. We have worked with gas refrigerator manufacturers to cut down deaths from this source. We have attacked the problem of side-bar water heaters. We are now working on radiation, and have helped make X-ray apparatus safer and have outlawed those ridiculous X-ray shoe fitting machines. We've cut the death rate from home accidents in half in 20 years in New York City. It has taken work in almost every imaginable combination of circumstances, with almost every type of person. We know how much more there is to be done.

I want to leave you with only one thought. This problem of home accidents can be solved. Let us move into it. Let us give it the hard work it deserves, the imagination, the research. We can cut these unnecessary deaths and injuries, and when we do, it will be no accident.

(b) ON COMMUNITY GROUPS

By GEORGE W. LOWIS

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The purpose of this paper is to review briefly some of the important research considerations concerning a community study of social class and home accidents. This investigation is being directed by me and

is conducted and sponsored by the Division of Environmental Safety, Pennsylvania Department of Health. Because the data from this research have not been completely analyzed, no findings will be presented here.

The report will therefore be confined to summarizing the research plans and actual methodological procedures used in the study. Discussion of the first of the two aspects contained in this paper, namely, that of the research plans, follows presently.

Recently, Professors Hollingshead and Redlich, of the departments of sociology and psychiatry respectively, at Yale University, demonstrated in their community study of New Haven, Conn.,¹ a significant relationship between social class membership and mental illness, two formerly unexplored facets of life. It is this speaker's contention that social class and home accidents also represent two major unexplored problem areas in our society, problem areas that can be dealt with quantitatively and qualitatively.

The purpose of this study is to determine for the city of Bethlehem, Pa., the relationship between social class and home accidents. There are four major research questions in this study:

1. Are home accidents related to social class in Bethlehem society?
2. Does an accident person's position in the Bethlehem status system affect how he is treated for his home accident?
3. Does an accident person's household activities relate to class in Bethlehem society?
4. Does the position of an accident or non-accident household in the Bethlehem status system affect this household's attitudes toward home accidents?

The major conceptual assumption of the research is that there is a functional and reciprocal interdependence between the class structure of Bethlehem and a number of different aspects of home accidents such as expenditure and treatment for, and attitudes toward, home accidents. Six working hypotheses were written into the research design. Each hypothesis will connect social class and home accidents in such a way that the resulting proposition can be tested empirically. The six hypotheses are:

1. The prevalence of home accidents is related significantly to an individual's position in the class structure.
2. The types of home accidents are connected significantly to an individual's position in the class structure.

3. The expenditure for treatment on home accidents by the accident population is related significantly to an individual's position in the class structure.

4. The household activities of the accident population are connected significantly to an individual's position in the class structure.

5. The reporting or not reporting of a home accident for treatment by the accident population is related significantly to an individual's position in the class structure.

6. The attitudes toward home accidents maintained by the accident and non-accident households are significantly related to a household's position in the class structure.

The negation or affirmation of the first hypothesis, which concerns the relationship between class status and prevalence of home accidents, depends on the outcome of the two major questions posed in this hypothesis:

- a. How many home accidents are there in the population of the Bethlehem community?
- b. Is the distribution of home accidents linked to class status?

Prevalence is defined in this research as the number of cases of home accidents present in the sample population during the one year recall period of June, 1960 to June, 1961. In the first hypothesis we are interested in learning whether class status is connected with the fact that residents of Bethlehem are or are not accident persons. The respondent reporting the home accident is the primary unit around which the tests of hypothesis one will be built.

But in order to determine whether the prevalence of home accidents in the population of Bethlehem is related to class status, a comparison of the reported accident persons in each class in the population will be made with persons in the appropriate class who are non-accident persons. In other words, the comparison will be between the accident and non-accident persons by class. All tests of hypothesis one, then, will be made by comparing the general population in each class with the number of accident persons in the class.

The negation or affirmation of the second hypothesis which concerns the relationship between types of home accidents and class position depends on the outcome of

the three major questions posed in this hypothesis:

- a. Are types of home accidents connected significantly to an individual's position in the class structure?
- b. Is the nature of the accident significantly related to an individual's position in the class structure?
- c. Is the severity (i.e., disabling vs. non-disabling effect) of the accident related significantly to an individual's position in the class structure?

This second hypothesis postulates essentially the existence of significant relationships between the types of home accidents persons have and their positions in the class structure. If this hypothesis is not true, the accident persons' accidents should be distributed in the status structure in a random manner. However, if it is correct, we will find that class status is connected with the kinds of home accidents persons have. We will examine in this second hypothesis, then, the types of home accidents persons have to see if they are associated with class status.

The negation or affirmation of the third hypothesis, which concerns the relationship between economic cost of the accident and class position, depends on the outcome of the three major questions asked below:

- a. Were there any expenses associated with the treatment of the accident?
- b. What were these expenses, i.e., what was the nature of the expenses?
- c. How much were these expenses, i.e., what was the actual cost involved in treatment of the accident?

It is contended in this research that all three components that comprise this third hypothesis are linked significantly and distinctly with class status.

The negation or affirmation of the fourth hypothesis, which concerns the relationship between household activities of injured persons and class status, depends on the outcome of the six major questions asked below:

- a. What kinds of things do injured persons do in their spare time?
- b. What kinds of things take up most of the injured persons spare time?

Time and Activity: General Reference

- c. Where do injured persons spend most of their time?
- d. What kinds of things take up most of the injured person's time?
- e. What is the amount of time spent by injured persons in the home?
- f. What kinds of household chores are performed regularly by accident persons?

It is contended in this research that all six components that comprise this fourth hypothesis are linked distinctly and significantly with class structure.

The negation or affirmation of the fifth hypothesis, which concerns the relationship between reporting of the accident for medical treatment to a medical agent outside the household and class status, depends on the outcome of the five major questions asked below:

- a. Did the injured persons report the accident for medical treatment to medical agents outside the household?
- b. Who were the medical and non-medical agents that treated the injured persons?
- c. Where did the injured who were treated by medical or non-medical agents go for medical treatment or the accident?
- d. What kinds or types of medical care or treatment were prescribed for those injured persons who were treated by medical agents?
- e. What was the length or period of time that the injured persons, who were treated by medical or non-medical agents, were under medical care or treatment for their accident?

It is contended in this research that all five components that comprise this fifth hypothesis are distinctly and significantly linked with class status.

The negation or affirmation of the sixth hypothesis, which concerns the relationship between attitudes of accident and non-accident households toward home accidents and class status, depends on the outcome of the six major questions asked below:

- a. Do the household activities of both accident and non-accident households relate significantly to a household's position in the class structure? If yes, what is the nature of the relationship?
- b. Is membership in a particular class of

both accident and non-accident households connected significantly with attitudes toward expectation of home accidents?

c. Is membership in a particular class of both accident and non-accident households related significantly with attitudes toward accident causation?

d. Is membership in a particular class of both accident and non-accident households significantly related with attitudes toward accident safety and prevention?

e. Is membership in a particular class of both accident and non-accident households connected significantly with attitudes toward medical treatment of the accident?

f. Is membership in a particular class of both accident and non-accident households related significantly with attitudes toward economic cost of the accident?

It is contended in this research that all six components that comprise this sixth hypothesis are linked distinctly and significantly with class status.

All six hypotheses will be tested from data collected and analyzed by way of an interview schedule. Over twenty experienced Pennsylvania Department of Health interviewers administered the schedule to 1,987 sample households or dwelling units during June, July, and August of 1961. Only adult members, (that is, 18 years and over) of the sample population were interviewed. The number of persons permitted to be interviewed was confined to one person per household. Any adult member of the household agreeing to be interviewed was acceptable as a respondent. Due to the nature of the programming of the interview schedule so that an almost equal proportion of interviews were taken in the day time as well as evening hours—to include those persons who were not at home during the day because of social functions, employment, etc.—it is expected that the respondent selection bias will be kept to a minimum.

A home accident was defined in this research as any injury having been sustained by one or more family and non-family members living in a household, and having occurred within or immediately outside the home during June, 1960 to June, 1961. In addition, such an accident must have fulfilled one or more of the following requirements:

a. That it required any monetary expense for medical treatment.

b. That it required some form of medical treatment by a medical agent such as a doctor.

c. That it interrupted the normal daily routine of doing things for any length of time.

Determination of accident and non-accident households was made during the interview when 1,987 adult respondents were asked a question of whether they or any member of their household had a home accident within the past year. If the answer to this question was yes, and it made no difference which family member had the accident, this household constituted an accident dwelling unit; if no, this obviously constituted a non-accident household. A total of 170 households or about 12 per cent of the 1,987 sample households were consequently determined to be accident households.

The second major division of this report concerns a discussion of the major methodological techniques utilized in the study. Briefly stated they are: (1) the interview schedule, (2) a two-stage probability sample, (3) the Hollingshead index of social position, (4) data processing, and (5) the use of statistical techniques.

The interview schedule was used to collect data from both the accident and non-accident populations. The schedule was divided into two sections, the first of which both accident and non-accident households were required to answer, and the second where only accident households were asked questions. Both straight and open-ended questions comprise the schedule. The interviewing time respectively for the non-accident and accident households was, on the average, 40 and 60 minutes. Problems of non-response were handled as follows: A minimum of three and maximum of six recall visits were made for respondent refusals. In addition, the most experienced and qualified of interviewers were assigned specifically to handle this refusal problem. As a result, the refusal rate for the survey approximated only 4 per cent or 86 households. Some typical "causes" of refusal by respondents enumerated in the study are:

a. Respondent reported as being too busy.

b. Respondent was interviewed previously -- a sampling error.

c. No reason given by the respondent—in cases such as these the interviewer received a flat "NO" or "NOT INTERESTED" type of answer.

d. Respondent slammed the door upon seeing a "stranger."

e. Respondent expressed an anti-government, or anti-administration, or anti-business feeling.

f. Respondent reported working (at place of employment or around house) and could not or would not take time for an interview.

g. Respondent reported having already been interviewed by other organizations who misrepresented reason for the visit.

h. Foreign language involved with some suspicion of the interviewer's mission.

i. Respondent expressed the feeling that surveys are "silly" or "not worth while."

j. Evidence of some antagonism towards the interviewer by the respondent with no real reason given for not wanting to give interview.

k. Old age, illness, or illiteracy involved.

The various types of major refusals in the survey were seen to be five:

a. Illness, old age, and illiteracy.

b. Don't know.

c. Partial refusals. Respondents here gave part of the information requested but not all.

d. Outright refusal to answer any questions.

e. Too busy.

Other problems of non-response, in addition to the one just discussed—that of refusals—are in order of pending discussion, problems of foreign language, race, and not at homes. Foreign language problems associated with lack of comprehension were handled by interviewers versed in the language concerned. Most Negro respondents were interviewed by a Negro interviewer.

For those respondents not found at home on the initial visit, no fewer than three and no more than ten revisits were made. Consequently, respondents classified as "permanent not-at-homes" were kept, percentage-wise, below 2 per cent or 35 households. The percentage of non-response households, then, in this survey, and including refusals

and not-at-homes, approximates 120 dwelling units or 6 per cent of the sample population.

The sample design utilized in this research conforms to a probability model because the probability of selection of every block and dwelling unit was known in advance of the actual selection of the sample. These probabilities give the fraction of times that each possible block and dwelling unit would be drawn if the sampling procedure were repeated an indefinitely large number of times. For each block and dwelling unit in Bethlehem, then, some specific probability was assigned.

Several months prior to initiation of the interviewing, the total number of occupied blocks and dwelling units in Bethlehem was determined to be respectively 1,633 and 23,840. Using essentially a sampling procedure suggested by Dr. Leslie Kish of the University of Michigan a sample of blocks was made with the interval 6—that is, every sixth block of the total 1,633 was selected. The total number of sample blocks, therefore, was determined to be 272. Within the 272 selected sample blocks the sample of dwelling units or households was then made with the interval 2—that is, an average number of 2 sample dwelling units per sample block was used. Following this, another sampling procedure demonstrated that the total number of dwelling units in the sample was to be 1,987.

Complete listings of all 272 sample blocks and dwelling units within these blocks was then made. This was done prior to the interviewing phase of the study by trained Pennsylvania Department of Health personnel. The method of listing addresses was uniform for all sample blocks. The system involved the starting of the listing of addresses for each block on the northwest corner and proceeding in a clockwise direction around the block, listing the addresses of each dwelling unit as it was passed until the starting point was again reached. The method of listing within dwellings containing more than one dwelling unit was also uniform. For those dwelling units using the same numerical street address, the order of listing was by apartment number or flat number if such number appeared on doorbells, mailboxes, or doors of individual apartments. The lowest number and lowest letter of the alphabet was listed first

(e.g., a, b, c, etc. or 1, 2, 3, etc., or 1a, 1b, 1c, 2a, 2b, 2c, etc.). When there was no numerical or alphabetical identification of individual rooms, apartments, or flats the listing was done in the following order: right to left; basement to ground floor, to second floor, etc.; front to back on any given floor. This process of complete listing of addresses within sample blocks, or "identification" is it is sometimes called, is the crux of probability sampling. It is the guarantee that 10 interviewers or 10,000 interviewers instructed to visit dwelling unit number 16 could all find the same one.

Upon completion of the listing of all addresses within the 272 sample blocks, it was found that 4,014 dwelling units existed. Following the within-block sample interval of 2, every second dwelling unit or address was selected, for purposes of interviewing from the total of 4,014 enumerated, until the required number of 1,987 dwelling units was reached.

The social position individuals and families occupy in the status structure of Bethlehem will be determined through the modified use of the Hollingshead index of social position. (See Hollingshead and Redlich,¹ pp. 387-397). To determine an individual's class status the Hollingshead index utilized three scales: occupation, ecological area of residence, and education. The index used in this research will also consist of these three scales. It does not, however, have the same six residence positions or categories that comprise the Hollingshead residence scale.

For reasons of unadaptability, i.e., of not being able to apply the New Haven oriented Hollingshead residence scale to Bethlehem, the W. L. Warner residence scale, comprising seven positions and modified to the extent that the seven categories are reduced to six, will be utilized instead. (See Warner,² pp. 151-154). The seven occupation and seven education positions, however, comprising the occupation and education scales in this study are similar to the Hollingshead categories in number and in substance.

The procedure for determining the index of social position is rather complex. Very generally stated, however, to obtain a social class score on an individual or/and family, one must know the head of the household's

occupation and education (that is, number of years of school completed) plus the address of the dwelling unit. Information pertinent to determining the occupation and education class score, and placing each respondent into one of seven positions in the education and occupation scales, was obtained from the interview with the respondent. Residence determination, on the other hand, was made by way of visiting each of the 272 sample blocks plus their surrounding areas and placing each of these blocks into one of six positions on the residence scale.

Following this each of the 1,987 dwelling units was given an appropriate 1-6 residence scale score in conformance with the sample block score. These scores for each of these three variables, ranging from 1-6 for residence, 1-7 for occupation, and 1-7 for education constitute the *scale position score* or *value* for the household. There will be but one such score for each of the three variables and three per household. Each of these scores will then be multiplied by a *factor weight* which will be assigned to each of these three variables. This *factor weight* will be determined by a standard regression equation. The three products will then be summed, and the resultant score will be taken as an index of this household's position in the community's class system.

The data gathered from the interview schedule will be edited and coded and then punched on cards for IBM processing by the Statistical Bureau of the Pennsylvania State Department of Health. The coding will be done in red pencil. Every interview schedule will be coded with an identifying number that will be punched into several IBM cards. This will be done so that at any phase of the analysis we can return from referral to a particular interview schedule and make an investigation on a punch mark in the cards.

The primary emphasis in this study is to test the six hypotheses on relationships between class status and various aspects of home accidents. Our main interest is to see what happens if the independent variable, class status, is varied in terms of each of the six major hypotheses under study. The chi square test will be utilized in statistical analyses of data under consideration. The 5 per cent probability level

will be used throughout the study as the minimum for the determination of significance. Each of the six hypotheses will be tested through use of the "null hypothesis." This states that there is no relationship between, for example, in hypothesis two, class status and type of home accident. If this is true, we would expect to find the same proportions of accident persons having received disabling and non-disabling accidents in each of the five classes.

For example, if in the total group of accident persons 20 per cent experienced disabling accidents and the null hypothesis is true, 20 per cent of the Class I accident persons should have experienced disabling accidents along with 20 per cent of the Class II, 20 per cent of the Class III, 20 per cent of the Class IV, and 20 per cent

of the Class V. However, if the observed proportions in the different classes differ greatly from this expected proportion, our null hypothesis will be rejected and the conclusion made that there is a relationship between class status and type of home accidents.

The statistical procedure of "null hypothesis" will be used to test all six hypotheses. It is expected that the major findings of this research will be published sometime during this coming summer.

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(c) ON COMMUNITY PLANNING

By DENNIS O'HARROW

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(Outline of Talk)

- I. Serious impact—son of community planner leaves roller skates
 - A. What I know about home accidents
 1. Roller skates
 2. Rocking chair
 3. Wife slicing meat
 - B. Change title—"Impact of Community Planning on Safety"
- II. Two points
 - A. Community planning—police power, regulations to promote the "health, safety, moral" and general welfare of the community"
 1. Sometimes wonder about "morals"—what nonsense
 2. Note "safety" specifically stated
 - B. If one dominant principle—all actions, regulations, plans must be considered in context, with all others—*coordinate* (many ways)
 1. Economic, social, physical
 2. Health, safety, morals, general welfare
 3. Transportation, land use
- III. Precise field of home safety, other aspects of safety, safety with all other aspects of community development
 4. Perfection in home safety absurd if external conditions unsafe—and vice versa (what good to travel home safe if only to fall down cellar steps)
- IV. Community planning is applying best intelligence, gained from past experience and continuing research, to producing the best human environment, the community that permits its citizens to reach maximum potential—insofar as community can do so
 - A. Done through preparation of plans, guides, standards for
 1. Streets and highways
 2. Land use
 3. Schools
 4. Parks and playgrounds
 5. Water supply and sewers
 6. Libraries, fire and police stations
 7. Airports, railroads, ports
 8. Host of other things that make up a community

B. We see planning carried out

1. Zoning ordinance
2. Urban renewal
3. Construction of public works
4. Smoke abatement, housing, building codes

V. Back to revised title—talk about several aspects

A. Backyard swimming pools

1. In 1953 sensed trend
2. Tried to find out about safety
3. Called National Safety Council, insurance companies—nothing!
4. Pull out report—specific warnings—out of our head
5. Our fears have been borne out, but were able to bring dangers to our attention of civic authorities

B. Billboards—people don't like them—on what to base control

1. Police power—health, safety, morals, general welfare
2. Fastened on safety—bad men could lurk
3. Also morals—weeds hid immoral acts
4. Although probably has happened, I knew no incidents

C. Billboards—strongest objection aesthetic—still safety

1. Two-second distraction at 75 mph—220 feet
2. Outdoor advertisers argue, with some justification, that billboard breaks hypnotic spell cast by modern hi-speed monotonous thoroughfares

D. Brings to one of most important fields in which community planning contributes to safety—transportation

1. In the transportation house, there are many mansions
2. Safety of limited access highways
3. Design of neighborhoods and cities to reduce traffic in residential areas
4. Problem combatting integral curb-gutter sidewalks

5. Radburn—design of superblock neighborhood to give footpaths for children

6. Location of schools away from major traffic arteries—still fighting (safeway—teach kids how to avoid traffic; Marines—train with live ammo)

E. Airport problems

1. Approach areas clear
2. Proper land uses in area (Tennessee State Hospital)

3. Location of jet ports

F. Planners make mistakes

1. For years advocated thru streets
2. Warped centerline
3. Suddenly, someone decided to study—T intersections about 25 per cent as hazardous as +

G. Planners advocate mass transit

1. On economic basis
2. Concomitant safety improvement

H. Uses in zoning ordinance grouped for general compatibility, mutual needs—schools and churches in residential areas

1. Also where pertinent isolate fire-work factories, cleaning plants using inflammable cleaning agents

I. A few years ago—research report on storage of LPG butane—worked with LPG Institute

1. We decided was hazardous
2. LPG Inst. wrote a problem letter
3. Gruesome, but one of those fortunate catastrophes—as went to press
4. LPG storage blew up—killed a dozen people
5. Added letter and newspaper clipping without comment

J. Problems with "safe" land uses

1. Petrol people keep city safety of filling stations—low insurance rate, etc.
2. Most Z. O. keep away from schools—certainly slim chance, but you can't afford to take even that chance

K. Nuclear power plants—we are at

loss to assess danger—but our present attitude is same—cannot afford to take a chance

1. Difficult to differentiate in planning power between health and safety—health hazard is unsafe
2. Very active efforts to abate or avoid air pollution (recognition—National Advisory Committee on Community Air Pollution of USPHS)

3. Downwind placement of industry—basic premise of one prominent consultant—so much so know as Smokey Joe—knocked into a cocked hat with new smokeless fuel industry

4. Avoidance of sanitary pollution—unsafe dirty water

5. The abolition of slums, unsanitary and hazardous—good mixture of

economic, social, and physical health, safety, even words, general welfare

- VI. In conclusion, I want to revert to special pleading for the planner's chief qualification—his ever-present attempt to see the community as a whole, to plan it as a whole, to take into account the inter-relationship of every aspect of community development, social, economic, political, and physical, health, moral, spiritual, and general welfare, as well as safety. We know that specialists are indispensable, but we also believe that generalists are also indispensable. So when we are propagandizing to a group of specialists, we ask that from time to time they lift their eyes and try to recognize the general picture, to recognize the *gestalt*—the whole is greater than the sum of its parts.

HERE'S HOW WE DID IT!

(a) VOLUNTARY AGENCIES

By CHRISTIAN SMITH

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To come here and speak on voluntary agencies seems a bit like carrying coals to Newcastle. I suppose there is no country in the world where voluntary service has been more developed than in the United States—where there are more citizens engaged in it and where volunteers have a greater impact on the welfare of a nation.

However, voluntary effort is also a highly developed and influential social phenomenon in a number of European countries and, notably, in the United Kingdom. I recall that, during World War II, Robert Priestley, the novelist, remarked in a book that "the free societies are the bedrock of English democracy." That is also the way in which citizen volunteers and their organizations on this side of the Atlantic are regarded.

In the Canadian province of Saskatchewan there is a great variety of voluntary services and the number seems to be growing.

In some ways the small towns seem to be overorganized. I recall a survey of one town of about 2,000 population which had more than 50 voluntary agencies. Moreover, a relatively small number of very active persons seemed to be the core of many of them.

Our own attitude in the Province of Saskatchewan, Department of Public Health is one of "better too many than too few." We have a very keen appreciation of the value of voluntary effort. When we speak of a partnership between the people and their government, we really mean it; and in many, many ways, it is a reality in our province. We are under no illusions that the people can be made or kept healthy and safe by our efforts alone.

That is why, although we have a very active health education service, we welcomed the formation of a Saskatchewan

division of the Canadian Mental Health Association a decade ago and pruned the pump to get it started with both federal and provincial grants. Mention of federal aid brings to mind that the Canadian Arthritis and Rheumatism Society was founded with the encouragement and assistance of the Department of National Health and Welfare.

Another good illustration of how we operate is our food hygiene institutes, or safe food fairs, as we call them, which are designed to prevent food poisoning, a type of accident that sometimes lands many people in hospital. Now it would be possible for our provincial department or a health unit to organize such an institute, but we believe it better to encourage local people to do this themselves with a little guidance from us. Thus, a community organization, such as a Women's Institute or a Farm Union local or perhaps a religious group like the Catholic Women's League, may sponsor a safe food fair.

There are, of course, actions which such a voluntary group can take which a government or public agency could not very well consider, such as the matter of door prizes. The voluntary agency can solicit food hampers, sets of paper tableware, and other prizes from local merchants. This an official agency cannot do, nor would it be likely to meet with much success. When a government agency runs anything, everybody expects it to pay all the way, and then some.

Now to come specifically to the field of accident prevention, I might mention that our provincial government has financially backed the Saskatchewan Highway Safety Council since its inception a number of years ago. The Council has now recognized the need to broaden its program and has approached the government for an annual grant of \$40,000. It expects to raise nearly as much again by voluntary subscription. I have no doubt that this request will be favorably considered because the government recognizes the vital role of the voluntary safety organization. This is so in spite of the fact that the Department of Public Health conducts a comprehensive safety program and various other government agencies conduct preventive programs in some specific areas.

When I was asked to organize and direct the health education services of the health

department 17 years ago, I was under no illusions that my division, or even the whole department, could do an effective job in isolation from the people. From its inception, the Division of Health Education set out to work through and with existing community organizations of all kinds—the Parent-Teacher Associations, Women's Institutes and other women's organizations, professional and business groups, lodges, churches, agricultural organizations, and so on.

Through the years, we have maintained a close liaison with these bodies through their provincial and regional officers and by means of our Saskatchewan Health Newsletter, a bulletin that goes monthly to some 12,000 community leaders, professional persons, local governments, school authorities, teachers, and voluntary groups of all kinds.

Perhaps I should tell you how compulsory pasteurization of milk was achieved a number of years ago; in fact, within a relatively short period after the health education service was set up. After a year's public education regarding the hazards of raw milk, we found the government unwilling to risk public opposition by putting in the legislation. Actually, in my opinion, the government misjudged the situation.

However, our next step was to approach the Provincial Council of Women, a body which, at that time, represented about 125,000 organized women in Saskatchewan. The Council conducted a year's educational and action program among all its affiliates so that women from the smallest hamlets to the largest urban centres were equally involved. At the end of a year it had collected the views of hundreds of organizations and went to the government with a brief. Very soon after this, the legislation was approved unanimously by the Saskatchewan Legislative Assembly.

In 1952, our Health Education Division was given the task of organizing and conducting a comprehensive accident prevention program. I might interject that we began to give major emphasis in those areas where no other agency, official or voluntary, was conducting a preventive program, but, at the same time, we supported the work already being done. There was no point, for instance, in developing a great water

safety activity when this was already being done by the Red Cross. Nor did it seem wise to launch a fire prevention program of some magnitude when this was the specific responsibility of the provincial fire commissioner.

For these reasons, we put most of our effort into the prevention of home and agricultural accidents, later tackling special areas such as child safety and the prevention of accidents in hospitals and other institutions. Some special attention has also been given the safety of elderly citizens.

After the success we had had in working with voluntary associations in health education, it was natural to follow the same course with respect to accident prevention, so we began immediately to develop partnerships with a variety of organizations. These included the Provincial Federation of Parent-Teacher Associations, the Saskatchewan Teachers Federation, the Women's Institutes, the Saskatchewan Farmers Union (and its 1,000 women's locals), the school system, the farm implement companies and other agricultural supply enterprises, provincial 4-H groups and, of course, the churches, in name but some principal agencies.

For a government department to set out deliberately to organize a voluntary agency is almost unheard of in Canada and perhaps even in the United States but, in our farm safety program, the need of a voluntary agency was so evident that, one day, we called together the representatives of some 30 organizations to organize the Saskatchewan Farm Safety Committee. Today it has some 300 members. This group is the obvious nucleus of a farm division when the Saskatchewan Safety Council comes into existence.

Our happiest liaison, however, is with the Saskatchewan Junior Chamber of Commerce. To tell about this, I have to explain Canada's annual Child Safety Day, observed annually on the first Sunday of May. This is how it came about. In the early spring of 1954, after two years of hard work, we seemed to have made very little progress in interesting the people of Saskatchewan in the accident tragedy. The indifference, based on ignorance, because the people just hadn't listened, was reflected by the newspapers. Stories on accidents, even the shocking totals for a year, invariably

were mutilated and buried somewhere back of the financial pages under meaningless label headings.

Personally, I found this very disturbing, so much so, in fact, that it gave me bad nights. One morning about three o'clock I lay awake worrying about it and the solution came very easily. It occurred to me that, when a problem proves too tough, why not bite off a piece one can handle? I remembered someone saying that the way to a man's mind lies through his heart. Now we well know in public health that people who are indifferent or careless about their own health and safety will go to all lengths for the protection of their children. We have seen this in recent years in the prevention of paralytic poliomyelitis. A check last year indicated that 94 per cent of the children to age 16 had been adequately immunized with Salk vaccine, but only 67 per cent of the adults, 17 to 40 years of age, had taken advantage of our free clinics.

Having found an apparent solution, I went back to sleep and, when I arose later, I telephoned the head of my department who approved the institution of a child safety day. It was our assumption that, if we could induce grownups to make the environment safer for children and if we could induce parents to teach safety by precept and example, not only the children but their parents and others would be safer.

So, with rather short notice, we observed our first Saskatchewan Child Safety Day on the first Sunday of May, 1954. Sunday was chosen advisedly because we decided immediately to involve the churches and stress the moral responsibility of everyone for the safety of children (and adults), and we also considered it likely that we could reach more people in the press and by radio and television on a Sunday than any other day of the week. We wanted to reach the fathers as well as the mothers.

The venture caught on immediately with the press, the churches, and some scattered organizations. Then, as since then, we wrote to clergy of all denominations and asked their cooperation. We sent them sample materials and sermon suggestions. Later this became a prepared sermon. Each year a selected minister or priest contributes the sermon, which we print and send out to all clergy. We also lithographed a Child Safety Day poster, and every year we have

produced a different poster illustrating an attractive Saskatchewan child.

However, it was soon evident that we needed the assistance of some organized group with the enthusiasm and energy one often finds among young persons, and we hit on the idea of involving the Junior Chambers of Commerce.

Here I should interject that already, several years ago, we had thought about the total Canadian problem and not just the loss of children in our own province. We wanted Child Safety Day to become a national event. We approached the national president of the Jaycees for advice and followed his suggestion that we try out a pilot program with the Jaycees in one of our cities. This was to be followed by a province-wide pilot program involving all Jaycee units in Saskatchewan. A national project might follow—and it has.

The Junior Chamber of Commerce in Saskatoon has a well-established record for "firsts" in public-service projects . . . for instance, it was the first in Canada to launch a venereal disease education campaign, a project in which 35 other units later joined. It fought prewar Nazi activities and set . . . not a movement in Canada to counter enemy activity. It took the lead in forming the second credit union in Saskatchewan. It was instrumental in the development of an entirely new child welfare program and in providing better juvenile court practices.

This Saskatoon group readily accepted the Child Safety Day project and it was an immediate success. The following year, the remainder of the Jaycee units in the province followed suit and, a year ago, the national organization unanimously adopted Child Safety Day as a project. There are 270 Jaycee units in Canada and it was necessary to write them three times this past winter with suggestions and ideas.

Now voluntary associations are often strapped for funds and the Jaycees are by no means wealthy, at least in our country. We had offered cash prizes to farm and community organizations for the best local safety programs. We did not need to offer the Jaycees any money, but we did have to supply them with posters, literature, radio and television materials, exhibits, and other vital materials. Of course, we could not do this on a national scale, but even when

such assistance is provided only in our own province, it runs to considerable volume.

Having enlisted the Canadian Jaycees, it would be unwise to assume that everything necessary has been done. It seems best to try to interest other agencies, both official and voluntary, to support and supplement the Junior Chambers.

This summer, the Canadian Federation of Home and School, and Parent-Teacher Association held its annual conference near Montreal, Quebec. I had been its provincial and national health convener and have maintained close contact with the organization. I must say that I have been disappointed that so few of the locals in my own province showed any sustained interest in any project for the health and safety of school children, and I had almost despaired of restoring their partnership.

However, one day last June, just before the national convention, the editor of our parent-teacher magazine wrote me that the Province of British Columbia Federation proposed to bring in a resolution to make it a crime to use plastic bags which were not specifically labelled as dangerous. Now we have had very few plastic bag accidents in Canada and only one in Saskatchewan since plastic bags came into use. I wrote immediately to the magazine editor urging her to get the Saskatchewan delegates to press for a much more comprehensive attack on accidents among children and, in fact, accidents generally.

I could not go to the convention but learned later that my views had been incorporated in an amendment to the British Columbia resolution and passed unanimously. The federal authorities were pressed to give leadership and also to encourage the formation of a National Safety Council similar to the American organization.

Subsequently, I wrote a piece for the magazine urging the parent-teacher members to carry on vigorously for the prevention of accidents now that they had made a good start, and I reminded them of their influence and power. I told a story of something that had happened not long ago in Saskatchewan which well illustrated the power and influence of women in voluntary organizations.

Several years ago, I was asked to speak on mental health at a series of farm women's

days, promoted in small rural centres by the Farmers Union. Just before this, a demented woman had shot and killed one of her children and wounded two others on a lonely farm. This woman had only recently been a patient in a psychiatric institution, but she was cast into a local jail and then sent to a provincial jail for women to await trial like any common criminal.

The woman who chaired the Farm Women's Days programs and introduced me asked me if I would make a reference to this incident. I did so in the course of my talk and said that the most shocking aspect of the treatment of this apparently sick woman was not the action of the police or the magistrate who conducted the preliminary hearing, it was the silence of the people of Saskatchewan, particularly the women. Saskatchewan is a province which prides itself on its sophistication and humaneness in the treatment of the ill and less fortunate.

Immediately after my paper there was a five minute break, and one of the women asked me to help with a resolution addressed to the attorney-general of Saskatchewan proposing the treatment of the farm woman as inconsistent with Saskatchewan's progressive and humane policies. The resolution was passed unanimously.

"Now what do we do with it?" the chairwoman asked.

"If you do like so many other organizations, you'll file it and forget about it," I answered. "However, if this case shocked you and you don't want something like that to happen to you or any other person, I suggest you send the resolution to the attorney-general with a covering letter and that you publicize your action in the press and by radio and television," I said.

Similar resolutions were drafted, passed, and handled at a number of such meetings in the weeks that followed.

One day I was chatting with an official of our Psychiatric Services Branch and, somehow, the story of the mentally ill farm woman came into the conversation. He told

how our department had urged the removal of the prisoner from a jail to a mental hospital and how this had been rebuffed with a legalistic statement that "the law must take its course." Suddenly, however, the Department of the Attorney-General had reversed its decision and moved the unfortunate woman from prison to hospital.

I think this well illustrates the power of voluntary effort in influencing public affairs, and I submit it can be just as powerful in dealing with the prevention of accidents. There are two English quotations I want to leave with you:

"That community is greatest where the greatest number of persons accept unimposed obligations."

This is by Lord Moulton, an English lawyer. I think of it when I see a community which seems to be over-organized.

The other quotation is this and, unfortunately, I can't recall the author:

"There is no limit to the kind of good a man can do if he doesn't care who gets the credit."

I think of this when sometimes a voluntary association seems to get the credit for something we have done.

One day I spoke at a public health conference about the value of voluntary associations to the medical health officer or unit director.

A health officer asked: "But isn't there a danger of the volunteers wanting to take over your work?"

The reply was that volunteers only want to wear the pants in the community household when the head of the family isn't doing a good job and, even then, only long enough to make him do it.

I think there is a tremendous challenge to American volunteers in the tragedy of child accidents. Perhaps you can bring yourselves to accept an idea from your neighbors in Canada, and make Child Safety Day an international event.

(b) INDUSTRYBy **WILLIAM J. KERNS**

Safety Advisor, Humble Oil & Refining Co., Bayway Refinery, Linden, N. J.

We, at Bayway Refinery of Humble Oil & Refining Co., believe that a comprehensive and progressive off-the-job safety program is essential before any continuing degree of success can be achieved in an industrial safety program. We believe that to significantly reduce industrial injuries we must try to eliminate all injuries whether they occur at work or off-the-job.

After all, safety is primarily a matter of attitude and, as you know, attitudes are difficult to change. Employees do not suddenly become safety conscious when they walk into our plants and put their safety hats on, any more than they become reckless and violators of good safety practices when they leave the refinery. We believe people tend to work, drive, and play as they live. Therefore, if we can influence them to live safely, we believe this will improve their safety performance in all areas of their activity.

In order to accomplish this, our safety program must be one of "Safety Around the Clock" as shown on one of our 130-foot diameter storage tanks. The National Safety Council states it—"Safety. Everywhere. All the Time." The off-the-job safety program must naturally supplement a sound industrial safety program.

Any good safety program should be based on the three traditional "E's" of safety. It is essential that operations be well engineered, employees be well educated in safety rules and in their safety responsibilities, and that rules be adequately enforced. A good safety program has been referred to by safety experts as being like a three-legged stool. Take away any leg, engineering, education, or enforcement and it comes.

We believe that this analogy should be carried further to point out that a good safety program can bog down just like this stool through monotony unless it has other essential ingredients in addition to the three traditional "E's" of safety. Our top management must be sincerely interested, but just as important must actively participate in the safety program. All levels of management must accept employee safety as their

responsibility on equal terms with cost, quality, and production, and there must be a real opportunity for participation by both management and wage employees in the development and execution of the safety program.

We have found that these ingredients can add a base of enthusiasm, a fourth and very essential "E" to our safety activities. We have found that a solid base of enthusiasm will prevent our safety activities both on and off the job from bogging down. It is one of the keys to the progress we have made at Bayway Refinery.

One of the areas where this influence of enthusiasm can be most forcefully demonstrated is in the reduction of off-the-job disabling injuries. Off-the-job injuries are considered less subject to management control than industrial injuries, and the principal tools available to management are the motivation and education of the employee and his family. We believe the employee must be given standards of conduct in the area of off-the-job safety and the stimulation to meet these standards of conduct.

The situation we had at Bayway in off-the-job disabling injuries in 1956, the first year we began our off-the-job safety activities, was this: 263 disabling off-the-job injuries, resulting in our employees losing 3,391 mandays of work. In 1956 by comparison we had 13 on-the-job disabling injuries. In other words, we had 20 off-the-job disabling injuries for every industrial disabling injury we had at the refinery. How could we possibly believe that our industrial safety program was for real? Our employees were hurting themselves off the job in exactly the same ways they were hurting themselves on the job.

For comparison of performance, both with ourselves year by year and with other industries, it is customary to express off-the-job disabling injuries in terms of frequency, injuries per million manhours, assigning 312 manhours per month per employee. Our frequency in 1956 was 17 off-the-job disabling injuries per million manhours.

Our progress since we began our off-the-job safety activities in 1956 is noted in that our frequency was reduced from 17 disabling injuries per million manhours in 1956, to 11.8 in 1957, and 6.5 in 1958. We made little progress in 1959, for an interesting reason I will describe later. In 1960, our frequency reached a low of 4.75. So far this year, we are not doing nearly as well. Our frequency is up to 6.5 and again I will describe the reasons later. I would like now to outline some of the activities we have conducted beginning in 1956 to secure a rapid reduction in off-the-job injuries.

Our Central Safety Committee has as its chairman, the refinery manager and includes all of his department heads as members, with the safety advisor as secretary. When this committee recognized our problem of off-the-job safety in 1956, an analysis disclosed that one-half of these disabling injuries were due to home accidents. A Home Safety Carnival was developed to be held at the refinery on a series of Saturday mornings. As part of the carnival activity, a home safety essay contest was conducted for the children of employees, with awards of over \$3,000 in cash. The theme of the carnival was the relation between industrial safety and home safety, or "Safety Around the Clock."

A collection was made of every safety sign used in the refinery. We were surprised to find we had so many types.

A display was made of all the protective equipment used in the refinery along with the home hazards that are similar to refinery hazards. We built a little garage with a dummy lying in it to show the hazard of carbon monoxide poisoning from automobile exhaust.

We demonstrated the right and wrong ways for medicine chests, showing the typical home medicine chest and how it could be.

We had a demonstration of home electrical circuits and showed how fires start when oversized fuses are placed in the box or the fuse is short-circuited with a penny.

The committee collected samples of all the common household chemicals and enlarged the warning labels, relating these chemicals to the chemicals we used in the refinery and the cautions to be observed.

We had a booth demonstrating the vari-

ous do-it-yourself hazards around the home as well as a modern kitchen with all of its hazards; and our rescue squad gave a demonstration of artificial respiration and heavy rescue. Our fire department put on a spectacular demonstration.

We found that the displays which had been set up for the guests' participation were most effective. For example, kids and employees could slam a steel ball against safety spectacles to see how effective they are in preventing eye injury.

Incidentally, we are quite proud of the reduction in foreign body in eye cases we have secured at the refinery through our safety spectacle program which was instituted in 1956. We have cut our foreign body in eye frequency from 192 foreign bodies in eyes per million manhours in 1955, to a range of 11-14 in the years 1958 through 1960.

A little model was used to demonstrate techniques in lifting heavy objects.

Over 5,000 company employees and their families attended our first safety carnival, with over 600 children entering the home safety essay contest. As a result, we decided to repeat the essay contest and carnival in 1957, and to give more attention to participation. In addition, we added a home safety poster contest for employee children.

We held a safety quiz in the refinery auditorium for all the employee children. We believe the safety quiz was effective for our employees also.

The winners of the home safety essay contest and poster contest were presented their prizes by the quizmaster. Each child answering a safety question received a token prize.

We again had demonstrations of the common home hazards such as an attic showing both the normal disorder as well as a properly equipped and maintained attic. We also had a workshop and a garage showing the normal disorder vs. good order.

We even set up a bathroom showing all the common hazards in this vital room of the home.

The local police put on a demonstration of their drunkometer machine. This secured a lot of interest, particularly on the part of the man being tested as did the

various driver testing or psycho-physical testing units.

Local police put on a dramatic outside demonstration of the use of radar in catching speeders.

Both the winning home safety essay and winning safety posters were placed on display. We used the winning safety posters from this contest to design our safety calendar for all of our employees this year.

We believe that home safety carnivals such as these are very effective in setting the stage for an off-the-job safety program. It is a good way to involve a large group of employees in preparation and to demonstrate the company activity and interest in off-the-job safety to employee families.

One of the programs which has had a continuing effect on our off-the-job safety since the middle of 1957 is our individual employee safety award program. In both 1955 and 1956, we had made group safety awards for all employees when the refinery went 30, 60, or 90 days without an industrial disabling injury. We decided to develop a program which would include performance in off-the-job safety as well as industrial safety.

And in line with our philosophy of eliminating all accidents, we decided to include minor or dispensary type injuries as well as industrial disabling injuries for contest purposes. Each employee must go a specified time without having an industrial disabling injury, a non-disabling industrial injury of any type, and just as important, must not have an off-the-job disabling injury.

The employee competes only for himself and his family. He becomes eligible first for the Red Esso Regular prize, and as he continues injury-free, he graduates to the Blue Esso Extra, and then to the top, Golden Esso Extra. As he continues injury-free, he continues to win awards.

The catalogues are mailed to the employee's home with an appropriate congratulatory letter from the refinery manager. The employee and his family then make the award selection together, and the award is mailed to the employee's home from the supplier.

The individual employees' safety awards are continuously displayed on the main thoroughfare of the refinery. And you can tell from the lack of grass in front of

this cabinet the high degree of interest on the part of the employee. We believe this approach to safety awards is somewhat unique in industry and that it is a good way to show an employee and his family frequently, that he is doing a good job as an individual both on and off the job and that he is meeting high standards of conduct. We believe the award program helps to maintain a base of enthusiasm for our safety activities.

Carrying the thought of individual recognition further, the refinery manager presents a gold tie pin to the employee upon his completing 20 accident-free years on the same basis of no non-disabling or disabling industrial injuries and no off-the-job disabling injuries. In addition, verbal and written commendation are given to our employees upon their completing five, ten, or fifteen years on the same basis. An honor roll has been established with their names.

Another inexpensive safety activity revolves around our company picnics. In the past several years, we have given demonstrations of recreation safety by having the American Red Cross water safety instructors conduct swimming instruction and water rescue demonstrations such as this life preserver rescue, canoe rescue, and surfboard rescue.

Local sportsmen clubs have given demonstrations of fishing, archery, and hunting safety at our picnics and we have had the local police put on bicycle safety contests, with over 700 of our employees' children competing.

The New Jersey Bureau of Navigation brought a power boat to our picnic and gave a demonstration of boat safety.

The New Jersey State Police gave a skin diving demonstration including rescue techniques. In addition, our Rescue Squad has also given spectacular demonstrations, and we have again included psycho-physical testing as well as radar and drunkometer demonstrations. With 5-7,000 employee and family members attending, these demonstrations are well received with a good return at little expense.

During 1959, we held a highly successful contest for the wives of our employees who submitted their family home safety programs. Approximately 43 per cent par-

ticipated. This program, "How to Keep My Family Safe," was designed to have the whole family think hard about safety for at least several hours. The quality of the essays was excellent, and some 60 wage employees and supervisors made up judging teams for the 868 entries. The final judging was supervised by the chairman of the Home Safety Committee of the New Jersey State Safety Council. The winners shared \$250 in cash prizes and all participants received a safety award.

We capitalized on the excellent ideas in these safety essays by preparing a safety reminder calendar which was mailed each month to all employees. Each day of the month carried a safety thought from one of our employee wives with credit given to her.

We believe that our safety program in the plant and off the job is strengthened when employees and members of their families make safety commitments to themselves through contests and programs such as, "How to Keep My Family Safe." We believe it strengthens our base of enthusiasm.

Up to now, I have been reporting some of the activities that have enabled us to reduce our off-the-job injury frequency steadily downward through 1958. You will recall that in 1939 we showed no further improvement, even though we continued our activity in the area of home safety.

As we reduced off-the-job disabling injuries in 1937 through 1938, we found we were making little progress in the area of traffic accidents. Traffic accidents, which accounted for only 18 per cent of our off-the-job accidents in 1936, rapidly increased to 34 per cent in 1939, and this increase offset the reduction in other areas in 1939. Also, in 1939, 54 per cent of all the days lost as a result of off-the-job accidents were due to traffic injuries. This then was our main problem area in off-the-job safety in early 1960 as well as 1959.

Early in 1960, our Central Safety Committee decided to have an adult training program developed for our employees, and what safety experts tell us is unique, for their wives and teenage children who drive or soon would drive. The decision to budget funds was based on our desire to cut traffic accident costs in half. In 1959, our employees had 20 off-the-job disabling injuries

as a result of traffic accidents, including one fatality. The Defensive Driving Program was developed early in 1960 with the help of the Esso Safety Foundation, now the Humble Safety Foundation, and various New Jersey state agencies. The program was designed primarily to explore attitudes and their effect on driving habits and how to improve them.

Because of our success in past years in motivating employees to participate in safety activities, they and their families were invited to a full course dinner party prior to each of the four evening sessions of the program. This gave Mom a night away from the stove, the family a free meal, and provided an opportunity for our supervisor and employee families to mix.

We wanted to have the maximum number of employees attend the course so each participant who attended all four sessions received an incentive award, whether an employee or member of his family.

We widely publicized the program to our employees with nine feature articles in our bi-weekly newspaper, through a letter of invitation from the manager, and with local newspaper coverage. Incidentally, the main in space is being rescued in one of our disaster drills.

The program was held in the refinery auditorium with portable microphones used to gain maximum audience participation. Throughout the four sessions, full use was made of visual aids and movies dealing with traffic safety. The program was conducted by the very best traffic experts we could secure within traveling distance. Representatives of the New Jersey State Police and the New Jersey Division of Motor Vehicles attended all sessions to answer questions.

The first session was devoted to the basic causes of traffic accidents which were developed through audience discussion. The meaning of defensive driving, namely avoiding mistakes by others by anticipation and early recognition, was also developed as well as the point that the individual behind the wheel is responsible for and can control his own safety.

Prior to the second session after dinner, a spectacular demonstration of stopping distance was made. One of the program participants drove the car with an instructor alongside.

When the instructor fired this detonator, the pavement was marked with a burst of yellow powder. When the driver removed his foot from the accelerator and hit the brakes, the detonator fired automatically again. The point of the final stop was marked, and the audience could clearly see the distance of reaction time and that you could not stop a car on a dime.

The second session was devoted to a demonstration of psycho-physical testing and the significance of these tests. Also, sell them the truth—the alcohol story, showing physiological functions, and that there are no warning signs at the time drinking becomes dangerous. Also, a development of what makes us tick, a discussion of how emotions are related to attitude development, and how attitudes influence our actions in practical situations.

The third session was devoted to the differences of throughway driving and the development of safe driving practices and specific steps to meet the more common driving emergencies; also, to improve perception in driving and to provide audience practice in early recognition and anticipation principles.

The fourth session was devoted to a panel discussion including representatives of the State Motor Vehicle Division, the State Police, the New Jersey State Safety Council, and the course instructor, and covered "things I would like to know," a question and answer discussion built around the questions submitted on cards prior to and during the session. At the concluding session, a voluntary test taking about one-half hour was given and 85 per cent participated. As a further incentive, the top five per cent in grades became eligible to complete in a driving skill rodeo with the first prize of \$100 and second of \$50 for both men and women. Consolation prizes were also awarded to contestants in the driver skill rodeo who did not place.

Nearly 1,200 employees, their wives and teenage children, participated in the Defensive Driving Program and represented approximately 25 per cent of our employee group. We found the program a wonderful mixer for management, employee, and family all learning together. Ninety-nine per cent of the participants taking the course indicated they thought the course was either

excellent or good as submitted on evaluation cards. We believe the night out for the family, the attendance awards, and most importantly, the quality of the course were the reasons that only two and one-half per cent failed to attend all four sessions of the program, a program devoted to exploring attitudes and acceptance by the individual that he can improve his own.

We will continue to keep employee interest alive in traffic safety throughout the year with ideas like a road marker, which was mailed to the employee's home with a letter on traffic safety from the refinery manager, and through further feature articles in our local communications and stunts—like the crash scene developed by one of our wage safety committees for the Christmas holiday season.

It is too early to predict the ultimate benefits of the program on defensive driving. However, these are the results to date. Where our employees had 20 off-the-job disabling injuries as a result of traffic accidents in 1959, we had six in 1960 following the program and nine for the year. We have had nine through September of this year. Only two accidents out of the 15 following the program involved Defensive Driving participants. I mentioned earlier that our days lost as a result of traffic accidents had steadily climbed to 54 per cent in 1959. Our days lost as a result of traffic accidents in 1960 decreased to 30 per cent and the days lost in 1961 have decreased to 23 per cent.

Our total off-the-job injury frequency was reduced to 4.75 injuries per million man-hours in 1960, due primarily to our breakthrough in control of traffic accidents. We recovered our full investment in the Defensive Driving Program through reduced accident costs last year, and the savings are continuing to date. Just as important to us is the fact that fewer of our families had the suffering and misery associated with a bad traffic accident.

I mentioned earlier in my talk that we have not done nearly as well this year as we did last year. There have been problems and also shifts have taken place in our off-the-job accident experience. Below is an analysis of our off-the-job accidents by the categories of home, traffic, pedestrian, and recreation for the years 1956 through

1960, and for the nine months of this year. All categories are expressed as a per cent of total days lost.

In 1956 and 1957, our main problem was in the area of home accidents and this motivated the Home Safety Carnival, essay and poster contests for our employee children. Traffic accidents, perhaps less subject to control, crept upwards in 1958 and 1959. Home accidents, substantially reduced in 1958, climbed in 1959 and 1960. Pedestrian accidents jumped up in 1960, and snow-balled in 1961 to 40 per cent. In fact, in the first three months of this year, as we experienced one of the most severe winters in our history, 75 per cent of all the days lost were due to falls in ice and snow either pedestrian or on the outside steps at home.

An analysis of the number of accidents rather than the days lost highlights the fact that in 1960 and 1961 home accidents again became our predominant problem.

This spring, we made a test by sending the *Home Safety Review*, now named *Family Safety*, to all of our employees and asked them if they wished to continue receiving it. We were amazed at the results. Over 65 per cent of all our employees have returned IBM cards signifying their desire to continue receiving the magazine. Over one-half of these people took the time to write enthusiastic comments about the excellent quality of the magazine and its effect on their families' safety thinking.

Because of our continuing concern about off-the-job accidents, we developed a new home safety plan contest this summer that would involve the whole employee family working as a unit. The contest was purposely designed to require many hours of group thinking. A merchandise prize was offered to each family that made an entry in the contest and \$750 cash prizes were awarded to the six best family entries.

The contest was divided into two parts. The first part, "What's Wrong Here?" required each family as a group to find as many unsafe situations in a specially created cartoon as possible. The 20 families finding the most unsafe situations received a merchandise award. Incidentally, there are approximately 270 unsafe situations portrayed covering all areas of off-the-job safety in the cartoon.

The second part of the contest required each family to develop their Home Safety Plan, "How We Keep Our Family Safe," pointing out what each family is doing to prevent accidents in the general areas of falls, traffic, pedestrian, do-it-yourself, recreation, vacation, electrical, fires and burns, poisons and chemicals, and gardening and backyards. All members of the family signed the home safety plan. Where a child couldn't write, his parent was required to sign for him.

Over 600 families entered the contest in spite of the hot, humid weather of August and early September, and vacation period, and from the quality of the entries, had invested hours of thought.

The judging, taking four days, was done by 30 wage and management employees; again supervised by Miss Edith Doane of the Home Safety Department, New Jersey State Safety Council. We presented the cash awards at a special luncheon attended by the complete families of the winners.

We have accumulated so many novel ideas that we are planning to shortly publish a booklet of safety tips from Bayway families; again, capitalizing on their excellent safety thoughts.

In September of this year, we secured a significant decrease in number of off-the-job injuries continuing to date. We believe this contest will have some lasting effect and will be interested in following the off-the-job accident experience of the contestant group and judges in comparison to the rest of our employees.

I stated at the beginning that we believe that to significantly reduce both disabling and non-disabling industrial injuries we have to try to reduce all accidents whether they occur at work or off-the-job.

In the period 1956 to date, we have not yet seen a gratifying improvement in our industrial disabling injury frequency. It has held in a range of 3.9 to 1.7 injuries/million manhours. However, we have secured a substantial reduction in non-disabling industrial injury frequency. We have cut our frequency from 413 injuries per million manhours in 1955 to 53 in 1960. We believe that continuing concern for our employees' "Safety Around-the-Clock" is paying dividends in the reduction of injuries, both industrial and off-the-job.

We strongly feel that our most successful activities are the ones that involve the employee and members of his family in active participation, where they have to give something of themselves and make commitments to themselves.

We believe that the contests and other programs we have described here today

have been helpful in motivating our employees to do a better job through an improved safety attitude. This in turn has led to establishing a base of enthusiasm on the part of our employees for our safety program.

We know that this enthusiasm has made our safety program better.

(c) SAFETY ORGANIZATIONS

By AL McGEE

Home and Public Safety Dir., Seattle-King County Safety Council, Seattle 4, Wash.

We have a brand new Public Enemy No. 1 out in King County Washington. *Home accidents* are now killing more of our citizens than *traffic accidents*. The change is due both to rising home accidents and declining traffic fatalities. This is the first time this has happened to us, except for a brief period during World War II when gasoline rationing sharply cut the use of cars. In 1960, 139 King County residents died from home accidents, while only 116 were killed in traffic.

Looking at the national figures for 1960 (38,000 traffic deaths, 27,500 home accident deaths), it appears to me that before long many more areas across the country must face the same problem. Perhaps you and your community may profit from our experience out in Washington.

Re-Educating a Million People— With Volunteer Teachers

The most startling aspect of our experience in King County has been the fact that hardly anyone wants to believe what the Coroner's figures show. We have spent so many years publicizing traffic as the No. 1 killer that this notion has become a fixed belief for many of our people. When told that they are now safer on a busy freeway than in their own living rooms, they simply can't believe it. So our Home Safety Committee has the task of reeducating nearly a million people.

Fortunately, our Committee is composed of persons who are well qualified to teach others. One member is a lecturer on public health at the University of Washington. We have the top health educators from our city, county and state health departments.

We have a doctor, fire chief and the director of nurses for Children's Orthopedic Hospital. The Committee has more than 30 members, each a specialist in some area related to home safety.

Drafting a Positive Program

Our Committee chose to approach the problem from three directions at once. First, we decided to edit, publish and circulate a quarterly home safety leaflet containing seasonal warnings and advice. Second, we planned to invite representatives from community groups to attend a home safety workshop where they would be urged to start home safety projects within their respective groups. And third, we decided to hold a county-wide Home Safety Week once each year, with massive publicity via newspapers, radio and TV. Then we discovered that we didn't have enough money to finance any of these things.

How to Get Something for Nothing

Because we had so little money for postage, we designed our quarterly home safety publication as an envelope stuffer. We made it the size of a business envelope, and asked some of our member business firms to see if any of their office mail was going out "light." That is, we asked them to see if they could slip one of our stuffers into each outgoing letter without increasing the weight enough so that more postage would be needed. We discovered that the average business letter contains one sheet of paper, weight one-fourth of an ounce and carries postage for a full ounce.

Moreover, no one seemed to object to getting the stuffers along with their monthly statement or interoffice communication. So

we called this our "Piggyback Distribution System," and it worked so well that when our fourth issue was published, an even dozen business firms distributed a total of 21,000 copies. There was no cost to us. If our Home Safety Committee had mailed each of these individually from our office, the postage would have amounted to \$840.

Although we were able to get our distribution costs down to absolute zero, we didn't quite manage this with our printing costs. Printing costs for the 21,000 copies of our latest issue were \$21.32. We paid that to a small offset printing shop for making the paste-up, negatives and plate. Then one of our member firms, the Washington Natural Gas Co., took the plate, furnished their own paper and ran off 10,000 copies for us on their company press. When the gas company had finished, Pacific Northwest Bell Telephone Co. took the plate, ran off 11,000 copies on their press and sent them to their employees. We call this our "Panhandle Printing Program," and on this issue alone, it saved us more than \$100.

Our Home Safety Workshop was somewhat less than a rousing success. We invited representatives from more than 300 community organizations and some 60 showed up. Each one received a copy of *Sixty-Five Home Safety Program Ideas*, an 11-page booklet. The back-page contained a coupon to be returned when a club home safety project was started. To my knowledge, not one of these coupons was ever returned. We did, however, get several phone calls reporting on fresh home safety activities, and two or three of these groups did go on to complete fine projects.

Planning Home Safety Week

Our Committee gave Home Safety Week a trial run in 1960. Nothing much happened. When we made plans for this year, we decided that an "out-of-town" expert was needed to lend mystery and glamour. We persuaded General Stewart to send us Lois Mersdorf, senior home safety consultant for NSC. By the time she arrived, we had her booked almost solid for four days.

She conducted seminars for doctors and nurses at city, county and state departments of health and was drafted for similar duty

by the health officer of a neighboring county. She addressed the Seattle Council of Parents and Teachers and met with the safety chairmen of 23 homemakers clubs. She had lunch with staff members at a 70,000-member medical co-op and made six radio and television appearances. As Miss Mersdorf herself remarked, "You just can't beat the 'out-of-town expert' for getting attention."

Getting Our Name in the Papers

Since we had no funds with which to purchase paid advertising, we had to play up the news and public service value of Home Safety Week: the two big metropolitan newspapers in King County (combined circulation, 444,000) were quite willing to help, but the 46 weeklies (combined circulation, 501,000) demanded string local (neighborhood) news angles. We tried to give them these by asking the mayors of all 31 incorporated towns and cities in King County to proclaim Home Safety Week. Fifteen of them did, and when the clips were in we found that 18 newspapers with a combined circulation of nearly 700,000 had given us 211 column-inches of space worth more than \$750 at their general advertising rates.

Public Service—at \$100 Per Minute

Radio and television have had a rough time at the hands of congressional committees during the past couple of years, and we on the staff of the Seattle-King County Safety Council have religiously reported to the Federal Communications Commission each public service effort by Seattle stations in behalf of safety. We have defended them repeatedly, so we were not surprised when each of them scheduled Miss Mersdorf for an interview, during Home Safety Week. One station used her twice, and when we got through counting the minutes and multiplying the minutes by commercial rates which averaged \$100 per sixty seconds, we discovered that the TV stations had given us \$2,910.00 worth of time. A radio station gave us \$60 worth, so when we added the free newspaper space to the free radio and TV time, we discovered that these mass media had given us \$3,731.72 worth of the only things they have to sell.

What to Do When Nobody Comes

One of our Home Safety Week projects fell flat on its face. This was our Child

Accident Workshop, held at Children's Orthopedic Hospital. We gave it enough publicity to fill the Hollywood Bowl and exactly 12 people showed up. The director of nurses hurriedly rounded up a bunch of student nurses and shoed them into the auditorium so that the doctors would not have to lecture to empty seats.

This Child Accident Workshop was far from a brand new project. It had been put on more or less successfully each of the past six years. The program featured one doctor explaining the operation of the Poison Control Center, another lecturing on burns, a third on broken bones and at times a fourth on cuts and bruises. Each of these performers used excellent visual aids and made a fine presentation. Why didn't the audience show up? We did our best to find out.

The audience we were trying to pull was composed entirely of mothers of small children. That meant each one of them had to get a baby sitter. If father had driven the family car to work, then mother had to get on one bus, ride downtown, get on another bus, ride out to the Orthopedic Hospital, and then repeat the whole tiresome process to get home again. Mothers with cars were not much better off, the Orthopedic parking lot is small and perpetually full.

Next year, we will let these mothers stay home and we will bring them the Child Accident Workshop via television. We'll take the mountain to Mahomet, by hauling the doctors and their props to the studio. Mother will get it without baby sitter problems or traffic hazards, right in her own living room. It has already been definitely scheduled on KOMO-TV.

Those Men in the Funny Hats

When you are trying to re-educate a million people through the efforts of one staff man and 20 volunteers, you will quite likely need help. We certainly did, and we got it from the firemen. King County has 32 fire districts, each with one or more stations staffed with paid and/or volunteer crews.

The cultural myth, which casts the fireman as an imbecile in a funny hat who chops holes in your roof for no good reason, dies hard. For this reason, firemen always need public relations aid and will work

hard for it. Today's fireman is a highly-skilled, highly-trained, alert and knowledgeable individual who is likely to know more about home safety problems than anyone else in the entire community!

What's more, he's likely to have a bit of free time—once he has polished the pumper and dried out the hose—to put his ideas into practice. We signed up every fireman we could reach, and used them as volunteer home safety consultants during Home Safety Week. Those who participated spread the word to the rest and it wasn't long before they began asking and finally demanding to be allowed to serve on our Home Safety Committee. We are mighty glad to have them.

What can firemen do in home safety? There is hardly anything that they cannot do, if they really want to. They can teach kindergarten courses in first aid to youngsters. They can expand home inspections to include most home hazards. And if just one fireman's wife in each district would clip home accidents from the local paper and send them to Jess Carper, we could make the *Home Safety Review* grow as big as *Life* or *Look* or even *Reader's Digest*.

How to Keep Your Home from Killing Your Family

King County, Wash., is not always considered the best of all possible worlds, even by those of us who live there. It does, however, have a mild climate, and this feature has turned out to be both a blessing and a curse.

Many years ago, northwest architects began taking advantage of this mild climate by "extending the living room into the front yard." They designed outdoor patios with floors that were a continuation of living room floors. A large section of living room wall was replaced by sliding glass doors which could be opened wide during warm summer days and closed in the chill of evening.

At first, these sliding glass doors cost a small fortune and were thick enough to withstand Indian attacks. But price competition soon took care of this. Down, down, down went the price—and the quality too. Now you can buy a sliding glass patio door for \$39.95, but it is much more dangerous than the Indians ever were. When bumped slightly, the thin crystal glass in

these doors explodes into dozens of razor-edged shards which slash the victims' tendons and arteries to ribbons. We have documented cases where:

- (1) 184 stitches were required to sew up A SINGLE CUT on a 9-year-old boy;
- (2) Fourteen permanent scars on an 8-year-old will require years of plastic surgery to remove;
- (3) death resulted from severed arteries for a boy nine and a girl 19, in separate accidents two years apart.

The mother of the boy with the fourteen permanent scars is now a member of the Home Safety Committee of the Seattle-King County Safety Council. Already, her research into this problem has resulted in a feature article in *Home Safety Review* (Spring, 1961). We have not yet been able to impress the building code authorities of either Seattle or King County with the urgency of this problem. They keep asking for more accident statistics, and these are harder to come by than figures on the incidence of incest.

Hospital emergency wards and doctors' offices, where these statistics are spattered in blood on the walls and floors, are considered sacred to the patient. Both hospital administrators and doctors are bound by the ethics of their profession to keep the patients' problems in strict confidence. But we have found a few doctors and hospital administrators who also recognize a simple duty to all humanity—the duty to keep people alive and unmaimed, if possible. We hope that these few can convince the many to help us collect the statistics, and that the statistics will convince the building code people that only shatter-proof glass is safe in sliding doors.

(d) HEALTH DEPARTMENTS

By RICHARD E. GALLAGHER
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Philadelphia Dept. of Public Health, Philadelphia, Pa.

Here's how we did it in the Shenandoah Valley of Virginia.

In the fall of 1957 the Virginia State Department of Health and the United States Public Health Service selected a five county area, including one independent city, in the

The Kaboom is Now Kaput in Washington

Explosive fireworks were outlawed by the 1961 State Legislature. The Seattle-King County Safety Council and the Washington State Safety Council teamed up with the firemen on this and in about two months had secured signed resolutions from 50 cities and towns, 25 municipal fire departments, 23 fire protection districts, 18 professional associations and 39 civic and community clubs. The statewide geographical distribution of this support was almost perfect, and the editorial support was likewise well spread. In one ten-day period, the Seattle-King County Safety Council mimeographed and gave statewide distribution to some 40,000 pieces of literature.

When we started this anti-fireworks campaign, the old pros in the legislature smiled tolerantly and shook their heads. At the 1945, 1947, 1949, 1951, 1953, 1957 and 1959 sessions, they said, the firemen, police officers and humane societies had introduced fireworks control bills and taken a licking every time. For seven sessions in a row, the bills got bottled up and died in committee. Why? Because the firemen and policemen always had other legislation to worry about too—pensions, equipment, working rules, etc.—and in the dim, dark final hours of the session, they always had to trade off the fireworks bill for something more vital to survival. You can't beat solid money with resolutions, they said, even when 80 per cent of the people of the state are represented by the resolutions. The devil you can't! You can't do it very often and old John Q. Citizen has to be pretty mad, but you can do it. We know—we did it—through the good offices of our Seattle-King County Safety Council.

Robert Anderson, Director, Bureau of Health Education, Virginia State Department of Health.

The valley area was selected for the study because it was generally comparable to many rural areas with its economy based on agriculture and light industry. The population was generally stable and there was a lack of any organized accident prevention program.

The project included two health districts each with a population of approximately 30,000. In the Rockingham-Harrisonburg Health District the staff was centrally located in a new health center. The Page, Rappahannock, Shenandoah, and Warren County District was composed of four separate offices under the jurisdiction of a single director.

The project was divided into two phases. The first a fact finding phase began July 1, 1958, and ended June 30, 1959. During this period the "normal" accident experience of the five counties and city was recorded. The purpose of the first year's baseline study was to determine the number of deaths due to accidents and to determine the number of nonfatal injuries which required inpatient or outpatient hospital care or were serious enough to require a physician's attention. The knowledge derived from these reports provided the foundation for the activities of the second or educational phase.

The second part of this project, began July 1, 1959 and was an intensive education campaign to determine if community education could prevent accidents.

The study had its headquarters in the Rockingham Health Center. Mr. Lewis G. Polk was assigned to the project in January 1958 and I came on board in April 1959. We were both on loan from the U. S. Public Health Service to the Virginia State Department of Health to staff the project. Mr. Polk coordinated the statistical activities and I was charged with the education program.

Physicians and hospitals reported all accidents requiring medical attention throughout the three year project. This involved 84 physicians, 34 dentists, 2 doctors of osteopathy, 4 hospitals, and 2 clinics. Mr. Polk visited each of them each month and in addition to sustaining interest accom-

plished a great deal of professional education.

Education Phase

Education has been accepted as an essential activity in raising the standards of health of the community, and it is a method common to all accident prevention programs. There is, however, a continuing need to evaluate the effectiveness of the educational techniques currently being used in accident prevention programs.

In the two year education campaign we worked to involve as many community institutions and organizations as possible in accident prevention, utilizing the usual methods and techniques of community motivation.

Working with fraternal, civic, and farm organizations with the cooperation of the press, radio, and television outlets, the educational effort was directed not only toward recognition of hazard situations in order to create a general awareness of safe habits and practices, but also towards teaching safety measures applicable to specific situations i.e., seat belts and rescue breathing.

Objectives

To reduce, or lessen the severity of, accidental injuries.

To focus community attention on the principal accident hazards, through use of project statistics, and to generate public opinion in support of the necessary action to meet these needs.

To increase the public's understanding of specific actions that individuals, groups, and communities can take to reduce the toll of accidental injuries and deaths.

To obtain information about barriers, resources, and methods related to achieving the above objectives.

To work closely and cooperatively with all groups to stimulate and assist in building sound programs in accident prevention.

It should be recognized that only the first of these objectives could be evaluated by our statistical procedures. The reporting system could only provide information on accidental injuries and baseline information on safety knowledge, attitudes and skills was not obtained.

How to meet these objectives, how to begin, were questions that faced us as we

resolved the action program into six basic approaches. These were community organization, public information, training meetings and workshops, consultation, physician education, and in-service training of the health department staff. Nothing new here and yet as you will see some did involve a slightly different twist.

Central to our community organization effort was a policy decision to build the program on the involvement and strengthening of the safety chairmen in the existing organizations rather than attempt to form safety councils during the early stages of the project. Therefore, it was proposed that a considerable portion of staff time would be spent working directly with groups such as home demonstration clubs, Ruritan, 4-H, and PTA to encourage, stimulate and expand their efforts in planning accident prevention activities.

Four radio stations, one television station, four weekly and two daily newspapers covered the five county area. Throughout the life of the project we received wonderful support from them. To maintain interest and reinforce our ongoing community programs we furnished the news media with spot announcements, discussion panels, talks by community leaders, safety experts and members of our staff. In addition news releases of seasonal and local interest were provided. Stories on poison hazards, firearm safety, and children's accidents were sent out periodically.

A staff speaker's bureau, consisting of Mr. Polk and me during the first year, and involving public health nurses in the final year, provided over 250 programs to organized groups in the study area.

Two summer workshops for teachers were offered in school safety by Madison College, a state teachers college located in Harrisonburg. It was my privilege to help plan and serve as co-instructor in each of these courses. Two regional safety conferences sponsored by the Virginia Safety Association were held in Harrisonburg.

Community Organization

In initiating community organization plans the first task that faced the Health Department was to create an awareness of the accident problem in the minds of as many of our citizens as it was feasible. To aid in this the "speaker's bureau" con-

sisting of the two staff members was formed and a post card, listing three safety topics was mailed to more than two-hundred organizations in the five county area. The names of these organizations were gleaned from sources such as chambers of commerce, civic club posters, and from county agent's offices.

The response was immediate and during the fall of that first year, almost overwhelming. The staff spent as many as five nights a week talking to these organizations, fulfilling as many as four speaking engagements in one evening. The programs were purposely kept short and limited to a maximum of 20 minutes.

In addition to presenting information on the safety problems in their particular area, as recorded in the statistics of the baseline year, the staff was able to ascertain many of the attributes, knowledge, and safety skills to be found in these clubs. Whenever possible the safety chairman of the club was encouraged to organize and/or reactivate his safety committee.

It was hoped that accident prevention would be recognized as a much needed program and that with a little help and recognition an appreciable amount of activity and involvement could be initiated.

Through these contacts with the groups in our study area we developed many of our working relationships. It was also felt that these appearances aided in sensitizing the audiences to the continual display of safety material found every day in our newspapers and on our radio and television stations. The men's organizations though seldom involved in direct participation at least were aware of the need for their wives and children's participation in safety projects.

Examples of some of the projects initiated during this study are:

The Harrisonburg Kiwanis Club sponsored a 4-H Safety Award in Rockingham County. Each 4-H club was given information on the award and requested to keep a scrapbook and other data which they could submit at the end of the year to the judging committee. Prizes totaling \$75.00 were appropriated. This type of activity tended to be typical of the contributions from men's groups. They were most generous in providing funds but because

of the pressures of earning a living, seldom directly involved their membership in specific accident prevention activities.

The business and professional women, in addition to devoting their regularly scheduled meeting on community health to the safety project, also planned for an additional meeting during the year.

Perhaps outstanding in terms of depth and organization was the work of the home demonstration clubs. With their trained staff leaders, the home demonstration agents, these clubs demanded and received a high priority. The project was also fortunate in that the state safety chairman for this organization resided in the study area.

The home demonstration agents had been involved in the project from its beginning with the result that two of the counties voted to make safety their "federation program of work" for 1960. By this they meant that this would be the program emphasis for all clubs in the county. In Rockingham County this meant 27 clubs and some 600 women. We met with the county safety chairman and with the individual club chairmen in the fall of 1959 to help plan the 1960 program. Materials were studied and a series of monthly safety topics outlined.

The outstanding features of this program were the devotion of ten minutes of each meeting to safety and the direct participation of each member in the safety program. Each member was required to survey her home with a home safety checklist and eliminate five hazards during the year.

During the year two additional training meetings were held for the county safety chairmen. The staff worked with them by suggesting materials and ideas for topic presentations during the coming months. Problems were reviewed and answers provided to technical questions. An interesting sidelight to this program was that over 90 per cent of these women purchased copies of the booklet, "What to do About Home Injuries," from the National Safety Council.

I will have to retract slightly one of my earlier statements concerning evaluation. We did have one other program with a measurable impact. Early in the study a sample of automobile dealers had been contacted to determine the status of seat belt sales.

Much to our chagrin, we found them gathering dust or not stocked at all.

To remedy this situation we contacted the Northern Virginia Automobile Dealers Association and made arrangements to appear at their next meeting. The film "Safety Through Seat Belts" was shown and the matter discussed quite freely. They recognized the problem but said that as businessmen they could not afford to stock an item that did not sell. We accepted the challenge and actually involved them in our efforts to the extent of including a seat belt pamphlet in the packet of material placed in each new car. When the survey was repeated at the end of the project over half of the dealers were stocking seat belts and reporting many sales and installations.

Public Information

A rural area such as the study area provides or at least approaches an information person's dream. Over 90 per cent of our news releases, feature stories, and editorials were used. We had ready access to public service time on the primary television and radio station.

At one time we had two radio shows, on Thursday from 1:15 P.M. until 2:00 P.M. where four ladies from a local club would appear and discuss their safety projects and a five minute spot on Friday morning at 10:30 A.M. when Mr. Polk or I would discuss a pertinent safety topic.

Posters were distributed bi-weekly to doctors' offices and the 70 schools in the five counties. These were produced locally and our main objective was the recognition of the phrase "Accidents Don't Just Happen" printed across the top of each poster.

Safety Association Workshops

Throughout the accident prevention project the cooperation from the Virginia Safety Association was excellent. Because of the interest in accident prevention in the five county area the safety association sponsored two one-day workshops, the first in October 1959 and the second in April 1961. While these conferences were sponsored by the state association, in each instance the project staff served as coordinators and were responsible for local arrangements and invitations.

The contrast in audience participation in

the first and second workshop was striking. The 1959 conference was primarily an information-giving session with little interaction and long silences serving as the question period.

In the 1961 session it was obvious that a change had taken place. There was little need for the staff to participate in the discussion sessions. The "laymen" were telling us what needed to be done. No longer were the suggestions in terms of correcting environment hazards, nor were many ideas presented for quick, easy superficial solutions, rather the discussions centered on the need for long range programs necessary to change attitudes and behavior.

What did we learn? Our decision to strengthen existing safety programs resulted in four of the five counties forming safety councils. Safety councils that came from common needs for cooperation and coordination rather than councils formed because someone suggested them.

There is a tremendous untapped resource in these local safety chairmen. Did you ever stop to think that of the ten leading causes of death, accidental death is the only one that has a person designated in al-

most every club to combat it. The health chairman has many agencies vying for his attention. However, to reach him you will need to meet him in a face-to-face situation; he seldom gets the mail you send him, and he is not interested in problems that do not occur in his area.

You can be most successful with generalized safety education when it is coupled with something specific. Our most popular program was built around the film "That They Might Live," on mouth-to-mouth resuscitation. Each person felt that they had gained a valuable skill after seeing this film. It also allowed us to discuss the hazards that lead up to these traumatic situations and means of preventing them.

Did we prevent any injuries? You will have to wait for that answer. The final tabulations will not be completed until mid-October. For those of you who would like more information than I have been able to present in this short time, if you will write to Mr. J. Robert Anderson, Virginia State Department of Health, Richmond, Va., I am sure he will mail you a copy of the final report when it comes off the press in early 1962.

HOW TO COMMUNICATE HOME SAFETY INFORMATION EFFECTIVELY

By ROBERT A. JARNAGIN
University of Illinois, Urbana, Ill.

1. Ask such professional communicators as radio, TV and newspaper editors how to prepare messages for use by their media. They know better than anyone else who their audiences are. Each is interested in giving his readers, viewers and listeners what they will listen to and watch and read.
2. Know your intended audience.
3. Prepare your message in the language of the audience.
 - a. Use terms your audience will understand in reference to their background of experience, not yours.
4. Use simple, clear, direct language whenever possible.
5. Use illustration whenever you can.
6. Use as many available media outlets or communication channels as possible to send your message. The more times and places your message appears, the better chance it has to be noticed and acted upon.
7. Evaluate the results of your communication efforts, and change them if they don't seem to be doing the job that you want them to do.

JOINT SESSION WITH TRAFFIC

TRAFFIC SAFETY AND DRIVING SIMULATION

By SLADE HULBERT
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It would be worthwhile at the outset to say what is meant by driving simulation (which is accomplished by a driving simulator). It means that a driver is placed in an automobile in a laboratory. He is then surrounded with a potential driving environment and upon commencing to drive he sees pictures, hears sounds and feels physical forces all of which are as realistic as is necessary for the particular study.

Essentially what it amounts to is that this fellow is pretending to drive but he is actually standing still; his reactions can be observed in detail. It also enables duplication of the exact highway situation for many subjects; that is to say, the same series of traffic events can be presented to a hundred people thus getting a statistical measure of what a hundred drivers do when faced with one set of traffic circumstances.

In addition to the ability to repeat identical situations, it also is possible to present traffic conditions that would be too hazardous or too costly for field experimentation on the road. The simulator also enables isolation of a single variable by holding all conditions constant except the one to be studied.

A national conference on driving simulation was held last March in Los Angeles under the sponsorship of the Automotive Safety Foundation, the U. S. Bureau of Public Roads, and the U. S. Public Health Service. Participants included engineers, highway administrators, scientists, and educators. There were representatives of industry, government, universities, safety organizations and research institutes.

The conference report¹ included on page 16 the following: "Driving simulation has been defined. Its role in highway safety research has been suggested, its benefits and limitations put into perspective. The assessment makes clear that new and useful

techniques are available for experimental research which can contribute importantly to safer highway transportation.

"Ultimately, a step-by-step development of increasingly complex simulators offers promise of new and urgently needed information on the functioning of the vehicle-driver-road system. This could lead to a major break-through in the program to increase traffic safety."

Simulators range in cost and complexity from million dollar flight trainers for jet pilots on down to devices that can be purchased for less than a thousand dollars to train high school students to drive. For research uses, the cost is dictated by the behavior to be studied. Complex traffic situations will require complex simulators; however, the cost will be more than balanced by savings in lives, insurance, repair charges, and time, as we put research results into practice.

The need for creating driving simulation research facilities was pointed out in the Williamsburg Conference Report in 1959. In a recent publication of the Special Committee on Highway Research Priorities of the Highway Research Board of the National Research Council, the driving simulator was included among the "19 broad areas of highway research, each of which is adjudged to rate A-1 in importance and urgency."

We believe that important advances may result from laboratory and field research into problems arising in driver licensing, highway design, vehicle design, traffic engineering control, and law enforcement and education. Driver reactions and habits play a large role in all of these fields and to that extent they can benefit from driving simulation laboratory research and evaluation studies. At this time, by way of example, I shall discuss only three promising types of investigation: fatigue, aging, and

experience. Each is representative of a different type of study.

*Fatigue*² can be generally defined as a mental and physical condition of decreasing efficiency from which full recovery is possible. Some characteristics of importance for research are:

1. The act of measuring can drastically alter the condition.
2. The condition is likely to be irregular over time and specific to sub-tasks.
3. The experimenter must control environments and direct behavior in order to produce the condition.
4. All drivers can be affected by the condition.

I suggest that these characteristics also describe the following conditions:

A. Effects of some ingested chemicals, such as drugs, alcohol, food, etc., excluding irreversible effects, e.g., poisons.

B. Emotional states, such as anger, despair, frustration, etc.

These conditions represent research interests that today are somewhat diverse, each with its devoted groups of investigators. If there are the common characteristics suggested above, and because of this a consolidated research effort can be mounted using driving simulators as a general tool, it might herald a number of simultaneous breakthroughs in previously unrelated areas.

Even if the driving simulator laboratory approach only serves to bring these researchers together, it will be worth the expenditure in terms of the interdisciplinary mental cross-fertilization that can result. I have yet to talk with a researcher interested in human behavior who did not become enthusiastic over the possibilities of doing his research within a simulation laboratory.

*Aging*³ can be generally described as a gradual process of organic change eventually resulting in irreversible impairments to function.

Research characteristics are:

1. The act of measuring has little if any effect on the condition.
2. The behavioral effect is likely to be consistent and predictable and resistant to change.
3. The condition must be investigated as

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it is found in various individuals and groups of drivers; it is not subject to experimental manipulation.

These research characteristics apply at least in part to the following:

- A. Physical disabilities, sensory and motor.
- B. Mental disabilities, such as emotionalism, rigidity, persecution feelings, etc.

Experience in this context refers to exposure to a series of critical driving situations which affect subsequent driving behavior. Learning through experience provides driving training for the bulk of our population.

Research characteristics are:

1. The act of experiencing greatly effects responses to subsequent exposures of identical events.
2. Past exposures are difficult to determine and evaluate.
3. Some experiences terminate the drive.
4. Experiences can be vicarious in nature.
5. Negative transfer must be evaluated.

Research into the learning process as it continually occurs on our highways can result in more effective programs of public education and implement a positive approach of guidance to replace the current practice of scolding and punishment.

All three types of human factors exemplified by fatigue, aging, and experience lend themselves to vigorous and fruitful investigation in driving simulation laboratories. If science can discover what exactly happens to the abilities of the temporarily incapacitated, and the disabled and just how it is that drivers are learning to survive, a wealth of remedial efforts can be launched to offset the traffic toll.

Progress to Date

The simulation techniques that have been used so far at the University of California at Los Angeles are built around the showing of movies that were taken from cars moving on the highway. This work, on a limited scale, was initiated in 1948 by J. H. Mathewson and has resulted in a series of Institute studies of the human factors in highway transportation. Some simple task simulation techniques were developed and

the feasibility of more complex simulators has been studied and in some aspects demonstrated. In several publications¹ the following descriptions appear of the Institute's simulation devices:

In a 30 x 20 x 10-foot room, an automobile with its rear wheels on the steel rollers of a chassis dynamometer can be operated in response to two motion pictures. One picture presents the forward view and the other the rearward scene which is seen in the rear-view mirror. On a curved screen, eight feet from the driver, the forward picture is shown by a projector above the car in line with the driver's position. The rear scene is projected onto a screen just behind the rear window. Stray light from the projectors provides fairly uniform illumination inside and outside the vehicle at between five and ten foot candles. The adjustable dash light is set to balance the illumination and make the speedometer clearly visible.

Steering wheel movements displace the forward picture from side-to-side which gives the driver a strong impression of controllability of his lateral position on the highway. A "highway feel" of steering is accomplished by having the front wheels rest on turntables to increase ease of movement. The steering system is spring loaded to simulate the self-aligning tendency of a rolling vehicle so that the steering wheel tends to return to center. Engine noise is real, but indicated speed has been made twice that of the actual speed of the wheels on the rollers. This doubling of the indicated speed has the effect of equating it with vehicle noise (engine noise and tire-on-roller noise). A flywheel attached to the rollers simulates vehicle momentum and contributes to realism of engine performance and speed changes.

Engine temperature is controlled directly by an auxiliary radiator and indirectly by a refrigerated air-conditioning unit which controls room air temperature. Tire overheating is prevented by a cooled-air system blowing on the tires. Exhaust fumes are ducted outside the building and there is a continuous change in room air.

The vehicle undergoes some low-amplitude vibration at approximately 30 cps produced by the action of the tires on rollers. This action is similar to that experienced and

recorded while driving on a newly surfaced road.

Driver responses are recorded on five channels of a Brush six-channel, ink writing recorder. Vehicle speed, steering movements, brake and accelerator pedal action, and the driver's galvanic skin response and breathing rate are recorded along with written notations about the motion picture events being shown to him.

The Tilting Chair

To provide simulation of the physical forces experienced while driving, a driver's compartment is mounted so that it can be tilted fore and aft (pitch) and from side-to-side (roll) as well as rotated (yaw). The driver's outside view is restricted to a motion picture projected on a cylindrical screen six feet from him. This picture, from an extremely wide-angle (160 degree) lens, completely fills the driver's field of vision through the windshield. Because this picture is of low brightness the entire room is made dark during projection with all stray light being trapped by a ventilated box that houses the projector.

The essence of this device lies in the fact that both the projection screen and projector are attached to the driver's compartment and, therefore, move with that cockpit when it is tilted. Thus, when he is tilted the driver's visual world including his horizon reference does not move for him and the changing physical forces exerted on his body by gravity are then perceived as acceleration forces or centrifugal forces depending on the direction of tilt (pitch or roll), respectively.

At the present time this device is tilted by an operator in response to the driver's actions and the motion picture scene. When, for example, the driver removes his foot from the accelerator pedal or applies the brake, a signal light informs the operator and he tilts (pitch) the device an appropriate amount and at a rate depending on the traffic situation. The laboratory apparatus described above is only a beginning step, but it serves to demonstrate the great promise of this approach in traffic safety research.

The Institute's work has led to a more advanced design for a proposed simulator that will use closed-circuit television to project the traffic scene from a model landscape. The driver's actions will guide a T.V.

camera along the miniature roads and thus provide the freedom of choice that a motion picture display cannot.

The entire assembly—dynamometer, projectors, projection screens and enclosing shell—would be mounted on a tilting platform whose movements would be dictated by the driver's actions. An electronic control system would handle the complex and rapid interchange of signals among the various units of the simulator and at the same time serve as a data recording device that would create records that could be fed to electronic computers for analysis.

1. Much of the present development work is supported by U. S. Public Health Research

Grant No. RG-8819. Additional support has come from the Automotive Safety Foundation, General Motors Corp., Douglas Aircraft Co., Paramount Motion Picture Studio, and Candy, Chocolate & Confectionary Inst.

2. See "New Horizons for Highway Safety through Driving Simulation." Copies available from supporting agencies.

3. For reference information see "A Study of Performance Decrement in Simulated Complex Task Situations and Simulated Environments," a report prepared for Division of Accident Prevention, Public Health Service, U. S. Dept. of Health, Education and Welfare (April 15, 1961).

4. For reference information see Birren, J. E. "Psychological Aspects of Aging," Annual Review of Psychology, Vol. 12, Page 161-194.

5. One of these is Highway Research Board Bulletin No. 261.

PERIODIC PHYSICAL EXAMINATION FOR DRIVERS

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This report on the medical examinations for licensing of drivers in Pennsylvania is similar to a report on this subject given by me at the annual meeting of the American Medical Association this year. Since that paper was presented on June 27 and this is October 19, there are but a few new items to report. Such new items have been added.

On June 1, 1960, the official program of required medical examinations for drivers in Pennsylvania was placed in operation. This was one item of a thirteen point traffic safety program announced by Governor David L. Lawrence at a special press conference on February 2, 1960. The entire motor vehicle and driver licensing responsibility in Pennsylvania rests in the Department of Revenue, and that department, therefore, enforces the requirements for driver examinations.

The driver examination program did not spring forth suddenly. Its inception might be considered as dating back to three years before it actually became effective. In the middle of 1956, a Section of Traffic Epidemiology was established in the Pennsylvania Department of Health. The need for health departments to become intimately involved with traffic safety has been clearly

delineated at three workshops on traffic safety held in Washington at which representatives from the American Association of Motor Vehicle Administrators met with state health officers.¹

It has become clearly evident from a number of studies, including those of the Committee on Medical Aspects of Automobile Injuries and Deaths, that human failures overshadow all other factors in the production of highway accidents. Thus, the work of a health department in this area has to do with the human factors in accidents. It was decided that the Pennsylvania health department's program would confine its endeavors essentially to three subjects—(1) physical standards for licensing of drivers; (2) the alcoholic and his driving ability; and (3) studies of accident repeaters.

The Governor's Traffic Safety Council and the Board of Trustees of the Pennsylvania Medical Society agreed upon the need for having uniform physical standards established for drivers licensed to drive within the Commonwealth. Consequently, under the chairman for traffic safety of the State Medical Society, there were formed in October of 1958 at the annual meeting of the Society, subcommittees dealing with spe-

rific areas of standardization. The subcommittee titles included general medicine, cardiovascular diseases, neurological disorders, visual standards, auditory standards, orthopedic standards, mental health and drug and chemical aspects. These titles were similar to those used by a Symposium on Medical Aspects of Motor Vehicle Accident Prevention held in December, 1956, by the New York University—Bellevue Medical Center and the Center for Safety Education of New York University.²

Using all available studies they could obtain, these committees reported a year later to the Board of Trustees of the medical society, which then accepted the report. The report was forwarded to the Secretary of Health and to the Governor's Traffic Safety Council. The Secretary of Health served as a liaison person between the medical society and the Secretary of Revenue. The Pennsylvania Optometric Association had submitted a somewhat different set of standards for visual testing, but one meeting between the committee of that association and the medical committee on visual standards quickly resolved the differences in favor of the standards set by the committee of ophthalmologists. The standards were then approved in principle by the Governor's Traffic Safety Council. They were later accepted by the Governor and the Secretary of Revenue, and after a tooling up period, put into effect a little over a year ago.

Least there be any thought that these standards might be considered final or unequivocal, there is hereby quoted from the introduction of the prepared driver standards the following: "Because of the sparsity and unreliability of statistical data, the standards which follow are based on an armchair analysis. Since automobile transportation is such an important economic factor, the emphasis is on restricting rather than revoking licenses. A functional approach has been attempted wherever possible. The diagnostic entity is important in predicting progression and recurrence of signs and symptoms."

It was further pointed out that because the periodicity of the examination of drivers is an important factor which must be considered from an ideal and practical standpoint, the report recommended that the examination be given all drivers on initial

application and re-examinations given at ages 30, 40, 50, 60, 65 and every five years thereafter. Periodic examination is still our aim, but it will take several years to get the initial examination of the five and a half million licensed drivers in Pennsylvania and to definitely establish the periodicity of examinations. In fact, we estimate that at the rate of 15,000 examinations per week, it will take seven and a half years to cover all of Pennsylvania's drivers.

Considering the importance of the human factors in driving safely and how lethal the modern vehicle is, today's driver unquestionably should be in a physical and mental condition which is not a severe hazard to himself and to his fellowmen. For many years, the Pennsylvania law concerned with driver licenses has had a general clause requiring the licensee to be free of any disorder which might prevent him from properly driving an automobile. Licenses have been removed, suspended or given on a restricted basis upon decision of the Bureau of Traffic Safety of the Department of Revenue that the individual was incapable of properly handling an automobile. The Bureau, however, had no well-defined medical standards for making its decision until the present ones were established.

A number of case histories of severe accidents clearly indicated the dangers to life and limb caused by drivers suffering from severe physical and mental disorders. In one instance, an individual was on the blind pension payroll and was operating a light truck, with his steering being directed by a child sitting between his legs. He was, not surprisingly, involved in a fatal crash.

In another instance, a truck driver hauling gasoline on a tractor-trailer truck was involved in seven or eight accidents before it was discovered that these accidents were caused by convulsive seizures. Not long ago, a mentally disturbed young man who had some psychiatric treatment drove east in the west bound lane on one of the high speed highways of the state for about 40 miles. Although it was night, he turned off his lights and drove at speeds of 90 to 100 miles per hour. He was killed when his car crashed into a roadblock the police had thrown across the highway. In

other instances, before the required examination for drivers went into effect, individuals were sporadically prohibited from driving because of reports sent in by practicing physicians.

The standards approved by the medical society and others concerned were condensed into categories or disqualifying groups which are listed on an IBM punch card for the purposes of simplicity, identity and ease of mailing, filing and tabulating. As listed on the card, disqualifying factors include the loss of use of both hands; 20/70 vision or less in the better eye with correction; neurological disorders, such as to prevent responsible control of a motor vehicle; any cardio-vascular disorder, including hypertension, such as to prevent control of a motor vehicle; neuropsychiatric disorders such as to prevent control of a motor vehicle; conditions causing lapses of consciousness, e.g., epilepsy, narcolepsy, hysteria, etc. (may be considered for licensure if episode free for two years with or without medication); alcoholism, addiction to narcotics; and uncontrolled diabetes.

Inasmuch as the Pennsylvania State Police has for many years been charged with the responsibility for visual acuity tests and were equipped with instruments and testing areas, it was decided that the visual testing and the testing for the loss of use of both hands would be done by the State Police. Thus, the individual who is to be tested first takes these two tests from a state policeman and then takes his testing card to a physician of his choice. He is encouraged to use his family physician for this purpose, since in some conditions, the medical history is a pertinent factor, but the individual makes the final choice as to his examining physician. The physician then mails the completed form directly to the Bureau of Traffic Safety of the Department of Revenue.

Prior to the initiation of the physical examination program for drivers, each physician in Pennsylvania was furnished by the State Health Department with a copy of the American Medical Association pamphlet "Medical Guide for Physicians in Determining Fitness to Drive a Motor Vehicle" as well as a short guide specifically concerned with completing the examination form.

Results of First Year of Operation

As of the first of June of 1961, this program had been in operation for a year. Like other large, new programs, this one started slowly and had a few difficulties at its inception, but is gaining momentum. The State Police have a limited number of persons and facilities for the examinations. It was therefore decided that for the first six months, only those newly examined. It had been hoped that the next to be examined would be drivers licensed before 1924, a time when no examination whatsoever was required for obtaining a license; but, unfortunately, a flood in 1936 in Harrisburg destroyed or ruined a number of record files, so that this was not possible. Consequently, since the beginning of 1961, driver names have been selected at random for examination. In addition, all persons driving automobiles on state business have been required to be examined.

The physicians of Pennsylvania have cooperated extensively in promoting this program. At first, there was some fear on the part of a number of physicians about their legal liability in case an individual who had been examined had an injury-causing accident. However, the Attorney General of the Commonwealth has quieted these fears by an opinion which stated that the physician's responsibility as to the condition of the individual applied only to the individual's condition at the time of the examination and to those elements included in the examination. Furthermore, the legal department of the American Medical Association has stated that for the physician to be held liable, it is necessary to show: (1) he was guilty of negligence in conducting the examination or in reporting his findings to the state; (2) that the negligent act was the primary cause of injury or accident; and (3) that damages resulting from the negligence were foreseeable, since an injury which cannot be foreseen, or reasonably anticipated as the result of negligence is not actionable. The decision as to whether an individual receives a renewal of his driving permit, receives a limited permit, or has his permit suspended or revoked rests with the Secretary of Revenue, so that the legal decision is made not by the physician doing the examination.

tion, but by the Secretary of Revenue in view of the information forwarded to him.

A number of borderline cases are received by the Bureau of Highway Safety. These cases are referred daily to the physician working full-time on traffic epidemiology in the Department of Health for opinions as to the categories in which the applicants should be placed. One of the most striking observations that he has made from these reviews is that many applicants with severe—possibly dangerous—physical conditions seem to have a complete disregard for, or unawareness of, the possible consequences of operating a motor vehicle under these conditions. Hundreds of physicians have taken it upon themselves, in addition to completing the physical examination form, to write clinical summaries; this is ideal and very helpful in making the decision for approval or rejection.

In an attempt to validate the often-made "highway diagnosis" of heart attack as a cause of fatal traffic accidents, a study project in this area has recently been started. All accident reports in the Commonwealth bearing such information are sent to the Section of Traffic Epidemiology of the Department of Health. The data are checked against the official death certificates. In each case the coroner having jurisdiction is contacted and asked to outline his reasons for the diagnosis. Such a query is also made of the one medical examiner in Pennsylvania—in the city of Philadelphia. The family physician is contacted to determine whether the individual was under treatment for cardiac disease. Pertinent information

is also obtained from the individual's family. Forty-five persons died of alleged heart attacks on our highways while operating a motor vehicle during 1960. One coroner has stated "From my 28 years of experience as coroner, I feel many fatalities are due to unknown and untreated cardiac conditions and not by blackouts." Before long we shall be able to present some statistical data as to the accuracy of such an observation.

Of the total 421,857, examination forms received, 245,809 or 58 per cent were males, 176,048 or 42 per cent were females, 151,135 or 36 per cent must wear glasses, and 602 or 0.14 per cent were rejects.

Table 1 shows that the number of applicants for new licenses and for renewal of licenses examined during the first year of the medical examination program totaled 421,857, and of these, 602 were rejected for disabilities discovered by the examination. Thus, rejections constituted 0.14 per cent of the total. It can reasonably be expected that this percentage of rejections will be higher in the future, since the first year was weighted toward the younger age group due to the first half of the year being given over to examinations only of those with learner's permits and these were mostly individuals in the 16 to 20 year age bracket. As would be expected, the older the age group, the higher the percentage of failure. This is particularly noticeable in the age group 61 and over where 0.79 per cent were rejected. The oldest individual to apply for a learner's permit was 91 years of age and he received his permit.

Table 1—Complete Total of All Physical Examinations (Learners and Re-Examinations) June 1, 1960 to June 1, 1961

Age	Number of Applicants	Percentage	Number of Rejects	Percentage of Rejects per Group
16-20	181,657	43.1%	108	0.06%
21-30	70,340	16.7%	37	0.05%
31-40	29,600	7.0%	39	0.06%
41-50	58,521	13.9%	56	0.10%
51-60	42,948	10.2%	83	0.19%
61-70	30,227	7.2%	238	0.79%
Not Stated	63		96	
	421,857	100%	602	

Table 2 depicts the reasons for the 602 rejections. There were 613 total disorders, some individuals having more than one disorder. The largest single category is comprised of those who withdrew voluntarily because they felt they would not be able

to pass the examination. Next, in order of magnitude, are those with severe cardiac or circulatory disorders and third were those with conditions causing repeated lapses of consciousness. Uncontrolled epileptics have been, for the purpose of this table, singled

Table 2—Total Disorders and Rejections from Beginning of Program June 1, 1960 to June 1, 1961—exclusive of Learners Permits and Physical Re-Examinations

Reason	Number
1. The loss of use of both hands.....	3
2. 20/20 vision or less in better eye.....	61
3. Neurological disorders such as to prevent reasonable control of a motor vehicle.....	46
4. Any cardiac or circulatory disorder including hypertension such as to prevent reasonable control of a motor vehicle.....	97
5. Neuropsychiatric disorders such as to prevent reasonable control of a motor vehicle.....	42
6. Conditions causing repeated lapses of consciousness, etc.....	79
7. Alcoholism.....	31
8. Narcotic addiction.....	3
9. Uncontrolled diabetes.....	25
10. Uncontrolled epilepsy.....	15
11. Person does not have the intellectual maturity of his chronological age.....	6
12. Doctor states operator unfit.....	47
13. Voluntary withdrawals.....	133
Total Disorders	613

Accounting for 602 rejects
Male rejections—435 (72 per cent)
Female rejections—167 (28 per cent)
Total 602

out from other conditions causing lapses of consciousness. Nearly three-fourths of the rejections were males. No only were a greater number of males examined, but cardiac disorders, alcoholism and narcotic addiction are conditions with a much greater preponderance in males than in females.

In accordance with the findings resulting from the 422,000 applicants who were examined and the 133 voluntary withdrawals, a house-to-house survey was made to determine the reasons why 978 persons scheduled for physical re-examination failed to take the examination.

Table 3 shows that 130 of these persons did not take the examination because they felt they could not pass for the reasons shown in this table. Unlike the 133 voluntary withdrawals, they had made no effort previously to report their reasons for not taking the examination. Thus, actually a total of 263 persons did not take the examination because of their own diagnoses of physical incapacity in accordance with the criteria set up for the examinations.

Table 3—Survey on Applicants Who Failed to Take Physical Re-Examination—Total 978 Physical Conditions..... 120 or 12 per cent

1. Need glasses.....	10
2. Eyes failing (cataract), etc.....	23
3. Applicant was afraid to take eye examination.....	1
4. Total cases pertaining to eyes.....	34
5. Hard of hearing.....	2
6. Heart condition.....	6
7. Felt unfit to drive (age).....	40
8. Physically unfit to drive (diabetes, stroke, nervous).....	29
9. Doctor states applicant unfit.....	6
10. Applicant was afraid to take physical examination.....	4
11. Total cases pertaining to other than eyes.....	96
Total	130

In the last group of 130, the 10 who needed glasses were informed that should they be able to pass the eye examination, they could renew their licenses and the individual who was hard of hearing was told that this was not a criterion for rejection. These 130 who thought their physical conditions precluded their passing the examination represent 13 per cent of those who failed to take the physical examination. However, included among those who did not take it are 313 who moved out of the state, so that if one disregards these 313, then the percentage of individuals who failed to take the physical re-examination because they felt they would not pass, but had not reported such previous to the survey, rises to 19.6 per cent.

One other table may be of interest. Table 4 shows for 1960 the comparison of the death rate from traffic accidents per one hundred million miles traveled in Pennsylvania as compared with other states of a like class. Last month the National Safety Council presented Pennsylvania's Governor with a Certificate of Achievement in special recognition of the exceptional death record and progressive accident prevention

Table 4—Pennsylvania's Comparison of Death Rate from Traffic Accidents per 100,000,000 Miles Traveled with Other States of Like Class 1960

State	Death Rate
1. Pennsylvania.....	4.0
2. New York.....	4.5
3. Illinois.....	4.4
4. Texas.....	4.9
5. Michigan.....	5.0
6. Ohio.....	5.2
7. Indiana.....	5.2
8. California.....	6.8

program activities as shown in the annual traffic inventory. Of the eight major states in the group in which Pennsylvania falls, Pennsylvania was the only state to receive such an award. The fact that Pennsylvania has the lowest rate here is, of course, not necessarily tied in with the driver examination program nor even necessarily the result of the thirteen-point improved traffic safety program inaugurated in February of 1960.

Of these thirteen points, the only one other than the medical examination program which might be considered in the health field is an educational program to encourage the use of chemical testing for intoxication. It is interesting to note in this respect that a survey by the State Police to determine the attitude of judges and district attorneys in the 67 counties of the Commonwealth on this matter indicated that in 55 counties there was favorable reaction toward chemical testing, but in the remaining 12 counties the authorities involved were either indifferent or against chemical testing. The 1961 session of the Pennsylvania Legislature passed a state-wide chemical testing law. As passed, it is a much weakened version of the original bill, using 0.15 per cent by weight in the blood as presumptive of intoxication instead of the recommended 0.10 per cent, and requiring specific consent of the driver for the testing rather than the recommended implied consent.

Pennsylvania is pioneering in an attempt to remove from behind the steering wheels of its automobiles, drivers with handicaps so severe as to make them, in the best of medical judgment, hazardous to themselves and to other individuals. The comparatively low percentage of rejections encountered among the 422,000 persons examined during the first year indicates that not many individuals are losing their driving privileges because of this examination requirement. We feel that the driving license is a privilege. In some respects it may be considered a right of an individual, but one individual's rights end where the other one's begin and therefore because of society's right to determine various types of licensure, the term privilege might be the best one to use.

Case histories, not only in Pennsylvania but elsewhere, have shown individuals with

the types of disorders used for rejections in Pennsylvania to be dangerous drivers in many instances. While we cannot, without more specific research data, such as some obtained by studies by McFarland* in Boston, Goldberg* in Sweden, Popham* in Toronto and McCarroll and Haddock* in New York City, adequately predict the number of severe or fatal accidents which will be prevented by removing such hazardous drivers from our highways, the "functional approach" as it is called by the medical society's committee, seems to be justified and reasonable.

It might be pointed out that this type of reasoning is behind many traffic accident preventive measures and many public health measures. The number of lives or disabilities saved by a traffic light at a given corner, by an unbroken white line in the middle of the road on a given hill, by the installation of a sewage treatment plant or by an air pollution abatement program cannot be well documented, but from the case history approach and in some cases from years of experience, (but experience which would not have been attained had ultimate, definitive cause and effect research been allowed to delay application) we continue to vigorously encourage and support these preventive measures.

It is to be hoped that the findings of the medical examination program in Pennsylvania will provide useful data to other parts of the nation in their evaluation of this aspect of working with human behavior factors of traffic accidents, the most important causative factor involved. It is believed that as the general public becomes more aware of the gravity of the problem, persons in ever-increasing numbers will turn to their physicians for advice and assistance in this field. Although the role of the physician in making decisions in this regard is not always an easy one, it is hoped that more and more physicians will accept this responsibility as a part of their role and duty and will realize how vital to the saving of lives and the prevention of injuries is an honest, critical evaluation of the driver.

Much more detailed consideration needs to be given to the age component for the major chronic disabilities of our people increase considerably as they get into the older age brackets. Pennsylvania has not yet completely decided on the periodicity of its ex-

aminations, but as has been pointed out by the medical society study, this component must be seriously faced and a decision made before long.

An important auxiliary benefit of the examination program is the uncovering of a number of cases of heart diseases and other disabilities of a chronic nature, often unknown to the individuals involved. Such conditions are being discovered on a rather large scale, and individuals with these conditions are receiving earlier treatment and subsequently have a better chance of preventing death or disability from them than would have been the case without early discovery due to the examination program.

The Governor's Traffic Safety Council, the Commissioner of Traffic Safety and the Department of Health feel that a further constructive step in driver safety would be a requirement that taxicab, bus, truck and other commercial vehicle drivers have a more frequent and a more rigid physical examination than the one currently in use for all drivers. Bills have been introduced into the state legislature along this line but none has, as yet, been enacted.

SUMMARY

1. Since the behavior of human beings seems to be the most important factor involved in causation of traffic accidents, physicians and health departments should play a major role in helping to reduce traffic mortality and morbidity by focusing their time and efforts towards solving the problems of the physical and mental behavioral components that lead to accidents.

2. In the Commonwealth of Pennsylvania one point of a thirteen-point traffic safety program inaugurated by the Governor at the beginning of 1960 has been a medical examination for all individuals obtaining new driver licenses or renewing driver licenses. The compilation of this program took three years before it was actually put into effect. During this period of compilation, the Pennsylvania Medical Society, the Pennsylvania Department of Health and the Governor's Traffic Safety Council worked

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tatives of American Association of Motor Vehicle Administrators and State Health Officers, Washington, D. C., June 7-8, 1960.

3. The results of the first year of application of the physical examination of drivers program are reported. Of 421,857 learners and re-examined drivers, 0.14 per cent were rejected as being unfit to drive in accordance with the established criteria. By age, percentage of failures ran from 0.05 per cent in the 21 to 30 age group to 0.79 per cent in the 61 and over age group. Of this group of failures, there were 133 individuals who voluntarily surrendered their licenses because they felt they would be unable to pass the examination and so notified the Bureau of Highway Safety. In addition, a house-to-house survey of 978 applicants who failed to take the physical re-examination after notification found 130 to have failed to take the examination because they felt they could not pass it. This latter group had not officially notified the Bureau of Highway Safety.

4. Heart diseases and other disabilities of a chronic nature are being discovered due to the mass examination of drivers and potential drivers. Individuals with these conditions are thus enabled to receive earlier treatment than would have been the case without such screening examinations.

5. It is felt that in consideration of the marked increase in severe chronic disabilities in the older age groups, the examinations will need to be given on a periodic basis, although this periodicity has not yet been determined. The medical society's study recommends that examinations be repeated at ten-year intervals to age 60 and at five-year intervals thereafter.

6. It would seem to be desirable for drivers who spend much of their time on the road as commercial drivers of such vehicles as taxicabs, buses and trucks to have a more frequent and a more rigid physical examination than the one now required for all drivers.

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THE RATIONALE FOR MOUTH-TO-MOUTH RESUSCITATION

By DR. A. V. MONTO

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Probably all of you are familiar with the fact that in 1957, the National Academy of Sciences—National Research Council's Ad Hoc Panel on Manual Methods of Artificial Respiration—changed from previous recommendations to the recommendation of the mouth-to-mouth method of artificial resuscitation. If asked as to why this change was made, many of you might state in a general way that the mouth-to-mouth method was "better," but if asked to discuss in detail why it was better, perhaps some of you would find some difficulty in describing all of its advantages.

That is my task here today: to discuss the rationale—the reasons why—the mouth-to-mouth method is now universally recommended as the best available method.

It has been pointed out in films on the subject that the mouth-to-mouth method can be started at the top of an electric pole, inside a car, in a small boat, or even in the water, where methods requiring that the victim be laid flat on a firm surface would not be possible.

But these advantages alone, I think, would not be sufficient to recommend the new method over those which have had as wide acceptance and use as have the various back- and chest-pressure and arm-lift methods. However, the mouth-to-mouth technique has decided physiological advantages. More surely, and in greater quantities, it gets the required oxygen into the victim. The de-

tails of this process will take up the remainder of my presentation.

To consider the subject, we must first have an understanding of certain elements of anatomy and physiology. The normal adult has a total lung capacity of about 6 liters or 6,000 cubic centimeters, usually abbreviated as cc's. A liter, of course, is approximately equal to one quart. However, in normal breathing, only the middle 500 cc's of this total capacity is used, that is, in a normal breath, 500 cc's of air approximately, is taken in and expelled. If maximum effort to deflate the lungs is made, an additional liter of air can be expelled. This leaves a residual air in the lungs which cannot be expelled by any human effort, of about one and one-half liters.

On the other hand, upon inhaling with maximum effort, the normal adult can inhale about three liters more air than he inhales in a normal breath. This additional capacity for inhalation or inspiration of three liters is referred to as the complementary air. Thus, with maximum effort, the normal adult can breathe in and out, four and one-half liters of air, which quantity is referred to as his vital capacity. In contrast, his own respiratory needs are satisfied with about 500 cc's, or half of a liter of air. The remainder is available for use in inflating the lungs of a victim who is not breathing.

Returning to the normal breathing of 500 cc's or half a liter taken in and out in a normal breath, it can be seen that with a remaining amount of air in the lungs of about two and one-half liters, the air in the lungs is at no time entirely "fresh air" from the outside, but is always a mixture with a relatively small amount of fresh air and a relatively large amount of air which remains from previous breathing. In a sense, the breathing process is normally somewhat inefficient, in that it would be possible to get much greater quantities of fresh air in and out in one breath.

However, this relatively slight movement of air in and out of half a liter, and the consequent mixing process in the lungs, suffice to take care of normal needs while breathing at the normal rate of about 16 times a minute. Actually even the 500 cc's of air moved in and out in a normal breath does not become mixed completely.

If you consider the breathing apparatus for a moment, you will realize there is a certain amount of space in the nose and mouth, a space where they join at the back of the throat called the pharynx, and additional space in the larynx, the trachea, and the bronchi which carry the air into the lungs. Actually, all these passages down to the finest subdivisions of the bronchi, the bronchioles, do not have the kind of lining which will permit the oxygen to go in and the carbon dioxide to come out of the blood, and therefore, are of no use in the primary process of external respiration which might be termed aeration of the blood.

This space occupied by the above tubular structures which carry the air in and out of the lungs is termed the *dead space*, and has an average volume of 150 cc's. Thus it can be seen that, of a normal breath, only 350 cc's actually goes to ventilate the true respiratory parts of the lungs, which are the respiratory bronchioles, atria, and alveolar structures. The remainder, 150 cc's merely moves in and out of the dead space, and is not useful in exchanging carbon dioxide and oxygen.

From the above considerations, it can be seen that the rescuer, by making use of the entire vital capacity of his lungs, can easily take care of his own respiratory

needs and have ample air to ventilate the lungs of a victim by mouth-to-mouth resuscitation. In fact, he has such an ample excess capacity, that he can actually move more air in and out of the victim's lungs than the victim's normal breathing. However, what we have considered so far are chiefly theoretical measurements. How does this method work out in actual practice, in comparison to other methods of artificial respiration?

In making comparisons of methods of artificial respiration, we must be very careful to use conditions which duplicate as closely as possible the conditions which would be available in the average rescue situation, where artificial aid such as tubes would frequently be unavailable, and in which the rescuers would frequently be untrained, and, as fact, frequently be applying the method for the first time.

Actually, the idea that the chest- and back-pressure and arm-lift methods could provide adequate ventilation of the lungs, apparently arose because the tests were conducted in an artificial situation in which the subjects were ventilated by these methods when a tube had been inserted all the way into the trachea through the mouth (endotracheal), thus insuring an open passageway from the outside down into the lungs. This situation does not correspond very well to the average situation in emergency rescue.

An experiment performed by Safar and his colleagues utilized 107 untrained rescuers who had not used the mouth-to-mouth method previously, who were given one demonstration on the spot, and for comparison, 18 trained rescuers to perform the chest-pressure and arm-lift methods. The subjects were 25 volunteers who had been anesthetized and completely paralyzed with a curare-like drug. Artificial respiration was tried both without any artificial aid, and with an oropharyngeal airway of the type which could easily be carried by a rescuer.

Two variations of the mouth-to-mouth technique were tested: the first with the jaw held forward by a finger in the mouth; the second, with the jaw held forward by external pressure. Both variations were done on a simulated victim lying prone and with the head extended, that is, flexed backward on the neck.

The performance of the 167 rescuers was as follows: of the untrained rescuers, 90 per cent were able to produce tidal respiratory volumes above 500 cc's within one minute by the first variation of the mouth-to-mouth technique, and 89 per cent were successful in the same task with the second variation. By the mouth-to-airway technique, 100 per cent were successful, 50 per cent were successful with the mouth-to-nose technique, all within 60 seconds.

Of the trained rescuers using the back-pressure, arm-lift method (Holger Nielsen) under the same conditions, only 14 per cent were able to produce tidal volumes above 500 cc's within 60 seconds with that method and with the addition of an artificial oropharyngeal airway, 39 per cent were successful. Using a chest-pressure, arm-lift method (Sylvester) alone, 31 per cent were successful, and with the same method and an artificial oropharyngeal airway, 50 per cent were successful.

Thus, it can be seen that under these conditions, the mouth-to-mouth technique in the hands of untrained rescuers with minimum instruction was much more frequently successful than the back- and chest-pressure and arm-lift methods in the hands of trained rescuers.

What is the reason for the success of the mouth-to-mouth technique in this comparative study? I think that the essential difference is in the position of the head and neck, and jaw, of the victim in the mouth-to-mouth technique, in extension, by which the air passageway to the lungs is kept open; whereas with the back- and chest-pressure and arm-lift methods, this position of the head and jaw in extension cannot be maintained by the rescuer, who must devote his full attention to applying the pressure. The tendency of the tongue and jaw muscles in the relaxed, paralyzed position of the victim is to collapse, thus blocking the airway unless the head and jaw are extended, even with the insertion of an artificial oropharyngeal device.

The preceding points are illustrated by the following study on 80 anesthetized women, also done by Safar and his colleagues. These women were breathing normally and spontaneously, but their jaw and neck muscles were relaxed by the influence of the anesthetic. In other words,

they were asleep as during an operation (light, general anesthesia, stage 3, plane 1-2).

The airway of these patients was recorded as being open when the anesthesia-machine breathing bag was moving freely and there was no noise in breathing. The airway was recorded as being partially obstructed when the bag was moving but there was noisy breathing. The airway was recorded as being obstructed when the breathing bag was not moving and no air exchange could be heard despite respiratory motion of the patient's chest and abdomen.

In the supine position (lying on back) with the head flexed and the chin down, 100 per cent had an obstructed airway, and even with an artificial oropharyngeal airway, 98 per cent were still obstructed and 2 per cent partially obstructed. With the head in mid-position between flexion and extension, 36 per cent were obstructed in natural breathing and 54 per cent partially obstructed, and only 10 per cent had an open airway. With an artificial oropharyngeal airway inserted, 29 per cent were still obstructed, 51 per cent partially obstructed, and 20 per cent had an open airway.

In the extended position of the head, with the chin up, 5 per cent had an obstructed airway, 46 per cent had a partially obstructed airway, and 49 per cent had an open airway. With an artificial oropharyngeal airway, none were obstructed, 12 per cent partially obstructed, and 88 per cent had an open airway. With extension plus support of the jaw in a forward position, with natural breathing, 1 per cent were obstructed, 21 per cent partially obstructed, and 78 per cent open.

With an artificial oropharyngeal airway, none were obstructed, 2 per cent partially obstructed, and 98 per cent had an open airway. A similar incidence of airway obstruction was found with the patients in the prone position (lying on the stomach), both with the face directly downward, and with the face to the side, as in the usual back-pressure, arm-lift method.

I think that the preceding study corrects a number of popular misconceptions. To quote Safar, "It is a common belief that airway obstruction due to 'swallowing of the tongue' is prevented by the patient in the prone position. Our data and roentgeno-

grams (x-rays) indicate that in the prone position the tongue does not simply 'fall forward' but rather that the site, mechanism, incidence, and degree of pharyngeal obstruction is similar in the prone as in the supine position.

The thought that foreign matter such as vomitus or water would drain from the mouth by gravity provided another basis for the recommendation of the prone position in the past. In actual resuscitation, we often found semisolid vomitus and other foreign matter which did not 'drain.' Water and mucus formed foam which could only be removed by wiping out or by the use of a suction machine. Drainage of foreign matter from the lungs in the prone position is as unlikely as in the supine position since the trachea is horizontal in both."

The performance of artificial resuscitation on the unconscious infant has long been a matter of considerable difficulty. The reasons are in part anatomical. Not only are the infant's ribs and chest softer, but the ribs are in a different position than in the adult, extending more directly forward from the spinal column. For this reason, the infant's breathing is more completely due to diaphragm motion than the adult's breathing.

The chest- and back-pressure and arm-lift methods of artificial respiration are intended to produce movement of the chest wall, but such movement as is produced is often negated by the contrary motion of the relaxed, flaccid diaphragm which moves back and forth instead of air moving in and out of the lungs.

This is, of course, not true in the normal conscious person, in whom the diaphragm is contracted and tends to move with, rather than against, the respiratory motion produced by chest-wall expansion and contraction. Suffice it to say, in infants, methods to overcome the special problems they present, such as the rocking method (Eve), have been shown to be relatively unsuccessful; and the only method which

can be relied on to successfully produce sufficient air movement in and out of the infant is the mouth-to-mouth technique.

Detailed studies of the oxygenated hemoglobin and carbon dioxide levels in simulated victims' blood have shown that these are maintained within or close to normal limits, and that they are rapidly attained when the mouth-to-mouth technique is started. Additional advantages of the technique are the fact that additional pressure can be exerted by forced expiration on the part of the rescuer to overcome partial obstruction of the airway that may exist despite the most skillful effort, due to the anatomy, the presence of excessive obesity, or other peculiar conditions existing in the victim which would preclude success by any other method of artificial respiration.

Large differences in the size of the rescuer and the victim are easily offset, and boys and small women have been successful at resuscitating victims twice their size. Mouth-to-mouth breathing can be done for over an hour by the untrained rescuer without excessive fatigue; this has been demonstrated a number of times.

Due to the advantages of the mouth-to-mouth technique of artificial respiration which have been detailed above, the National Academy of Sciences—National Research Council's Ad Hoc Panel on Manual Methods of Artificial Respiration—unanimously recommended this technique. Subsequently, the American National Red Cross, the several departments of the Armed Forces, the Public Health Service, and numerous other organizations adopted the mouth-to-mouth technique as the method of choice.

Case histories of many successful resuscitations performed by laymen with this method demonstrated that it is readily acceptable, easily learned, and has been, on a number of occasions, successfully applied without previous practice in the method by the rescuer.

RELIGIOUS SAFETY ACTIVITIES SESSIONS

HOW CHURCHES AND SYNAGOGUES CAN HELP PREVENT ACCIDENTS

By DAN HOLLINGSWORTH
Chief of Police, Oklahoma City

The keynote address of the Safety and Religion Section of the National Safety Congress, Conrad Hilton Hotel, Chicago, Illinois, Tuesday, October 17, 1961.

There are three situations in a person's life where they can have their attitude toward traffic accident making situations changed; that is, changed either for better or for worse.

One of these situations comes when a policeman at the scene of an arrest has the violator in tow, with ticket book in hand.

The second time a person can have his thinking changed and his views altered is when a Traffic Court Judge has the violator before the Bench and says to him, "Are you guilty or not guilty?"

These are both cases after the fact. As a result, the person is always on the defensive and when on the defensive we are not in a very receptive mood.

The third case is before the fact. The situation and location may vary but the person who can change this attitude and viewpoint is a minister, a Priest, a Rabbi, a Religious Counselor or Church School Teacher.

Policemen generally are not equipped with the necessary knowledge, nor do they possess the appeal factors to do this changing of views. Nor does their work take place in an atmosphere conducive to changing a man's attitude.

The Traffic Court Judge has the edge on the Policeman in so far as atmosphere is concerned, but he usually has to grind out cases by the minute and the time element completely whips him.

But when a person is in his church, his synagogue, or his Sunday School room, or whatever his place of worship, he went there in a frame of mind to receive the level and degree and a type of spiritual guidance that can and will change his view of things. The atmosphere, the climate, the

surroundings of his sanctuary causes him to drop his false defenses and open his mind, his heart and his soul.

Man in his pew is in a mood which causes him to accept the idea of changing his attitude, his views, his sense of values, his standards, and probably he is never in that position at any other time during the week.

The minister, the Rabbi, the Priest, the teacher, the leader, the counselor, or whoever delivers the message, has the sales opportunity that no one else can ever get; a sales opportunity to make that person a better driver, a better citizen and a better church member, and a safer member of society.

In every lesson or sermon presentation another need—another situation exists, and this first thing—the opportunity, and the second thing—the need, are compatible. They serve to complement and to aid each other.

Because, you see, at the same time this minister, this speaker, spiritual leader, advisor, has a problem and I think this is a universal problem. Regardless of faith or belief, age or situation, this speaker needs examples. The good teacher uses real life cases to illustrate his point that is on an experience level with the membership of his audience. He needs to, if he is effective, talk about life situations, experiences, problems that face as many of his listeners as possible.

True, he can talk about the pleasures of raising roses. The problems of the parents of teenage boys and girls. The happiness of having a house full of boys. The question of what constitutes gambling. But in these and hundreds of other examples, he misses most of his congregation, they just don't know about the experience to which he refers.

But every person in that audience has had experience in traffic, not just one of them, but literally hundreds of them. Furthermore, five minutes before they sat in that pew, they had an experience in traffic. Five minutes after they leave the Church they'll have another experience in it.

And if you hear the same stories I hear, most of these traffic experiences are had with feeling. Apparently few people drive the streets and highways today without developing strong feelings about some phase of the traffic problem, and that feeling is usually of a critical, negative nature.

You know in our business of policing, we listen to lots of complaints, and if you don't like to listen to complaints, you won't be very happy in the Police business.

But one of the things which worries me about our people is that it has been a long time since I've heard anyone say anything good about our individual transportation system, all of these good automobiles which we own and drive and really enjoy, although we don't admit it. Evidently, we've forgotten there can be some nice things about them. The word "joy-riding" has disappeared from our vocabulary except its use to describe a type of auto theft in the police field.

In the past several years, Mrs. Hollingsworth and I have had the pleasure of entertaining in our home dozens of Police Officials from around the world. These men were brought here by our government to study the Policing system in this country.

One of them a few months ago, a Moslem, was visiting in our home and we talked to him through an interpreter. Just by chance I asked him the question, "What thing impresses you most about our country and our people?" He replied, "What I am about to say to you may hurt your feelings, but in speaking in truth I must tell you that the lack of gratitude and thankfulness and appreciation on the part of the American people for what they have, shocks me." He went on to say that as he people had all the nice things that we have, including homes and conveniences and comforts and automobiles and highways and the freedom to travel, that his people would spend half of each day in prayers of thanksgiving.

Traffic Safety—The problems of Traffic

Religious Safety Activities Sessions

Safety. We have been trying to get a thing done through the newspapers, billboards, schools, radio, television, Safety Education units and other activities that will change people's minds about this automobile and its use and maybe as the Police Official from Iraq said, "Make us more grateful." Certainly these activities help, at least they plant the seed of the idea, but you see, you as a religious leader can cause that seed to bear fruit.

One of your own ministers in one of these Safety Congress Sessions just a few years ago said, "The greatest force and power in a democratic society are the newspapers, the lecturers, the person who has the responsibility for creating public opinion."

Dr. Preston Bradley, Pastor, People's Church, here in Chicago is right as far as mass action, mass decision is concerned. But you prevent automobile accidents one at a time. You chance and improve man's attitude just one man at a time and you make him a better driver right here in his heart and not in his mind. I think it was the mind Dr. Bradley had reference to.

You do not sell a man on the idea of loving and appreciating his neighbor, the same way you sell him a Cadillac or cause him to buy an Arrow shirt.

The automobile, which brought us the world's finest individual transportation system and made us the envy of the world has become a status symbol and representative of one's individual freedom in this highly regulated world in which we live.

May I cite this example, you'll find women who will not shampoo their hair, trim their toenails nor give themselves a manicure, but every week they will wash, to a spit and polish job, their automobile. Sometimes watch them wash this car. Watch them stand back in a stance of awe and worship. Why? Because that automobile represents, in many instances, about half their income. To them it is a golden calf. It is their vehicle of pleasure, self-satisfaction and it feeds their ego and makes them equal with, and so, a lot of things and situations. And men have an equal reaction. You may well say, people have been doing this for years, oversize homes, sterling silver, two carat diamonds, mink coats. All these too are status symbols.

Yes, but the automobile is different. These other status symbols may break a little girl's heart. They may cause temptation to overcome a man's moral fiber. They may upset a little boy. But none of those things ever killed 38,000 people and injured a million and a half and caused an economic loss of two billion dollars a year. This is the thing which makes it sinful to feel the intoxication of the power of 300 horses under the hood of an automobile and fail to control that power.

Someone the other day asked the question, "Have we become a nation that worships and bows down to a shorter and quicker way?" When we do things this quicker, shorter way, we say it's justified because it is the expedient thing. It may be expedient. But the question is, in the case of the automobile, is it morally sound? Is it the right thing? Is it in the best interest of the American system of justice? Is it in keeping with the principles you religious leaders propose and propound each Sunday? We justify our misuse of our cars on the grounds that this is the expedient way. Therefore, it is good. Well, is it?

If you haven't read Vance Parkard's "Hidden Persuaders," read it. If you don't have time to read it all, read the last chapter, "The question of morality." If you can't spare the time to read the last chapter, read the lead paragraph in the last chapter, which quotes the President of the Public Relations Society of America, "The very presumptuousness of molding the human mind through the techniques we use has created a deep sense of uneasiness in our minds." Look about you and see if you don't become uneasy about the things this automobile is doing to our people. Talk to your people, talk to them about what are the real meaningful things in their lives and see how many of them think more of that car than any other concrete or abstract thing they possess.

Any preacher or Rabbi or speaker delivering a message with a religious theme admits the need of a vehicle to make his point more meaningful. He can call his point laws, statements of eternal truth, or quideposts. Take our traffic signs, they are actually a brief statement of the law. Some of them are absolute, some of them are merely warning and some of them are con-

ditional. This same principle applies to some of the laws you propound.

I believe one of the most understandable sermons on the Ten Commandments I ever heard was one which was based on a parallel comparison to highway signs and how they were alike, one to the other.

"Slow down and live," could easily be a doctor's slogan as well as a highway sign and it could be an excellent spring board for a sermon, even with a highway safety overtones.

You talk about our obligation to God, obligation to the Church, what about our mutual obligation to each other on the streets and highways or in the plant. A simple yet important obligation, just to help each other stay alive and stay in one piece.

The encouragement for the support of the laws we now have on our books is the thing in which all ministers could help. Among the paradoxes of law enforcement and there are many of them . . . Not the least is this self-endorsed righteous one who wouldn't violate any law, who supports all things which are good, but was on a jury and failed to convict the flagrant drunken driver.

He probably will have a lot of good, sound reasons why he didn't convict that person, but the real reason was that he lacked the moral courage. We need a lot of things in traffic safety work, but citizens with the moral courage in jury boxes is pretty close to the top of the list, and you, as that person's spiritual advisor and counselor, are the only person who can say to the prospective juror, "You must, if you believe this man guilty, find him guilty. This is your obligation to God and to your fellow man."

If you ask a preacher what he sells and ask him to define it in one word, he might find difficulty in finding that one word. I find it simple, being a simple person. I think the one word to describe the sales package of the preacher is a four letter word "Love."

What does a preacher stand for and what does he stand against, make it simple and keep it in two words, He's for "love" and he's against "hate."

As I view it, there's little love lost between motorists. Motorists are believing

more and more every day that they should hate each other, when, if you, as a spiritual advisor, would remind them they should love each other. I have got to love every other user of the road. I just cannot take any other position. Why? Because, I'm alive and know it, because some other users of the highway, maybe one of you, in the thousands upon thousands of miles of my travels in this country, some few people have zigged when I zagged the wrong way and by their willingness to get out of my way, I'm still alive. And I know this is going to occur again. This is the reason I try to be a liberal driver and not to be too insistent on that right of way.

My life on the highway literally depends, not only on the ability of somebody to think and act faster than I can, but he must be willing to do it. You can't teach that person to think and act fast at the wheel, but as a spiritual leader, you can cause that person to be willing to do it. This is the important thing.

Not only do I love every other user of the highway, but I appreciate their being there. They're not in my way because, you see, they make it possible for me to be out there with them. I realize that if X-millions of people didn't own and use cars, I couldn't afford to own one.

When we look at America and the American home and the American scene and we look at all the influences on man's behavior and we take this thing apart and try to single out what one thing stands out far above all other things, we find several factors. Over here is the love of a woman for a man and the love of a man for a woman. And their mutual love for their children. Here is the spirit of sharing with each other good things and things not so good.

You grew up in a home. Will you just for a moment, think back and go back to your childhood and remember the simple lessons, the elementary church school lessons, family prayers, the choir activities, and the calls of the preacher.

As those years passed as we grew from a child into a youngster, into an older person and we became the head of a family, we recall vividly the words of the minister who said in substance, after he had pointed out the things he was talking about, "These

things are wrong, these things are sinful these things good people do not do."

These simple admonitions, the quiet expression of any opinion by a man, based on the word of God. This in my opinion is the greatest influence on our civilization, our lives and the communities in which we live.

If we can get our ministers, our church school teachers, our counselors and our rabbis, using as their authority the word of God, and say to us repeatedly and quietly it is wrong to kill, to injure and to maim people. It is sinful to damage another person's property, even though your only contribution was simple carelessness. If we can get the religious leaders of this country to do this, that action alone will have a tremendous impact on the traffic accident problem and other types of accidents as well.

It would be presumptuous on my part to offer you suggestions on the theology of safety.

My religion is not a theory, not a set of rules, but a way of life. A way that is permissive instead of restrictive. Positive rather than negative.

I believe His question to Cain, and Cain's reply, "Am I my brother's keeper?" . . . followed by His answer, "Thy brother's blood crieth unto you from the ground," . . . are as true today as they were when they were first spoken.

The golden rule, the act of the good Samaritan, the commandment not to kill, the admonition about temperance in all things. The commandment to love thy neighbor and not to take or covet what is his . . . all these are here and are true today, and they are as workable here on Michigan Avenue, or on Highway 66 between Chicago and Oklahoma City as they were on the road from Jerusalem to Jericho, and where the good Samaritan found one opportunity, today we can find hundreds of them.

I think He meant and still means it to be just as wrong to kill by negligence or carelessness, or by excessive speed, or through a flare of temper in the use of a car or any other kind of a machine as it was to kill with a stone.

On a Global basis, we are all concerned about this question of survival. Actually, the problem of safety and the solution to this

problem of individual survival may be a lot closer to us than the United Nations Building in New York or a Button Pusher in Siberia.

If we are to survive this battle between each other on the streets and highways, my religious belief, my experiences in the investigation of over 17,000 accidents at the scene and a quarter century's study of the causes of accidents, and my professional training, all tell me we must, if we profess to believe the things you propound, learn to respect the dignity of life and the life of man in the accident making situations which takes so many lives and maims so many, and costs this nation a disgraceful economic loss.

We must follow the Golden Rule, right along with the right-of-way rule and we must learn to love our neighbor in the next traffic lane as well as next door.

Individually, and this is what all these teachings are about actually, it won't do us any good to survive a missile war if day after tomorrow we die under the wheels of

a car between our house and the corner grocery.

Yes, my Master was on that road from Jericho to Jerusalem and just as sure as he was there, he is out yonder on the Congress Street Expressway today.

Well, I said it would be presumptuous for me to impose upon you my thoughts on the theology of safety. If I became too involved and stepped too far into your field, please forgive me.

A fellow says to me the other day when we were talking about this topic, he says: "Do you believe you can convince the religious leaders of their obligation to take on this task? Do you think you can sell them on the advantage of using an occasional traffic safety example in their services?" "Do you believe the religious leaders will accept their obligation to build better attitudes for traffic safety?"

Being an inherent optimist, I certainly do believe that.

But if perchance the religious leaders of this country don't help us, God help us!

RELIGIOUS ACTIVITIES

Panel Discussion on the Religious Role in preventing Traffic Accidents

Participants: Rabbi Jacob Pressman, Temple Beth Am, Los Angeles, Calif.; the Rev. Warren Ebinger, Illinois Council of Churches, Springfield, Ill.; the Rev. Gregory Bezy, S.C.J., Sacred Heart Southern Missions, Walls, Miss.; J. Lloyd Evans, National Conference of Christians and Jews, Dallas, Texas, and Chaplain James W. Keys, Christian Transport Association, Toronto, Ontario, Canada.

Rabbi Pressman said his congregation is developing a program of voluntary vehicle inspection as a means of cutting down on accidents. He said his state does not have such a program. Rabbi Pressman also has used posters on safety rules in his synagogue and has preached specific sermons on safety.

The Rev. Mr. Ebinger, who is a registered lobbyist in the state legislature, has urged the clergy to work for legislation that will help save lives. He said the clergy should work for stiffer regulations in traffic laws. He used some examples of drinking drivers in connection with traffic accidents to stress the need.

Father Bezy founded the Sacred Heart Auto League in an effort to make every driver a religious driver. He said that drivers must respect other drivers because all drivers have a personal relationship to God.

Mr. Evans pointed out there is a necessity for education about the safety problem. He said the conference has organized seminars for this purpose in his area of Texas in an effort to educate the clergy and religiously motivated persons. He said safety should never become a religion but should be an outward expression of religion. He said there is a need for a Religious Activities Committee on every safety council. He said the seminars often include panel discussions, films about safety, etc., so the clergy can give direct answers to questions from members of their congregations and others.

Chaplain Keys said his organization works closely with the trucking industry. It has organized a publication, "Transport For Christ," for the truckers giving safety tips from the moral aspect. He said it stresses safe driving as a moral obligation to one's fellow man.

WOMEN IN SAFETY SAFETY AND THE PHYSICALLY HANDICAPPED HOMEMAKER

By DR. LILLIAN M. GILBRETH
New York City

The National Safety Council has always interested itself in the problems of safety in the home, and of course the Women's Department is much concerned with what happens in this most important area of our lives.

Any household which includes a physically handicapped member or a guest—either permanent or temporary—is keenly interested in avoiding accidents, and in making sure at the same time that no one is made to feel conspicuous by equipment which makes him look or feel "different."

The projects which have been developed for work simplification in the home have helped us evaluate the safety factors. The questions constantly asked: "Is this necessary? Why?" always assume that safety is of paramount importance. For example, in planning the kitchen initiated and sponsored by the Heart Association, the physician's estimate of his patient's "safe" expenditure of energy set the limits within which the planning was undertaken and provided the incentive to make minimum demands on the homemaker's time and energy.

In the case of the young mother, physically limited as the result of polio, but eager to do a fine job in housekeeping and family relations, it was recognized that safety raised special problems for her.

This became evident in the work with physically handicapped homemakers carried on at the University of Connecticut. Here these homemakers cooperated with the

university staff in making an extensive study of their problems. The results of the study show:

1. They face the same problems as all homemakers.

2. Because of their disabilities there are added problems, such as learning to accept help graciously but at the same time refusing to be over-protected.

3. They must make sure that their children understand what they may do and may not do—and why. The children must obey and understand why they must obey.

4. They believe they can "live with" their families, at work and at play.

5. Their experiences can help other homemakers, whether these other women have obvious physical handicaps or not.

The literature, films, etc., available at the University of Connecticut are being used increasingly, both here and abroad. A research project which would lay emphasis on the safety features of this homemaking program would be an appropriate and valuable activity for the Women's Division to sponsor.

At your invitation, I am privileged to speak to you about it today and I hope you will want to think about such a project and initiate it. I can assure you that it will create worldwide interest and participation and will not only make a real contribution by solving some of today's problems but will help us face the new ones which await us tomorrow.

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NATIONAL SAFETY COUNCIL 1961-62

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Automotive Safety Foundation—JOHN L. MARKS, Director, Rural and Education Division, Automotive Safety Foundation, Washington, D. C.
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Future Homemakers of America—MILDRED REEL, Assistant National Adviser, Future Homemakers of America, U. S. Office of Education, Department of Health, Education, and Welfare, Washington, D. C.

American Farm Bureau Federation—CLAUDE DE ST. PAER, Program Assistant, American Farm Bureau Federation, Chicago, Ill.

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PLAN NOW--

TO ATTEND THE 1962 NATIONAL SAFETY CONGRESS

**Celebrating the 50th Anniversary
of the NATIONAL SAFETY COUNCIL**

WHEN: October 29 through November 2, 1962

WHERE: Conrad Hilton Hotel, Chicago

The National Safety Congress brings together safety people from all over the country—10,000 of them! By attending the Congress you become part of the largest and most important safety meeting of the year. You meet safety men with the same safety problems and responsibilities you yourself have. You exchange views and ideas on accident prevention, health, hygiene and fire prevention—on safety in industry, in traffic, at school, at home and on the farm. From a program of more than 400 meetings, discussions and demonstrations you select the activities that interest you most and that most closely relate to your safety work. This week-long educational program—planned and presented by the National Safety Council—can be your most inspiring, most thought-provoking safety experience of 1962.

**See the Latest in Safety Equipment
At the Greatly Expanded Congress Exhibit Hall**

See nearly 300 exhibits! This alone—the largest of all safety equipment exhibitions—will make your trip to the Safety Congress worthwhile. The industry's leading suppliers will display their newest and best safety products for your inspection. See . . . compare . . . ask questions. There is no finer opportunity to reach well-informed buying decisions for your company.

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COAL MINING INDUSTRY

SAFETY ASPECTS IN THE MODERNIZATION OF A COAL MINE

By T. K. DALE
Safety Director
Alabama By-Products Corporation
Birmingham, Alabama

Southern Electric Generating Company Mine, No. 1, is opened in the Mary Lee seam of the Warrior Coal Field, near the town of Parrish which is located about 35 miles west of Birmingham. It was constructed and is operated by the Alabama By-Products Corporation on a management fee basis.

Access to the coal seam is gained by two vertical shafts and one slope. One of the shafts is used for return air and the other is used for an intake.

An automatic elevator is installed in the intake shaft for transporting personnel and small supplies. The slope serves as an additional intake and a second escapeway to the surface. It is also equipped with a supply track and a belt which hauls the coal from the slope bottom to the surface.

The coal seam averages 55 inches in thickness, which includes 6 inches of rock near the bottom of the seam. It is essentially flat, however, local grades up to 10 per cent have been encountered. Generally the top is shale of good structure. However, it does vary considerably throughout the mine.

Coal production was started in September, 1959 and reached the contract tonnage rate of 1,500,000 tons of washed coal per year in December, 1960. All of the coal is consumed at the Electric Utility Plant at Wilsonville.

Production is from conventional type, off-track equipment and haulage is by means of conveyor belts.

In designing and developing this mine the aim was to make it the safest and most efficient mine possible. Safety in the selection of equipment and mining plans was given primary consideration to protect the health and lives of the employees. Equal

consideration was given toward selecting and training of personnel.

Production was commenced by using a nucleus of trained men from a previously closed Alabama By-Products' mine. Then a personnel department was set up to interview and obtain a biographical record of all prospective employees. Later the background of the applicant was investigated with emphasis being placed on past work experience and his ability to get along with other people.

To further assist in selecting employees, especially the young inexperienced men, mental ability and manual dexterity tests were given. Failure of any of these tests did not necessarily eliminate a man from consideration as there are jobs which do not require these qualifications.

Each man has to pass a rigid physical examination which includes a back and chest X-ray. We feel that these examinations are essential in building a sound safety program because "physical fitness" is one of the great factors we have in eliminating accidents.

The safety department initiates the training program for all new employees. We firmly believe that getting the men started off on "the right foot" is very influential in developing a safe workman for the future. After briefing by the safety department the new man is transferred to the operating department as a trainee. There he is given on-the-job training until, in the opinion of the supervisor, he can safely handle the job he is performing.

Other educational programs include accident prevention courses, first-aid and mine rescue training. There is also a program set up to train competent young men for future supervisors and to upgrade our present foremen. Group safety meetings are

also held with all employees at regular intervals.

Two full time safety inspectors are employed. Their duties consist of coordinating all phases of safety, including inspections, educational and other related subjects.

Mine facilities for the department include a large training room equipped with chairs, tables, blackboard and other accessories needed to conduct various safety courses.

Large quantities of methane gas are released from the mine which requires positive ventilation at the working faces at all times. For this reason the main entry system is used, consisting of six intakes in the center and five returns on each side. They are driven in separate sets with a solid barrier of coal left between the adjacent sets to reduce the number of stoppings.

Permanent stoppings are built out of 6"x8"x16" solid concrete blocks. At temporary locations they are constructed of wood and are covered with a layer of plastic cloth.

Each production section is provided with a separate split of air and a minimum requirement of 15,000 c.f.m. is maintained in the last open cross-cut.

Overcasts, constructed of steel and concrete slabs, are provided at permanent locations. At temporary locations they are built of pre-fabricated metal and are recovered.

Air is induced by two modern fans, one of which is standby. Each fan has a capacity of 500,000 c.f.m. at a 3.1 inch water gauge. The operating fan is powered with an electric motor and the standby is driven with a diesel engine of equal capacity.

These fans are provided with controls which will automatically start the standby unit if the operating fan fails for any reason.

Air is conducted to the immediate face areas by means of curtains which are nailed to a 2"x2" wood strip supported from the roof.

In general the mine is dry and rock dust has to be applied. High pressure rock dust machines, equipped with 300 feet of hose, are provided for this purpose. About twelve pounds of rock dust is used for each ton of coal that is mined.

Water, for allaying dust, is used on all cutting, loading and roof drilling operations.

The source of the water supply is from a nearby creek. Two pumps, one a standby, discharge into a three and one-half million gallon reservoir located on top of a hill near the mine. A high water level is maintained at the reservoir at all times.

Water flows by gravity through a pipe line from the reservoir into the mine. Pipes extend along the main entries and are provided with fire plugs every 250 feet. A supply of fire hose, equipped with fittings and nozzles, is located at each belt drive.

All producing sections are provided with two, 20-lb. dry chemical fire extinguishers, a supply of rock dust, self-rescuers for each man and two all-service gas masks. There is also 500 pounds of dry chemical powder stored in metal containers to be used in connection with the rock dust machine for fire fighting purposes.

In addition, all electrical installations, pumps, portable welding machines, belt drives and material locomotives are equipped with fire extinguishers.

The surface facilities are constructed of incombustible material. However, for additional protection, fire hydrants, with sufficient hoses and nozzles, are provided at strategic locations. Chemical fire extinguishers are placed at suitable locations in the buildings.

Fire drills are conducted at regular intervals and two mine rescue teams are trained to assist in emergencies.

To insure that fire fighting equipment is in readiness at all times three inspections are made each month. One is made by the mine superintendent, one by the safety department and one by an outside agency.

Segco Mine No. 1 is the first large mine in the state of Alabama to employ AC current for face equipment and as the primary mine-power system. The decision of AC over DC resulted from a series of studies and field examinations made by officials of the power company and was concurred in by management of Alabama By-Products.

The main power supply is from the utility company at 44,000 volts, and 440 volts, alternating current, is used to operate all electrical equipment on the surface and underground, except the DC trolley system which is used to transport men and supplies. The primary current for underground use is 4160 volts and all transformers are dry type, delta

wire connected with a resistance grounded neutral.

One of the safety features incorporated in the underground power system is a very unique cable monitoring scheme for tripping an automatic circuit recloser in the event any apparatus in the secondary circuit should become ungrounded. The cable is equipped with pilot wires which are continuously monitored. Any time these pilot wires are disconnected the substation circuit breaker will open. The cable connectors are so designed that these pilot pins will disconnect before the phase plugs, thereby preventing the plugs from being disconnected with power on.

Additional safety is provided by using a key "interlock system" at high voltage switches. The key is removable only after the switch has been locked out.

Power cables, with fire resistant covering, are hung on copper coated messenger wires suspended from the roof. They are hung in 50 foot sections and are equipped with high voltage connectors which are "pad locked" to prevent separation from strain or tampering.

Function boxes are provided at points along the main entries where it is necessary for a power take-off to be made at secondary entries, belt drives, and pumps.

Other electrical equipment includes a portable switch house for sectionalization purposes, a 300 KVA transformer for reducing the primary voltage (4160) to operational voltage (440) and safety circuit centers for operating equipment. They are provided with overload and ground fault protection.

A systematic method of roof support was adopted. Coal is mined under roof bolts installed in full compliance with the U. S. Bureau of Mines approved plans.

Roof bolts, of the expansion shell type, are installed with a hydraulically operated rotary type roof bolt machine. They are installed on five foot centers and as close as possible to the face.

Safety jacks are set temporarily in the working faces until the bolts are installed.

Along beltways and in all permanent airways it has been found advisable to bolt a treated wood header 2"x8"x24" for additional support. This type of support prevents spalling around the individual bolt.

Generally it has been possible to support

the roof almost entirely with bolts. However, where faults, slips and other unconsolidated materials are found wood and steel timbering has to be done.

Coal is transported by means of cable-reel shuttle cars and belt conveyors.

Shuttle cars are kept in a safe operating condition by careful and regular maintenance. Additional safety is provided by keeping haulage roads free of obstruction and providing adequate side clearance.

Belts are constructed of fire resistant material as approved by the U.S. Bureau of Mines. When installed they are leveled and aligned in such a manner that good tracking is obtained to prevent edge-wear and spillage.

To prevent slippage belt drives are provided with pneumatic or hydraulic "take ups" to insure that uniform tension is maintained when the belt is operating.

Electrical controls are provided to start and stop the conveyor anywhere along its entirety. The control wires are installed directly over the belt and are provided with switches that are easily accessible to personnel riding or maintaining the belt.

Permanent belt drives and electrical controls are housed in a well lighted, fire-proof room and all electrical wiring is installed in conduit.

All employees are encouraged to take first aid training at least once each year. At the present time about 50 per cent of our employees have been trained. Although this training has not been as successful as we had hoped, we do feel that enough men have been trained to effectively take care of an injury when it occurs.

Two well-trained mine rescue teams are kept in readiness at all times. Men for these teams are selected from all shifts, surface and underground. This distribution is made to prevent having "all our eggs in one basket" should an emergency arise. The latest type of rescue equipment is provided, which includes the full face mask, communication system and other related accessories.

Safety in handling and storing of material is given primary consideration. Old coal cars, with the sides cut out, are provided for hauling such materials as concrete blocks, roof bolts, timbers, oil and rock dust. One of the safety features incorporated in

this type of car is that it minimizes the lifting hazard. Also, one other factor to take into consideration is that adequate cars are provided to allow the vendor to unload supplies directly into the car, thus minimizing handling.

One unique safety feature incorporated in material storage is the manner in which oil barrels are handled. Racks built similar to those in which baby food is dispensed in food stores are provided. You simply have to pull a lever and a barrel will roll directly into the material car.

The production plant is one of the most modern in the South and is designed to utilize high speed washing facilities with a maximum degree of safety.

Good housekeeping is practiced at all times. Such practices include cleanliness, orderly storage of materials and the removal of tumbling hazards.

Stairways, elevated platforms, floor openings and runways are equipped with hand rails and toe-boards.

Railroad cars are loaded by an almost fully automated system. This system consists of a winch operated from the car loading

station, an endless rope, two dolly cars and sheave wheels mounted between the rails of the two loading tracks.

The railroad engine crew simply couples a train of cars onto the dolly cars. The cars on one track are loaded while the cars on the other track are being positioned for loading. No uncoupling of individual cars is required and the setting of brakes is unnecessary.

Safety was not overlooked in the design of the repair shop. It is constructed of fire-proof materials, is adequately lighted and well ventilated. Such equipment as a shop "jeep," overhead crane and chain hoist are provided to handle heavy equipment and materials.

Storage of supplies and assemblies is maintained in an orderly manner and good housekeeping is practiced.

In conclusion I would simply like to state that it would be naive to predict what the ultimate outcome will be. We only hope that with the installation of these safety and labor-saving devices, in conjunction with a progressive safety program, we are headed in the right direction in preventing accidents.

METHODS OF USING AUXILIARY FANS FOR FACE VENTILATION WITH CONTINUOUS MINING SYSTEMS

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About 30 years ago, when conveyor mining was widely practiced, auxiliary or booster fans became rather common in underground coal mines. During that period it was common practice to drive a single room 300 to 400 feet long utilizing a room and face conveyor. These rooms were generally driven as wide as top conditions would permit.

When the room advanced to a point where the ventilating current would not clear away the smoke and powder fumes, a small booster fan would be placed at the room entrance

and a tube extended into the room. This was done to provide enough movement of air to clear the working face. These fans were generally very small, sometimes no larger than an ordinary house fan, and as a result of their use in this manner the air returning from the face was often recirculated back through the fan and tubing to the face. The use of these fans constituted an attempt to overcome a deficient main ventilating system, rather than to dilute and render harmless explosive mixtures of air and methane.

The indiscriminate application of auxiliary fans resulted in, or contributed to a number of mine fires and explosions. The Federal report of a mine explosion and fire at a mine in Kentucky, in which 25 persons were killed, lists a blower fan motor as a likely source of the ignition. The report goes on to show that the blower fan was positioned so that a large portion of the air at the face was recirculated. As a result of this and other similar incidents, the use of auxiliary or booster fans was placed under severe restrictions by State and Federal authorities.

The Federal Mine Safety Code, which became effective July 24, 1946, vested in the Director of the Bureau of Mines the authority to approve the use of auxiliary fans under certain conditions specified in the Code. These conditions were very stringent and tended to discourage their use.

As continuous mining developed and was applied in more gassy coal beds and more deeply in virgin blocks of coal, conventional jute line brattice in many cases proved inadequate. Plastic and other more impermeable brattice materials in some cases were satisfactory, but more positive ventilation methods were sought. Auxiliary fans long in disrepute, and barred by the Federal Mine Safety Code from coal mines (except by special permit) appeared to offer a possible solution.

With the passage of the Federal Coal Mine Safety Act, the Code was accordingly revised as of October 8, 1953. The revised Code omitted many of the previous conditions under which auxiliary fans could be used, but made it mandatory for mine operators bound by the National Bituminous Coal Wage Agreement to obtain a permit from the Joint Industry Safety Committee. Under this plan all requests for permission are submitted to the Joint Industry Safety Committee, which in turn refers the request to the Director of the Bureau of Mines. Following an inspection of the mine and a study of the proposed plan for use of the auxiliary ventilating system and equipment by Federal inspectors, the Bureau develops rules and standards covering the particular installation and refers them back to the Committee for approval or disapproval.

This system remained in effect without modification until April, 1957, when the Joint Safety Committee granted permission to the

Bureau of Mines to conduct experiments with auxiliary fans and tubing without individual permits from the Committee. However, it was stipulated in granting this permission that the Committee be notified of the name and location of each mine in which experiments are to be conducted, and periodic reports are to be made on the progress of these experiments. At the conclusion of the experiments, if the mine operator wishes to continue to use the auxiliary fans, a permit must be obtained from the Committee. Under this arrangement the permit can usually be granted more expeditiously, since the Committee has at its disposal the progress reports on the experiments.

Since 1953 the Committee has granted 35 permits for use of blower fans with continuous mining systems. The geographic distribution of these permits is as follows:

- 10 in Pennsylvania
- 9 in Illinois
- 4 each in West Virginia and Kentucky
- 2 each in Ohio and Colorado
- 1 each in Utah, Indiana, Washington, and Alaska

The requirements for auxiliary fan installations are now fairly well standardized, but specific variations may be required in any given case. Requirements of state mining laws must be given consideration; these laws are presently in wide variance.

The primary function of the ventilating current in the face regions is to supply fresh air to the workers and to remove any methane released from the coal or the enclosing rock strata. Additional objectives are maintenance of good working temperatures and the removal of dust and mist.

In continuous mining systems, the mining face is advanced at a steady rate. There is no chance for the released methane to bleed off as there is between the cycles of conventional mining. This is particularly true of borer-type mining machines since they virtually fill the working place and block or retard the flow of air to and across the face. The production crew on a continuous mining machine must work for extensive periods of time in one place. If methane is encountered a comparatively steady flow is to be expected, and it must be met with sufficient air flow to remove the gas quickly. Methane is prone to accumulate, particularly

in the face corners, and to stratify near the roof. Stratification is likely to occur throughout the length of the working place, rather than just in the face region.

There have been numerous occasions where gas was detected outby the operator's position at the mining machine. To prevent the accumulation of methane anywhere in the working place the entire space must be swept continuously by controlled air currents. In extremely gassy conditions methane is given off so rapidly that the moving parts of the machine do not allow it to accumulate or stratify. Instead it is found in varying amounts in different parts of the face area. In these circumstances a small fan mounted in a strategic location on the machine diffuses the methane and prevents it from accumulating before it is removed by the auxiliary fans.

The safety aspects of maintaining a safe atmosphere in any coal mine are well known to everyone in this audience. There have been instances of fires and explosions caused by the ignition of gas in the working face, both with conventional and continuous miners. The elimination of these ignitions is the prime concern of those persons who have worked so diligently to improve face ventilation. While safety remains the most important consideration it should be remembered that productivity is a factor too. There are numerous instances on record in which inadequacy of ventilation has made it necessary to stop work until a safe atmosphere could be restored. In some instances this delay is reported to have become 50 per cent of the available production time. In some mines the use of continuous mining machines has been alternated between places, letting one place stand idle for gas clearance while the other is being mined. The time consumed in moving the machine is lost from its productive time.

Soon after the introduction of continuous miners it was found that unassisted coursing of air into a panel in a gassy coal bed was inadequate for effective methane removal. The first approach to the face ventilation problem was the use of line brattice. One company using a borer-type miner ran some rather extensive tests to determine the effectiveness of line brattice installations. It was found that with the line brattice erected on the intake side on which 80,000 c.f.m.

of air was delivered to the mouth of the working place, that only 4,000 c.f.m. at a velocity of 500 ft./min. reached the end of the curtain. On this setup the shuttle car did not pass through the cloth and a tight curtain, made of No. 10 brattice cloth, was maintained. Even so, 95 per cent of the available air was lost before it reached the face area.

In driving multiple entries with a double split ventilation system, which is almost always used in gaseous mines, this situation is rarely encountered. Instead, when the line brattice is installed on the intake side, it is usually necessary for the shuttle cars to pass through the curtain. With shuttle haulage through the curtain at the crosscut, air leakage was so great that it was very difficult to maintain a safe atmosphere at the face.

In order to eliminate haulage through the line brattice, an installation was made with the brattice on the return side. In this setup the line brattice could not be extended beyond the back end of the miner due to the close clearance around the machine. This left the end of the brattice some 20 feet from the face. With the area behind the line brattice restricted, a large volume of air could not be forced to the face area. It was found the velocities along the line brattice were much greater than along the far rib.

Another step taken to improve face ventilation, using line brattice, was the installation of a door in the shuttle car haulway. This method too was ineffective when large methane liberations were encountered.

In addition to the above-mentioned deficiencies, it was found that objectionable amounts of fine coal dust hung in suspension or settled out in the face area. Experience in continuous mining of coal has shown that face ventilation and dust control are interrelated problems. Either may become critical in a given situation.

The results of these experiments with line brattice and the experience of similar applications by other coal companies led several of the more progressive and safety-minded companies to start experimenting with auxiliary fans. These experiments were conducted under a permit issued by the Joint Industry Safety Committee or in conjunction with the Bureau of Mines under the permission granted by the Committee in April 1957.

The first permit issued by the Joint Industry Safety Committee for use of an auxiliary fan with tubing in connection with a continuous mining system was granted to a mine in Illinois in 1953. The permit was granted for a period of one year and a renewal was not sought by the company when it expired. The oldest active permit was issued to a mine in Western Pennsylvania on April 13, 1954. The mine operates in the Pittsburgh coal bed, which averages 90 inches in thickness in the active workings. It produces about 3,000 tons of coal a day, all mined by ripper-type continuous miners.

The exhaust fan is placed in the last crosscut and a 2-foot diameter tubing is extended from it to approximately 15 feet from the face. A check made from plastic or double layers of jute brattice cloth is built around the fan so that the motor drive is on the intake side of the check, but the fan discharge is on the return side. A by-pass for the air in the ventilating circuit in excess of the amount that the fan takes is constructed by having an opening in the check at the fan. A piece of plastic brattice cloth with a suitable weight fastened to the bottom is hung from the top side of the check in such a way that the opening is completely covered.

When a greater quantity of air is flowing in the section than the fan uses, the excess air blows the by-pass open and goes directly into the return. If the quantity of air circulating in the section is less than the fan uses, the pressure in the return side of the check will become greater than on the intake side, then the by-pass will be blown shut and prevent any recirculation of air back through the working place.

In an attempt to alleviate the hazard from float coal dust being deposited in the return of air courses, a hopper for discharging rock dust into the fan discharge stream has been mounted on the fan housing. This has proven to be fairly successful, but the rock dust is fed solely by the vibration of the fan housing and some difficulty in maintaining a steady flow of rock dust has been encountered. In order to overcome this difficulty, the company has ordered two coaxial motor fans which will be equipped with a rock-dust hopper from which rock dust will be automatically and continuously fed into the fan discharge stream by a star feeder.

Another system is now employed by a mine in northern West Virginia in conjunction with borer-type miners. This mine operates in the Pittsburgh coal bed and at times extremely heavy liberations of methane are encountered. A small 12-inch electrically driven fan with a free flow capacity of 2,500 c.f.m. is mounted on the miner and forces air through 12-inch tubing with a velocity of about 3,000 feet per minute. This blast of air is sufficient to provide air flow in the far corner and force it into a larger volume circulated by the exhaust fan. In order to prevent recirculation, the end of the exhaust tubing is maintained in by the blower fan inlet at all times. The 16-inch diameter exhaust tubing must be kept close to the face to be effective, and without the aid of a blower does not provide adequate ventilation in highly gassy faces.

It has been found that when extremely heavy liberations are encountered the installation of two fans and two sets of tubing are necessary. In such a case one tubing line is extended to the immediate face while the extreme end of the second is located within the area between the miner and pick-up loader, where stratification of methane occurs when the single exhaust fan is used beyond its ventilating capacity. When such extreme methane liberations are encountered, aid can be given to the double fan setup by erecting a short wing brattice in the crosscut to facilitate splitting the air current within the working place instead of at the intersection. Part of the working place is then ventilated by the extra air forced in by the short line brattice.

Another system worthy of mention is one used by a mine in Central Pennsylvania. This mine operates in the Lower Kittanning coal bed, which averages 42 inches in the present workings. The mine is classed as gassy by the State and Bureau of Mines, and at times fairly heavy methane liberations are encountered.

In coal 42 inches in height, tubing as used in the two previous methods would be quite cumbersome to install, and with a borer-type miner almost impossible to maintain near the face.

These difficulties were overcome by installing a network of sheet metal air ducts on the miner along with a dual intake fan. The fan, a centrifugal blower-type capable of various capacities depending on the mo-

tive force, is driven by an explosion-tested 2 h.p., 250-volt d.c. motor. At the present time the fan operates at 3,400 r.p.m., and the air output at the face is about 900 c.f.m. The fan is mounted on the rear bumper of the miner and connected to a system of rigid ducts that convey air to the face. The arrangement of ducts permits drawing fresh air from either side of the miner and also directing it to either side of the machine at the face.

It should be emphasized that with this system the line brattice is kept to within 4 feet of the fan. This diffuser system acts as a supplement to, and not in place of the line brattice. If the fan should fail or stop, the primary source of ventilation is still in effect.

A mine in Illinois employs a system utilizing a blowing fan and tubing. This mine operates in the No. 6 coal bed which averages 86 inches in thickness in the present areas being mined.

Due to top conditions which are peculiar to this coal bed, permission has been given to drive crosscuts at 300-foot intervals. Two adjacent entries are developed simultaneously, employing continuous miners, extensible belts and/or shuttle cars. Entries are developed by a single cut by the miners, with crosscut intervals a maximum distance of 300 feet. Positive face ventilation is accomplished by the use of 12-inch permissible blower fans equipped with fire-resistant "spiral-tube," suspended from the roof. The fans are placed on the intake side of the place, or in the last open crosscut, and operate blowing. The effectiveness of the system is evidenced by a special report made by the Mine Ventilation Section, Branch of Health Research, Bureau of Mines, which states in part:

"These auxiliary blower installations, used to ventilate Goodman continuous miners, were providing good face ventilation. The tubing was advanced promptly and was properly installed and maintained. Equivalent face ventilation by means of line brattice without auxiliary blowers would be very difficult to obtain."

The final system to be discussed is one

used in a mine in Utah. This mine operates in the Lower Sunnyside coal bed which varies from 8 to 16 feet in thickness and dips in an easterly direction from 12° to 26°. Coal is mined by six continuous miners of various types.

The system itself is not unique. The fan operates exhausting and tubing kept up to the miner. The thing that makes this installation of interest is that the mine is classed nongassy by the State of Utah, and the auxiliary fan is utilized for the express purpose of improving health and safety standards for employees operating the continuous miners. In granting this permit the Joint Industry Safety Committee imposed the same strict conditions that are required by operating auxiliary fans in gassy mines.

The results obtained from experiments and the application of auxiliary fans used with continuous miners under actual mining conditions have emphasized several points:

1. Line brattice systems of ventilation are inefficient and very often fail to meet all the requirements of proper face ventilation.
2. Auxiliary fans and tubing, properly used, offer a much more positive, efficient and reliable method of face ventilation.
3. Coal companies, signatory to the National Bituminous Coal Wage Agreement, who want to incorporate auxiliary fans and tubing in their mining systems, must obtain a permit from the Joint Industry Safety Committee or request the Bureau of Mines to conduct experiments under the special permit granted it by the Committee.
4. The Joint Industry Safety Committee has shown an alertness to the potential hazard of misuse of auxiliary fans. It has also demonstrated an understanding of the operating problems involved in effecting proper face ventilation with continuous mining systems.

The writer would like to express his appreciation to the several coal companies whose face ventilation systems were reviewed, the Joint Industry Safety Committee and the Federal Bureau of Mines for their cooperation in supplying the information that made this paper possible.

CONTROL OR EXTINGUISHMENT OF GOB FIRES

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The Orient #3 mine of the Freeman Coal Mining Corp., located about one and a half miles southwest of Waltonville, in Jefferson Co., Ill., has, during the past year and a half, experienced several instances of spontaneous heating. This mine is working in the Illinois #6 seam which in this area has a cover of approximately 800 feet and a thickness of from seven to twelve feet. The mine is ventilated by an exhaust system with bleeder entries.

All of the production since the mine opened in 1951 has been from continuous mining machines with shuttle cars and belts for haulage. The mine was designed to produce 7,000 tons of coal on each of two shifts but has surpassed this production with a record of 15,458 tons of prepared coal representing about 17,000 tons of run-of-mine.

History

During the period from 1951 to 1956 there were no records of heating conditions in the mine. Although there have been no major changes in mining procedure since that time, there have been several cases of spontaneous heating. These "hot spots" have occurred in areas where the gob has been less than two years old.

From May 1956 until October 1961, the Orient #3 mine has experienced eight separate instances of spontaneous heating in gob areas. Since fire has been defined as "the evolution of heat and light by combustion," it should be pointed out that these have not been gob fires, in the true sense of the word, since flame has not been present.

The first indication of spontaneous heating occurs when a haze or fog-like atmosphere is noted in the return airways. The second indication is the presence of beads of condensed moisture on the roof near the g.b. The third indication is the presence of an odor of heated bituminous material and the fourth is a measurable content of carbon monoxide.

In one area where heating was discovered in July of 1960, there was a small synclinal area about fifteen feet in depth for a distance of approximately one thousand feet. Since the heat and carbon monoxide being generated seemed to be coming from near the bottom of the basin, a three inch water line was laid and water was discharged into this low area until approximately eight acres was flooded. At this point the heat and carbon monoxide could no longer be detected. Because of the natural conditions, control of this area was relatively simple.

In each instance the exact location of the point where heat and carbon monoxide were being generated could not be ascertained. The general consensus was that the zones were near the outer edge of the gob and were relatively close to the bleeder entries.

Seven of the areas where spontaneous heating has occurred have been controlled by sealing with masonry stoppings and flooding with carbon dioxide. These areas varied in size from 20 to 800 acres and the amount of carbon dioxide used varied from 18 to 300 tons depending essentially upon the area involved. After sealing all access openings to the gob area where spontaneous heating has been discovered, CO₂ is then introduced.

There is a three inch fresh water line from the surface which is connected to all parts of the mine. This line is drained and then purged with compressed air. The line is connected to the sealed area by use of a rubber hose. An expansion joint is provided at a point approximately fifteen hundred feet from the surface connection to the CO₂ delivery truck. This rubber expansion joint, approximately six feet long, is used to compensate for the contraction in the pipeline following introduction of the liquid carbon dioxide. The greatest distance that CO₂ has been transported through a pipe line at this mine was about three miles. A delivery truck containing nine tons of liquid CO₂ can be drained into the gob area in four hours.

The volume of gas resulting from the eighteen thousand pounds of liquid carbon dioxide would fill a six by twelve foot entry two thousand feet long. There are about eight cubic feet of CO_2 gas per pound of liquid.

With the established criteria for discovery of the spontaneous heating condition (haze, moisture, odor and carbon monoxide), the mine officials take the necessary steps to control the condition as soon as any one of the symptoms is discovered. With the primary purpose of reducing the oxygen content in the affected zone, the usual procedure is to build masonry stoppings in all access airways to the area, minimize and equalize the pressure differential by placing all of these seals on intake or return in preference to a combination of intake and return, and then flood the area with carbon dioxide.

In every instance the precautionary measures taken at the time of the discovery of the spontaneous heating condition have been successful. In February of this year, when the seventh case of heating was discovered, the Freeman management along with the state and federal bureaus and approval of the union, decided to try to discover the source of the heating. Using conventional loading machines, the gob was penetrated in various locations through cross-cuts in an attempt to ascertain the hot spot. After outlining the zone, and determining the approximate location, a cross-cut was driven through a pillar to the gob and, the suspected area probed.

It was at this point, twenty-six days after discovery of the affected area, that flame was observed. We think that we speeded the flame activity by opening the "hot spot" in introducing oxygen by increasing ventilation to this spot. As soon as the flame was seen the men were withdrawn, seals built, and carbon dioxide was used to flood the area. This is the only instance where flame has been observed in connection with the heating.

Coal Oxidation and Spontaneous Combustion Research

In order to get to the bottom of the cause of these "hot spots" we made a study of the research work that has been done on the oxidation and spontaneous heating of coal.

The mysteries of coal oxidation and spontaneous combustion have been studied over a very long period of time by many investi-

gators and current research on these subjects is continuing in many research institutions throughout the world. The results of past research have been published to a considerable extent so that several hundred papers on the subject are available to interested persons. A rather extensive review of the literature has been completed. In many cases the original publication has been consulted but, because of language difficulties and the inaccessibility of some of the articles, some information has been taken from *CHEMICAL ABSTRACTS* and is so noted in the bibliography of this paper.

As soon as a fresh coal surface is exposed to the atmosphere, oxygen will immediately begin to react on the surface of the particles. Howard¹ reports that the rates of primary reactions are a function of the rank of the coal, the surface area, temperature, oxygen partial pressure and the time that oxidation continues.

In his work to determine the rates of oxidation of Illinois, Pittsburgh and Pocahontas coals at 75°, 100° and 125°, he found that a difference of 18 to 32 per cent volatile matter showed relatively small differences in the oxidation rate. However, he points out that very little quantitative information is available on the relation between rates and surface area because of the uncertainties in measurements.

In a study of oxidation as a factor in self-ignition, Orleanakaya² observed ignition temperatures from 300-400° and concluded that initial oxidation (e.g. during mining) lowered ignition temperature. Veselovskii³ reported on his work on the surface oxidation of coal that the moisture adsorbed from the air had an accelerating effect on the oxidation process.

Adsorption of oxygen, which is fairly high above 50°, is rather small compared with chemisorption, which increases rapidly with the rise of temperature, according to Olpinski.⁴ At the same time the amount of oxygen that forms carbon dioxide and carbon monoxide increases. At 100-150° the chemisorption reaches its maximum. At low temperatures the rate of carbon dioxide formation depends on the decomposition of the surface complex rather than on the rate of formation of this complex.

Olpinski⁴ stated in 1960 that knowledge of the heat of reaction during the oxidation of bituminous coal at room temperature is of

value in connection with spontaneous heating and ignition of coal. Neither heating nor ignition can take place unless the heat of reaction exceeds the heat losses. Because of the lack of data in the pertinent literature, the heat of reaction during oxidation of bituminous coals at room temperature was experimentally determined in a twin calorimeter submerged in a constant temperature bath. The bath was maintained at a temperature of 50.4° while the heat of reaction was determined on four coals containing from 45.0 to 9.06 per cent volatiles on a moisture and ash free basis.

The results indicated the heat of reaction depends upon type and degree of coalification of the coal. High volatile coals developed more heat of reaction than semi anthracite. This observation is in agreement with the frequency of spontaneous ignition of the coal seams. Heat of reaction was higher at the beginning of an experiment and progressively decreased with time of exposure. For coal number 1 with 43 per cent volatiles the heat of reaction was 10.1 cal/g. of coal during the first five hours of the experiment while it had dropped to 0.5 cal/g. after 365 hours of exposure.

Budryk⁵ reported on his studies of the temperature of spontaneous ignition of coals as an index of the degree of oxidation. The influence of this degree of oxidation on spontaneous ignition were determined under laboratory conditions. It was found that there is a close correlation between the volatile content of coals and their ignition temperature, vitrain and durain constituents have practically identical ignition temperatures, and unoxidized coals have similar temperatures of spontaneous ignition.

However, another investigator studying Russian coals in 1956 concluded that vitrain was more easily oxidized than fusain and that the petrographic composition of coal had a definite effect on its oxidation. Mazumdar⁶ et al report that vitrains require 800-1200 hours to attain complete immunity towards further oxidation at 170° C whereas whole coals require 300-400 hours to attain the same condition. They concluded that this phenomenon may be due to the catalytic effect of the mineral matter content of the coal being studied.

The role of pyrite in spontaneous combustion of coals has been the subject of study for many investigators. In 1954 Napton⁷

published his spontaneous combustion theory in a letter to the editor of *Chemistry and Industry* stating that the rate of weathering of pyrite is a function of the surface area available for oxidation but although it appears that the spontaneous heating of finely divided pyrite may be responsible for the ignition of stored pyrite, this does not appear to be probable with most pyritic coals.

In this case the influence of pyrite is usually considered to be due to the disintegration of the coal by its expansion on weathering, and thus exposing a greater area of the coal to the action of the oxygen. In view of the fact that ferrous sulphide is a normal weathering product of pyrite, and that it is pyrophoric when finely divided (as it would be when formed by the oxidation of pyrite) the possibility that this material may be responsible for some cases of spontaneous combustion of pyrite or pyritic coal should not be overlooked.

A report by the Ruhr Coal Community Organizations, Essen, Germany, states that the rate of oxidation is a function of particle size (area phenomena), nature of particle packing, and an oxidation potential. Self-ignition is related to the rate of absorption of oxygen. Oxidation of impurities does not cause coal self-ignition, although soluble Fe salts in which Fe may change valence catalyze the reactions.

Chalupa and Drabek⁸ studied a method for the determination of the tendency of coal to self-ignition and analyzed the causes of self-ignition underground. They criticized the present method used for determining the tendency of coal to self-ignition and designed a new one, in which the relative tendency of coal to self-ignition is expressed by means of the following values:

- a) the rate constant for the oxidation of the coal substance;
- b) the amount of oxygen consumed at defined conditions;
- c) thermal losses during the oxidation process;
- d) the deficit ratio of oxygen, which means the ratio between the amount of the oxygen, and the amount of oxygen that entered the reaction.

Doomum⁹, in his publication dated 1954 made an attempt to put the evaluation of the self-heating tendencies of coal on a rigid basis for a quantitative analysis. He states

that the main external factors affecting the rate of heat generation in a particular coal of specific chemical and physical characteristics are: 1) temperature, 2) elapsed time, and 3) oxygen concentration. Since he was working with coal storage problems, one of the important determinations was the bulk density as well as values for specific heat and thermal conductivity.

Chalupa, Drabek and Doornum have probably made two of the better attempts to arrive at a method of evaluation for the self-ignition of coal. While many researchers are content with an evaluation on a relative basis (coal A is more liable to spontaneous heating than coal B) these men have tried to put their findings into a formula for a quantitative analysis. Of course this method of determination is subject to considerable criticism in the case of field determinations, because of the lack of knowledge in the area where the hot spots are occurring in Orient #3 mine.

The chemical factors of the coal involved would probably not be too much different in the place where the heating is going on and the place from which a sample can be obtained. However the physical factors are the ones about which practically nothing is known. Three of the more important items which must be known are size of coal particles, temperature, and oxygen concentration. Since each of the hot spots in Orient #3 have occurred in gob areas, it would be strictly a guess in arriving at values for these three items.

Elder, in 1945, published a list of variables used to determine the rate and extent of the reaction of coal with oxygen: 1) nature of the coal, 2) temperatures, 3) past history (when mined, etc.), 4) availability of oxygen, which is a function of oxygen concentration in the atmosphere present, 5) particle size, which determines effective surface area, and 6) moisture and ash content.

With this information available he established equations for the per cent oxygen consumed, therefore he could derive "R" which he calls the rate of reaction in per cent oxygen consumed per day by weight of dry mineral matter free coal. The surface area of the coal he found by empirical equation developed from Needham and Hall which is that the rate of heating is proportional to the cube root of the surface area present. He found that the ash seemed to diminish

the tendency to heat and that the rate of oxidation was proportional to the oxygen concentration in contact with the coal raised to the 0.66 power.

Berkowitz and Schein¹ studied the heats of wetting and the spontaneous combustion of coal in prolonged storage and state that the heat release resulting from the oxidation of coal will be determined by the end products of the reaction and not by the stages via which these are formed. Thus, if carbon dioxide is formed, the heat release is 94,400 cal/gm atom of carbon, and if carbon monoxide is formed, it will be 26,800 cal/gm atom. These may be significant values when considering the volume of carbon monoxide present in Orient #3 Mine.

In a review of the literature on the oxidation of coal made by Yohe,² he points out that Jones and Townsend report that below 70-80 degrees carbon monoxide is the main gaseous product of oxidation, whereas above this temperature carbon dioxide and water are formed in much greater proportion than carbon monoxide.

In regard to bacterial action as a possibility in bringing about spontaneous ignition in coals, Yohe reports that Zavarzina³ concluded from his experiments that spontaneous heating and ignition in coal piles are chemical chain processes, not bacterial processes.

Yohe also reports that in investigations made by Terposova,⁴ petroleum products, their emulsions, soaps, fatty acids, calcium hydroxide, and "other substances" were studied for the inhibiting action on coal oxidation. All petroleum products and their emulsions protected coal from oxidation, but the other substances mentioned were "less effective."

In 1928 Davis⁵ listed the factors known or thought to affect self-heating of coal and classified them as chemical or physical.

Chemical

1. Pyrite finely-divided is a factor
2. Rank of coal-constitution of coal. High water content increases ease of ignition. According to Winnill (1916) a high content of natural moisture is a poor (but used) indication of the oxygen absorbing capacity of coal, and complete removal of the water markedly reduces oxidation rate.

3. Weathering
4. Water
5. Organic Sulphur
6. Alkali, calcium chloride, sodium bicarbonate
7. Ozone
8. Bacteria

Physical

1. Size
2. Water
3. Oxygen supply
4. Temperature
5. Occluded gases
6. Ventilation and conductivity.

Winnill has shown that the rate of oxidation varies as the square root of the oxygen percentage of oxidizing atmosphere.

Spontaneous combustion is the result of a progressive oxidation under specific conditions but according to leading coal chemists it is impossible at the present time to chemically analyze coals and determine the extent of the oxidation process. It would not be possible therefore, to take samples from areas in the #3 mine where spontaneous ignition could possibly occur and by chemical analysis anticipate the occurrence of a hot spot.

Although large quantities of fusain have been found in the Orient #3 mine, the coal petrographers have considerable doubt that the petrographic constituents are instrumental in the heating tendencies of this coal.

U. S. Bureau of Mines Cooperation

Because it seemed that the chemical composition of the Orient #3 coal may be important in determining the cause of the hot spots, the Pittsburgh Coal Research Center of the U. S. Bureau of Mines was asked to cooperate in the study. Samples of coal from carefully selected points in the mine were sent to Pittsburgh for analysis. Dr. Arthur A. Orning, supervisory technologist (fuels), agreed to run relative ignitability tests as well as proximate analysis and BTU's on the samples submitted.

Six two-hundred-pound samples and three fifteen-pound samples were collected in June 1961 according to the following plan. The first sample was collected near a "wan" area where a fire was suspected but flame was never seen. The purpose of this sample was to see if it showed any signs of being dif-

ferent from other samples which could be related to its position of being near a geological disturbance. Following the channel sampling method, a large and small sample, representative of the mining height of the seam, was collected.

The second sample was collected from the floor in an active working section. This material was intended to be representative of the type of loose coal which is being left in an abandoned section after mining. The sample was noticeably wet as a result of the sprays on the miner.

The third sample was intended to be representative of the one area in the mine where a fire was actually seen in order to try to determine if it was significantly different from the other samples. A large and small sample, both representative of the mining height of the seam were taken within 350 feet of the known fire.

The fourth sample was taken in an area which had no known geological disturbance and which had experienced no hot spots. It was a sample intended to be representative of those portions of the mine which have caused no difficulties in mining.

The fifth sample was taken in an area which is known to contain a large amount of exceptionally thick coal. In the particular location where the sample was taken, the roof coal, above the mining height, was about three feet thick. This coal was representative of that which would be present in large quantities following caving. This could be the coal which has an opportunity to experience a temperature rise as a result of the caving action, therefore it was desirable to see if the sample showed any significant differences from the other samples.

The sixth sample, like the third, was taken as close to a hot spot condition as possible.

Relative ignitability tests were run on the Orient #3 samples and the results were compared with Pittsburgh seam coal and Wyoming sub-bituminous coal. The critical point in the tests conducted by Dr. Orning was defined as "that temperature at which a measurable self-heating takes place."

Dr. Orning reported that the oversized material was crushed to pass a one-inch square screen opening and sized to plus

one-half inch, one-half inch by one-quarter inch, and minus one-quarter inch. A fifty-pound sample was externally heated with one cubic foot of air per minute with a heater temperature rise of two to three degrees Fahrenheit per minute. The self-heating point was detected by a change in the form of thermal wave from the cylindrical heating surface into the sample.

A copious evolution of carbon monoxide occurred at the self-heating point for each sample. The amount of carbon monoxide being generated exceeded the scale of the MSA colorimetric tester. The self-heating point in degrees Fahrenheit for each sample was as follows: 1) 401, 2) 304, 3) 395, 4) 396, 5) 415, 6) 391. A similar point for the Pittsburgh coal is 472° F., and for the Wyoming coal is 327° F.

Analysis of Relative Ignitability Tests

As a result of the data collected by the Bureau of Mines about the only factual statement which can be made is that the Orient #3 coal is more likely to ignite spontaneously than the Wyoming coal tested.

Further interpretation of the test results may be risky, but would seem that one or two other conclusions may be drawn. For instance, although the samples were carefully selected from areas which would contrast, the range of self-heating temperatures was only 21° F., from 391 to 415. This would seem to indicate that there is practically no difference in the relative ignitability of the six samples of Orient #3 coal tested.

Equally important is the finding that large amounts of carbon monoxide are released before the self-heating temperatures. This fact may explain why the inspection method at Orient #3 has been so effective in finding the hot spots. Some people have suggested that the reason carbon monoxide can be detected is because it is present as a product of active combustion, or burning fire, whereas the data from tests indicate that the carbon monoxide is a result of oxidation which will cause it to be produced in large quantities before any sign of active combustion occurs.

One conclusion, which seems obvious from the test data, is that there are practically no discernible chemical differences in the samples submitted and that therefore one

or more of the physical factors involved are probably more important in the determination of the reasons for the hot spots.

Other Factors in Spontaneous Heating in Orient #3 Mine

In addition to the chemical and geological similarities which may occur in Orient #3 Mine and have a bearing on the reasons for the occurrences of the hot spots, there are several physical factors to be considered. One which would seem to be of utmost importance is the time element. On the basis of available information it seems that the time elapsed between the mining of the coal and the discovery of a hot spot in the same area has varied from about 13 months to 29 months with two years as the apparent optimum period.

Hearsay evidence, rumors and vague memories combined with a few known facts have caused some to believe that sources of ignition have been present in the hot spot areas other than just the coal itself. It is known that machines must be repaired and in the process of doing this work oil must be cleaned from the parts, usually with a rag or waste. Lubricating oil is stored in various locations underground and drippings may accumulate. Poor connections or a leaky hose can cause considerable loss of hydraulic fluid which may accumulate in quantity in some particular areas of the section.

Because management is insistent upon good housekeeping and "clean" sections, we know that sorts of scrap materials are discarded in the gob or "hidden" in back entries or abandoned rooms. Worn-out brattice cloth, wood, paper and even oily rags are sometimes discarded in this fashion. Granted that Orient #3 mine would probably not be an exception to this long practice in coal mining, and that many of the items so discarded could be instrumental as the source of the beginning of a hot spot, the fact remains that in spite of this general practice in coal mining, Orient #3 experiences hot spots and most of the others do not. These discarded materials may, in some cases, be a contributing factor, they do not make up the principle cause.

Other events and conditions which were investigated for a correlation among the hot spots were: time of year of occurrence, but the mining and discovery of the hot spots

have occurred in at least three seasons of the year; underground differences in elevation, the thought here being that maybe a stressed condition of the overburden or coal was creating a condition conducive to the generation of heat to the point that normal spontaneous ignition conditions were greatly advanced, but the hot spots have occurred in low places in the mine as well as in high places.

Although the rate of oxidation of coal in a mine is impossible to determine at the present time, we do know that it goes on. From laboratory experiments it has been determined that the surface area exposed is an important factor in oxidation. To determine the surface area available in the coal particles remaining in an abandoned portion of a mine would be at best a wild guess, however we are sure that in the normal sequence of mining and sloughing that the surface area of coal would be enormous and that in a gob area it would be even larger. It is possible for oxygen to come in contact with these fine coal particles because atmospheric air is available.

The large surface area is present and oxidation takes place since one way to detect the presence of a hot spot is to find carbon monoxide in the near vicinity. One researcher pointed out that when carbon monoxide is formed there is a heat release of 26,800 calories per gram atom of carbon, therefore we have the beginning of heat generation.

Of course the conditions surrounding the creation of a hot spot must be "ideal," but what factors effect the ideal condition. The critical point seems to be that the heat generated must exceed the heat transferred from the area by conduction and convection. This is not a difficult situation to visualize in an abandoned portion of a mine, particularly when some attempt is being made to ventilate these parts.

CONCLUSIONS

In every instance of the occurrence of a hot spot in Orient #3 mine, the location of the hot spot has been in a gob area. The exact location of each occurrence cannot be positively ascertained, however the evidence indicates that in each instance the hot spot was near the location of the concentration of a small amount of air. This leads one to believe that in the middle of

the gob area the conditions are not conducive to the creation of a hot spot, possibly because of a lack of oxygen, and in the bleeder entries around the gob area there is probably enough air to carry off the excess heat from the oxidation process. But in some location in between these two zones there is just enough oxygen available to keep the oxidation process active and not enough air current to dissipate the heat generated. This would be an almost impossible theory to prove and yet it is a logical one.

In every instance of spontaneous heating in the gob at Orient #3 mine, control has been achieved by: 1) sealing all openings to the gob with masonry stoppings, 2) equalizing and minimizing the ventilation pressure differential on the seals, and 3) flooding the area with carbon dioxide or water.

Anticipated changes in the future mining plans in order to help the control of hot spots in the gob areas are that the size of the gob area will be diminished and the number of access openings from the bleeder entries to the gob will be kept at a minimum in order to reduce the number of seals required to isolate the area.

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HAZARDS ENCOUNTERED IN MINING THICK, INCLINED COAL BEDS

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Most coal mining areas of the western United States are characterized either by thick beds, steep pitches or heavy cover. Individually, each of these may present certain inherent safety hazards that influence the mining operation. When all are met at one location, the combined effect is to make the safe operation of the mining property a real challenge to mine management.

These combined conditions are met in the coal mines of the Columbia-Geneva Steel Division of the United States Steel Corporation, located in Southeastern Utah. This coal bed measures up to 16 feet in thickness, the pitch is as much as 25 percent, and mining is being conducted under cover approaching 3,000 feet.

The Sunnyside coal bed is found in the Book Cliff Mountains, a great escarpment extending from west of Castle Gate, Utah, some 180 miles to Grand Junction, Colorado. West of Green River, Utah, the Book Cliffs swing sharply to the north because of the domelike uplift of the San Rafael Swell to the southwest.

It is in this northerly extension of the Book Cliffs in which is found the Sunnyside coal in the Blackhawk formation of the Mesa Verde group, Upper Cretaceous age. The strata is transected by numerous faults, with from a few inches to as much as a hundred feet of displacement. All of these faults have had some effect on the mining operation, either in the form of presenting roof control problems or in the case of major faulting, of dictating the pattern of mine development.

Mining has generally been confined to the Lower Sunnyside Seam which measures from 7 to 16 feet in thickness. The floor of this seam is formed by a massive sandstone member. The immediate roof is a variable thickness of siltstone, laminated sandstone and sandy shale overlain by the Upper Sunnyside Seam. This rock interval between the Upper and Lower Sunnyside Seam ranges from a few inches to many feet. When the rock interval is thin, the 2½ foot upper coal seam may be recovered with the lower seam. The high volatile coal produced is used for the manufacture of coke for blast furnace use.

The mines are opened by slopes off which are driven sets of strike entries, or levels, which are carried to the property boundaries. Coal lying between these sets of entries is recovered from belt conveyor raises driven up the pitch. Retreat is from the property boundary to the main slope and pillars are recovered. Haulage from the belt raises is by track to the slope, then by either belt or rope haulage to the surface.

While at first thought, a seam thickness of up to 16 feet would seem to afford an unparalleled opportunity to achieve high production tonnages, this has not always been true. Above a convenient working height, the natural hazards and increased difficulty of the work functions combine to nullify the advantages that might be expected with high coal.

This is particularly true if the nature of the coal and the weight of the overlying rock result in unstable rib conditions. These high ribs and the high faces present a constant hazard to the men working below. When a bumping condition exists this hazard is intensified. The roof cannot readily be checked and the installation of roof support is a major undertaking.

The standing of a 14- or 16-foot prop is a job requiring the efforts of no less than three men and a well developed technique. Roof bolts can be installed only with special equipment. Face preparation requires special high coal machines equipped with hydraulically controlled drills so that the operator may be removed from the immediate face area. Loading and tamping of holes in this height necessitates working from a ladder or the use of loading troughs.

What at first appears to be a wonderful expression of nature's bounty turns out to be a questionable blessing.

While the hazards encountered during mining of this bed may sometimes be related specifically to the thickness of the seam, the pitch or to the depth of cover, more commonly the unfavorable condition is the result of effects from all of these.

As in most mining operations, the first consideration is given to adequate roof support. The standard bolting plan calls for use of full ¾ inch high strength steel roof bolts with 6 inch square bearing plates anchored in 1½ inch diameter holes with expansion shells. These are installed at

maximum 5 foot centers; however, the local conditions determine spacing and bolt length and the average spacing in the mines approximates 4 feet.

When continuous support is required between bolts, steel mats 9 feet long and minimum of 16 gauge are used with roof bolts. Timbers are used to supplement bolting as required. Poor roof conditions may require the extensive use of timber. However, timber used in conjunction with roof bolts in retreat work are generally used as indicators of roof action or "squealers" and the bolts serve as the principal means of support.

In most areas of the mines this standard roof support system does an excellent job. There are occasional areas where the standard bolting does not suffice and either these areas are reinforced with additional bolting in conjunction with timber or a roof failure is experienced. These roof failures are investigated by a roof control committee to determine the cause and take remedial action when this is indicated.

Probably one of the most prevalent causes of the roof failures experienced has been some hidden geologic phenomenon discernible only after the failure occurs. Investigation frequently discloses cross bedding, fractures, faults, water courses, old stream channels or other features that contribute directly to the failure. Little can be done in these instances except to attempt projection of these features into adjoining areas so that above standard support may be provided.

The thickness of the seam has an indirect effect upon roof control. Although the standard width of development work is 16 feet and that of rooms 19 feet, ultimately when the full seam thickness is being extracted, it is difficult to maintain these spans and silt trim the high ribs of loose coal and slope them back at an angle to afford some protection to the men working below.

The depth of cover has a very definite relationship to the roof control problem. The effect may be direct upon the roof rock, and roof conditions have generally deteriorated as mining depth increased. The effect may also be indirect in the widening of the pillars. That this is severe is evidenced by the fact that, in an area of 14 foot coal, the pillars may be reduced to a

height of 10 feet before final recovery is made.

A characteristic action of heavy cover on the ribs is a crushing or cutting action in the center of the exposed rib. As this extends into the rib and loose coal sloughs away, the result is a V-shaped rib, the point of which may be four or more feet in from the original rib line. In order to stabilize such ribs and also to support the resulting overhang, ribs are frequently bolted. Wooden header blocks may be used with the bolts and wire fencing has also been bolted to the ribs. More commonly the conventional steel mat used for roof support is used, and bolts will be anchored in the coal; or angled holes may be drilled into the roof, and anchorage will be in rock.

This widening of roof span, whether from necessary trimming of ribs or from crushing due to weight, can eventually lead to a roof failure.

The location of the Upper Sunnyside coal bed above the immediate roof rock also poses a constant problem in roof support. Bolts used to support the roof are from four to eight feet in length in six inch increments. If the rock interval to the upper seam is $4\frac{1}{2}$ feet or more, bolts are generally anchored below the upper seam. If the interval is less than $4\frac{1}{2}$ feet, longer bolts are used to anchor in the rock overlying the upper seam. In some instances the upper seam may be of such a thickness and so located that anchorage cannot be made above or below, in which case bolts are anchored in the coal and supplemental timbering installed.

Every effort is expended in providing the best possible roof support and constant attention is given to testing of roof, face and ribs by the production crews. A roof bolt testing program is also followed to insure that bolts are installed to proper torque and that adequate anchorage is being attained.

The effect of the pitch on roof control and any possible effect it might have on the bumping experienced in these mines is largely undetermined. Normal retreat lines are on approximately 45 degrees with the pitch, although comparatively flat lines have been carried down the pitch with favorable recovery and without unusual roof problems. Retreating lines up the pitch as in the case of slope pillar recovery have in

some instances led to unfavorable roof conditions.

However, there is at least one example of this under comparatively light cover, less than 1,000 feet, that worked out very well. There is occasional evidence of lateral movement at the contact of the coal bed with the roof rock and in some instances, where overlying rock is exposed because of roof failures, this lateral movement is evident in the bedding planes of the rock four or five feet above the coal. The resulting thin, slickensided layers are sometimes the horizon to which the roof failure occurs.

Closely allied with the roof control problem is the occurrence of bumps which, depending upon degree of severity, may present a serious hazard. Some minor bumping during the mining operation is actually beneficial, since it makes for easier mining and by speeding up the mining operation reduces exposure in the immediate face area.

However, when bumps assume such major proportions as to affect several pillars or a whole mining district, with the dislodgement of large amounts of rib coal, heaving of the bottom and possible roof failure, all with the possibility of injury to members of the mining crew, they become a problem of paramount importance. Such bumps usually come suddenly, without warning, and consequently without time for evasive action.

Interestingly enough, in many instances there is no major involvement of the roof. The bump results from the sudden collapse of supporting pillars loaded beyond their capacity and usually the major effect is that of displacement of rib coal. Coal from the ribs may completely fill the roadways and rib coal remaining in place may be badly crushed. The top of the remaining pillar may be separated from the roof rock for a distance of several feet back of the original point of contact.

All factors affecting the occurrence of bumps are as yet unknown. However, depth of cover, nature of overlying and underlying rocks, size of supporting pillars and degree of recovery in worked-out areas play major roles.

The effect of the depth of cover assumes added significance in these mines because of the land form assumed by the overlying rocks. The Book Cliffs rise abruptly from the valley below so that there are only minor

areas available with less than 500 feet of cover. The steep walled canyons and side canyons give rapid changes in depth of cover over comparatively short distances in the mine. For example, the depth of cover may change from 1,000 feet to 1,500 feet in a horizontal distance of less than 500 feet, the distance along a district pillar line.

The depth of cover and the character of the overlying rock which includes the massive sandstone layers conducive to bumping cannot be controlled. To some extent, the other factors can be influenced.

The mining plan recognizes the desirability of uniformity in pillar size in order to distribute equally the weight of the overlying rock. The standard 80-foot centers result in uniform pillar size and an effort is made to have a series of such blocks well ahead of the abutment zone of a retreat line. Occasionally the importance of this is pointed out by having a non-uniform sized block adjacent to the retreat line, in which case the bumping may be particularly severe.

It can be seen that the proper engineering of the mining property plays a significant role in its safe operation.

High recovery in pillar work is important to good caving action and results in relief of roof stresses. The premium value of this coking coal makes high recovery essential from an economic standpoint as well. The pillar pocket system of pillar mining permits a high recovery and the final stumps left are normally drilled and shot to induce caving.

Because of the many hazards associated in working adjacent to high ribs and against a high face, a longtime objective has been the removal of the men back as far as possible from the danger area. The use of rubber-tired, universal cutting machines equipped with automatic bug dusters, dual controls, and hydraulically operated coal drills, is an example of how modern equipment can accomplish this object.

The dual boom roof bolting machines are equipped with hydraulically rotated percussion drills. All movements are hydraulically controlled which allow the operators to drill and install roof bolts while standing well back from the face and under previously supported roof.

Most of the hazards of working a thick, pitching seam under heavy cover, that relate directly to roof and rib control, have now been mentioned. In a large measure these have been met through a top bench system of mining.

Prior to the advent of roof bolting it was the common practice to mine under thick top coal which would be recovered as the final step of mining. This served to keep the rib height to a practical limit and the top coal served to support and protect the comparatively weak rock forming the immediate roof. Since roof bolting has now become the standard roof support, much the reverse of this is now the standard practice in the top bench system of mining. All development headings, rooms and the initial splits in pillars are driven at a height of 9 feet against the rock roof which is supported with roof bolts and the balance of coal is left as bottom coal.

In the bench system of mining the upper portion of the seam is mined on advance, and the lower portion of the seam is recovered on retreat.

This 9-foot working height materially affects the efficiency of the various mining operations and has a pronounced effect upon the safety of the operation through ease of roof inspection and control, reduced hazards from high, unstable ribs and face, and increased efficiency of the ventilation structures. Full seam mining is done only in the last stages of pillar recovery.

The first pillar split and the first mining of the inby tender of the split are done as top bench mining. A ramp is then made into the bottom coal under the first split; the inby stumps and the outby tender are then recovered at full seam height. Most of this final recovery at full seam height may be made under roof support installed during the top bench phase.

To some degree, the trend to continuous miners has led logically to the top bench system of mining, because of the height limitations of this type of equipment. Driving against the rock roof with the installation of support being made at a convenient height is preferable to driving under top coal which necessitates later top coal recovery with conventional equipment and installation of final roof support at full seam height.

The top bench system is not without certain problems, one of which is maintaining satisfactory roadways on top of the bottom coal. Usually this is not a major problem, although continuous miners weighing over 30 tons tram over it. Occasionally, however, there are local areas where the bottom coal breaks out and roadways must be rebuilt. Many times these areas relate to faulting where the coal shows some alteration. The usual remedy is filling, in an attempt to maintain the bench height. Sometimes it is necessary to load out the bottom coal, but only as a last resort since it results in the high ribs that are so objectionable.

It is felt that adapting this top bench mining system as a solution to many of the problems relating to the mining of thick, pitching seams under heavy cover has resulted directly in providing safer working conditions. This is borne out by the continuing downward trend of injuries resulting from falls of roof, face or ribs.

The shotfirer is the man most closely exposed to high face conditions, however, his job, too, has become safer through the use of milli-second delay blasting which cuts his exposure in the face area by eliminating the necessity of returning to the face between shots as was previously required. The top bench mining system has also limited the height of the face and, of course, the use of continuous miners very nearly eliminates the need for any shooting.

The problem of protecting workmen from the hazards of roof falls and from unstable rib conditions, particularly coal dislodged by bumping, has been met in one way by providing protective cages for the operators. The value of these cages has been proven conclusively over the past few years and many disabling injuries have been prevented. Use of these cages has until recently been limited to the continuous miners and all types of miners, boring, ripping and milling have been so equipped.

A similar cage was recently installed on an 11-BU type loading machine. In no case do miners advance ahead of supported roof so the cage serves its principal function as protection against falling rib coal. Occasionally there have been instances where it has proven, spectacularly, its value in protecting against roof falls as well.

While it is not intended that these cages

replace proper testing and trimming procedures, they do serve a valuable and proven role in injury prevention.

The most obvious effect of the steep pitch in these operations is that of the service imposed on the use of the mining equipment. Most of this equipment was designed for use on cooperatively minor grades. Traction power and braking capacity are severely taxed by the steep grades encountered in these mines. The mining plan has been developed to keep up-pitch movement of coal to the minimum but obviously there are instances when this must be done.

In slope development, and in development of the lower entry of a set of strike entries, the shuttle cars must travel loaded up the pitch of the seam. Bringing loaded shuttle cars and other mining equipment down these steep grades also poses a serious problem. A failure of the brake system, or inadequate capacity, or failure in the steering system, could have disastrous results. Maintenance problems, involved in keeping equipment in shape for safe operation under these conditions, have been monumental.

In some instances major redesign and rebuilding of brake systems and increasing traction power has been necessary. Even with the brake system in top condition, if the wheels of a shuttle car are completely stopped from rotating, the unit may continue to slide down pitch for some distance in much the same manner as an automobile sliding down a steep, icy hill. It is common practice to weld cleats on crawler mounted equipment to provide additional traction. Wear on tires is limited so as to always have a good tread remaining.

Haulage problems resulting from the pitch exist away from the face area as well. While motor roads are driven on the strike, local rolls or the necessity of grading through faults preclude the uniformity graded haulage roads that are desired. Large locomotives with mechanical and dynamic braking are provided and, when necessary, sand shoes are used to control the trip. Use of a brake car is now being considered with some of these haulages. Electrically controlled derails are used on motor haulages and rope slopes to provide protection in case of a runaway. Trolley phones are standard equipment on main haulages to con-

trol trip movement. Men working in slope development are protected from rope failure on the slope above by a combination of derails, track blocks and car drags.

Adequate mine ventilation is a necessity in any operation. At these two mines a total of four fans are exhausting 900,000 cubic feet of air per minute. Installation and maintenance of curtains and line brattice in full seam height is a real problem and here, too, the top bench system of mining has been a distinct advantage.

The pitch has a decided effect upon the ventilation of the mine. The warning air flow has a natural tendency to move up the pitch and when possible this is considered when laying out the district ventilators. Rarely, hydrogen sulphide gas is encountered and when this occurs in a downhill place movement of the heavy gas is difficult.

Currently all new belt conveyor installations are being made in multiple entry raises with the belt isolated from the district ventilation. This would be a distinct advantage in case of fire.

Avoid from the hazards that relate directly to the unusual conditions encountered in these mines, there are those commonly found in any mining operation and the safety program takes proper recognition of these.

Experience has pointed out the hazards associated with operating belt conveyors, and these installations are subject to a complete guarding program; a well developed control system is in use which incorporates audible and visual warning before movement of the belt is made.

The mine electrical system has certain inherent safety hazards, and overload protection is provided throughout. All electrical circuits, AC and DC, are provided with means of lock-out protection while maintenance is being done. Lock-out is also

provided on trailing cables and mining equipment.

The safety program at this location follows in general principles a basic program established in all facilities of the United States Steel Corporation. It is implemented by direction from the Columbia-Geneva Steel Division, and locally, the problems peculiar to coal mining are incorporated into the basic program by the Mine Inspection Department.

In a large measure the safety program is dependent upon almost constant employee contact to develop the safety awareness necessary to prevent mine injuries. This is brought about through weekly safety meetings scheduled in each mining district and held on company time and also through an individual contact program. Records of all contacts are made to insure that all men are receiving the proper number of contacts and variety through the safety program.

The physical condition of the operation is subject to routine inspection by the Mine Inspection Department, by the general superintendent's safety committee, and by division inspection and audit committees.

Surely the effectiveness of the safety program is ultimately measured in the results attained. The goal at these mines is the same as that of all segments of United States Steel Corporation, frequency zero. It was with great pride that Columbia Mine attained this goal in 1960, and in so doing, won the Sentinel's 101 Safety trophy in the Bituminous Coal group.

While past accomplishments may be reviewed with pride, the ever present hazards associated with mining thick, inclined coal beds under heavy cover are fully recognized by all those associated with this operation. All possible effort will continue to be directed to meeting these hazards with a forward looking safety program and continuing the safe operation of these mines.

DUST STUDY PROGRAM, PENNSYLVANIA DEPARTMENT OF MINES AND MINERAL INDUSTRIES

By W. ROY CUNNINGHAM
Deputy Secretary

At the time of this presentation, our active participation in this program is one year old. While we are too new at this work to offer definite conclusions, we are hopeful that through this discussion we will be able to give you some helpful information.

We in Pennsylvania, as well as you from other coal-producing states, have long been concerned with the explosion hazard of bituminous coal dust. Through intelligent research we have learned how to guard against coal dust explosions. The same consideration has not been given health hazards from coal dust in all areas. This could be due to the fact that medical authorities are not in unanimous agreement that the breathing of bituminous coal dust is harmful. Be that as it may, the growing lists of those suffering from silicosis among our bituminous coal mining people are reason enough for those of us having to do with the health and safety of persons employed in our mines to study the problem and attempt to offer corrective solutions.

There have been limited studies made in the bituminous area of Pennsylvania by various agencies and some by individual companies, but it has not been done on a large enough scale to be sufficiently valuable to health authorities in enabling them to evaluate the harmful effects of breathing such dust. In the anthracite area, more concentrated studies of coal dust conditions have been made. It is recognized that the breathing of quantities of anthracite coal dust is harmful, but even in this area, these studies were not comprehensive enough to offer any definite conclusions.

In the bituminous area, we do know that various processes of mining aggravate and increase the silica content of the suspended dust. Medical authorities are in unanimous agreement that silica dust is harmful when breathed over an extended period.

In 1933 the Governor of Pennsylvania requested the United States Public Health Service to make a study of certain phases

of the people associated with occupational disease possibilities in the anthracite region of Pennsylvania. It was hoped that such a study would offer some criterion that would enable the establishment of safe limits of dust concentration. This study was made and a report submitted to the Governor of the Commonwealth. Among other conclusions, the report contained the following:

"Analysis of the data for the purpose of determining safe limits of dust exposure indicated that employment in an atmosphere containing less than 50 million dust particles per cubic foot would produce a negligible sum of cases of anthracite-silicosis when the quartz contents of the dust was less than 3 per cent. In the gangways where the silica content of the dust was about 13 per cent, a safe limit appeared to be 10 to 15 million particles per cubic foot. The limit of toleration for rock workers was set tentatively at 3 to 10 million dust particles per cubic foot of air."

The above listed allowable limits apparently were the basis for threshold limit values adopted by the American Conference of Governmental Industrial Hygienists. These threshold limit values were first adopted about 25 years ago and were reaffirmed at the meeting of this organization in New York, April 23 to 26, 1960. They are as follows:

1. Below 5 per cent free silica, 50 MPPCF*.
2. From 5 to 10 per cent free silica, 20 MPPCF*.
3. Above 10 per cent free silica, 5 MPPCF*.

*Million particles per cubic foot.

I have not had the opportunity to become fully acquainted with occupational disease laws of the various coal mining states. That part of Pennsylvania's occupational disease law pertaining to lung disorders is contained in Pamphlet Law 520, Act of June 21, 1939, as amended in 1957:

"The employer liable for the compensation provided by this article shall be the employer in whose employment the employee was last exposed to the hazard of the occupational disease claimed regardless of the length of time of such last exposure, provided that when a claimant alleges that disability or death was due to silicosis, anthracite-silicosis, asbestosis, or any other occupational disease which developed to the point of disablement only after an exposure of 5 or more years, the only employer liable shall be the last employer in whose employment the employee was last exposed to the hazard of such occupational disease during a period of six months or more and providing further that in those cases where disability or death is not conclusively proven to be the result of such last exposure, all compensation shall be paid by the Commonwealth."

A greater part of the bill for occupational disease falls on the taxpayers of Pennsylvania. This is due to the fact that because of the very economic conditions of the coal industry, miners are forced to change employment from one mine to the other frequently. During the last biennium ending June 1, 1961, the total occupational disease bill to the taxpayers of Pennsylvania was upwards of \$27 million. Approximately 90 per cent of this was paid to miners for lung disorders. In my opinion, the authors of our present legislation are to be commended for their humane effort in alleviating suffering and financial distress among our mining people because of health disorders that originated during their work in various mines. My purpose in describing a part of our law is to point this out to further explain why the Pennsylvania Department of Health and the Department of Mines and Mineral Industries started and will continue this study. You can readily understand that a compensation bill to the state of this magnitude excited public opinion to the point that the reasons therefor were demanded.

Some years ago the Pennsylvania Department of Health started a study wherein chest X-rays were taken of individuals working in our mines both in the anthracite and bituminous regions. This X-ray study is continuing and will continue throughout both areas of Pennsylvania. Because of the Department of Health's findings through their study of the various X-rays, they felt that

they would be in a better position to offer intelligent solutions to this problem if they could likewise study the dust conditions in our mines. An Attorney General's decision gave the Department of Health personnel the right of entry into the mines for the purpose of making this dust study.

The Department of Health personnel were most proficient in dust sampling techniques. However, they were not familiar with the various mining practices in the anthracite and bituminous divisions. The Secretary of the Department of Health at that time realized that his people would need assistance from trained mining personnel, and requested the Secretary of Mines and Mineral Industries to have a mine inspector accompany the survey team and be responsible for their safe conduct during the study. In Pennsylvania as in other states, mine inspectors are charged with certain mandated duties. One provision of our mine law requires mine inspections at regular intervals. Time taken from legally required duties for the purpose of conducting dust study survey teams into the mines necessarily interrupted regular mine inspections.

Our department felt that the mine inspectors could not continue this additional work and still comply with the mine inspection laws. A meeting was arranged and attended by representatives from mine management, United Mine Workers of America, the Secretary of the Department of Health, and the Secretary of the Department of Mines and Mineral Industries. At this meeting coal operators justly objected to having personnel unfamiliar with coal mines unaccompanied by representatives of some state agency who would be responsible for their safety. They felt that the Department of Mines and Mineral Industries should be charged with taking dust samples underground in the coal mines.

The Secretary of the Department of Health and the Secretary of the Department of Mines and Mineral Industries were both cognizant of the fact that to be of any value, a dust study would have to be a continuing function of one of the departments. Spot checks had been made in the past, and they were of little value. We are fully aware that the data being collected by our people during this continuing study must be made on a division-wide basis. Anything less than this would be of no more value

than those spot studies taken previously at infrequent intervals.

Secretary Lewis E. Evans of the Department of Mines stated at a later meeting, comprised of the same representatives who attended the original meeting, that it was his intention to employ first-grade mine foremen as dust study personnel both in the anthracite and bituminous divisions. Following this meeting, four first-grade mine foremen were employed—two assigned to the anthracite division and two to the bituminous division.

A comprehensive six-weeks training period was arranged to familiarize our dust study personnel with various techniques of sampling and analyzing coal dust. Following this training period, we equipped two complete laboratories—one in each division. Presently, dust counts are made with a microprojector. Some work has been done on direct counting, and our personnel are familiar with both methods. Qualitative samples are collected by our people and the determinations are made by the Department of Health. The laboratories are not presently equipped to make qualitative analyses.

At the end of the training period, Secretary Evans met with the dust study personnel from both the anthracite and bituminous divisions. He outlined a tentative procedure and described his expectations. Briefly, his instructions were:

1. He emphasized that dust study personnel must be concerned only with the work for which they were employed. This department had reports that on some occasions, personnel making similar studies had exceeded their authority and reported situations about which they had no knowledge or jurisdiction.

2. He insisted that before entering the mine, our personnel should have a thorough understanding of the property, thus enabling them to conduct a study that would be representative of the dust in suspension throughout the mine.

3. He suggested that periodically, procedures were to be discussed with representatives of the Department of Health and with mine management.

4. Our people were advised that the purpose of this study was to enable the Department of Health to evaluate the effects of dust on the lungs of our mining people,

and that any piece-meal publication of the report, could have undesired effect. Therefore, it had been agreed by all parties to this study that one copy of the report would be furnished to the Washington office of the United Mine Workers of America, the operator of the sampled mine, the Secretary of the Department of Health, and one copy was to be retained in the Department of Mines and Mineral Industries.

Before our entry into the first mine, three of the major companies operating in the bituminous area expressed the desire to conduct studies simultaneously with our personnel in their mines. We welcomed this idea and felt that in time other coal companies in Pennsylvania will express the same interest and conduct studies of their own.

At the time this was written, we had completed surveys in at least one mine of each of the companies who were making simultaneous studies. We then met with the coal company industrial hygienists from these companies and outlined our procedure. We invited their criticism, and I am happy to report that in the main, they were most complimentary. It was felt by all concerned that periodic meetings of this type would prove most beneficial in arriving at a standard procedure that would be indicative of the intended purpose.

Insofar as is possible, we have adopted similar procedures both for the anthracite and bituminous divisions. It might prove interesting and helpful to this group to outline this procedure:

1. The Deputy Secretary of Mines and Mineral Industries of the pertinent division makes arrangements with mine management to conduct a dust study in a specific mine.

2. The dust study personnel meet the state mine inspector at the mine for the purpose of becoming acquainted with local mine management. At this meeting, the mine inspector goes over the mine map and gives a description of the methods of mining being practiced. It is only for this one-day meeting that our state mine inspectors are delayed in their regular duties. They can, of course, as time permits, accompany our dust study personnel on at least a part of the survey.

3. No attempt is made to study every working place in the mine. During the orientation discussion, our dust study per-

sonnel ascertain the number of ventilation splits, the percentage of retreat mining compared to first mining, and a general description of the haulages over which men are transported. This orientation period has proven most helpful in making plans for the actual survey.

4. Determinations are made of each of the various classifications and in proportion to the number of such classifications in each mine. For example, if there are twenty continuous mining machines operating in a mine, we make an effort to take dust counts and samples at at least half of them. Likewise, the same procedure is followed for each of the various job classifications.

5. Daily samples are correlated into average time weighted exposures. For example, if a continuous mining operator is to be sampled on a certain day, the operator is met at the lamphouse by at least one of our dust study people. The sampling period starts on the incoming mantrip. Originally, we took 10-minute samples, but we learned that sampled periods of such short duration were not necessarily representative of each individual operation. Now, samples are extended over a one-hour period and at least 30 minutes of that hour represents the sampling time. This is done by sampling for 10 minutes and delaying for 10 minutes throughout the hour. By doing this, we feel that the entire day during high dust and low dust concentrations, periods can best be described.

6. With each time weighted exposure, a dry dust sample is taken. We have tried various devices for collecting dust from the atmosphere without success. Presently, we are collecting adhering dust from ribs and/or timbers. Along haulages, dust traps are installed so that this dust can be collected over an entire shift period.

The quantitative samples are collected in alcohol using a midge impinger. The Department of Health feels that counts should be taken within 24 hours. Some of the coal company-employed hygienists do not agree that this is necessary. However, since this information is sent to the Department of Health, we comply with their directions. The qualitative samples are collected and sent to the Department of Health for analysis. With each time weighted exposure, there is also listed a silica determination of the dust collected during the operation.

In our years of operation, we have sampled

five mines. To be of any value, there are not shortcuts to be taken in making a dust survey. Our dust study people are fully familiar with mining and mining operations. It is not necessary for mine management to assign personnel to accompany them into the mine. They stay with the individual classification being sampled on each particular shift and need not be taken into or brought from the mine during the shift. At the completion of a dust survey, reports are prepared and sent only to the interested representatives of each agency and mine management of the sampled mine. Since it was originally agreed that these reports would contain all information pertinent to the survey, they are quite voluminous and are composed of the following:

1. Letters of transmission.

2. A synopsis description of the mine. This description includes the number of persons employed, methods of ventilation, methods of alloying dust, transportation, and conclusions. If, during our dust study, we find that dust concentrations are beyond the allowable threshold limits for an entire average time weighted exposure, this information is given to our district mine inspector for his action. I am happy to report that in the mine study thus far, there has been little necessity for this procedure.

3. Location of qualitative dust sampling points.

4. Qualitative analysis results.

5. A description of the impinger samples taken and the determination of the dust count.

6. Dust size determination from 0 to 10.1 microns.

7. Copies of the various forms used in making this study are attached for your information.

The Department of Health is only interested in dust sizes from 0 to 5 microns. However, some of the coal companies continue these size determinations to 10 microns, and we for the present are doing likewise.

We are too new at this work to offer any definite conclusions. We have learned that ventilation alone is not sufficient for alloying micron-size dust. Likewise, spray systems alone will not sufficiently alloy dust particles of this size. We do feel that we have learned conclusively that a healthful atmosphere at working faces, particularly

where mechanical mining is being practiced, is dependent upon an efficient combination of both ventilation and water sprays.

In roof bolting operations, we have been able to determine the efficiency of certain dust collectors. I would like to say at this point that some of these collectors are most efficient. It is this dust containing from 35 per cent to 65 per cent silica, depending upon the nature of the material drilled, that is most harmful.

As this program continues, I am certain that we will be able to offer more conclusive and valuable information to groups of

this kind. I feel that I have had an invaluable experience in being permitted to initiate this program in the bituminous division of Pennsylvania. Secretary Evans has emphasized on many occasions that health is a function of our department, and if through this program we can prevent one case of silicosis, anthracosis, or pneumoconiosis, the program will be well worthwhile.

I am certain that this is not only Pennsylvania's problem, but a problem in all mining states throughout this nation. It is well deserving of our best efforts and consideration.

SAFE PRACTICES IN STRIP MINING

By EUGENE E. QUENON

Director of Safety, Peabody Coal Co., St. Louis, Mo.

Injury records at strip mines, compiled on a tonnage basis, have always been enviable when compared with deep mines, and one is likely to take for granted that serious hazards seldom exist in strip mines.

Shortly after being employed by Peabody Coal Co., I had a very rude awakening to the fact that hazards in the strip mines were numerous—and that many of these hazards were serious and decidedly dangerous.

While many hazards exist in strip mines under normal mining conditions, some of these same dangers become much more serious under adverse weather conditions, and cannot be entirely eliminated without the assistance of improved weather. Peabody Coal Company's injury records definitely indicate that adverse weather has a direct bearing on the increase in frequency and severity rates of accidents at our strip mine operations.

The following example will serve to point out the effect of severe weather changes on the operation and maintenance of our strip mines. Late last Fall, a round of inspections was made at our strip operations. The weather was ideal, and conditions of the pits, haulage roads, equipment, shops and cleaning plants, as well as newly painted buildings and well-kept lawns and yards, all seemed to coincide with the wonderful weather.

Working conditions such as were observed during this inspection, along with the attitude of employees toward adhering to safety practices, gave me a confident feeling that real progress was being made toward an over-all improvement in safe working conditions which would ultimately result in a much lower frequency and severity rate.

A prolonged cold spell of several weeks' duration followed these inspections. During this time, the surface had frozen to a depth of 15 inches; and when thawing started, the pleasant surroundings observed a few weeks earlier at many of our mines had, indeed, changed to such an extent that conditions throughout the operation seemed to invite accidents. The hardships caused by muddy terrain not only created new hazards, but were indirectly responsible for several equipment breakdowns. The overall adverse weather conditions actually appeared to discourage both workers and supervisors from following adopted safety practices that were normally in effect.

Other than the main haulage roads and uncovered coal at these mines, the surroundings were a mass of mud that definitely retarded the entire mining operation and created new hazards. Highwalls and spoil banks now presented a definite danger from falling or rolling material; handling power cables in the mud was much more

dangerous; walking and working under such conditions caused fatigue, resulting in a lack of alertness. A majority of strip mine officials, who were consulted regarding the greatest hazards involved in strip mining, stated that unusual weather conditions—such as heavy rains, extremely low or high temperatures, thawing of the surface following long periods of freezing, and extremely dry weather—were all conducive to accidents.

Frequently, a heavy rain will completely flood a pit, necessitating the setting of pumps, moving equipment to higher ground, causing slides along the spoil banks and unstable highwalls. Until conditions return to normal, employees are exposed to abnormal hazards.

Zero temperatures in the open pits retard the operation and tend to increase the frequency of accidents. One of the superintendents explained his reasons why an employee is subject to injury during low temperature: "His ears are covered up—he can't hear. He sometimes has his face covered up to where he can hardly see. He is so cold that he's numb, and has but one thought in mind—get the job done and get thawed out." The superintendent might have exaggerated a little, but from observations, I don't think he is too far wrong.

It was also the consensus of opinion that more breakdowns occurred in periods of extreme weather conditions. Temperature changes caused expansion and contraction of metals—in cold weather metal becomes brittle and lubrication becomes less effective—plus the fact that equipment working in mud and water is subject to overloading. Our experience in the past four and a half years proves that a large percentage of serious injuries resulted from employees doing repair work in the open pits during periods of inclement weather. Such injuries are partially due to weather and also due to the fact that the men are required to perform different types of work from their normal routine. Lack of experience makes any task more dangerous, and repair jobs always require haste, which is also unsafe.

The seriousness of safety problems involved in a modern preparation plant depends to a great extent on the construction, maintenance and operation of the plant. In recent years, Peabody Coal Co. has constructed several modern preparation plants,

building into them certain features that will enable management to operate them safely and efficiently.

While these types of cleaning plants are built to include the most modern equipment for maximum safety and efficiency, these modern devices will only help to eliminate accidents. Constant supervision is necessary to make certain that personnel think and work safely at all times.

An employee is less likely to be injured when he has been trained in his routine work and when the plant is being operated under normal conditions.

Since the cleaning plant at River Queen Mine is of modern construction and similar to those at other Peabody operations, it will serve as an example to describe, briefly, the importance of building the plant with certain features to increase efficiency and eliminate hazards.

The River Queen preparation plant is of fireproof construction throughout; all electrical wiring is in closed conduit; motors for driving the various pieces of equipment are moisture-proof. The equipment is arranged to provide adequate room for safe maintenance and repair work. The moving parts of equipment are adequately guarded. Stairways and cross-overs are installed at convenient locations and are guarded with toe boards and hand rails. Floors, stairways and cross-overs are, in most instances, constructed with metal grills, thus eliminating accumulations of coal and dust. A series of water jets, spaced about 30 inches apart, are installed on the ground floor for cleaning purposes.

The plant is adequately lighted throughout by windows and incandescent lights, and provisions are available for heating in cold weather. The entire plant can be cleaned with water, without damage to equipment. Switchboards and control panels are provided with rubber mats, and the equipment is controlled by a series of pushbuttons from a central location. A railroad car spotter, controlled by pushbuttons, eliminates the hazards of having workers exposed, as when conventional methods—such as dropping railroad cars by gravity—are employed.

The most hazardous period in the preparation plant is believed to be while repairs are being made to equipment following a breakdown—usually, because those doing the

repair work are in a hurry to get the plant back in operation and do not take time to do the job in the safest possible manner; and, again, are required to perform tasks which are not familiar to them.

Trailer trucks, with capacities as high as 95 tons, are used for transporting coal from the pits to the preparation plant. The safe and efficient operation of a transportation system at a strip mine depends almost entirely on a competent driver. The safe condition of the truck, maintenance of haulageways, and obedience to rules and regulations governing the movement of trucks, are contributing factors to the safety and efficiency obtained.

You can best appreciate the responsibility of the operator of a trailer truck if you take a trip with him to the pit. Under ideal weather conditions, there would be nothing unusual about the trip, except perhaps the driver may complain about a few rough spots on the road or occasional dusty conditions.

Take a similar ride in the same truck with the same driver following a heavy rain, or after the ground has thawed after freezing weather. On this trip, you will really learn about the hardships encountered in strip mines due to adverse weather conditions, not only by the truck operator but by everyone who works in or around the pit. The secondary haulageways, which were in A-1 condition prior to the change in weather, are now covered with two or three inches of soft material. The inclines into and out of the pits, which are only temporary haulage roads, are now slick and muddy. In some instances, the trucks are pushed into and out of the pits by bulldozers.

Traffic regulations governing the movement of vehicles are, in most instances, strictly followed by the truck operators. The crossing of railroads and public roads is done with great concern. Officials and other key employees, who are required to travel by automobile over the same routes as the coal trucks, offer no serious problem; as they are familiar with the hazards involved and will give the right-of-way to the coal hauling equipment.

Visitors, not familiar with the operation of traffic in the strip pits, should observe the posted signs reading "No Trespassing." And when it is necessary to enter the pits, they should be accompanied by a person

fully familiar with the transportation system at the mine and the regulations in force.

Overburden, ranging in thickness from 20 to 120 feet, in most instances must be drilled and blasted. Whether holes are drilled vertically or horizontally, much consideration must be given to the safety aspects as well as to the effectiveness and practicability of the adopted method. Without taking the practical viewpoint into consideration, drilling holes vertically from the highwall would appear to favor the safety aspect, since the drilling crew would not be exposed to the hazards of falling or rolling materials from the highwall; and the explosives, drilling equipment and power cables would be out of the pit and separated from the normal pit activities.

Whether the overburden is drilled vertically or horizontally will be governed, to a certain extent, by the character of the various formations that make up the materials to be blasted, and the surrounding conditions. Irregular surface, unconsolidated top material, and heavily wooded areas make vertically drilling, in some instances, inefficient and hazardous as well as impracticable.

The overall improvement in the heavy equipment employed in both horizontal and vertical drilling has not only added to the efficiency of drilling but has eliminated many of the hazards common to conventional drilling. These larger drills are operated from an enclosed cab, thus protecting the driller from exposure to inclement weather, as well as other hazards to which drillers are exposed when working in the open.

One of the most important advancements in recent years toward the improvement of safety in strip mines has been the adoption and use of commercial grades of ammonium nitrate as an explosive for blasting heavy overburden. The increased use of ammonium nitrate explosives since 1955 has been a major safety factor in the way of eliminating the hazards inherent in the transportation, handling, storage and use of explosives containing nitro-glycerines. The use of a safe primer, detonated with primacord for ammonium nitrate explosives, is also a big safety improvement when compared with methods employed in the past.

Ripper attachments mounted behind a heavy-duty crawler tractor are used in several of our strip mine pits to break up the coal beds prior to loading. Eliminating the

necessity for blasting coal also does away with the hazards caused by use of conventional-type explosives.

Although many dangers have been eliminated with the use of explosives containing non-nitro-glycerines, the same precautions employed in the transportation, handling, storage and use of dynamites are the recommended practice at our mines. At all Peabody strip mines where it is necessary to blast overburden, ammonium nitrate explosives are used. However, some of the strip mines continue to use dynamites for blasting coal beds where rippers are not in use.

Peabody Coal Co. has in service several machines that are used for loading and tamping horizontal holes. These machines reduce the hazard of having three or four workmen charging and tamping a single hole. Vertical holes are usually charged immediately after drilling, and fired between shifts, or as soon after the holes are charged as is practical. Before overburden shots are detonated, the area surrounding highwall and pits is inspected to ascertain that everybody is well in the clear. The operators of shovels or draglines give a warning whistle when a blast is to be fired. A second signal is given after everyone has had time to get in the clear. The charge of explosives is fired immediately after the second warning signal.

Falling or rolling materials from the highwalls can become extremely hazardous unless the cut is properly blasted and the loose material is removed during the time of stripping operations. Overburden composed entirely of sand and clay, and saturated with water, creates a difficult problem in stacking and presents a serious hazard to workers in the pit. Materials made up of such a composition have been known to flow across the open pit with such rapidity as to cover up persons working around the equipment.

Constant supervision is necessary to make certain that explosives, regardless of the type, are transported, handled and used in a safe and careful manner. When this is done, we can then reap the full benefit of the safety built into explosives.

Electricity, ranging in voltage from 110 to 6900 A.C., presents a serious shock and electrical burn hazard to the majority of employees at a mine. The hazards from

shock and burn are much more serious when the surrounding conditions are wet, following heavy precipitation. Proper maintenance and careful installation of electrical equipment at a strip mine are very essential to the prevention of injuries. The use of insulated cable hooks and the wearing of insulated shoes and gloves will minimize the ever-present dangers from electricity at the strip mines.

Employees are instructed to call the mine electrician when any electrical equipment is in need of repair or when connecting or disconnecting power conductors.

Erecting, dismantling, moving or repairing heavy stripping equipment is an everyday procedure with Peabody Coal Co.'s organization. This type of work is extremely hazardous, especially during inclement weather, and has resulted in several serious injuries in the past. Fortunately, supervisors assigned to this type of work are thoroughly skilled in their art and, from their past experience and knowledge of hazards, our injuries are reduced to a minimum.

General repair work on all types of equipment at the various mines is done daily, and those assigned to such work are highly trained through many years of experience. Capable supervisors, who supervise the repair work, are employed at each strip mine to make certain that the job is completed in the safest possible manner.

Federal and State mine inspectors have been of much help in the elimination of substandard safety conditions in and around our pits, shops and cleaning plants, and few violations of the state laws and Federal Mine Safety Code are reported by these agencies which are not corrected during the inspection. These agencies have, in most instances, done an outstanding job in helping to bring about better cooperation between employee and employer in the interest of safety and accident prevention.

Progress will continue in the reduction of injuries and fatalities at our strip mines through the improvement of equipment and the continued efforts of all employees to fully cooperate in the interest of preventing accidents. Elimination of substandard safety conditions in our strip pits is very close to a reality. Therefore, our future safety problem is to encourage all employees to work safely, at all times, and to take no unnecessary chances.

EXPERIENCE IN FIGHTING MINE FIRES WITH FOAM FIRE-FIGHTING APPARATUS

By WILL B. JAMISON
Safety Development Corp., Greensburg, Pa.

High expansion foam is an effective and proved tool for the control of mine fires. It has been proved by its actual and successful use at the Montour 4 mine of the Pittsburgh Coal Co. and at the mine of the Marquette Cement Manufacturing Co. at Oglesby, Ill. The effectiveness of high expansion foam on class A and B fires has been shown by extensive testing at the laboratory of the Factory Mutual Research Corp., at the testing facilities of Safety Development Corp., and at numerous demonstrations and tests held at state and municipal fire school training areas.

As with any new technique, high expansion foam is still under development. Recently, improvements have been tested which permit quicker erection of foam generating equipment. Other improvements are the development of new methods of creating an effective movement of foam into a dead end place. Perhaps one of the most significant improvements is the discovery of a new foam concentrate which overcomes the substantial limitations of the older foaming agents.

Credit for the concept of high expansion foam belongs to the Safety in Mines Research Establishment, Buxton, England.^{1,2,3,4} This group showed that a light detergent foam, developed by erecting a net across the mine entry, wetting the net with a detergent solution sprayed from a hand-held nozzle, and directing the air current from the mine ventilation system through the wetted net, would create a mass of bubbles which could control and extinguish a fire of timber and rubber belting. Foam "plugs" 600 feet in length were developed in roadways of some 60 square feet cross-section area.

Since the original British announcement, their work has been devoted to study of the chemistry of high expansion foam, to improvement of the hand-held nozzle, and to study of the flow characteristics of high expansion foam within the limitations imposed by their methods of foam generation.

The first British report came to the attention of Mr. C. R. Nailer, then president of the Christopher Coal Co., who arranged to run tests on this foam at one of his company's mines. These tests showed that the British method required considerable set-up time and that the normal air pressure available in an American mine was insufficient to develop a foam plug much over 200 feet in length. At the request of Mr. Nailer, the USBM undertook to study the method; as this agency was equipped, at its experimental mine, to simulate underground mine fires.

The Bureau worked on high expansion foam for some years making substantial contributions to it. The Bureau found that the foam developed by the British was effective against a wood fire but was not effective against a coal fire which has become very hot and deep seated. The Bureau undertook to study foaming agents and found one which provided a foam wet enough to be effective on coal fires. After repeated tests, the Bureau was able to suggest a minimum water content of the foam necessary to make the foam effective on a coal fire.^{5,6}

At the end of two years of fruitful work, the Bureau started to publicize the results. With the exception of some efforts on techniques for fighting mining machine fires, the Bureau seems to have completed its work on high expansion foam.⁷

Upon the completion of the major portion of the work of the Bureau, it was apparent that there was a need for further study and improvement of the method, for well-designed and effective equipment to make high expansion foam, and for the application engineering and instruction necessary to make the system a useful tool to the mining industry. With these purposes in mind, we formed Safety Development Corp.

The work of Safety Development Corp. which is of greatest interest to mining men, concerns the successful use of high ex-

pansion foam on mine fires. Equally interesting should be the various developments of the USBM and ourselves on the problem of fighting fire in a dead end place. Of less specific interest is the extensive program carried out by Safety Development Corp. of testing high expansion foam on fires of various types and, finally, certain new developments should be mentioned.

Perhaps best understanding of high expansion foam is promoted by discussing first the foam itself, how it is made and what it can and can't do; then recounting its use on actual mine fires; and, finally, the work on fires in dead ends and new developments.

How High Expansion Foam is Made

High expansion foam is made by spraying a special fabric net with a solution of water containing a foaming agent and, simultaneously, by blowing air through the net. How well these steps are carried out will determine the effectiveness and efficiency of any equipment designed to make high expansion foam.

The British used a cotton-fabric net having a relatively open weave. We decided against cotton fabric because it is vulnerable to mildew attack. The British used the open weave to conserve the limited available ventilation pressure. By providing fans able to furnish the required volume of air at substantial pressure, we are able to use a closer weave net which makes more uniform foam. Thus our fabric is a very heavy nylon, with relatively small holes, which is mechanically strong, mildew resistant, and less flammable than cotton.

This fabric and its arrangement in the net frame, coupled with careful attention to uniformity of liquid and air distribution, have permitted a rate of generation twice that successfully attained by the USBM, reduced liquid loss to about two per cent compared to 10 to 25 per cent, and achieved an amazing uniformity of bubble size. These are the important details which make for efficiency in performance of the foam generator.

Size of the equipment is a most important factor also. If too large, it may not be easily transportable or it may not be possible to keep it supplied continuously with water or foam concentrate. If too small, it may not do the job. We believe that

conservative judgment must be used in considering the results obtained during testing under controlled conditions.

At actual fires and in actual mines, our experience shows that the foam can travel many paths and often only a percentage of the foam generated will reach the location of a fire. A unit which is proportioned to a test fire may be too small and therefore ineffective.

The rate of foam generated also can affect the water content of the foam when it reaches a fire. Numerous tests have shown that the loss of water from a foam is negligible if the rate of movement of the foam is in the order of 10 to 20 feet per minute. If the foam moves too slowly, rapid drainage will take place, possibly rendering the foam ineffective. Since the foam often can take many paths, the rate of generation should be high enough to give this minimum velocity in all paths to avoid excessive draining.

The very important and general problem of foam chemistry will be discussed later in this paper.

The expansion ratio of foam is the ratio of the volume of foam to the volume of the liquid within the foam. In high expansion foam, this ratio can be varied from a low of about 50 to 1 to a high in the order of 1500 to 1. The low ratios may have some special uses in other fields but are too heavy for mining applications. The high ratios tend to be less stable.

We have found that a ratio in the order of 1000 to 1 is an excellent compromise of a foam wet enough to have very good extinguishing properties but still light enough to be driven long distances horizontally or to be forced up a shaft or raise. The foam used in fighting the mine fires, and in the various tests to which we have subjected high expansion foam, has had an expansion ratio of about 1000 to 1.

How High Expansion Foam Controls a Fire

When a foam having a ratio of 1000 to 1 is driven on to a fire, the heat of the fire will flash the water of the foam to steam. The expansion of water to steam at atmospheric pressure is on the order of 1700 times, with the result that there now exists a mixture of 1000 volumes of air and 1700 volumes of steam. This mixture

will have an oxygen content of about 7.5 per cent or well below 10 per cent, the level at which active burning of most flammable materials will cease.

The conversion of water to steam absorbs a great deal of heat. Hot objects break the foam causing the water of the foam to be deposited upon the object, cooling and wetting it. Steam is an effective coolant since its temperature can be raised when it is in the presence of hot material. All of these means can combine to cool and extinguish.

In a mine where the paths by which oxygen can feed a fire are limited, foam can be driven onto the fire and will quickly render the fire dormant. Cooling by the steam will take place immediately. The foam will cover and cool burning material. If this contact by steam or covering by foam is maintained for a sufficient period, complete extinguishment will be obtained. The nature of the burning material and the depth of the burning will determine the amount of cooling needed. Coal produces a great deal of heat and can build a relatively substantial depth of burning. A coal fire is difficult to extinguish completely, but is easy to knock down so that subsequent direct attack is easy. Wood ignites more readily than coal but does not produce quite so much heat.

A more important difference between coal and wood is that wood does not produce much depth of burning so that cooling is much more difficult. Flammable liquids produce the most violent easily ignited fires; but since there is little storage of heat, they are easy to cool and extinguish. The fires of more volatile, low flash point liquids are more difficult to extinguish; however, when they are covered by high expansion foam to sufficient depth, they will go out.

The USBM has shown that the foam can control relatively deep seated coal fires. Testing at the Factory Mutual Laboratory has shown that the foam can extinguish standard gasoline pan fires and standard wood pallet fires. We have carried out tests on such diverse fires or materials as tightly stacked rubber tires, large fires of gasoline and diesel fuel, acetone and ethyl alcohol. In all of these tests, the fires have been controlled and extinguished when the

foam covered the fire and the cover was maintained for a sufficient period.

The Montour Mine Fire

The large coal mine fire at Montour 4 mine of Pittsburgh Coal Co. has been reported in some detail by the USBM⁸ and before meetings of mining societies.⁹ In view of the ready availability of at least one of these reports, it would not be profitable to attempt to tell the complete story of this fire. Certain parts of the story should be recounted, however, because they represent the observations of others of us who were present and have noticed, or wish to stress certain other aspects.

Some of the following comments are made in the light of later facts and knowledge gained. They are not presented as a criticism of the handling of this fire; but are presented in the hope that useful lessons in the handling and use of high expansion foam can be learned and appreciated.

The long and unavoidable delay of about 10 hours between the discovery of the fire points up the importance of having the necessary equipment and material on hand to make high expansion foam. The effectiveness of high expansion foam on the fire after it had grown to very sizeable proportions makes it easy to conclude that the fire could have been controlled easily if foam had been applied shortly after the fire was discovered.

The long delay was very serious and in fact nearly critical. When foam was finally driven into the fire, the combustible gas in the return had reached a high level. The first gas analysis taken after the foam generator had been started showed that the combustible content had fallen, indicating that it was safe to stay and fight the fire.

The coal on the roof and ribs extending over many hundreds of feet of entry was afire when foam was first made. After sufficient foam had been put into the fire area to remove the danger of ignition of flammable gases, it was decided to start at the right hand side of the involved area. This side was coal as an extensive partially mined and pillared area existed to the right. If the fire had succeeded in getting to this area, it would have been very difficult and, conceivably, might have be-

come impossible to extinguish by any available means.

The foam generator was moved to the right side and foam was driven into the involved area immediately in front of the generator. This permitted the prompt extinguishment of the fire in this area. The area was then explored and the only active burning was found beneath a mine car where the foam could not move readily. This small fire was quickly extinguished with a hose stream.

Later the unit was moved back toward the left, to a point one entry short of the original location. Since the fire was out on the right, it was decided to move the equipment in steps to the left, permitting a logical progression of driving foam to cool and extinguish, followed by an exploration. Exploration was made by cutting the foam with a water spray while admitting a controlled amount of air at the back of the men, who were advancing. Breathing apparatus was not used or required. It was possible to explore in this manner without the presence of heat or smoke.

No fire was found until a large fall was encountered which had burning coal beneath it. The temperature in the area was low and it was possible to stand on top of the fall in the current of air. However, the fire could not be extinguished even with the hoses on hand. It was apparent that the fire had been controlled by the foam and that it would not be able to spread as the rock which shielded the fire from the foam would also prevent it from breaking out. The smoke beyond the fall was sufficient to prevent exploration beyond this point. No fire was visible beyond the fall.

Here, again, a major decision faced those in charge. A man door had been opened to prevent smoke from being carried into the working area. It was known that the air movement then would carry the fire to the man door. If the fire had gone through the man door, it might have spread into the adjacent partially mined area and even into an adjacent mine which was separated by a heavy stopping. The threat of such a spread was so serious that it was decided to carry fresh air around and behind the fire so that the area in the vicinity of the door could be checked.

When this was done, it was found that the fire actually had consumed the door and a part of the door frame. No fire was present in the vicinity of the door showing that the foam had extinguished the fire as it was going through the door and had prevented the fire from spreading. During the period required to bring fresh air to the door, the foam generator was used to hold the fire beneath the falls in check. No foam traveled far to the left of the man door as the direct path of movement to the return was through the man door. Thus foam was not forced to the left where the only active fire remained.

As the work of bringing fresh air to the door involved the building of a number of stoppings or seals, it was found that complete sealing of the relatively small fire remaining would be easy. The seals were so planned that a relatively small area was inclosed and the valuable face equipment was outside the seals, easily recoverable for use in another mining area.

Certain important facts should be noted:

1. The foam completely extinguished the fire in many hundreds of feet of entry.
2. The only points where the foam clearly traveled in volume and extinguishment was not obtained were places where something, such as a mine car or rock fall, shielded the fire against the foam.
3. Wherever the foam had traveled, control of the fire was established and temperature lowered so that men could move and fight any remaining fire directly and at close range.
4. The foam will tend to take a direct path between the point of generation and the return, particularly if the openings to the return are relatively close and clearly defined.
5. None of the posts or timber set during the exploration after driving foam showed evidence of having been subject to any heat when the area was inspected upon reopening some six months after sealing.
6. During the sealing operation foam was introduced into the fire area at a controlled rate. Many of the seals were erected at points quite close to the fire area. While the area was

only partially covered, and was being introduced a number of times of the gas present. The scale showed very low oxygen content, on the order of 1 per cent. There seems to be no explanation for this, unless it is that the foam completely filled the small area.

With the better understanding of the above facts that has come with continued study and thought, it is more probable to see where performance of the foam could have been made more effective, the fighting of the fire could have been easier and less prolonged, and complete control and extinguishment obtained without sending. These improvements could have been obtained by:

1. The course that the foam took could have been controlled and directed, just as air is controlled and directed, using temporary stoppings or checks of doubled brattice cloth. Thus, the time and effort used in relocating the foam generator were expended uselessly. Also it would have been relatively easy to direct the foam to the left into the area which was not reached.
2. The fire beneath the falls could have been flooded by building a few low dams, or merely held by periodic applications of foam until the remainder of the fire had been controlled.
3. Periodic and regular checks of the temperature and analysis of the gases returning from the fire area would have shown progress in controlling the fire. This is extremely important as falls, smoke, and dangerous roof may make the task of quick exploration of the fire area difficult or impossible.
4. By control of the area where the foam was driven, and by careful choice of route to be traversed, I feel that the man door could have been reached and inspected without the necessity of building stoppings. The foam could have been made to cover the falls beneath which fire still existed, sealing the smoke at least for the time required to inspect inby the door.

Marquette Cement Manufacturing Fire

This was a severe fire in a massive timbered area of the limestone mine of the Marquette Cement Manufacturing Co. at Ogishby, Ill. The mine had been converted to an open pit operation in about 1917, the entrance area of the old workings was used for storage of trucks, other equipment, and supplies including lubricating oil. Because of important facilities upon the surface and the relatively thin cap rock which overlaid the limestone bed, substantial amounts of heavy cross-tied timbers had been set over the years as tight cribs to support the exposed mine roof. The fire ignited the cross-tied timber and spread rapidly throughout the timbered area. The cause of the fire is not known.

The fire was discovered upon arrival of the day shift on a Monday morning. Smoke was found inside the mine in the areas used for parking vehicles. Employees recovered a few trucks but were unable to get six trucks, two bulldozers, two highlifts and some 150 drums of lubricating oil and non-flammable chemical. The night watchman's car was one of the last vehicles recovered.

Originally the mine was worked with natural ventilation using many openings in the outside along the exposed ledge of rock above the river and numerous small timbered shafts. Most of the shafts had caved or had been filled and many of the openings filled. The plan of mining left random pillars with the openings between pillars some 20 to 40 feet wide and 15 to 18 feet high. The roof material was limestone except, in some areas, where a shale cap rock was encountered.

We had been alerted earlier in the week that our equipment might be needed. On Thursday we were asked to help. By Friday morning the fire seemed to have spread widely throughout the area and smoke was being discharged from all openings in the vicinity of the plant. By the afternoon, three small fans had been set to pull smoke from the mine. The 60,000 cfm which these fans provided was sufficient to prevent smoke from issuing from the openings into the plant area and was much less than would be required to give the positive air current needed to enter the mine. The following day a fourth and larger fan was put in

operation. This fan was large enough to give a total air volume of 120,000 cfm.

It was decided to try to contain the smoke by ventilating the area. One of the doors of the left main portal was opened for about two hours. No improvement in smoke resulted and the fire seemed to be affecting the roof. A door at the main right portal was opened and a substantial fire could be seen on a crib with two trucks silhouetted against the fire. The foam generator was set up and foam was introduced for about 30 minutes into the area where the trucks and the fire had been visible. Foam appeared at the left hand portal indicating that the area was being filled.

The foam generator was shut down and we entered the left portal. We cut our way into the foam with a fog nozzle, taking the first cross cut to the right, working our way past a large truck and bulldozer. We reached the first of the two silhouetted trucks, and cleared the area around both trucks of foam. The only burning in the area was a slight flicker of flame from between the dual tires of the inby truck. The crib inby this truck was out and foam stood in all of the openings holding back heat and smoke from the fires farther in the mine.

To the right of the first silhouetted truck was a corrugated sheet iron stopping. Through cracks of this stopping, a substantial fire was visible. We pulled off one and then a second corrugated sheet and turned the stream of the fire hose on to the fire for about 10 minutes. The hose stream was beginning to get control when smoke started to come in on us forcing us to retire. It was apparent through the holes in the stopping that fires were burning inby and outby the small area which we could reach with the hose stream.

The foam generator was set up in order to deliver foam into the area visible through the stopping. Foam was delivered into this area for about one-half hour. While this area seemed warm, fire was not visible thereafter.

At this time the decision was made not to attempt to extinguish the fire, but to limit our objective to the recovery of the equipment and drums of lubricant. The reasons for this decision were:

1. The mine had no value. Its usefulness as a storage area was replaceable at a point where no timbering was present.
2. The extent of the fire was unknown, but it probably was quite large. Fighting such a fire would be costly and dangerous.
3. No trained mine firefighters were available. Until two inspectors from the USBM arrived with Chemov apparatus, no breathing apparatus was available.
4. The smoke contained a high percentage of carbon monoxide and was loaded with creosote.
5. While the fire could consume a substantial quantity of timber if permitted to burn unchecked, it would run out of fuel eventually and die out. The support of surface facilities could be provided relatively cheaply by hydraulic filling, if necessary.

Work on this limited objective was delayed until Tuesday morning, until the motor of the large fan was repaired and replaced. On that day all of the equipment—trucks, bulldozers, and highlifts—and the drums of lubricant and chemical were recovered. The procedure was to fill the area with foam, cut access through the foam to the equipment with a spray of water, erect canvas to hold back the smoke, or to permit the foam to hold it back and to pull the equipment out with a tractor. This was done without resorting to breathing apparatus and without having any personnel in a heavy concentration of smoke.

Important experience gained at this fire includes:

1. The high expansion foam was clearly able to extinguish the actively burning timber cribs.
2. The high expansion foam provided an effective barrier against heat and smoke, without which the entire operation would have been impossible.

In at least one location, a large crib was extinguished even though it was known that foam did not reach the full height of the crib. Cooling of the upper portion of the crib could have resulted only from the steam generated when the foam contacted the hot material in the lower part

of the crib. The sealing action of the foam prevented air from moving over the crib, allowing the steam to stay in contact with the upper part of the crib, cooling and extinguishing it.

Fires in Dead End Places

The most common fire which occurs in underground coal mines is that which originates on mobile mining equipment. In fact about 50 per cent of all of the serious coal mine fires reported by the USBM during 1960 started as machine fires. If the equipment is outby an open break-through and the ventilation is adequate or subject to control, the problem of approaching this type of fire is not too difficult.

Usually the equipment fire takes place in a working place where the equipment is only the last open break-through. Any fire in a dead end is difficult to approach as the smoke and heat of the fire must be faced or controlled.

A recent report of the USBM, RI 5846, entitled "Practical Aspects of Controlling an Underground Fire on a Mining Machine," is a useful study of the relative effectiveness of various techniques and extinguishing agents when tested under controlled conditions upon a simulated mining machine. These tests showed that water fog was most effective if the fire could be approached closely; however, loaded streams or wet water were more effective than water alone. The effectiveness of any type of stream or spray rapidly decreased as the distance between the fire and the nozzle increased.

Tests on dry powders of various types applied by shovel, necessarily at close range, showed that sodium and potassium bicarbonate were the most effective. Application of dry powders by rock dust distributor upon the test fire was uniformly unsuccessful. In all cases tested, high expansion foam was successful in controlling the test fire.

RI 5846 tells of the Bureau's development and construction of a small "foam-duct generator" to which a roll of 24-inch diameter polyethylene plastic tubing was attached. The fan of the foam-duct generator is capable of unrolling the tube and, by closing and opening the damper of the fan rapidly, the tube can be snapped by pres-

sure to attempt to straighten it if it becomes fouled. This unique scheme permits the foam to flow in the tube to the fire where the tube has been burnt off by the heat of the fire. Testing by the Bureau showed the usefulness of this approach, at least under the conditions of the experimental mine and simulated machine fire.

The authors of RI 5846 have placed substantial emphasis upon the development and performance of this "foam-duct generator." It is important to examine the concept and range of application of this machine critically as it is easy to overestimate the potential of the equipment. My purpose is not to be critical of mechanical deficiencies, if any, of the actual machine developed by the Bureau. An efficient machine of this size and pressure potential can be built. The points to be examined are what it can and cannot do.

In the tests at the experimental mine, the unit was able to extinguish the simulated mining machine fire. Thus, the equipment makes enough foam for its purpose if the simulated fire is a fair test. This question now becomes one of examining the simulated mining machine fire, the circumstances of location, and the facilities where the simulated fire was tested.

The simulated fire of oil containing a little coal dust with some rubber tires, makes a hot concentrated fire. The coal, oil, and part of one tire were placed in a rectangular tray and a tire was placed against the tray. The entire fire was partially shielded to make the control of the fire by hose streams more difficult. The fire was a reasonable test of a machine fire except that the shielding provided was far less than would normally be found on a piece of current mining equipment where cover plates, guards, and structural members shield the interior of the machine, particularly in locations where hydraulic oil is found.

The pre-burn of four and one-half minutes is reasonable in that all equipment tested could be functional in that period had it been closely available on the section. In fact the pre-burn might be too long when considering hand extinguishers.

One questionable element is that the test area had sheet iron as a roof; concrete for ribs and a concrete bottom. A simu-

lated fire, which was to be repeated many times, could not be permitted to ignite roof or ribs and to cause falls of roof; however, an actual fire generally spreads in the coal and causes falls of roof.

Unfortunately the area of the experimental mine chosen for the fire tests is not representative of actual conditions usually encountered in the area of a machine fire. The area chosen had ribs lined with concrete or concrete blocks and a bottom of concrete, slag, or crushed stone. The conditions more nearly duplicated a hall corridor than a mine entry. A mine entry is rough, may have debris on the bottom, and be obstructed by posts. If the fire has had much of a start, usually it will have falls of roof. More than one fire of a loading machine or continuous miner has caused the operator of an outby unit to leave his machine, in which case the outby unit becomes a substantial barrier to the plastic tube. Also, it is impossible to cause the tube to turn into a break-through.

It is apparent then that:

1. The test fire described in RI 5846 is a good effort to simulate a mining machine fire.
2. The pre-burn is reasonable.
3. The concrete-sheet metal lined entry prevented the normal spread of the fire and, to this extent made the problem easier.
4. The tube can be an efficient method for delivery of foam to the fire.
5. The test area was particularly favorable for the process of unrolling a tube.
6. While repeated and rapid opening and closing of the damper will snap the tube and tend to free it from obstructions, the tube can be diverted and obstructed by many objects to be found outby a machine fire.
7. The tube cannot be made to travel into a break-through.

Three important conclusions are incapable:

1. To provide the intended degree of protection, a foam-duct generator would have to be provided on each operating section. If the fire were given time to spread, the limited capacity of the foam generator could not cope with a sizeable fire of coal.
2. There is no certainty that the tube can be caused to reach a mining machine fire.

Obstructions and the possibility that the burning machine is in a break-through will assure that the tube cannot reach all fires. If the fire has caused falls of roof, the percentage is further reduced.

3. The small capacity of the foam-duct generator (5000 gpm or 667 cfm of foam) limits the usefulness of this equipment to small fires. Thus the foam-duct generator cannot be used to fight a sizeable fire.

Our approach to this problem has been to develop techniques and equipment which will permit delivery, with certainty, of foam from our much larger foam generators to the face of a dead end entry or break-through. In developing a high expansion foam fire truck for municipal fire fighting, we experimented with cloth tubes of various lengths, to be attached with zippers. This work has been the key to the delivery of foam into buildings from the fire truck. The mechanics of this tube have been proved by about eight months successful use of an experimental high expansion foam fire truck by a local fire company.

We have found that the foam will carry some 30 to 50 feet beyond the end of the tube into a dead end place and fill the entry, making a solid foam plug beyond the end of the tube. Thus the foam can be the shield against heat and smoke for men to reach the end of the tube. When there, a new length of tube about 20 or 25 feet long can be added.

If no major obstruction is expected, the length of tube so added can be straightened most easily by operating the foam generator. The procedure followed is for the men who have added the tube to return to the foam generator, which is started and operated initially at low air volume. Low air volume with normal liquid rate will make a heavy wet foam. When the generator has operated long enough to fill the tube with the heavy foam, the damper on the foam generator is opened and the heavy foam will be pushed out of the tube at high velocity. The weight of this foam will tend to carry it a substantial distance from the end of the tube. Then the generator is operated normally until it is apparent that good foam movement is visible back over the tube an appreciable distance. The liquid supply to the foam generator is cut off and the fan drives air through the tube. The air will

carry back out over the tube without disturbing the foam in the end of the tube. Thus, the tube has been extended, a new foam plug made in the end of the tube, and a visible opening made over the top of the tube for men to travel to the end of the tube so that it can be extended again if necessary.

If the tube, which had been added, caught or was diverted as it was being extended by the passage of foam, we find that it cannot become so entangled that it will shut off the foam completely. Since the foam will always move a little distance in the end of the tube, even if the tube has become so twisted that the velocity of the foam is not directed in, an effective foam plug will always be present in the end of the tube. Since access to the end of the tube is always possible, it can be straightened and the procedure repeated.

If, upon adding a length of tube, an obstruction is known or anticipated or it is necessary to turn the tube into a breakthrough, the foam plug in the end of the tube can be cut carefully, with a spray of water, the distance required to extend manually the added length of tube. Care must be used in cutting the foam to be sure that only the absolute minimum amount of foam is cut so as to leave the plug intact as a shield against heat and smoke.

When it is known that the foam has reached the fire, foam should be applied for a good length of time before any effort is made to explore or to extend the tube.

We feel that this technique offers a degree of certainty of delivery of foam not present with the foam-duct generator. Since it has been adapted for use with high capacity foam generating equipment, the technique broadens the range of usefulness of this proved equipment. The disadvantages which this technique introduces are that the method is slower in operation than the continuous plastic tube, the equipment is more bulky, and naturally requires more water than the foam-duct generator.

Other New Developments

Development and experience with tubes of various sizes which are expanded by the foam have led us to test a tube of substantial circumference in a mine entry. The circumference of the tube used was appreciably greater than the circumference of

the entry where the test was carried out. It was found that the tube would swell until it completely filled the entry making a tight seal, preventing the foam from recirculating to the fan of the foam generator. This tube effectively eliminates the necessity of building a special stopping into which the foam generator was formerly erected. Thus, the erection time of the equipment has been shortened to a small fraction of the old method.

The only problems introduced are the handling of a very large tube made of a strong neoprene coated nylon fabric. Since the tube must be so large and strong, it is heavy, especially when wet after use.

The other new development which should be covered is the discovery of a new foam concentrate. The need for an improved foam concentrate is quite apparent when the difficulties of the original material discovered by the USBM are listed. These difficulties are related to the high freezing temperature and sensitivity to water hardness found in the original material.

The relatively minor improvements which we were able to make on the first material forced us to search for new ones. Initially, our search in the laboratory involved the screening of some 400 surfactants. The result of this was a substantial list of materials which would not work. Fortunately, one material proved promising and is the basis of our new foam concentrate.

Now our laboratory work is aimed at developing the optimum physical properties of the new foam concentrate while retaining its excellent characteristics of foam formation and stability. The table below lists the physical and foaming characteristics of the two materials as we now know them. Because the laboratory work on the new material is still productive, its exact characteristics are not finally set; however, we do know that we can meet the specifications listed as a minimum.

This new foam concentrate represents a substantial breakthrough in the chemistry of high expansion foam. While we cannot be certain that the new concentrate will be able to make good stable foam with all mine waters, we do feel reasonably sure that many mine waters can be used. This material has not completely satisfied all of our hopes for a perfect foam concentrate, but it is close to it.

Characteristics of Foam Concentrates

	Old	New
Name	FDL-15	SA & I Series
Foam Laboratory	Excellent	Excellent
Foam Stability	Good	Excellent
Concentration required with 50 ppm water	2.5%	2.5% or less (1)
with 200 ppm water	5.0%	2.5% or less
with 1000 ppm water	Foam stability lost	2.5% or less
with 2000 ppm water	Labels	2.5% or less
with water (3)	Labels	2.5% or less
Freeze point	About 40°F	Rate at 20°F (2)
Viscosity	Steadily affected by temperature	Steadily affected by formulation

Notes: (1) There is a possibility that the concentration requirement can be reduced for 20°F formulation.

(2) Probably also safe at 0°F. Formulation can be changed to give freeze point less than minus 20°F but concentration requirement may increase.

(3) Over 18000 ppm hardness.

Over the course of some years, I have had more experience in fighting mine fires than I like to recall. Also, during the past two years of effort aimed at improving, developing, and finally marketing equipment for generating high expansion foam as a fire fighting tool, I have had many opportunities to discuss the problems of fire protection in mines and to examine the facilities present in a number of mines.

I have seen both extremes. There are too few mines with really adequate facilities, with equipment which is thoughtfully engineered and carefully maintained, and with fire-conscious employees and officials who believe in and work at fire drills and fire prevention. There are far too many mines which are trying to get by with luck and the bare minimum. There is a vast majority with some equipment, some training, and some thought; but, I am afraid, not enough. That a fire can get out of hand in a mine having adequate facilities, a planned program, and personnel awake to the problem such as Montour 4 mine, should emphasize the serious fire protection problem in all coal mines.

High expansion foam is a powerful new tool for combating mine fires, but it does not replace the old tools and methods which are time proved. High expansion foam can only supplement them. Without an adequate water supply, no mine is equipped to fight a sizeable fire.

Just what is an adequate water supply? I am sure that you can get a different answer each time the question is asked. I

feel that the ability to supply 150 gpm of water at 100 psi for an indefinite period would satisfy my idea of an adequate supply. My idea is expensive and probably can be satisfied only by a pipeline. The pipeline should be equipped with taps each 300 or 400 feet.

Large water cars are useful and can be especially effective in quickly supplying a large amount of water at high pressure. It is most difficult to provide my definition of an adequate supply with water cars however.

Hoses require special consideration at mines. Cotton or linen jacketed hose should not be used as they are subject to mildew attack. Hoses should be rubber lined and be rubber jacketed if of cotton fabric. Neoprene rubber is preferable. Some of the new constructions such as neoprene lined with dacron jacket appear to be very good as they are not affected by mildew or oil. Two-inch hose diameter seems to be about right. Coupling threads should be straight iron pipe threads and the pin-type coupling should be avoided. Too few people know that hose couplings should be finger tightened only. The hose coupling wrench is needed for breaking the coupling only.

The best nozzle is a combination type, able to give a good long range straight stream and also a good spray. I have the feeling that the nozzles which adjust continuously from a stream to a wide-angle spray cannot throw a stream as far as the lever type stream-spray nozzle. Because range is so critical in mines, I feel that the characteristics of the stream should decide the choice of nozzle.

Hand extinguishers are useful and have their place at strategic points in a mine and on portable equipment. Dry powder, loaded stream, and foam hand extinguishers all can be useful. Too often though, the simplest, most effective and cheapest fire extinguisher is neglected on equipment which uses water for dust control. By means of a simple valve this water for dust control can be converted instantly to fire use. A hand directed nozzle on a short length of hose gives the operator a simple, quick and effective extinguisher which will not be exhausted upon the delivery of a few pounds of dry chemical or a few gallons of liquid. Another approach is to fit the

machine with mounted and piped sprays to cover critical points. Thus, even if smoke should force the operator to retire, the sprays will continue to check the fire and prevent its spread. At least one company has used this scheme on cutting machines for over 15 years with excellent results.

Many special dry powders or additives to water have been tested and evaluated upon standard fires and simulated mine-type fires. While the dry powders are effective against special fires, they are not especially useful, except as a first quick shot, on mine-type fires. Additives can increase the effectiveness of water streams and will help if the water supply is not adequate in volume. However, water itself is hard to beat. It is cheap, can be transported easily, and is about the most effective coolant known. Since most modern mines must use water during many vital mining operations, it makes sense to have an adequate supply that will do the job when seconds count.

The vital ingredient in fighting any fire is training. Untrained men do not know or understand what must be done or what they can do. Usually, their reaction in an emergency is to run. Only training and leadership prevent panic. Training with all pieces of fire fighting equipment is important. Until a man has tried, can he be sure that he can operate a hand extinguisher? Unless he has been shown, he may direct it improperly and ineffectively. Most men can use a hose reasonably well, but with just a little practice the hose will be stretched, coupled, and put into operation more quickly. Practice sessions develop team work and speed. When every man has a job there is a minimum of confusion and wasted effort.

Training also tests equipment. Hoses which have been neglected for long periods may not be in shape when needed. Training includes putting the equipment away in a safe and workmanlike condition. There is nothing which will cause more confusion and delay than a few lengths of hose which have been rolled the wrong way. The need for training with gas masks and breathing apparatus is obvious, of course. I feel that high expansion foam equipment deserves the same attention and care. To accept delivery of the equipment, see it demonstrated, hear the discussion on its use, and then to leave it untouched in the warehouse

will not make it an effective fire fighting tool.

Most mines find that this training will create a consciousness of fire and fire hazards among personnel which, of itself, is sufficient justification for the training. The training need not be so frequent or prolonged that the training time will become a severe financial expense. Since supervisors have the responsibility of leadership, extra effort and attention must be devoted to training these key men. A man does not suddenly become an expert fire fighter the day he is made a supervisor. Nor does training take place until it becomes company policy and someone's responsibility.

While the title of this paper would tend to limit it to the subject of high expansion foam, it is important to understand that high expansion foam is another of the tools available for controlling and extinguishing a mine fire. Experience has proved that it is an amazingly capable tool which should be put to use as quickly as possible in an emergency. High expansion foam is the only tool which can be effective when a fire is beyond the range of a hose stream. It is sensible, therefore, to use it to kill the heat, control the smoke, and subdue the fire even in cases where it appears that control by hose stream is possible.

High expansion foam, hose streams, and other extinguishing means are purposely referred to as tools so as to emphasize that someone must use them. As with any tool, the skill and judgment of the men using them is the critical ingredient. With some notable exceptions, I feel that the greatest deficiency in the coal mining industry is in training. Effective training programs will do more toward solving the fire protection problem of the coal mining industry than any other approach. Other deficiencies are automatically exposed.

In any phase of human existence fire is a useful and necessary tool, but it can be a terrible and cruel enemy. Nowhere is fire more terrible and cruel than in mining.

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DEVELOPMENTS IN THE USE OF FIRE RESISTANT HYDRAULIC FLUIDS FOR UNDERGROUND COAL MINING EQUIPMENT

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Application and use of fire resistant hydraulic fluids by industry began some 15 years ago and has expanded rapidly since that time. As might be expected, much of the interest and progress in this field has been paced by groups concerned with industrial safety.

About five years ago, a project was initiated to investigate application of an hydraulic fluid in coal mining machinery which would be less hazardous than conventional petroleum hydraulic oils. Various fluids and their application were explored and it was agreed that the water-in-oil emulsion offered the most economical and practicable approach.

Much field experience was available with such a fluid from five years of development in other industrial activities and it was judged that many of the operating conditions would be similar in the new field of application in coal mining machinery.

However, during early field trials, it was recognized that certain conditions were more severe than anticipated and many recommendations for machine modifications were suggested and accomplished. As in any project involving a new approach with certain unfamiliar material characteristics, a cooperative program between equipment builders, equipment operators, and suppliers of

hydraulic fluid is required. In this project, an enthusiastic cooperation has been experienced, leading to the exchange of much valuable information.

With specific coal mining machinery, it is important to have available records of machinery history and operating conditions as a base line on which to judge appropriate modifications if required. Accepted industrial hydraulic practice involves recommended suction conditions in pumps, sump tank capacity, operating temperatures and use of screening and filtration elements for maintenance of system and fluid cleanliness. Much has been written to aid operating personnel in a better understanding of factors involved in a dependable machine and fluid performance.

Introduction of fire resistant fluids to industrial applications in general has not been accomplished without various problems related to the differences in characteristics of these fluids. However, the incentive to accomplish an additional improvement in safety underground will provide the justification for continued effort and solution to these problems. It is our understanding in the petroleum industry that national coal production is increasing and that an increasing percentage of this production is being mined by machine methods. To reduce any possible hazard involved in operation of

such machinery will be an objective of greater economic importance.

The prices of suitable fire resistant hydraulic fluids in the coal mining industry will generally be somewhat higher than the average paid for conventional hydraulic oils. However, the cost per ton of coal mined has in many cases been less than with the latter products, principally because of reduced machine consumption rates. This may be considered a somewhat minor point in the overall importance of improved operation safety, but it has been our experience

that introduction of such programs are facilitated when the operating economics are attractive.

From our viewpoint, in retrospect of the past two years' experience in this particular work with the coal mining industry, it seems likely that future developments will involve modifications in machine hydraulic systems to provide improved fluid operating conditions. These will be accompanied by continued research and development in the area of improved fluids for this application.

DEVELOPMENTS IN METHANE MONITORING

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Since the development of the flame safety lamp by Davy, Clanny, and Stephenson early in the 19th century, this device with its numerous modifications and improvements has been universally accepted for detecting methane in mines. The principle of the flame safety lamp is well known to all informed mining men. When this device is maintained properly and is used correctly by a competent miner or official, it is reasonably safe and can be expected to detect methane concentrations of one per cent or greater.

Large-scale mechanization in coal mines has caused rapid extraction of virgin areas. This, in turn, has created a need for more accurate and more frequent determinations of methane so the effectiveness of ventilation and the rate of methane liberation can be measured.

The flame safety lamp will continue as a gas-detecting device for everyday use; it also can be used, with modifications, as the detector element in a methane-monitoring system. A deterrent to general acceptance of a flame lamp operating as a constant monitor in gaseous atmospheres is the fact that 154 of the 2,990 gas ignitions reported between 1857 and 1956 were attributed to flame safety lamps. Most of these ignitions were due to faulty or improperly used lamps. In a few cases, lamps suspected of having caused ignitions have been investi-

gated and found to be safe. However, they obviously can constitute a potential ignition source.

The degree of dependability reverts to the condition and assembly of the component parts and the competence of the user. This, of course, is true of any detecting device, but most other detecting devices are not disassembled and reassembled daily.

As a supplement to the flame safety lamp, a number of electrical methane detectors have been developed in the past 20 to 30 years. The American detectors approved by the Bureau are manufactured by the Mine Safety Appliances Company and the Union Carbide Corporation. Other detectors that are approved include the martinsen (F. W. Willhoit, U. S. Agent) and the riken (manufactured in Japan and sold in the U. S. by the National Mine Service Company).

Most of these detectors afford greater accuracy than the flame lamp, but they all have limitations, and their cost, compared to that of a flame safety lamp, enhances the continuing popularity of the latter. None of the electrical detectors mentioned will indicate a deficiency of oxygen, but, as a matter of interest, those utilizing a wheatstone bridge circuit will indicate concentrations of methane quite accurately in a deficiency of oxygen—as long as sufficient oxygen is present to completely oxidize the

methane. This ratio is approximately two parts of oxygen for each part of methane. The riken, which is an interferometer, is accurate only if the atmosphere contains no gases other than air and the gas for which it was calibrated. The presence of any other gas or vapor will result in inaccuracies, and an interferometer will not indicate an oxygen deficiency.

Flame lamps and portable electrical detectors only give spot determinations and must be observed by individuals, usually at irregular intervals. The need for an automatic, constant-monitoring methane detector resulted from modern rapid extraction in caving mines.

Monitoring devices may be divided into: (1) Those that continuously record methane concentrations but still require observation by individuals, and (2) those that sample methane and give a visible or audible warning or perhaps shut off electrical power or start up a fan when methane concentrations reach a predetermined level.

The director of the Bureau of Mines, recognizing the need for an automatic methane monitor of the second class, invited representatives of instrument, electronic equipment, and mining machinery manufacturers, operators' associations, the United Mine Workers, and the Bureau to a conference in Pittsburgh in February, 1958.

The desirable features to be incorporated in an automatic methane-monitoring system were outlined by the director as follows:

(1) The system shall give a visible or audible alarm if and when the concentration in the vicinity of the sensor reaches 1.0 to 1.5% methane.

(2) The system shall cut off all electrical power to the affected section if and when the concentration in the vicinity of the sensor reaches 2.0 to 2.5% methane.

The only restriction placed on the manner in which these two functions might be accomplished was that no ignition hazards were to be introduced.

The Bureau has subsequently established the requirements to be met by a manufacturer wishing to have a methane-monitoring system certified. These requirements are embodied in a proposed schedule which has not been published in its final form. Two preliminary drafts have been published in

the Federal Register. Subsequent to each publication, a meeting has been held with interested parties who had submitted comments concerning this proposed methane-monitoring schedule as it appeared in the Federal Register. The schedule in its final form should soon be available.

At the time of the director's conference, one manufacturer already had commercially available a device for cutting off electrical power at the source if a cable fault or a frame ground occurred. This device was readily adaptable to a methane-monitoring system.

Another manufacturer had a similar device not fully developed.

A third manufacturer had an approved methane alarm, which with some modifications, could be incorporated into a monitoring system.

Several other manufacturers submitted prototypes of monitoring detectors which were examined and evaluated, but none of these have reached final development.

It eventually became evident that private industry either was hesitant or, because of current business conditions, could not afford to invest in the research and development of monitoring equipment. Consequently, the Bureau undertook the development of a suitable monitoring detector.

In the Bureau's monitoring device, two elements, with well-known characteristics, were combined. One of these, which we call a "pellament," is a small catalytic mass which will oxidize low concentrations of methane. This element is mounted adjacent to the second element, which is a bimetallic switch such as that used in home-heating-system thermostats. The heat of combustion of the methane by the pellament is employed to actuate the switch.

The net result is a small, simple, inexpensive methane detector. The idea for this unit had occurred during experiments with a flame lamp in which a thermal switch was mounted. Subsequently, we learned that the idea was not original, for two patents had already been granted for a device employing these basic principles; one patent had been issued in this country and one in England—the latter had been granted to an Italian.

Although basically the Bureau's device is similar to those covered by these two

patents, it differs with respect to the catalytic element referred to previously as "the pellement." This element presents a relatively new concept in the combustion of low concentrations of methane by catalysis. Heretofore, the catalysis occurred on the surface of spongy coiled platinum filaments; however, with the Bureau's pellements, coiled platinum filaments are used only as heating elements. The catalysis occurs on the surface of a small bead of alumina which bead, so formed, is impregnated with platinum and/or palladium as catalysts. The pellement oxidizes methane at a relatively low initial temperature (approximately 400°F.) and gives ten times the life of a bare filament: 3,000 hours versus 300. Since the initial temperature need not be high, less energy is required to accomplish the heating.

As an example, a miniature methane detector has been developed in which two of these pellements are incorporated, one active and one inactive. The inactive pellement is made in the same manner as the active one except that it is not impregnated with the catalyst. Upon application of current to the bridge circuit, it is heated to the same initial temperature as the activated pellement, but it does not increase in temperature in the presence of methane because there is no combustion. The inactive element may be located in the same atmosphere as the activated sensing element or it may be housed in a cell containing fresh air, as it is in the case of the miniature detector.

This detector is energized with one D size flashlight cell. The pellements in it are wound with .002-inch wire and require a current of approximately 0.4 ampere. Those used for the monitoring detector are wound with .005-inch wire; consequently, more current (1.3 amperes) is required to heat them to the threshold temperature. Although pellements made with 2-mil wire may function satisfactorily for the monitoring detector, those made with the heavier wire seem to be more practical because of their additional mechanical strength. However, it is essential that the power requirement be kept to a minimum, since that determines the size of the power source required.

In the course of our investigations, numerous examinations with regard to both sensitivity and simplicity were made of various basic principles used in measuring low concentrations of methane.

In the table below, taken from a paper by Pritchard,¹ are listed the approximate percentage changes in output signal that will occur in instruments using various principles if 1% methane by volume is added to the air passing through the instrument.

	Percent
1. Gas temperature above a flame.....	16
2. Resistance of electrically heated filament on which methane is burned catalytically.....	3
3. Volume of pressure change on combustion.....	2
4. Density.....	0.5
5. Refractivity.....	0.3
6. Thermal conductivity.....	0.2
7. Velocity of sound.....	0.2
8. Viscosity.....	0.4
9. Infrared transmission (from path 600° C.—Black Body Source).....	0.3

Obviously the greatest degree of change is available if the methane is burned by an open flame. This principle was investigated, as already indicated, but it was shelved, at least temporarily, in favor of a device built on principle No. 2 because that one affords a much higher degree of safety.

In all field tests conducted to determine the performance and dependability of the Bureau's detecting device, methane recorders were employed. These recorders were developed at the Bureau using the wheatstone bridge circuit with pellement sensing units.

Preliminary field tests were first conducted at the Bureau's experimental mine under controlled conditions. Other tests were subsequently conducted at commercial mines located in Pennsylvania, West Virginia, and Indiana. From these field investigations, we learned the following:

- (1) The air flow pattern around a machine is very fluid; no homogeneity of gas-air mixtures can be expected.
- (2) Methane can be expected to rise to the roof and flow in a thin layer along the roof—even opposing ventilating currents.
- (3) Methane may be occluded in the coal and only liberated as the coal is broken down.
- (4) Methane may also be liberated from the solid face and ribs, in some cases floor or roof.

1. Pritchard, F. W., *Measurement of Methane by Combustion in a Flame*, London, August 1957, (21 pp.) (Great Britain, National Coal Board, Scientific Department, Mining Research Establishment, W.R.E. Report 2075), Research Programme Reference No. 8.2.

(5) Ventilation constitutes the most important factor for reducing methane concentrations but often may be inadequate or neglected.

(6) With relatively high rates of methane liberation, 40 to 50 c.f.m., one of the most effective means of delivering adequate air volume to the face with continuous mining is with auxiliary fans and tubing.

(7) The practice of piling coal behind a miner is an important factor in the restriction of air flow and consequently in the buildup of methane concentrations over the machine.

As for monitoring devices it was determined that

- (1) the detecting elements or sensors made with the catalytic mass and thermal switch could withstand normal shock and vibration when solidly attached to a continuous miner,
- (2) these sensors also functioned quite satisfactorily even in the presence of coal dust and/or moisture, and
- (3) they did not shut off power except when sensing methane concentrations at pre-set limits.

Recording equipment used in conjunction with the monitoring equipment was an excellent tool for studying the adequacy of face ventilation and the influence of operating practices to methane buildup.

The design of the machine dictates the location for the sensors. It was concluded that the sensors should be mounted as far forward and as high as practicable for adequate protection. No definite conclusion has been reached as to whether one sensor judiciously mounted will be adequate or whether in some cases two will be needed.

In the Bureau's investigations, two sensors were used; they were located from 7 to 15 feet from the face and from 12 to 18 inches from the roof, depending upon the machine with which they were used.

Recent concern because of numerous reported face ignitions in coal mines has placed definite emphasis, and I might add, pressure, on the progress of methane monitoring in this country. The problem is recognized and also has been given consideration in other countries.

In a paper titled "Recent Developments

in Methanometry" by F. J. Hartwell, M. Sc., of Great Britain, which was presented to the Sixth International Conference of Directors of Safety in Mines Research at Verneuil, France, in 1950, various handheld detectors were described as well as a "fire-damp recorder."

The first model of this recorder was built in 1936, and many improvements were later incorporated. This instrument measures the pressure changes following combustion in two independently operated chambers. A pointer is linked to an aneroid cell and registers the pressure in the combustion chambers on a chart fixed to a clockwork-driven drum that makes one revolution in 24 hours. The recording is not continuous; a .36 milliliter sample is pumped into the combustion chamber and burned. The complete cycle requires six minutes, and by having the cycles of the two chambers staggered by three minutes, 30 independent analyses are made every hour.

A second recorder is also described in the same paper. It is the ringrose methane recorder, a mechanized version of the ringrose methanometer. The basic principle for that instrument is somewhat the same as that first described; that is, the instrument gives a measure of the difference in pressure that results when combustion of methane occurs. The ringrose recorder gives one analysis every six minutes.

Another paper relating to methane monitoring in Great Britain, titled "A Recorder of Atmospheric Methane Concentration Based on a Butane Flame Lamp," by F. W. Pritchard and S. A. Phelps, was presented to the Tenth International Conference of Directors of Safety in Mines Research at Pittsburgh in May 1960. In brief, a thermopile is placed above the flame of a safety lamp in which butane as fuel is fed at a constant rate for stability. The electromotive force generated by the couple is used to close a relay which can be employed to initiate any desired sequence of operation.

With further reference to British methanometry, a recently published article titled "An Acoustic Methanometer" describes a unit used successfully in Great Britain in conjunction with methane drainage. It measures gas concentrations in the piping system ranging from 40% to 90% methane. Developing a practical methane-monitoring

detector on the acoustic principle may be rather difficult. Where the ratio of the gas to air is only one to ninety-nine, the degree of change is extremely small, and the resulting unit will be very critical, particularly to foreign gases, water vapor, and dust.

Dr. Maas of the Netherlands Department of Mines reports that a methanometer which is mounted against the wall of a roadway has been in use for about eight years in the Netherlands. This is presumably a stationary methane recorder, for he states that it is too fragile and too large to be mounted on heavy equipment. As he points out, any such instrument can be modified to actuate a relay and give an alarm at any preset value.

The following is a very brief article in the November 4, 1960, issue of the South African Mining and Engineering Journal which gives some insight into what the Russians have accomplished in the field of methane monitoring: "Methane measuring stations in various parts of a mine feed information through the mine telephone network to a computer which programs the ventilation system—as methane builds up in an area, more air is automatically directed into the area, thereby diluting the methane. If the methane builds up to a dangerous concentration, the mine power system is automatically cut off."

Methanometers built on seven of the nine principles (all but density and viscosity) listed in the table in Pritchard's paper, one based on the absorption of ultraviolet light passing through a methane-air mixture, and one that measures on a photoelectric cell the quantity of light emitted during the combustion of methane by a catalytic filament have been investigated, evaluated, or at least are familiar to those of us in the Bureau who have been involved in this problem. It is noteworthy that most of the successful methanometers and detectors for other combustible gases have been developed on the second principle listed, "resistance of electrically heated filament on which methane is burned catalytically." In most cases, the change in resistance that results from the combustion of the methane by a catalytic filament is employed to throw a bridge circuit out of balance. In the Bureau-developed detecting device, the heat transfer is used to mechanically actuate a thermal switch. The heat of combustion might also

be used in conjunction with thermistors and thermocouples.

Although a number of the listed principles might be applied in the development of satisfactory laboratory methanometers, certain limitations preclude their successful application as methanometers intended for use in coal mines. The resulting unit would be too delicate, too critical, or too expensive.

A study is in progress to determine the component parts best suited to the Bureau-developed sensor, the best arrangement of these parts, and an ideal source of electrical energy. The last is relatively simple if alternating-current power is available but somewhat more difficult if the mine power is direct current. Fortunately, alternating-current power is becoming more available. However, since the proposed schedule 32 requires that the system shall function for a period of 4 hours, independent of the mine power, the most logical source of energy for powering the methane monitor seems to be a storage battery which can be floated on the line, and thus kept at near full charge while power is delivered to the machine. The relatively new hermetically sealed nickel-cadmium batteries seem to offer the most nearly ideal source of energy.

Although a methane-monitoring system will not increase production other than by necessitating improved face ventilation and thereby preventing explosions, we have been encouraged by the response our experimental monitoring equipment has received from those in the industry who have seen it. There seems to be many officials in the coal mining industry who feel that there is a need for an automatic means of determining the methane concentrations in the face regions. This is particularly true in the case of those using continuous mining machines.

In conclusion, progress has been made, but the successful development of a complete methane-monitoring system is still not a reality. Furthermore, the Bureau-developed sensing element is not considered the ultimate in design and operation. There may be better ways of achieving the desired results. Considering all of the technological advances that have been made in recent years in this country, surely other satisfactory equipment can be developed. The Bureau will gladly cooperate in every way possible with anyone willing to undertake the task.

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CONSTRUCTION SECTION

PREVENTION OF LOSS IN UNDERPINNING

By HARRY T. IMMERMANN

Vice Pres. & Chief Eng., Spencer, White & Prentiss, Inc.
New York City

I have been granted the privilege of addressing you on the subject of the prevention of loss in operations requiring the technique of underpinning, from the standpoint of design and of execution, or perhaps I had better say *improper* design and *faulty* execution.

Underpinning has been best defined as the adding of new permanent support to existing foundations, either to provide additional capacity or additional depth. It is both an art and science—an art in that it requires skilled workmanship in its installation, and a science in that proper design must be based upon systematized knowledge.

Generally, underpinning is performed as either a remedial or a precautionary measure. In order to prevent further damage to, or collapse of, a structure in the process of settling, underpinning is performed to provide the additional capacity required to arrest the settlement. Such underpinning is remedial.

On the other hand, where excavation for a proposed new structure is to be carried to a depth below the foundations of adjoining structures, those existing foundations are extended by underpinning methods to a depth such that the new excavation will not result in their disturbance or loss of carrying capacity. Underpinning so performed is precautionary.

Again, if additional loading is to be brought upon existing foundations, as by the addition of stories to an existing building, the foundations may have to be extended in area, or depth, or both, to prevent overloading of the soil supporting the structure; this too is precautionary underpinning.

We may reduce the incidence of remedial underpinning by improvement in design and in execution, so that what is installed today need not be corrected tomorrow. As to the incidence of precautionary underpinning, as

long as subways, sewers, tunnels, new foundations, etc., are to be constructed in populated areas, such work will be required; and insofar as it is a concomitant of progress, we do not wish for a reduction in the amount. We can wish, however, for a reduction in the volume of remedial underpinning, and I shall therefore devote most of my remaining time to a discussion of that.

Statistics are not available, but it may be stated without fear of exaggeration that millions of dollars are expended annually in this country for the repair and strengthening of structures founded upon inadequate foundations. The deficiency in the foundation may be the result of insufficient investigation, improper design, faulty interpretation of the information available, or poor workmanship in the construction of the foundations.

Lest we become too critical of the foundation designers of the past, bear in mind that early in this century, the cost of carrying foundations to a great depth in order to reach a firm stratum was prohibitive; many structures were therefore placed upon inferior strata at a higher level, and many of them have suffered serious settlement and damage.

In defense of the contemporary foundation designers and constructors guilty of these sins, bear in mind that of all the elements of a structure, the foundation is the least open to exact analysis. We may test and accurately determine the shearing, tensile and compressive capacities of steel, concrete, wood, brick, stone, etc. Insofar as such materials are employed in the construction of a foundation, our knowledge is sufficient to permit of their proper design, if they are subjected to the stresses which we assume to be brought upon them. But the foundation of a structure is that portion which is placed upon some material whose characteristics are not as well defined as the ma-

materials of the foundation itself, nor one that permits of as exact an analysis.

Even under light loads, soils will deform to a far greater extent than steel or concrete. Deformation of steel or concrete results in a change in shape and a relatively small change in volume; deformation of soils is not only a change in shape, but is accompanied by a considerable change in volume as well; it is a change that does not necessarily accompany the application of the load, as in all the materials of construction, but one that may develop some time thereafter.

Bear in mind, too, that it is not possible to determine all the properties of soil from borings and from laboratory tests; unexpected changes may be noticed when excavation is underway, or when the foundations are being constructed.

That there have not been many more cases of serious settlements of structures may be attributed to the fact that many buildings carry but a small portion of the live load for which they are designed, and which is used in the computation of the loadings to be brought upon the foundations. Office buildings are designed for a live load of about fifty pounds a square foot; there is probably no office building in Chicago today that has half that live load. Apartment houses are designed for forty pounds a square foot, ten pounds per square foot would be a much closer approximation of the actual loading.

I shall not take the time to enumerate the known causes of settlement of structures. For those founded on spread footings, or mats, there is a list of around fifteen. For those founded on piles, there is a list of over twenty-five. These lists are not complete. They are based upon known, recorded observations, not on theory. Paralleling these lists is one comprising half a dozen errors in design that have resulted in foundation failures.

Fortunately, the science of underpinning has progressed with that of foundation construction and design, the latter receiving its great impetus from the advent of the eminent Dr. Karl Terzaghi and the science of soil mechanics which he founded, and from the practical application of his basic principles by great foundation engineers such as Daniel Moran and Lazarus White.

Yet, strangely enough, the dissemination of this science and its wide-spread application to the solution of foundation problems has not been accompanied by a diminution in the percentage of foundations improperly designed and improperly constructed. This has been a great surprise to me, and I can account for it only in this way: the principles of the science formulated by Dr. Terzaghi have been well taught, enlarged upon, and promulgated by an extraordinary group of disciples, great teachers like Casagrande, Peck, Rutledge, Baumister, Terzhobataroff and others.

But the principles of this science may not be successfully applied by the mere substitution of figures for symbols in some formula, nor may results be obtained in the same manner as you get a beam size from a steel hand-book, having previously determined the section modulus. The successful application of this fine science requires the combination of mature judgment with a realization of the possible shortcomings in the formula being applied; or a realization that the formula presupposes conditions difficult of attainment in the field. The science has not failed—the tool has just been improperly handled.

You may construe this, if you wish, as a suggestion—even a recommendation—that difficult foundation problems be referred only to consultants experienced in the solution of such problems, for underpinning is a specialized form of construction, and is generally considered quite hazardous. It can be as safe as many other features of construction if it has been planned by experienced engineers, and is performed by skilled field personnel.

As to the actual performance of the underpinning work, I should like to call your attention to the fact that the success of an underpinning operation depends primarily upon three things, namely, the care exercised in excavating so as to prevent loss of ground; secondly, the method of transferring the load of the structure being underpinned to the underpinning element installed to receive it; and thirdly the provision of proper lateral support to the underpinning as it becomes exposed during the course of adjacent excavation. We may discuss these three points briefly:

The first is care in excavating; here, skill is required, in the placing of louvered hori-

zontal partitions, and packing behind them in sand, until the placing of tight boards is self-evident.

The second point is the transfer of load; where the underpinning is of concrete, it is brought up to about 3 inches below the underside of the existing footing, and that space filled with a stiff mortar consisting of cement and sand, with very little water added. This is placed, a small amount at a time, and rammed solid by hammer blows on a short piece of 2 x 4. Such dry-packing is preferable to grouting, as no air pockets will be formed, and no shrinkage will result. It may not suffice however if at some subsequent period pile driving is to be performed near this underpinning, and there is the risk of the underpinning being pulled down by such work; here, recesses should be left in the top of the underpinning concrete for the insertion of jacks, and steel plates and wedges used for the filling of this space until the final transfer of load, when dry-packing may be used for final closure.

The third point is lateral support; it must be borne in mind that underpinning installed as a means of providing vertical support to adjacent walls, or columns, often has the added duty of serving as a retaining wall as excavation proceeds on one side of it. It must be braced, and care exercised in the design and preparation of "heels" installed for the retention of such braces.

There has been, in recent years, an unfortunate percentage of failures of one-story buildings, such as super-markets and bowling alleys—not so much of the shells of the buildings themselves, but of the floors on the ground. No longer may we heed the old-timer who is of the opinion that all soils are capable of supporting some load; surely you do not need much of a foundation for the support of a 30-pound bowling ball passing by every few minutes.

But the old theory of ability to support "some" load is erroneous, if the material is

consolidating and is therefore incapable of supporting any load without settlement. It is worth while remembering that the cost of installing a proper support for a floor, after the building is erected, is generally from four to six times the amount it would have cost, had it been done at the time the building was constructed.

We have, on occasion, been requested to install an absolute minimum of underpinning, or "temporary" underpinning beneath structures which are scheduled for removal in the near future. I reject such a request, for that leads to another subject on which I would like to touch, if I may be permitted this digression; it is not a matter of underpinning, but it is a matter of safety, and as we are discussing safety, I am not going far afield. The subject is "Temporary Construction."

The history of construction in recent years has been stained with records of the failure and collapse of shoring of forms for the pouring of floor arches and walls, of sheeting and bracing of the banks of excavations, and of scaffolding for building construction. Note particularly that these are all temporary structures. There must be a hundred failures of such temporary structures to one failure of a permanent structure. Why? Does the average engineer or constructor, under these circumstances of providing merely a temporary support, feel that he can take more liberties, which is tantamount to saving risks with life and limb? Is he less conservative when designing something that is not to be a permanent installation? The answer to these questions, I fear, is in the affirmative.

The danger has been recognized in some areas. In New York City, for example, the design of sheeting, and bracing of excavations, and of scaffolding and form work must be prepared by a professional engineer and submitted for approval along with the plans of the finished structure.

THE PRE-CONSTRUCTION CONFERENCE AS A MEANS OF ESTABLISHING SAFE WORKING PRACTICES

By GRANT L. SIVIER

Pres., Sivier Construction Corp., Oak Park, Mich.

I am a contractor from Michigan, and I suppose that as contractors in general go, we Michiganders are no better or no worse than others throughout the United States in our attitude toward job safety. We don't like to have accidents on our jobs and we like to see our insurance rates reduced; but to get us to do something constructive about it is another matter.

Concerning safety on one of the expressway jobs in the City of Detroit, William Leighton of the City's Department of Streets and Traffic put the situation this way: "This is a tough job from the standpoint of safety and one that will require real cooperation from all concerned. If a man puts his rear out a few inches too far on this job, he has had it."

We are quite proud, however, of our Michigan State Highway Department and the work they have done, and I would like to tell you a bit about how we try to cooperate with them in improving our job working conditions.

Beginning in 1954, and for two years thereafter, the Michigan Road Builders Association conducted six separate courses for the training in job safety of supervisors of highway and bridge contractors. They were held during the winter season when construction work was at a low ebb and were well attended. However, as these things have a habit of doing, interest lagged. Safety ratings which had started to improve became static and further improvement seemed impossible to achieve.

In October, 1958, the Association's safety committee, then headed by Ammon Schreier, decided something should be done and done soon, or the safety record of road and bridge building contractors was going to worsen and trouble would lay ahead.

About this same time the Michigan State Highway Department became cognizant of the fact that job safety records of their

contractors were not what they might be. Following the election of Commissioner John C. Mackie, the regulation of accident and fire prevention through the offices of the Highway Department was explored with the then Chief Engineer, Howard E. Hill. Mr. Hill's background in the Corps of Engineers, permitted him to visualize the benefits that might accrue from some type of contractual requirement. Also, several of the road and bridge building companies, not necessarily those in the Road Builders Association, were becoming concerned about their safety performance.

In addition to this, the handling of traffic control, both pedestrian and vehicular, around and through construction areas was not consistent, and quite often the placing of responsibility for such controls was not clearly defined.

Strange as it may seem to contractors elsewhere, according to Michigan custom, when a problem arises that concerns any part of the roadbuilding industry, the State Highway Department and the Road Builders Association get a joint committee together and work out the problem. It is as simple as that. The State Highway Department was embarking on a rapidly accelerated program of highway construction—as much as double that of previous years. Such a heavy work program demanded that something be done to improve safety practices, both for the workman on the job and for the traveling public which would be inconvenienced by the construction in progress.

At the annual joint meeting of the standing committees of the Michigan Road Builders Association and the central office personnel of the Michigan State Highway Department, held in October, 1958, the Accident Prevention Committee of the Association made the following recommendation: That the Association petition the Highway Department to institute regulatory

procedures for safe working conditions on the jobs and for fire prevention controls on the jobs. This recommendation was approved by all parties concerned and a joint committee was formed to work out the details.

During the early part of 1959, and well into the summer, the joint committee worked out a set of minimum specifications for job safety and for fire prevention that could be incorporated into the contract documents, and which could be a nucleus for any program that a contractor might care to use. It was recognized that this was a new approach to an important problem. It was obvious that the days were past when the elements of safety on a roadbuilding job were left to the after-thought of a job foreman. This new approach was not a legislated program wherein bureaus would be set up and many people hired as administrators, but rather a program worked on jointly by the participating parties.

The task of hammering out a set of rules and regulations to cover all the problems encountered was a difficult one. It was finally decided that, except for regulations covering trench excavation where rules could be specific, other safe working conditions could be better evaluated at the time of the Pre-Construction Conference. The contractor would be required to submit his program, using these safety specifications as a base, and the department, through its own safety department and its project engineers on the job, would be responsible for enforcement. If the contractor failed to live up to the requirements of the program, the engineer had the authority to stop all work until corrections were made. A quick-acting penalty—but a very forceful one.

Now let me explain what we mean by pre-construction conference. Subsequent to the determination of the low bidder on any project and prior to signing the contract documents for this project, it is required that a pre-construction conference be held. As its name implies it takes place before any construction begins. Those attending are the contractor, any subcontractor he desires, representatives from affected utility companies, traffic regulatory personnel, the district engineer and project engineer of

the highway department, plus other interested parties.

At this time, details as to progress schedules, traffic diversions, special job construction problems, right-of-way problems, interferences with public utilities, and any other special problems peculiar to the job in question are discussed and finalized. The results are recorded and then become a part of the contract documents subsequently signed by both parties.

You can see that this pre-construction conference is a very important part of the start of any project. I can cite here an example of one job in progress now. The John C. Lodge Expressway in Detroit is a difficult one to build. The expressway is depressed which requires the relocation of all utilities. The street on which this construction takes place carries great volumes of traffic daily into and out of downtown Detroit, and must continue to do so all during the construction period. Because of the many problems that these conditions can cause and the many people involved, the pre-construction conference becomes a most valuable aid to all parties concerned.

The joint committee in developing the safety specifications decided that this pre-construction conference would be the ideal place to begin the safety program for any job. Here the contractor could present his program based on the specifications, and the Highway Department could correct or augment it in accordance with these same specifications. The department safety engineer and the project engineer could discuss means of inspection and all the discussions would become a part of the contract documents, thus binding on both parties. The specifications state that "To properly plan the integration of an accident and fire prevention program with construction operations and activities," the contractor shall comply with certain provisions, one of which is, and I quote, "meet in conference with the engineer to discuss the 'Construction Safety Program' and to develop mutual understandings to govern the administration of the program. The agreements and understandings reached at the meeting will be recorded by the engineer and will be made a part of the contract, and will further form the basis on which the accident and fire prevention program will be administered."

The program works just this way. At the pre-construction conference the contractor presents in writing his plan for accident and fire prevention on the work to be done under the contract, and the manner in which he plans to carry out the specifications. The plan is discussed by those present and when approved by the highway department representatives, becomes a part of the contract documents. The project engineer, under the direction of the department safety engineer, outlines his proposed inspection procedures, and this, too, is mutually agreed upon. In this respect our Road Builders Association has been most helpful. The executive secretary, C. J. Carroll, has prepared check lists, outlines for a proposed contractor safety program, and has compiled other information for member contractors' use.

Also at this conference are representatives of utility companies involved, and representatives from local traffic safety departments. Procedures to insure safe operation around the specific utility are outlined and agreed upon. Local rules for traffic safety requirements for safe movement of both pedestrian and vehicular traffic are presented and steps outlined to enforce these requirements.

The contractor is given the forms on which he is required to report (1) the total number of employee-hours worked on the job, (2) all accidents and fires resulting in death or injury to persons, and (3) all accidents and fires resulting in damage to property, materials and equipment. This compiled information helps both the contractor and the highway department to evaluate the program and to point up areas of needed correction.

Several items in these specifications are worthy of special mention:

1. The contractor must designate a person in his organization known as the "Safety Supervisor" who has authority and responsibility to administer the accident and fire prevention program on the job.

2. The contractor must instruct his employees as follows:

(a) Location of first aid facilities on the project.

(b) Names, addresses, and telephone numbers of nearest doctors, hospitals, ambulance services, local fire fighting units, and inhalator squads.

(c) Location of fire extinguishers and other fire fighting apparatus on the project.

3. The contractor must designate certain employees to be in charge of administering first aid and have first aid kits available at designated locations.

4. Designate an area or areas as first aid stations, minimum size to be 8' x 10'.

5. Inform supervisors of traffic flow so emergency services might have adequate ingress and egress.

6. Designate "hard hat areas" and require wearing of protective headgear in these areas.

7. Properly equip employees with protective devices where eyes might be injured, and check on proper protection for hands, feet, and other clothing where necessary.

8. Designate areas for combustibles.

9. Locate sufficient fire extinguishers, especially near fuel and oil supplies and near welding equipment.

10. Properly brace and/or sheet trenches according to Manual of Accident Prevention of the Associated General Contractors.

Included in the general specifications of the State Highway Department are the rules governing the movement of vehicular traffic around and through the construction area. Standards for construction and placement of traffic control signs have been developed in accordance with existing state laws and all these became a part of the agenda of the pre-construction conference.

You will note that though the specifications are a minimum standard, they are rather all encompassing and do provide a sound basis for a good job safety program.

Needless to say, this plan is not a panacea to correct all ills in job safety. It would be wonderful to be able to say it has worked to perfection. While it is a very good start, one must crawl before he walks, and there are a number of areas that need strengthening. The workman must be made aware that the wife of a careless man is almost a widow. Specifically, the program needs more active participation by the contractors involved. Their job-safety programs must be enlarged and employees must be given more evidence that the program is meant to be carried out and is not used just for face-saving purposes.

As an example, during the past season one of our contractors who operates an asphalt plant had shut it down for a day or so and one of the bins needed cleaning. This was one of the newer automatic plants equipped with power operated discharge gates. One of the plant men, a responsible employee with more than 30 years service, was working on this bin with his body in the opened gates. If the power fails these gates automatically close, and while this employee was working on the bin a fuse blew shutting off the power. The man was decapitated.

The highway department must more actively inspect and enforce the programs approved at the pre-construction conference. But these problems are only those of a beginning program and time and effort will correct them.

The pre-construction conference plan has without doubt produced good results. The frequency and severity rate of Michigan's highway contractors during the period from 1959-1961 has dropped 17 per cent over that of the three previous years, which is evidence that the program is working. Insurance rates for highway contractors have

been reduced and this reduction is in the face of much higher awards for compensation for job accidents. Contractors are beginning to realize that it means money in their pockets. When they receive refund checks from their insurance companies due to their good rating, they become confirmed evangelists in the cause of safety. Also in the field of public relations much good has been accomplished. With the heavy program of highway building in Michigan, the public has been served well. Less difficulty with detours, with traffic control, with resulting savings in life and property damage has given the Michigan resident a friendly feeling toward the State's roadbuilding industry.

And last but by no means least, this program which utilizes the pre-construction conference has proven conclusively that the recognition of a common problem and the joint solution of such a problem by the people involved is the way to successfully insure the establishment of safe-working practices.

The moral of the story is: "He is safe from danger who is on guard, even when safe."

VISUAL AIDS AND THEIR USE IN SAFETY AND MAINTENANCE TRAINING

By J. W. SYMONDS

Equipment Superintendent, Peter Kiewit Sons, Inc., Omaha, Neb.

The story of how our company has been using visual aids in safety and maintenance training goes back to the closing days of the war in 1945. Our management realized that some drastic steps would have to be taken to overcome the losses in personal development of younger men during the war years as well as to get all of our people back to the competitive spirit of the pre-war construction period which would surely be with us in the post-war era.

We were impressed with the effective manner in which the various services had been able to rapidly train recruits, not only in the arts of warfare but in the maintenance

of construction equipment. Through the courtesy of some of the construction equipment manufacturers who had developed visual aids for the service, we were able to preview some of the films that they had developed for their respective equipment.

As a result of this preview session, a decision was made to proceed at once on setting up a training program. Facilities were constructed at our Grand Island, Nebraska, equipment depot which included a projection and lecture room, class rooms, and a shop area for the dismantle and repair of equipment.

In January of 1946, the first class met with our president, Peter Kiewit, and top management people as chief instructors, assisted by a staff being developed to continue the school project as well as representatives of various equipment manufacturers.

The student body of the early session consisted largely of our top project supervisors plus some new men who were being brought into the company, most of whom had military experience with either the See-Hees or Army Construction Battalions.

Aside from our own construction equipment which was brought into the shop area for study, servicing, and in some cases dismantling, the only aids we had were films which had been developed for the various services.

Four sessions were held during 1946. The reports on the progress of the men after their return to their field assignments were so encouraging that we have continued this type of training every year. Needless to say, safety training was a very important part of the first conference and continues to be an important part of every meeting we hold.

Naturally, we have modified and improved our technique for conducting meetings. Most of the changes came about through suggestions made by the men attending. Such things as better ventilation of the auditorium, longer breaks to provide more time for exchange of ideas, no-glare lighting, more comfortable seating were obviously required to ease the transition from field work to classroom.

The major criticism of the early meetings was along this line: "I am sure we would get more out of the pictures if they were taken on actual construction projects."

During the 1946 construction season and since, we have been taking pictures of all types of work and where possible, showing both right and wrong methods. These pictures find their way to the screens of our meetings as either 35mm. color slides to illustrate talks, or as frames for sound color strip films.

Over the years we have made many strip films, safety being the most frequent subject, but also on equipment maintenance, supervision, human relations, management problems, and many other subjects.

Here are some of the 35 mm. color slides and the way we use them in our training meetings:

Carelessly built steps and stairs to field tool houses and shops lead to falls and serious accidents.

Ladders should be built of sound material according to approved plans and with uniform rung spacing.

Blocking of equipment must be solid and firmly cribbed.

Most equipment damage accidents are caused by lack of maturity in operators. When selecting operators, be wary of signs of lack of maturity.

Flashing warning lights are required on all equipment that works on nearly finished roads.

Riders should never be permitted on any construction equipment except bona fide instructors or supervisors checking performance.

Proper latches and safety chains are required for all towed equipment.

Provide windshield washing equipment at all service stations to keep truck and pickup windshields clean.

ReflectORIZED belts are required on all men whose work requires them to be aloft at night around construction equipment.

Seat belts are required on all motor scrapers.

There is no such thing as safe ground. All trenches must be braced.

"DO NOT START" tags are clamped to starting controls to avoid a person starting a unit being worked on by another.

Flagmen should be pleasant and informative when dealing with the public. People like to know the reason for, and the expected length of, the delay.

Dump truck safety struts are provided for all dump trucks to avoid danger of falling beds.

All air hoses over one inch in size should be provided with a safety chain to prevent the hose from whipping and injuring men in case of a coupling coming off.

Cable clamps must be installed correctly. Cable must be lubricated.

Operators must visually inspect their equipment before starting a shift, looking for the more obvious faults as well as the less obvious such as crooked frames.

Our safety motto, which we proclaim by billboard as well as small emblems on hard hats is: "THINK! SAFETY PAYS YOU."

THE SLIDING TRENCH SHIELD AS A SAFETY DEVICE

By J. V. OTTER

Engineer—Special Services, Morrison-Knudsen Company, Inc., Boise, Idaho

It is proper and timely for the National Safety Council to include in its program for this Congress consideration of devices and innovations which contribute to accident reduction in the field of trench excavation, because this type of work goes on continuously throughout the entire country and carries with it more than ordinary hazards.

Various types of sliding trench shields will be shown by photographs projected upon the screen. These include examples of fixed-position reusable shoring and boxes from which concept of a moving shield evolved. Following the slides there will be presented a short moving picture showing trench excavation, pipelaying in a moving shield and backfilling of the trench as a continuous coordinated operation.

In my home town paper there appeared a few weeks ago, a photograph with a caption reading:

"Disheveled but not seriously hurt, John Duncan, center, 30-year old workman is given attention by firemen and ambulance attendants after being rescued from a sewer cave-in on North Pendleton Drive on the Boise Bench Tuesday morning. Duncan was buried to his chest and rescuers worked for approximately 90 minutes to free him."

I hasten to say that this did not take place on a Morrison-Knudsen Company project. The example, however, reveals to us in a vivid manner the responsibilities resting upon the shoulders of each subscriber to the National Safety Council, Construction Section.

The man on the job has responded to the safety challenge by operating with more evident interest in his own welfare as well as that of others. New devices and methods

contributing to removal of hazardous working conditions are constantly being developed and put into use. Often the safer methods and devices more efficiently accomplish the work. Where that occurs we have the happy combination of savings in the cost of construction and, reduction in severity and frequency of accidents. Such is the case of the sliding trench shield.

The concept of a protective shield or box slid forward by the trench excavating machine, as pipe laying advances, is probably an outgrowth of efforts to save time and money by replacing conventional, built-in-place shoring with reusable devices.

Ten foot wide panels retain the sides of a 20-foot deep trench where 36-inch sewer pipe is being laid. The panels are handled by overhead crane, but the struts are necessarily installed by workmen operating in the ditch. During the process of installation of the struts there is some element of exposure to accident due to caving ground occurring immediately before the struts are put in place, or immediately after their removal. This is a practical difficulty inherent in all conventional type shoring—in other words—what protects the workman who goes down into the ditch to install or remove the protective devices?

The basic idea of removable and reusable shoring can be shown in a relatively shallow ditch where the danger involved is that of caving of the soil structure at or near the top of the ditch, due to undercutting of the gravel strata existing beneath it. Horizontal stringers are not required by ground conditions in such a case. Vertical members and upper strut were placed by men working above ground. After pipe was laid the

shoring was taken out in the same way and moved forward for re-use as the trenching progressed.

In an improved version of the same idea the vertical members were hung from a pipe extending across the ditch. A trench jack, attached to the vertical members completed the assembly. This assembly was handled as a unit—the only adjustment to accomplish installation being to tighten the trench jack after placement in the ditch and to release it again prior to removal and reuse of the unit. All this was accomplished by men working above ground.

Ingenious removable and reusable protective devices, on a more ambitious scale, speeded installation of 14.2 miles of huge water pipe through the town and country on the southern edge of Los Angeles, California in 1959. The big pipeline—eight feet in diameter—was built by Morrison-Knudsen Company, Inc. and Macco Corporation under a \$12,000,000 contract awarded by Metropolitan Water District of Southern California.

The pipe itself was of heavy steel, coated inside and out with a protective armour coating spun onto the pipe shell. Each section was 30 feet long and weighed a hefty 20 tons, yet it had to be perfectly aligned before being welded within a gaping ditch that ran as deep as 35 feet.

Contributing greatly to progress of construction were many new pipelaying developments devised on the job.

One such development was the adaptation of a single combination dragline and crane to dig the deep trench and place the pipe in cramped urban areas. This rig, a 100-ton Manitowoc, swinging a mighty 5½ cubic yard bucket, laid open a trench with vertical walls made necessary by the narrow right-of-way.

Two other innovations were both in the realm of safety. One was a special steel housing lowered by the big crane into the roughly excavated trench as a safeguard for workmen during fine grading operations which were performed by hand to align the pipe. After the housing was in the open trench, workmen moved inside it and thus had positive protection from any cave-in; rather than relying on temporary shoring to brace the walls of the ditch. The shield, 35

feet long and seven feet wide, had ports along each side for disposal of the hand excavated material.

The other safety innovation involved the use of special made, semi-circular steel cages which enclosed the pipe inside the ditch to provide similar cave-in protection for welders.

The cages were slipped into bell holes—in other words, widened and deepened transverse sections of the ditch—which were dug around the ends of each section of pipe to give welders access. Umbrellas protected workmen from the renowned California sunshine.

Moving to the cooler climate of the Pacific Northwest, we find the origin of the sliding shield in Seattle, Wash. and, a recent example of its practical application on extensive sewer construction recently carried out at Boise, Idaho.

One Ronald Smith, an employee of Valley Construction Company, leading utility contractor of Seattle, is credited with originating the idea of the sliding trench shield, when in 1938 he put two ¼-inch thick steel plates, approximately 6' x 16' in size on edge and welded steel arches between to hold the plates erect and at the proper distance apart and, so positioned as to allow the pipe to be laid beneath the arches. This arrangement proved useful in holding mud away from pipelaying operations at the bottom of a V-cut ditch. He found that the unit could be slid forward in the trench by the excavating machine as the excavator progressed with the ditch digging.

This had the elements of the continuous process trench excavation, pipelaying and backfilling made possible by the use of sliding trench shields employed by Morrison-Knudsen Company, Inc. and their associate, Valley Construction Company, in carrying out a vast program of sewer construction throughout a major residential and commercial area in the suburbs of Boise, Idaho in 1960 and 1961.

Running the southeasterly edge of Boise is a plateau-like sector of former pastures and irrigated farm lands that blossomed, in recent years, into a heavily settled area without accompanying benefit of public sewer facilities. Instead, property owners had to maintain their own septic tanks and cesspools.

Few indeed of those who voted the sewer district into existence had any conception of the magnitude of the project or the impact upon the community that would result from putting over 127 miles of sewer lines through, across, and criss-crossing a 9-square mile area populated by 22,000 people in the relatively short time of 18 months—or about 390 working days computed on a 3-day week basis.

This project, costing well over \$4 million, is, we are told, the largest sewer job let in a single contract, west of the Mississippi River.

In Seattle, Wash., where a large and continuing sewer construction program is underway, the usual size of a job is in the nature of \$500,000. Rarely do they exceed \$1,000,000 and never in the \$4 million range.

The project involved a staggering quantity of work. Disregarding street restoration items and appurtenances, and thinking only of items involving excavation, there was constructed:

1. 459,292 lineal feet of main line sewer (87.0 miles)—with pipe sizes ranging from 8" to 36" in diameter.
2. 1521 manholes averaging 12 feet in height, and
3. 7475 service connections extending from the main line sewer in the street to the property line of each individual user. The aggregate total length of these services was 212,748 lineal feet (40.3 miles).

This meant that streets had to be cut length-wise for an aggregate total distance of 87 miles and cut cross-wise in over 7,400 places.

Compare this undertaking, if you will, with the sewer construction program of the older portions of Boise City where 74½ miles of sewers had been built up to that time. This means that substantially more sewers were constructed in the new District in the short span of 18 months than had been built in the older and larger portions of Boise City in the 94 years since it was chartered as a city by the Territorial Legislature on January 11, 1866.

Since there were few alleys in the layout of the new area, virtually all the sewers had to be installed in the streets, with a resulting upheaval that was a challenge to even the

City's staunchest exponents of western hospitality.

Construction was complicated by traffic. Vista Avenue was cut length-wise to install the mainline sewer and cross-cut at intervals of about 65 feet for installation of service connection stubs to the various properties along the way.

Sewer laying encountered overhead power lines and an underground network of domestic water supply and gas pipelines and telephone cable. On the surface, there was a system of irrigation canals, ditches and laterals conveying water to the urban area and agricultural lands beyond the city.

In the interest of public safety and convenience, no more than 200 lineal feet of sewer trench could be left open behind each excavating unit at the end of the shift. Manholes had to be completed and backfilled in five days.

Trenches varied from six feet to 24 feet in depth and averaged 12 feet deep for the 459,000 lineal feet of 8" to 36" sewer pipelines installed.

There was super-imposed upon the usual concern for safety of employees engaged in doing the work, the burden of the safety and convenience of 22,000 residents and the maintenance of access for fire and police protection, for ambulances, for the delivery of mail, for fuel deliveries during the severe winter weather and for the normal flow of surface traffic, including common carriers and school buses.

Work had to be arranged in such a way that a fire truck could be brought within 400 feet of every structure at any and all times.

Under the high speed construction schedule, production was required of:

1. 10,000 lineal feet of mainline trench excavation and pipelaying and backfilling per week.
2. Thirty to thirty-five manholes per week, and
3. 180 service connection stubs from the mainline sewer in the street to the property line at each residence and business establishment per week.

Nine major spreads of excavating and backfilling equipment were required, including three ladder-type trenching machines and six crawler-type backhoes. In addition ten

smaller tractor-mounted backhoes were used to install service connections. Thus, nineteen excavation operations were in progress simultaneously—each with its attendant exposure of workmen to the hazards of caving ground. This exposure continued for every working day for one and one half years. Danger to children, attracted to the excavations was an ever present concern. The heedless motorist was a problem 24 hours per day—7 days per week.

The characteristic ground condition encountered was that of gravel overlain as much as eight or ten feet of consolidated clay known as hardpan. The trench shield is the design generally used in conjunction with crawler-type backhoes which made fairly wide cut ditches. The lower portion is one-inch steel plate 6 feet high and 16 to 20 feet long with a structural arch at the rear and closed end at the front. Side panels of various heights were used as required.

There was a tendency for gravel to cave-in beneath the hardpan and for the unsupported layer above to fall in. Interchangeable bolted plates at front and rear of the shield were used to adjust its width to that necessary for the diameter of pipe. A hook welded into the back of the backhoe bucket made possible use of the machine as a crane as well as an excavating tool.

Fine grading, pipelaying and bedding of the pipe was accomplished inside the protective box after completion of which it was pulled forward by the backhoe bucket operating in its normal manner of accomplishing a pull toward itself. As a rule the operator simply hooked the bucket over the forward closed end of the box and accomplished the pulling movement. In the event the backhoe bucket could not reach the shield from its standing position, the bucket was hooked to an anchor chain attached to the forward end of the box.

Caving of the trench wall occurred with little or no warning and with terrific impact. Failure of the soil structure was by vertical fracture. The open type shield with structurally reinforced sheet steel side panels withstood the force of the cave-in.

Another type shield has withstood the force of a large cave-in. Cover on the shield protected the workmen inside.

Use of this type shield necessitated the advance cutting of water and gas lines. Serv-

ice was immediately re-established by quick coupling hose connections. As the trench excavating machine arrived, hose connections were detached long enough to let the equipment and shield pass by, and then re-connected. Property owners were, as a rule, not cut off from water and gas service for more than one hour.

The sewer main, in one instance, was located some 10 feet below the gas line but less than 3 feet from it horizontally. In cramped conditions such as this the trench shield has distinct advantages over wider cut V-ditch operations. Because shields permit a narrow ditch to be dug, they also contribute to successful passing of power poles where located close to sewer center line.

Men engaged in laying pipe inside the trench shield were protected by horizontal steel ribbing running lengthwise and by removable cross struts. The removable feature of the struts allowed them to be re-positioned as needed to clear the way for lowering sections of pipe into the shield.

By removal of side panels or substituting side panels of the proper height, shields of the side panel type could pass under some utility pipelines more readily than closed box-type shields for which utilities, as a rule, had to be cut. For major pipeline arteries or telephone duct where such severing was not feasible, the shield was removed from the trench and replaced after tunneling under the service.

Long handled pneumatic tamper permitted required compaction of backfill around the pipe to be accomplished by an operator working above ground. Backfill material, for bedding the pipe, was placed by a workman inside the shield.

Lower rear section of a box-type shield could be cut away, providing "back porch" arrangement for protection of workmen engaged in pipe bedding operations, which followed immediately after pipelaying in the forward end of the box. At the extreme right and at forward end "ears" were provided at various levels. These were for attaching chains used to pull the box behind trench excavating machines.

The sliding shield is pulled behind a ladder-type trenching machine by means of chains. Water sprayed on the trench side

walls reduced raveling and caving, and facilitated sliding of the shield.

An enterprising contractor at Aberdeen, Wash., working in a clay formation which had a tendency to stick to the shield and prevent its movement, is reported to have installed ports along the side walls of the shield into which compressed air at 100 lbs. pressure was introduced to get it on the move again.

Equipment is provided at the left for conveying excavated material to the rear and returning it to the ditch as backfill behind the shield. Fines were separated out by a screening device at the upper end of the conveyor and fed in immediately behind the shield. The fine material was used for bedding pipe being laid inside the shield. Only about 50 feet of trench was open at any one time between excavation and backfilling.

An auxiliary diesel-electric power plant, installed on the front of the trenching machine, provided the required energy to operate the backfilling conveyor and screening plant. Motive power of the trenching machine was sufficient to pull the shield, as well as to perform its ditch excavating function.

Photographs used today were not taken especially for this presentation. Most of them are on-the-job photos, taken during construction by our field engineers in the discharge of their routine duties of recording situations representative of good application of tools and equipment, trouble spots, or other job conditions—good or bad—for proper attention of management.

Sliding trench shields of various design have been developed and used for the past several years by contractors in the Pacific Northwest to effect economies in the cost of sewer construction and to provide better protection for workmen employed below ground surface. Conventional shoring is not entirely displaced by sliding shields but its use can be greatly reduced thereby.

On no two sewer construction projects are identical conditions encountered. Accordingly, adaptations of the basic moving shield concept have been developed to meet some of the varied conditions which include soil structure, trench depth, underground utility installations and the type of trench excavating equipment employed.

Because use of the sliding shield permits pipe laying and backfilling to follow closely behind trench excavation, streets can be made available for surface traffic more promptly than normally possible using conventional methods. Where sewers are constructed in populated areas, this especially is not only a matter of convenience to the public but also better serves the interests of public safety.

Use of the devices and innovations discussed in this presentation have produced enviable safety records.

A total of 326,000 man hours were worked on the 14.2 mile water line project in Los Angeles, described earlier, with no lost time accidents due to caving ground.

Contrary to the expectations of many who contemplated the risks involved on the Boise, Idaho sewer project, with its 127 miles of sewer lines laid in trenches averaging 12 feet in depth and reaching down as deep as 24 feet, the project safety record was good. In fact during the entire 18 months of big production operations, involving over 500,000 man hours, there was only one lost time accident below ground surface. As this was a mechanical type accident, not due to ground conditions, it stands on the record that there were no lost time accidents due to caving ground on that project.

In order to survive in the sternly competitive business of modern construction, constant improvement of methods, tools and equipment is necessary. This evolution affords an opportunity to bring forth parallel advancements in safety practices because the most efficient construction method is usually the safest method.

Existing safety codes of Industrial Accident Boards and other regulatory bodies should be upgraded and modernized as improved construction methods and devices are perfected. New codes should be written on a sufficiently liberal basis to permit accident prevention to keep abreast of advancements in the art and science of construction.

If this is not done, the very codes originally written to safeguard workmen become a deterrent by preventing or delaying adoption and use of new and better and safer ways of doing things.

In this connection, recognition is due the Associated General Contractors of America

for steps recently taken to improve its Manual of Accident Prevention.

No discussion of safety devices would be complete without reference to the most remarkable of all—the workman—whose wisdom as to the nature of the ground came, as did his leathery countenance, from years of exposure to the hazards that lurk in the

sidewalls of an open trench. More often than not, reliance can be placed upon his appraisal as to the extent of the dangers involved.

This man, teamed with management, willing to fix what's wrong, keep what's right and, move ahead with new and better methods and devices is, in the final analysis, what it takes to get results.

HANDLING OF PRESTRESSED CONCRETE MEMBERS

By KEN PHILO

Engineer, Massman Construction Co., Kansas City, Mo.

The title of this paper encompasses an important phase of a young but already large and fast growing industry. It has only been since 1947 that the problem of handling prestressed concrete members in the United States has existed. The methods now established have been evolved from the solution of specific problems on specific jobs with no precedent established. Also the methods of coping with such problems are constantly changing as the designers are ever widening the horizons of prestressed concrete. The net result is increasingly larger and larger members to handle.

A prestressed concrete member is composed of essentially two integral parts—A—pretensioned or post tensioned wire or cable and concrete. In handling such a member, two inherent characteristics of these materials are, in fact, handling limitations. These characteristics are 1—concrete will not resist tension, and 2—wire or cable will not resist compression. Therefore, the essential problem is to load, transport, unload, and erect these members while keeping the stress limitations from being exceeded. Also to be kept in mind is that the prestressed concrete members are but a portion of any major project, and therefore their handling is further complicated by site conditions, and the scheduling of other portions of the work.

To illustrate the specific problem and specific job approach to handling prestressed

concrete members, the recent completion of the Platte River bridge near Achland, Nebr., is investigated.

The Platte river crossings, as designed by the Nebraska Department of Roads, consisted of: a substructure of 26 pile bearing piers and four pile bearing abutments and a 28-span superstructure composed of 168 prestressed concrete girders and a 6½ inch reinforced concrete deck. The quantity of prestressed 14 inch piling was in excess of 30,000 lineal feet and was furnished in 95, 75, and 65 foot lengths. The contract for the subject work specified a completion date of December 31st, 1960, or completion of 165 working days, whichever was the earliest. Anticipated weather and river conditions further narrowed the time allotment to the period from June 15th to December 15th or 185 calendar days.

In planning a job of this nature, the schedule or time table becomes all important. To satisfy schedule requirements, the following plan was evolved. Start construction on the south or Lincoln side of the river because of rail and road access. Divert the river to the north side as far as possible and construct the substructure by use of sand dikes and a well point dewatering system. Build a rail spur from the main C.B. & Q. line parallel to the bridge and extend it across the river on the upstream dike as pier construction proceeded, this spur to be used primarily for prestressed

beam and piling shipments from Lincoln, Neb., some 35 miles away. When the substructure had been pushed as far north as possible, divert the river thru a trestle and under the south spans of the completed bridge, and thus continue construction of the bridge to the north abutment. At Lincoln, in the Nebraska Prestress Corp. yard, new production beds, storage, and loading facilities had to be constructed to manufacture, cure, and load the 110-foot, 56-ton girders and necessary piling for job site delivery on demand.

The overall plan was made possible by the close cooperation of the Massman Construction Co. with the Nebraska Prestress Corp.; The C.B. & Q. railroad; John W. Stang Corp., and the Omaha Ready Mix Corp.

Execution of the plan was initiated May 19th when the first of four crawler cranes was unloaded at the bridge site. Work was immediately begun on the rail spur and dike and storage yard on the south bank just upstream of the right of way. The 30 day period following was used to organize, supply, and equip the job for an anticipated starting date of June 15th. During this period 39-foot track sections were built and stored, pier forms and reinforcing prefabricated and well point material assembled at the job site. Thirty-five miles to the south, girder production beds were being constructed, piling cast and cured, and shipping units readied. Crawler crane job assignments were as follows: well pointing, a Northwest Model 6-D; form setting and pouring a Northwest Model 80-D; dike building and excavation a Northwest Model 95, and pile driving a Model 3900 Manitowoc.

Work had just begun on abutment Number one and the first stage well pointing, when on June 20th the Platte river overflowed its banks and flooded the job site. By June 25th the water had receded to a point where work could begin on a dike to divert the river. This 24 ft. wide dike was started 1000 feet upstream and angled downstream to intersect the bridge at midstream, enclosing the first 12 piers. This dike was pushed on a round the clock basis while connecting cells enclosing twin piers were constructed during the regular work hours which were 6 nine-hour shifts a week. Each cell was formed by constructing

an upstream dike and a downstream dike parallel to and 100 feet from the center line of the twin bridges. A cross dike between each set of piers 10 feet apart completed each cell. As the upstream dike was extended, the rail spur was advanced and as the downstream dike extended, its surface was rocked for a haul road.

Pumping on a 24-hour a day basis was begun July 8 on the first ring of a well point system that was to hold the water down some 20 feet below the dikes for a period of 4 months. This system was composed of five connected rings of which four rings were pumped by 8, 12, and 16-inch pumps, while the fifth ring was being leap-frogged ahead. Each ring was 110 feet by 164 feet and when the whole system was in place, was capable of handling 30,000 gallons a minute.

Pile driving initiated pier construction was begun July 14th. Since only four cells could be dewatered at one time, operations were grouped as follows: Cell one, excavation and pile driving; Cell two, pile cut off and pour footings; Cell three, place reinforcing and form piers; Cell four, pour and strip piers. For efficient progress then each operation including leap-frogging one ring must be geared to the same speed. A four-day cycle was achieved, which resulted in a complete pier every two days. By September 21st, at which time it became necessary to divert the river to the south bank, 18 piers and two abutments had been completed.

The first of the 168 prestressed girders was erected August 20th by a job built gantry crane. This Massman designed and built overhead crane picked the 110-foot 56-ton beams directly from the shipping units on the rail spur parallel to the bridge and traveled on the pier supported rail system to the beams final position. The placement there culminated an erection scheme featuring a minimum of handling. The gantry was moved ahead to each span on the first shipping unit carrying the first beams to be erected in that span. Rail supports for the gantry were moved by crawler crane, a procedure that could be completed in one working day.

Immediately after beam erection, diaphragms were formed by using expandable wooden forms to allow for minor width

differences between the beams. Deck forms and reinforcing closely followed diaphragm stripping, and September 26th the first of the 28 deck slabs was poured. These deck slabs were formed, poured, and stripped at a rate of slightly less than three working days each. The last one being poured December 17th, two days over the schedule.

Now the problems of handling the prestressed concrete members for this job can be analyzed with the proper perspective. Some 300 car loads of material had to be manufactured, stored, and loaded at Lincoln, transported 35 miles to the job site, and there put in place. You may now recall the type of member we are dealing with and its limitations, a member that weighs 150 pounds per cubic foot with dimensions over 100 feet, a member that is imbedded with cables stressed to 330,000 pounds each, a member that has been designed primarily to resist static forces from certain directions only. On this project, such members take three rail cars to carry and 14 inch octagonal members that, when lifted from the horizontal to the vertical, tower as high as a 9 story building. Do not forget that "in place" means in the middle of a river well known for its treachery.

To reduce these problems to a safe economical solution requires a sound plan, proper equipment, coordination, and always an awareness of the handling limitations of prestressed concrete members. To handle the subject prestressed members in the yard, two travelift rigs were used. These rigs were first designed for use in drydocking boats and were then found to be adaptable to prestressed yards. Each rig has two 15-ton hoists, and by the use of a spreader beam between the hoists one end of the girder could be picked up. These travelifts roll on four large rubber tires. The rig spans 32 feet and is 25 feet long. Highly mobile, the two rigs safely and satisfactorily handled all the yard handling, storage, and loading requirements.

For shipping the girders a rail spur was brought into the yard alongside the storage area. To ship two girders, a unit of three flat cars was used. The girders were brought over the rail cars by use of the travelifts and set side by side, bearing on the end 40-ft. cars. The center 50-foot car was utilized as a spacer only. As the unit

went around a curve the cars would take the curve of the track, but the girders remained straight. Therefore, bearing units had to be so designed that both would pivot and one would slide. This was done by using steel bolsters with steel shoes sliding on greased plates. The two girders were also properly placed and tied together while blocked from the ground so they acted as one unit.

At the site the gantry crane served erection conditions admirably well. The gantry crane hoisted the girders by the use of a torque converter double drum single shaft engine with a 20,000 pound lead line pull. Reeved with six part lines, hoisting was a smooth and efficient operation. The gantry was propelled by rubber-banding two lines attached at the opposite end of the track. Two tower bents supported the gantry over the cars and intermediate trusses spanned between the pier supported rails. During moves ahead the tower bents were supported on the cars by eight swinging jacks and the whole unit pulled ahead by a TD 15 dozer.

Pillings were shipped to the job site in 60-foot gondola cars and unloaded on the cross dikes by crawler crane. The 3900 Manitowoc was especially selected and rigged for the requirements of handling a 95-foot, 7-ton prestressed concrete pile. It was initially rigged with 127-foot leads fixed on a swivel at the boom point, and a telescoping moonbeam attachment at the base. One hoist line was used for the hammer, and two hoist lines were used as pile lines. The two pile lines with snatch blocks at the ends picked the long pile with spreaders at four pick up points. Special 2x4 and celotex cushions were used on the pile cap to prevent spalling.

This prestressed structure (the largest west of the Mississippi) was completed in 142 working days. The proper handling of the prestressed concrete members playing no small part in the establishment of this record—without a lost-time accident.

To summarize, then, it is suggested that specific handling methods should be utilized to solve specific job requirements and let the specifications for handling prestressed concrete members be of the end result nature, the only limits of which are the inherent limits of the materials themselves.

PUBLIC EMPLOYEE SECTION

HOW DO WE KNOW PUBLIC EMPLOYEE WORK IS SAFE?

By WILLIAM E. BESUDEN

Staff Member, International City Managers' Assn., Chicago

The observations I wish to make are based on contact with those in the field of safety and with some experience with safety problems. When I first began working for municipal government I was employed by the department of personnel of the city of Cincinnati, Ohio. The department there was just getting underway with a safety program and at times I assisted in safety training. Later as an assistant to a manager I was again impressed with the importance of safety when I attended workman's compensation hearings that resulted in costs to the city of 53,000 dollars because of accidents to employees.

Finally as a member of the International City Managers' Association staff I prepared a brief survey report on "Public Employee Safety Programs." In preparing this report I spent considerable time with the people of the National Safety Council. We also contacted a number of cities and we read the literature of the field.

The observations are based not only on what I have learned about safety from the above experiences but from what I did not learn. The observations I wish to make are four:

- (1) Safety is important.
- (2) You do not know the extent of the safety problem and what is being done.
- (3) You have not decided how to attack the problem.
- (4) The Public Employee Section of the National Safety Council is not known by cities.

The first observation is "Safety is Important," but is it? Your immediate reaction probably is, "Did I come all the way to Chicago to hear some fellow tell me that my profession is important?" Granted everybody thinks that safety is important. It's like being for motherhood. But what is lacking,

it seems to me, is a positive for safety attitude.

Safety is important to state and local governmental agencies because the work done can be dangerous and such agencies represent a large amount of employment. Work such as police, garbage collection, and construction are recognized by most people as dangerous employments. The last census figures (Oct. 1960) show that 3.5 million people, not including educational employees, work for state and local governments. In 1951 the figure was two million—a large increase.

Municipal employment alone increased 20 per cent from 1953 to 1960. It is therefore obvious that governmental employment is on the rise. Contrast this with some industries where employment is on the decline. Automation appears to be bringing an increase in employment in the service industries such as government and a decrease in some production industries.

Safety is important because it concerns people and this is a point I think we often forget. We get wrapped up in the economics of safety and fail to remember that the prime objective of safety programs should be the prevention of human suffering. People are important and I think in this day and age that an appeal to governmental officials based on this fact will carry great weight.

Safety is important because it does save money. Time after time you, I know, have discussed this particular aspect of safety programs. You have been told of many examples and each one of you can tell of still more where a safety program has saved money for a governmental agency.

Some examples that I uncovered in preparing the survey report referred to one in Royal Oak, Michigan, that reduced motor

vehicle losses by \$4,323 in a year's time; Iowa City, Iowa, reduced a workman compensation experience ratio, effecting premium costs from a debit rating of 123.2 to a plus of 31.8; and Glendale reduced the cost of accidents per employee by 21 per cent.

We are all aware of why safety is important. There is no one here that would disagree with any of the things that I have just said. But the question is have you convinced governmental officials of the importance of safety? Have you developed a *for attitude*? I think not. There are several reasons why it is difficult to convince public officials of the importance of safety. Perhaps if we looked at these reasons we would be better able to develop the necessary *for attitude* that is so vitally important to effective safety programs.

First of all, those who have the final say on governmental programs are the elected councilmen, county commissioners, state legislators. These officials come and go and they have not seen the importance of internal safety. It is indeed strange that they pass laws that affect the safety of many not only at work but on our highways. Yet the same officials do not seem to stress safety programs for their own employees. I do not believe that elected officials do this intentionally but I believe the story has not been brought home to them of the importance of safety for the governmental employee. Do not forget that the elected official has many interests attempting to get his ear.

Secondly, the diversification of governmental activities creates a most difficult problem for the safety engineer in governmental employment. Instead of having one integrated production facility he has a diversification of activities. This diversification of governmental activities conducted by one governmental body affects the collection of statistics and other aspects of good programs that we will briefly mention later.

The third problem is demands for money. Each activity has its pressure groups in our society and this places demands on a limited amount of financial resources. True safety programs save money, but elected officials must be made to see this. Otherwise they will consider safety simply as another program costing so many dollars which the

municipal, county, or state government does not have.

The fourth reason that more attention has not been placed on safety programs in governmental agencies is probably that there seem to be more pressing problems. The city official faces many, many problems and some of these are more paramount and of an emergency nature than the problem of safety. For instance the city council is going to be more concerned by the problems of the merchant who is demanding central business district improvement than he is with the safety program. The problem of central business district is not only more pressing but it is more glamorous to the general public.

The second observation I wish to make is: You do not know the extent of the safety problem and what is being done to correct the problem on a national basis. True, *Accident Facts* gives a three year average frequency rate of 17.64 for cities, but this figure represents an average of only 22 cities and approximately 60,000 employees. The total number of cities over 10,000 population is 1,762 and total municipal employment is approximately 1.5 million people.

You do not need to be a statistician to know that this is a poor sample. The figure is all the less valid when you realize that the 22 cities are some of those with the best safety programs. *Accident Facts* also gives a frequency figure for state highway departments. This figure is made up of only 12 states although it probably represents a higher portion of employees working for state highway departments than is represented by the municipal figure for municipal employment.

You do not really know what is going on in the field because there is no full study of safety activities of state and local governments. Yes, you know what some cities are doing. A survey report like ICMA published discusses some of these programs. But how many cities, counties, and states have fully organized safety programs? Few I suspect. For one thing I am told that there are 130 agency members of the Public Employee Section. This represents about 90 cities and 43 counties and states.

Maybe your immediate reaction is "that so many governmental units are small." I

submit that there is a need for safety in all governmental units. Interestingly enough, not all of the cities that belong to the PES are large. There are a number between 25 and 100 thousand and at least one is as small as 9,000.

Do not make the mistake of ending up talking to yourselves. Get out and talk to those that do not belong to your section. Talk safety and get other people interested. Let their reaction to your program.

The International City Managers' Association because of its interest in safety and the National Safety Council plan to make a survey to determine just how many cities have organized safety programs, a few facts about these programs, and how many cities keep accident records according to the American standard method of recording and measuring work injury experience. We are doing this because we believe we will be able to get a good sample of all cities over 10,000.

The International City Managers' Association for over 25 years has published the *Municipal Year Book*. Each year we survey cities for information on what has transpired in a number of fields affecting cities during the past year. In certain areas we get at least an 80 per cent return. We hope to give questionnaires that will represent at least 60 to 70 per cent of those cities with over 10,000 population. These questionnaires provide a good knowledge of which cities have programs and of which cities keep records and how.

The third observation is: You have not decided on how to conduct a safety program. Oh yes, you agree on certain things, or at least that's my impression. You agree for the need of top management support. You agree on the employee participation and you agree on the need for keeping accurate records. However, there is a need to agree that government (municipal employment, county employment, and state employment) is an industry. We find many agencies of the same government conducting their own safety program with little concern of what the

other agency of the same governmental unit is doing.

To acquire top management support the program must have central direction. Management's major task is to plan, control and direct all activities of the organization as determined by elected legislators and to keep a balanced program. It will naturally take interest in and support those activities which receive central direction. Further, if records are accurately to reflect safety experience of municipalities, it is necessary to provide for the central collection of statistics about accidents.

The fourth observation is that governmental agencies do not know of the Public Employee Section of the National Safety Council. On the other hand, there are few governmental officials that do not know of the National Safety Council's work in the area of pedestrian safety and highway safety.

Again it is indeed strange that many governmental officials do not realize that the National Safety Council's largest group of employees is concerned with industrial safety and that you people of municipal, county, and state governments have your own section with your own staff representative ready to serve other governmental agencies and help them in establishing a safety program. It seems to me that you can get out and sell your program more than you have. It was encouraging to hear your chairman briefly speak of some of the things that you have done during the last year in this regard.

I hope I have said a few things that may help you. If I encourage you to get out and be an apostle of safety, I have accomplished one purpose. If I perhaps suggested new ideas for your group to consider as projects, I have accomplished another purpose. Remember, I said that I was going to only make observations. I may be wrong but if I reflect the observations of others who are connected with government employment but not directly connected with safety, they should have some value for you.

LET'S TALK ABOUT OUR COMMON PROBLEMS

Presiding: WARREN D. WILT, Safety Engineer, City of Detroit.

Participants: JAMES F. GLEASON, Safety Officer, City of San Diego;

H. P. GOODIN, Safety Director, City of Minneapolis;

JOSEPH F. WICKLESS, Supervisor of Safety, City of Baltimore.

Mr. Wilt demonstrated the effective uses to which a set of flash cards showing caricatures of typical personalities encountered in safety meetings could be put. The character typology ranged from "quick, helpful" to "highly argumentative." Distribution of the flash cards at a meeting can jar the participants into an awareness of their own attitudes.

Mr. Wilt outlined a number of "safety vitamins" which might be administered to pep up any safety program. He listed the G.A.T.—Gummi-ck Aids for Training; the S.S.P.—Safety is Standard Practice; the B.P.W.—Basic Printing and Writing; the M.V.A.—Making Visual Aids; the I.S.C.—Improved Safety Command; and a D and C vitamin complex for Demonstration and Communication.

John M. Collins of New York City Department of Hospitals, entered the discussion at several points to confirm the fact that communication problems in the dissemination of safety information to New York City hospital employees are quite similar to those encountered across the nation.

Mr. Gleason gave expression to the underlying reason for the existence of problems found in common among safety-men in the public employee section: the rapidly increasing numbers of public employees in the U. S. have created communication problems at all levels of public employment.

Mr. Gleason set forth a three point pro-

gram for achieving safety goals in the public employee field: (1) determine needs in terms of frequency rates in individual departments by way of statistical review and analysis of hazards (2) create interest in safety in a given department by the best available educational and training techniques (3) obtain actual involvement of the employees in the safety program and provide opportunities to maintain their involvement.

Mr. Goodin commented on the role of unions in implementing public employee safety programs. In his experience, the unions had great influence on dissemination of safety information, having a system ready to hand for communicating with the rank and file. In times of labor-management conflict, occasional problems in free transmission of safety messages were noted.

Mr. Wickless posed a number of problems concerning the elucidation of driver psychology. An analysis of accidents involving drivers for the City of Baltimore showed that driver attitude was often a direct cause. Mr. Wickless appealed to the possibility of suitable psychological tests to arrive at a reasonable evaluation of driver temperament.

Mr. Wickless also explored problems of the budgeting of safety programs. The approach to the budget requires, in his view, tactical as well as strategic steps toward the presentation of accident cost analyses in the city council. Timing is of great importance for placing the accident picture in proper perspective.

SAFE BUILDING MAINTENANCE IS COST IMPROVEMENT

By RAYMOND DENOMME
Building Service Supervisor
Detroit-Wayne Joint Building Authority
Detroit, Michigan

The sanitary maintenance of buildings, schools, hospitals, hotels, and industries is a \$6 billion industry that employs over one million people.

These million people, to a greater or lesser degree, are responsible for the health, comfort, and safety of many millions of people each and every day.

As a sanitation program manager, I am interested in the manner in which this money is spent for materials or salaries and in the manner in which these million people do their work.

Until such a time as all or the greater part of this \$6 billion expenditure is wisely expended, and until such a time as these million or more people work in an efficient and economical manner, the sanitation program managers and their staffs will lack the prestige they deserve.

I, therefore, welcome the opportunity to speak to you today because you, not too many years ago, were in a similar position.

You had an important message for labor and industry. You were able to put across your message by pointing out to management that there was a dollars and cents approach to safety as well as a humanitarian approach.

The size of your convention currently being held reflects the success you have attained.

We in the field of sanitation are having difficulty selling sanitation to top management. We lack, at the present time, sufficient supervisory personnel with higher education backgrounds. Consequently, it is difficult for us to adequately present our case to top management.

It is my opinion that a powerful ally, such as you safety people who have been able to attract to your programs men and women of dedication and higher educational backgrounds, can materially help us reach our goal.

My mission here today is to convince you that you have a stake in our future and to ask for your help.

I would like to present my case to you and begin by asking questions.

1. Has it ever occurred to you that every individual working in the field of environmental sanitation is responsible to a degree for the health, comfort, and safety of at least 25 other persons?

Now that I am talking about the safety of 25 or more millions of people, do I have your attention?

2. Just how deep has been your interest in the activities of these one million people whose work performances and use of materials and machines affect the safety of another 25 million people?

In the places that you work and over which you may have direct or indirect supervision, there are floors, walls, furniture, and washroom facilities.

People slip and fall on the floors. Have you done more than just run tests on the product put on the floors? Do you know how these floors are maintained by sweeping, mopping, and refinishing processes? You should because in the majority of cases it is not the product that is at fault but the daily maintenance procedures.

Isn't it true that dirty furniture and walls affect people mentally, emotionally, and physically to a degree that the ground work for an accident is often laid by the poor performance of the cleaning staff?

Their work is usually done when no one is around and they are rarely thought of when you attempt to determine the cause of an accident.

How about washroom sanitation? Are you sure that many accidents occurring in washrooms and directly attributable to poor sanitation practices—which are not reported due to embarrassment—could not be

eliminated if you as safety people worked with the sanitation supervisor more closely?

There are six factors in the attaining and maintaining of a modern sanitation program. I will name these and will point out to you how you are or should be involved in each and every one of them.

1. Management Support of Our Efforts to do a More Efficient and Economical Job

Top management will heed our request for new equipment and for preventive maintenance programs if you in safety can point out to top management that worn out, defective equipment should be replaced or repaired on a regular schedule.

Further, the washrooms, locker room, and eating facilities of the custodial staff are usually of the poorest. This often results in lowering of the employee morale and very often loss of time due to poor dietary habits.

2. A Plan of Attack

A well organized sanitation program is one where work instructions are clearly written or typed and posted in the proper places. Part of this program includes one or more bulletin boards large enough to include safety posters and information on the availability of safety equipment both on and off the job.

3. Supervisory Effectiveness

In the promotion of individuals from the ranks to supervisory positions a review of each worker's safety record should be part of the examination.

A man who will not practice safety as a worker will not teach and preach safety to others when he becomes a supervisor.

There should be an adequate ratio of supervisors to employees. These supervisors should be trained to make periodic checks of each worker's area and to report in writing all safety hazards.

Most important, from the standpoint of safety, the supervisor must be one who recognizes that a "stitch in time saves nine." He should, if possible, take a first aid course and at all times should have access to first aid equipment and the means of reporting and transporting serious cases to a doctor or a hospital.

4. Employee Training

Employees must be trained to do the work

in the most efficient and safe manner possible.

Every injury, however slight, must be reported.

All bulletin board notices should include written memorandums to the employees on this subject.

Equally as important as the safety of the individual doing the work is the safety of those who use the premises. Here again, every employee must know this and be trained to report to supervision all instances of lights out, existing hazards, and potential hazards.

When a trained employee reports a chipped ash tray or broken desk glass and a competent supervisor makes a report to top management and top management removes the hazard, then the employee is impressed with management's concern for his safety and he in turn will be concerned with the safety of others who work in his place of employment.

5. An Adequate Amount of Good Materials and Machines

Cleaning work is a monotonous, repetitious, and generally speaking, unrewarding task. If it can be made easier and more interesting and more rewarding by the use of good materials and the needed machines, then, in all likelihood, employees will do a better job, will make fewer mistakes, have fewer accidents themselves and eliminate factors that contribute to accidents among those who work in our hospitals, hotels, schools, and industrial buildings.

6. Research and Development

Very few supervisors in the field of sanitation are equipped at this time to evaluate properly materials and machines from the standpoint of safety.

It is this area that the safety people can be of great assistance because within the ranks of safety people there are those with chemical and engineering backgrounds.

I sincerely hope that at this point you will see the sanitation worker and the sanitation program manager and his staff in a new light. While it is true I am asking for your help, it is equally true that the building maintenance people of many installations, hotels, schools, office buildings, or industrial facilities have never been out-

done in generosity. Traditionally, we have always returned more than we have received and I can assure you any help that you can give us will be returned to you three fold.

If you doubt that there is need for your participation in our program, then I ask you to spend a little time reviewing the work and procedures of the night cleaning force in your activity.

Check the work habits of the employees. Do they leave the equipment around in a careless manner creating hazards for themselves and their fellow employees? Do they take the proper precautions in using ladders and mobile vehicles in their night's work? Are they cleaning the washrooms properly? Are they reporting hazards or have they stopped because nothing was done in the past?

From my experience in visiting many buildings throughout the country and asking these questions I have asked you above,

I have found a great need for the help and counsel of you in the field of safety.

I have heard it said that people have more accidents at home than at work. I am sure the majority of home accidents are due to poor cleaning procedures, improper use of maintenance equipment, and carelessness in handling products.

These same people who are so careless in this area at home invariably bring these poor habits into our buildings where our children go to school, our friends and relatives are hospitalized, and where most of us work.

It becomes apparent that you in safety can kill two birds with one stone by helping us in sanitation have safer working conditions, safer equipment, and by helping us teach our employees to work safely with the results of having these good safe practices carried back into the employees home and into a worker's off-the-job safety program.

PROGRAMMING SAFETY IN FORESTRY WORK

By HAROLD W. MASTERS

Safety Dir., Asplundh Tree Expert Co., Jenkintown, Pa.

I have been engaged in safety work personally for over a quarter of a century and I don't believe basically there is any difference in organizing and programming a safety program for any industry.

Since the inception of accident prevention so much has been written and spoken about its various phases that it is becoming a difficult job to speak about it from a new angle. I am sure that all of you feel that, although safety is definitely important in tree work as in all other phases of industry, nobody can say very much about it that is really new. There is very little that is new or exciting about the basic philosophies and practices of the problem.

But we at Asplundh believe that we have discovered a new way to get our men more interested in safety. I would like to tell you about this new way because we are genuinely proud of the results. Our accident experience records are the best today they have been since the beginning of our

Company. Safety education and its results depends upon communication: what is involved in speaking, listening, reading and writing. Might we not get somewhere if we look at safety education in the terms of this business of how people communicate and why communication sometimes is unsuccessful?

We started with recognition of the fact that visual education is one of the most effective ways to put across any message. We recognized the impossibility of bringing to our office in Jenkintown our men from the 42 states in which we now operate so we knew that we'd have to take the program to them as a sort of "Road Show." We organized for months, with a number of trial meetings, before we found most of the answers—and then we started rolling in high gear.

Time here doesn't permit description of the entire program, which started with a good dinner at the best local hotel, and

then went on into a carefully planned and scheduled two hour show, with a short intermission between the major parts, but I would like to show you at this time one of the elements which we consider most important and I believe is a most essential factor in the organization and setting up of a safety program.

For the most effective results, will you for the next few minutes, imagine yourselves as employees of the Asplundh Tree Expert Co. so that you will understand more fully the message that I am going to bring you. This should not be a difficult impersonation for most of you. Our tree men, like you, love trees and are outdoor men in better-than-average physical condition. So, from now on, I am talking to you as members of our organization . . .

Do you realize that billions of dollars are wasted each year on accidents, and millions of non-productive hours are caused by accidents. It is unbelievable that intelligent people such as ourselves are forced to tolerate such a deplorable condition. If you stop to realize the homes that could be built, the automobiles that could be manufactured, and the tremendous amount of material things that could be made with the money that accidents cost the people in the United States alone each year, it is something that everyone would like to do something about.

I am going to attempt to help you visualize the tremendous importance, both financially and psychologically, that accidents and injuries have in our business.

As you know, we spend quite a bit of time harping on the subject of Safety. It's an old subject, but important. Sometimes this harping becomes quite monotonous, but nevertheless, it has had favorable effects—and until we have attained a Utopia in accidents, which you and I know can never be, the safety department will still play this harp.

To begin with, we know that tree trimming, whether it is a private job or whether it is a line clearing job, is more hazardous work than the usual office job and many other classes of employment. Tree trimming and line clearing involve falls, hazardous equipment, falling objects such as tools, branches or trees, high voltage wires, and a variety of other hazards connected with

outdoor work, such as poison ivy, brush fires, traffic accidents and weather.

We are inclined to think of an accident involving only the man injured—who suffers pain, lost time, lost income, crippling, and psychological effects. There are many other effects on which I will dwell slightly further on in this talk.

Aside from the direct effects on the injured man, an accident involves many others—the worker's family and friends, the members of the crew, the customer whom the injured man's company is working for, the general public, and the company the injured man works for. You can see from this that an accident is not singular in its effects, but very much plural.

The injured man's family and friends may be seriously affected. Aside from distress and worry, they suffer loss of income—not just at the time, but possibly future earnings will be seriously reduced as a result of physical or psychological effects of the accident. The injured man's children may be denied opportunities that will affect their future—opportunities that were planned without thought of how an accident could affect them. Have you ever been called upon to notify an employee's family of an accident or a fatality? If you have, you know exactly what I am talking about.

Members of the crew, too, are affected. The distress is only part of it. The accident involves adjustments for them, such as trying to operate without the man, or the effort involved in training a new man to become part of a good working team. There are also temporary psychological effects on a working crew when one of its members is injured through an accident. Sometimes it takes a long period of time for the crew to get over this psychological effect, and during that time production and efficiency of that crew is naturally reduced.

Effects on our customers are serious, too. Although we free the customers from any responsibility or worry, they still suffer from our accidents. An accident reflects on them in the eyes of the public. And, of course, interrupting the work means a loss to the customer of income or service as well as the confidence of the public.

The effects on the public may vary greatly. Psychological effects are involved. The public may be directly involved in the accident

—either through personal or property damage. In addition, there is the overall economic effect that is involved whenever an important job is interrupted—and the lost income because of a worker's reduced income resulting from an accident.

The effects on our company are many and serious. We are proud to be experts in our line of endeavor but, when an accident occurs, we cannot maintain our "expert" standing.

When we sell our Asplundh package of line clearance today, we sell much more than just clearing a line. This package has to contain, among other things, a good safety experience and a good accident prevention program.

To operate a business and to present an attractive package, there is a price tag—and this price must include all costs and still allow a profit and a margin for expansion. This price tag includes labor and equipment to do the job. It also includes the cost of insurance to cover compensation, public liability, property damage, and other factors—and many direct costs, such as administration and taxes.

Accidents are expensive—sometimes very expensive—and the price of the accident will go into our price tag or we will go out of business. Someone has to make up the billions of dollars spent each year on accidents—you and I are the "someones." Prices would be quite different if we did not have to include the money it cost to pay for accidents that we didn't want in the first place.

Obviously, accidents involve direct costs, such as money to the doctors, hospitals, and lawyers. Whether the accident is to one of our men or whether it also involves the public, these costs can be very great. These direct costs are borne both by the injured person and the company for which that injured person works. These are only a few of the direct costs.

Obviously, another very costly effect of an accident is the cost of equipment and property. It is no exaggeration to say that a single thoughtless or careless moment may involve thousands of dollars loss in property, equipment and other things.

The direct costs—to damaged equipment and property, and the medical and legal costs of liability—are, of course, largely covered

by insurance. But insurance costs money—premiums—and the cost of premiums must appear in our price tag.

It is our policy to carry insurance which completely relieves our customer of any responsibility or worry involved or any costs of accidents. This makes our package attractive to our customer who is anxious to get rid of these headaches—but it costs money.

The cost of insurance is based largely on our accident experience record. This means that an accident tends to increase the cost of insurance. Only by maintaining a good accident experience can we continue to get low rates on our insurance. The costs of insurance premiums have many times spelled the difference between success or failure of a company.

Now let's consider some less obvious costs involved in an accident that we overlook many times.

An accident interrupts work. There is nothing wrong with members of the crew helping their injured co-worker, but this does represent a loss—a hidden cost—while the crew stops work in production.

An accident often means that work must be rescheduled. The crew loses efficiency, and often this involves hiring and training a man to replace an experienced one who is lost to the crew.

Another hidden cost is that involved in investigating and checking on accidents—including constant efforts to study each accident, in order to prevent one like it in the future. Sometimes this means developing new safety equipment or new methods—which may be quite expensive.

An accident involves a great deal of office work—paper work that goes with keeping records, filing and handling reports, etc. If there were no accidents, our paper work and clerical work could be greatly reduced. The cost of this, then, is involved in accidents and constitutes another hidden cost.

Another effect of an accident is that it makes our work less attractive. The problems of hiring and keeping men are made worse when accidents give the impression that this is an undesirable type of work. This, too, can prove very costly.

When needless accidents occur this price tag gets too large, and we lose a customer

which will effect every worker. This is why we consider safety not a separate subject but an integral part of operations.

We have shown why the Asplundh package must include safety—both from the point of view of the customer who buys the package, and from our point of view as affecting the price of our package. We promise to deliver safety—now let's see how we can accomplish it.

We have seen that an accident is expensive—involving injury, damaged equipment, interrupted service and the overall effect of unexpert work.

To effect an improvement of our accident experience, we must have the cooperation of management, supervisory personnel and the crew. Here the supervisors and foremen become the important link. They are the ones who must make our accident prevention program a reality.

There is a definite sequence and certain factors involved in every accident. First, the social environment and ancestry. Second, personal faults, temperament and habits. Third, an unsafe act or hazard. This leads to an accident which in turn could lead to an injury.

Thus, when environment is wrong, and personal habits or characteristics are inclined to an accident, any unsafe act or hazardous condition may cause an accident which may result in an injury.

It is by preventing the unsafe act or hazardous condition that the foreman or supervisor can prevent an accident and thus prevent an injury. By recognizing the unsafe act or hazardous condition, this domino can be removed, and if there are no accidents, there will be no injuries.

The foreman's part in a safety program includes several things: intelligent hiring and selection of men, careful training, setting a good example, planning for every job and every condition, constant supervision and enforcement of rules and regulations.

This is the only statistic in our entire program. Study shows that there is a definite ratio of non-injury accidents to injury accidents. For every 300 non-injury accidents there will be 29 injuries and one serious injury or fatality. This shows why we cannot consider a safety record good, even if there are no injuries; because if

we have a high number of non-injury accidents, each is a *potential* killer.

We must not get the idea that accident prevention consists only of stepping in at the last minute when an accident is obvious. Too often, the idea of accident prevention is too late.

Accident prevention must start away back—recognizing potential accident hazards. There are many symptoms of a potential accident. Poor housekeeping always invites an accident, as well as giving a bad appearance and creating an atmosphere of sloppy work. Any tendency to disobey rules or disregard instructions invites an accident. Equipment in poor condition constitutes potential danger. Improper handling of vehicles, particularly, invites accidents. Foolish or thoughtless conduct is a sure sign of a coming accident.

The conscientious foreman or supervisor realizes that he has a responsibility to his crew. He might think he is being a "good guy" if he relaxes discipline or looks the other way at times—but he is actually hurting his crew.

For example, a foreman or supervisor is not being nosy or butting in if he points out to his men that their personal lives will affect their welfare and their safety.

The foreman should urge his men to be properly dressed for the job. Aside from appearance, there are real reasons for this. A hat must allow visibility and not be likely to fall off or catch. A loose shirt will snag on branches and affords poor protection against branches or weather. Pants must allow freedom of movement. Shoes must be the right kind.

Safety begins *before* the first man climbs the first tree. The crew must arrive safely at the job-site. The truck must be properly parked, and warning signs must be set up.

Before the job gets underway, tailboard conferences are extremely important. It is here that planning the job, clear instructions, assignment of work and special warning can contribute to safety.

The rules for climbing are important in accident prevention. There is a proper way to climb—and many improper ones involving dead branches, weak branches, trailing ropes, full hands, obstructed vision and loose tools.

Ropes are the treeman's lifeline, but they can also become his deathline. Ropes must be in good condition, properly used and respected at all times.

Properly used, ladders add to safety. But they are a menace if they are in poor condition, broken or slippery. They should be firmly set and climbed properly.

A healthy respect for power lines and all lines is of critical importance. Any wire may become energized!

During the job, many kinds of stupid acts can result in an accident—daydreaming, horseplay or sloppy work, or failure to warn others of a falling limb or tree, for instance.

Power equipment must be respected. In spite of the safety devices built into power equipment, stupidity will result in accidents—usually serious ones.

Poor housekeeping on trucks invites accidents. Disrespect of rules and regulations invites accidents. There is a right way to load a truck, and a proper place for every tool. Good housekeeping can help maintain a good safety record.

Obeying traffic laws and sensible driving are absolute musts for all of our men. On the job or off, this is most important. In addition, trucks must be kept in safe operating condition.

A great many other minor hazards exist in this work. Although they may not seem serious, they may lead to serious accidents. Minor injuries can become serious ones. Common sense added to safety rules will cut down the hazards of poison ivy, scratches, bad weather and cuts.

Our company provides all possible information for achieving a good safety record. Study and experience have led to the development of good safety regulations, and instructions covering every phase of our work give every man what he needs to keep a good safety record.

You may never know it—and may never get credit for it, but every day you have an opportunity to take an action that may save a man's life. The training, supervision, discipline and planning that you do today may make the difference between tragedy and this wholesome ideal—a good worker, healthy and happy, his family secure, his sense of a good job, and society well-served because a job was done the right way.

The end in view is *safety*, and the means of accomplishing this is complete, continuous appreciation of what is involved in an accident. First of all, what an accident involves. Second, prevention of the accident. Third, prompt and proper action when an accident happens. This end justifies this means!

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SAFETY IN THE MANUFACTURE AND OPERATION OF ELECTRONIC TEST EQUIPMENT

By CECIL LIGHTFOOT

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With the increased use of automatic and semi-automatic test equipment, safety becomes more important in the design, operation, maintenance, and repair of these devices.

In the transistor industry, breakdown voltage has increased to the point of offering a hazard unless properly controlled. Tests have shown that 12 volts AC, 25 to 60 cycle alternating current is the limitation of some individuals when in good contact with the circuit.

Other tests have shown that when dry electrodes were held in both hands, AC voltages ranging from 20 to 40 were all that were required to produce the maximum current that individuals could withstand for a short time, and still have voluntary control of their muscles.

Tests with direct current indicated that a human being could withstand slightly higher currents for a short time. The currents in these tests ranged from six to ten milliamperes.

The comparative immunity to injury in handling circuits up to 120 volts with the bare hands is due to the high resistance of the dry uninjured human skin. However, this resistance is greatly lowered by:

- Any thorough wetting of the skin.
- Perspiration.
- Many chemicals.
- Cuts and blisters.

Under the above conditions, 110 to 120 volts, alternating current, can produce sufficient current flow to cause a change in heart action, which may prove fatal. It requires only a few seconds contact with a 50-volt standard frequency AC circuit to produce blisters at a point of contact, thus destroying the dry skin high resistance protection.

The current tolerance of the human body is a factor of the frequency of the voltages creating the current.

Alternating currents of high frequency produce little sensation, compared with alternating currents of low frequency and equal magnitude.

Tests have been made to determine the "tolerance current" of typical individuals at several frequencies. The tolerance current was arbitrarily assumed as the magnitude of current that the subject could take through his arms and body, without marked distress or discomfort. Some results of these tests were as follows:

- 30 ma at 11,000 cps.
- 14 amp at 100,000 cps.
- Although the tolerance current was found to increase very rapidly above 11,000 cps, the increase between 60 and 11,000 cycles was much less rapid, ranging from about 5 ma at 60 cycles to 30 ma at 11,000 cycles.

The action of the electric current through the body is an electric shock and can affect the body in two ways.

- The current may pass through the breathing center at the base of the brain and cause this center to stop sending out nerve impulses which act upon the muscles responsible for breathing, as a result breathing stops abruptly.
- In other cases the current may affect the heart muscles, either stopping it or causing an uncoordinated action known as "ventricular fibrillation."

It is absolutely necessary that all possible safety precautions be taken in the design, construction, installation, maintenance and repair of all equipment used throughout the plant.

To fulfill this requirement, all equipment must present no external shock hazard to the operator or unnecessary hazard to the technician responsible for the adjustment or repair of this equipment.

This can be accomplished by the following:

1. Line cords should be three conductor cables with the third wire connecting the cabinet and chassis or framework to an earth ground. This will insure that no potential difference can exist between adjacent test sets. The line cords or power cables should be of the rubber covered type and of the proper size for current carrying capacity. Wire tables listing safe current carrying capacity according to the Underwriters Laboratories should be used as a guide. A good rule is to allow 1000 circular mils cross sectional area for each ampere of current.

2. Interlocks should be incorporated in all cabinets with high voltage exposed or accessible to repair or maintenance personnel.

3. Safety shields should be provided over exposed high voltage points since maintenance personnel do not always have equipment drawings at hand when making repairs; warning signs of high voltage should be placed in a conspicuous place. Remember warnings written into specifications will be of no help under these circumstances.

4. Power transformers or isolation transformers should be used in all test equipment. This isolates the operator or technician from the plant power source. Power transformers with any winding grounded to the frame or shield should never be used. Also any transformer with leakage between windings and core or frame should never be used. Auto transformers should not be used unless preceded by an isolation transformer.

5. All high voltage supplies should be designed with a series limiting resistor. This will prevent current flow from exceeding a safe value should anyone accidentally come in contact with the output terminals or other high voltage points.

6. Bleeder resistors should be designed across high voltage filter capacitors. A charged capacitor can be as lethal as if the equipment in which it operates were still turned on. All metal-can type electrolytic capacitors that have a potential applied on the can should be insulated from the chassis and equipped with safe insulating covers securely fastened.

7. All equipment operated from the AC power system must be equipped with fuses

or appropriate circuit breakers. Normally fuse size is determined by measuring current drain under normal conditions and a fuse of one and one half times this value installed. Fuse sizes for equipment that will draw intermittent heavy surges are usually determined by current measurements during operation. Fuses of the slow blow variety are sometimes selected, especially when used in high voltage equipment.

8. Input power switches should open both sides of the power line. The current rating of the switch should be capable of conducting current in excess of the equipment it is controlling.

9. Plug-in connecting cables must be designed that when disconnected no electrical power can accidentally come in contact with persons working near the machine.

In addition to electrical shock hazard, other safety factors must be considered in the design and operation of manufacturing equipment; they are:

1. In the design of equipment, weight of modules or completed units should be given careful consideration. Weights for women will vary from 25 pounds at table height to one pound when lifted over their head. For men the weight should never exceed 40 pounds.

In the design of tall rack mounted equipment, the heavier units should be nearer the floor if possible. It is a well-known fact that back injuries and other disorders such as strained ligaments and muscles are quite common among workers who have to handle large bulky or heavy items without the assistance of mechanical lifts or other similar devices.

2. Equipment should be designed to be stable during operation. It should not be such that it will slide during operation or be in danger of toppling over.

3. Equipment should be designed without sharp edges and protrusions. These can cause injury to the operator or persons passing the machine in the normal course of their work.

4. All belts and gears should be guarded to protect personnel working on or near the machine.

5. If equipment or any of its components offer a temperature burn hazard to the

operators, protective shields or insulation should be provided.

5. Equipment should be designed to insure a comfortable arm position and if used, correct microscope height. Cramped arms and neck strain are more apt to make an operator work in an unsafe manner.

It is the responsibility of the design engineer to observe every safety precaution in each design but the safety engineer

should inspect and pass on each new design before it is placed into production areas.

The safety engineer should assist purchasing personnel in the selection of all equipment that might affect the safety of operating personnel.

A good safety program well followed will result in more production, higher quality units manufactured, fewer accidents, and higher morale among personnel.

SAFETY IN PRINTED CIRCUIT MANUFACTURING

By HOBART A. WEAVER

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Printed wiring, the basis for printed circuit assemblies, is a technique for making electrical connections between components by means of metallic foil strips bonded in a prescribed pattern to the surface of an insulating material.

Within the past 5 years, considerable emphasis has been placed on the use of printed circuits by all of the commercial manufacturers of wired electrical products. National advertising campaigns have been directed to their inclusion in television and radio sets as if they, within themselves, were the answer to all of the problems that have risen in the past affecting the reliability and enjoyment of these products. While assuredly much of this is true, other advantages are present which are more tangible to the manufacturer.

The use of printed wiring in large quantities was initiated in the last stages of World War II in the manufacture of the electron tube proximity fuse for combat use, and while the same techniques were not employed that are present in today's manufacture, the ground work was laid for the advantages that could be gained from their usage. Subsequently, much of the development work in printed circuits has been made in the manufacture of electronic equipment for the Armed Services, culminating in 1953 with the Tinkertoy Project as an illustration of automation applied to mass production. Use of this media is becoming

more widespread in all of today's electronic hardware for the Armed Services.

Manufacturing methods for printed wiring are many and varied. Original manufacture perhaps dates back to the advent of ceramic disc capacitors in the 1920's in which a conducting surface was painted on a ceramic base with silver paint and fused into the base material with heat. Subsequent methods incorporated various and sundry procedures but can be reduced to two fundamental processes. The first, of which the disc capacitors listed above are an example, consists of applying the conductor paths to an insulating base. The second process consists of selectively removing unwanted conductive material from an insulating base. This is known as the etched foil process and is used at the Western Electric shops in Greensboro, North Carolina.

Several years ago we began a manufacturing operation for printed circuits to fulfill the needs of several military projects. To our manufacturing engineers this was a new field, and much exploratory work was necessary to start this operation. Essentially, the operation was broken down into the various steps. Each operation had to be investigated not only from a manufacturing aspect, but also from the standpoint of safety.

In Western Electric, the product, process, or project engineer is responsible for

the safe operation of those processes for which he has engineering control. In this way, when a new project such as printed wiring is inaugurated, the project engineer has the responsibility to incorporate all necessary safety features for the protection of employees. He specifies the design and quality of all types of personal protective equipment and prescribes standards for their use. Whenever special situations arise because of unusual operating conditions, the introduction of new processes, raw materials or machinery, the project engineer requests the hazards engineer (in cooperation with the safety organization) to approve his investigation, evaluation of exposure, and specifications for precautionary measures.

In the succeeding paragraphs I would like to review some of our planning for the manufacture of printed circuits with the aim of incorporating safety from the beginning.

The manufacturing process begins with an insulating material clad with copper foil on one or two sides. This insulating material can range from .006" to .250" thick but is generally a 1/16" sheet. The copper ranges from .001" to .010" thick. Several types of insulating materials are used, depending upon the circuit application. For most commercial products the paper base phenolics are generally used as an insulating base material. Whenever the electrical characteristics of the circuit demand superior dielectric strength, insulation resistance and moisture absorption properties, an epoxy glass or "Teflon" glass material is used.

In using the epoxy glass and "Teflon" glass material, problems have been encountered pertaining to safety. Several of our employees have been found to be allergic to the epoxy resins and have received treatment for a dermatitis condition. We have corrected this situation by minimizing exposure not only in the handling of the raw material sheets, but also in subsequent operations where epoxy dust has been created from a machining operation. We have provided our employees with protective skin creams made for epoxy resins. Housekeeping standards are kept very high and our safety and medical organizations are following this situation very closely.

Another problem encountered when using "Teflon" glass material was in the disposal of scrap. We have provided special marked cans throughout our shop to collect "Teflon" scrap to prevent mixing of "Teflon" with other waste material. Since the toxicity properties of "Teflon" are not fully known, we have taken precautions in disposing of scrap. Collected scrap is burned in our incinerator.

However, the practice of burning "Teflon" was introduced only after a thorough investigation was made of the draft system in this incinerator equipment. The height of the smoke stack on the incinerator is 135 feet, which is sufficient to carry the fumes away from other areas of the property. The operator of the incinerator has been informed never to burn "Teflon" scrap without first burning some other waste to ascertain that the draft is functioning properly.

Still another problem with "Teflon" was encountered in the machining operations. Machine operators have been cautioned not to carry cigarettes in an open pack or an open pocket while on the job. There is a hazard of small "Teflon" chips getting into the cigarettes, and thus the person could get "Teflon" fumes directly into the lungs by smoking the cigarettes.

Another problem encountered with the raw material was in handling. Most laminators make sheets of raw material in 36" x 48", or 36" x 72" sizes. Material this large was difficult to handle, especially since the copper surfaces had to be protected from scratches at all times. Also, the sharp edges of the thin copper foil on this laminated material created still another handling problem. To overcome this problem, we now have our material precut to specific working size and packed in polyethylene bags. Ragged precut panels are delivered to us in small containers not exceeding 60 lbs.

After the art work (circuit configuration) has been accurately laid out, photographed, and reduced, one of two methods of printing can be used. The photo process and the screening process are the most commonly used throughout the industry at the present time.

In the photo process, the copper clad raw material is uniformly coated with a light-sensitive enamel. A film negative is used

to photographically print the circuit on the raw material using carbon arc lights as an ultraviolet source. It is necessary to provide better than normal ventilation to exhaust the ozone fumes created by the high voltage on the carbon electrodes.

The other chemicals which are used for developing the panels and for subsequent cleaning solutions are well ventilated and kept away from the arc lights. In this area, also, the air pressure used as a solution blow-off is regulated to a maximum of 20 psi to minimize the hazards of blowing solvents onto the operators.

For the other printing method, screen printing, provisions have been made to draw the fumes from the molten printing wax resist directly off the top of the machine. The solvents used in this operation for cleaning the panel after printing are also directly ventilated.

Metallic finishes are usually required on the copper circuit paths to facilitate subsequent soldering of components to the assembly, whether mass soldering or hand soldering is anticipated.

The two most popular finishes are solder and gold. For most commercial applications, solder is electro-deposited to the circuit paths prior to the etching of the unwanted copper.

The plating operation first begins with a cleaning cycle in ammonium persulfate; next, a water rinse, followed by plating in a 60-40 lead-tin alloy solution. The safety aspect of these operations is that normal precautions are taken to protect the operator while using and handling these chemicals; also, proper instructions have to be passed on as to how these chemicals are to be mixed and what reactions occur when the chemicals are put into solutions.

To us at Western, the plating of a solder alloy was a new operation, and an extensive evaluation of all necessary chemicals was carried on before putting this segment of the manufacturing cycle into use.

The etching of printed circuits is somewhat similar to the plating of the circuits in that it is a chemical operation and the same safety precautions are necessary. The two most commonly used etchants are ferric chloride and ammonium persulfate. The ferric chloride is a more difficult solution to handle than the persulfate. The ferric

can cause irritation of the skin or the eyes. In both our plating and etching operations, the operators are provided with chemical resistant clothing and wear face shields. The operators are required to take a shower at the end of each shift. In addition periodic physical examinations are given to both the etching and plating operators. Also, exhaust systems are installed to each tank, (plating and etching) to insure that the fumes are removed from the work area. The highly corrosive ferric chloride fumes have necessitated the use of specially coated metals or plastics to minimize this corroding condition on our facilities.

Printed circuit boards are generally processed thru the printing, plating and etching operations in panel form; i.e., several images of the same circuit are put on a large piece of material. After these operations, it is necessary to fabricate the individual boards to size and shape. This is done by routing, punching and drilling. In all these operations, safety glasses are required to be used.

In the punching operation, precautions are taken to insure that both the operator's hands will be needed to actuate the controls for press operation. Also, our punch presses are protected against completing a started cycle when they are restarted after a shutdown.

Another method of fabricating small lots to size and shape is routing, an operation of cutting a contour from a template or guide. In this operation, a guard is used on the machine to prevent the operator's hand or fingers from coming in contact with the cutting tool. Also, for this operation, we have provided an exhaust on the bed of the machine to take away the major portion of the epoxy dust and chips. For routing small boards, we have made use of a double-ended routing fixture to afford a larger work piece for the operator to grasp.

On some boards it is necessary to drill small holes for component leads, and this operation for small lot sizes is done manually. For large production runs, multi-spindle drilling is used. For the manual operation, each drill position is equipped with an exhaust system to remove epoxy dust; and to reduce operator fatigue from drilling these small holes, each drill press is

equipped with a 4X magnifying glass adjacent to the drill spindle. Also, the spindles on these presses are readily adjustable; thus the operator raises or lowers the spindles as needed to insure that the drill point is never above the work piece more than $\frac{1}{4}$ ". This does not allow sufficient clearance for getting the operator's fingers under a drill point.

It is necessary in some instances to install terminals or standoffs to some particular circuits on the boards for making external connections. This operation is done with small pneumatic arbor presses. These arbor presses have presented some problems in regard to safety of the operator's fingers. Although the ram on these machines is set at a clearance of $\frac{1}{4}$ " maximum, we have had several minor injuries of pinched fingers. To eliminate these injuries, we have made use of a photoelectric cell to prevent the ram from being actuated if any part of the hands or fingers is in a 2" danger zone from the center of the ram.

In some cases, the photo-cell method would not suffice for large size boards. For the large boards, we have recently installed an electrostatic press. This is a solenoid operated press that contains a mechanical linkage from the foot pedal to a sleeve which surrounds the top tool. The foot pedal is depressed and the sleeve moves to the board. In this position a linkage to the sleeve trips a microswitch which energizes the machine and the top tool is forced downward. If a finger or any other object interferes with the bottoming of the sleeve, the microswitch will not be tripped and the machine will not operate.

In addition to the rigorous mechanical inspection to which each lot of boards is subjected, samples of our material and processes are evaluated periodically by Under-

writer's Laboratories (UL) to provide protection to the consumer and to insure that the material properties, such as insulation resistance and surface resistivity, have not been changed during our processing.

From the preceding paragraphs, it can be concluded that a manufacturing engineer is confronted with numerous problems in planning for the production of a new product. To summarize, we observed what we considered the basic principles of safety in establishing our printed circuit operation. We attempt to apply the following rules in all situations.

1. Recognition of hazards that may arise from the introduction of new materials and processes such as epoxy and teflon glass, plating, cleaning and fabricating.

2. Safety training of operators to do their new jobs.

3. Strict adherence to known safety practices.

4. Close coordination with the safety and medical staff to eliminate hazards.

5. Close coordination with other manufacturers operating in this field and the quick application of additional research and development when needed.

For items 3 and 5 such organizations as yours and meetings of this type are beneficial to us in the manufacturing industry.

I am proud to represent the Greensboro Shops of the Western Electric Company. Our shop now holds the world's safety record for the electrical equipment industry. We have recently passed twenty-seven million man-hours without a disabling injury. That is quite a record, and I feel that, to a great degree, our success is attributable to the fine and useful information that has been disseminated by your group.

SAFETY IN THE USE AND MAINTENANCE OF ELECTRICAL STORAGE BATTERIES

By ROBERT W. HOPEWELL

Mgr., Field Engineers, Gould-National Batteries, St. Paul, Minn.

To start with, I would like to show some slides of typical battery applications about which my discussion will be concerned. These batteries are all industrial types varying from groups of cells assembled into steel trays to individual cells in their own plastic containers.

1. *Ram Truck—Steel Mill* This piece of equipment handles steel rolls weighing many thousands of pounds and propulsion is provided by electric motors driven by the batteries mounted on the rear of the truck.

2. *Hand Truck* A smaller version of an electric materials handling truck is hand operated. The battery is composed of six cells assembled in a steel tray.

3. *Telephone Battery* A different type of application is a telephone central office battery. Its prime purpose is that of a standby power source, in the event the commercial power source fails.

Similar cells are also used in power-generating stations and sub-stations to operate valves, switchgear, and to supply power for emergency lighting equipment.

There are many other applications for industrial type batteries, such as starting batteries for railroad diesel engines, as well as batteries for air conditioning and lighting of railroad cars. These include baggage, coaches, diners and sleeping cars.

I am primarily going to concentrate on the industrial truck type batteries, as these are usually subject to more handling in their everyday usage.

There are three types of hazards involved in the handling of the industrial truck battery.

1. There would be the mechanical hazard involved in the changing and lifting of batteries when it is necessary to supply fresh power to a truck used on a multishift operation.

2. There is the electrical hazard due to possible shorting of the battery terminal when changing batteries, or carelessness when changing or repairing batteries.

3. The last and not the least important is the chemical hazard of personnel injury from splashed electrolyte when watering or repairing batteries.

Hydrogen gas is a by-product of charging and is explosive, therefore, caution should be exercised in handling batteries. This holds true for any battery which contains electrolyte, and to which a charging current is applied.

4. *Overhead Hoist*. As I stated before, whenever a materials-handling truck works more than one shift, it is usually necessary to install a fully charged battery for each shift.

This requires the use of an overhead hoist and what is called a spreader bar. The spreader bar and hoist must be strong enough to handle the largest batteries used. As an example, some of the larger batteries weigh over 5,000 pounds.

5. *Spreader Bar—Gould Design*. Here is a spreader bar, designed by Gould, which provides an insulating hard wood body. This prevents shorting of the battery terminals in the event the hooks come into contact with the intercell connectors.

In some instances where a chain or wire rope sling was used, severe shorting and explosion of the battery cells resulted due to ignition of the hydrogen gases.

6. *Spreader Bar—Four Position Lift*. Here is another type of lifting device designed for one particular size of battery, which uses four lifting hooks. Each hook is individually insulated from the spreader itself.

Here an additional precaution is taken through the use of a rubber mat to cover the top of the battery. This prevents the chains from the hoist shorting across the intercell connectors.

7. *Protective Clothing*. This points out that personnel handling batteries in the charging room, should wear protective aprons, gloves, boots and goggles whenever filling, charging or repairing batteries.

8. *Checking Cells for Water*. Whenever personnel check individual cells for solution level, only flashlights or adequate permanent lighting should be used. Never use matches or cigarette lighters.

9. *Authorized Personnel Only*. Always restrict the battery room to qualified personnel only. This will insure protection of the untrained worker and the equipment from each other.

A most important item is that immediate treatment be given personnel accidentally splashed with electrolyte. The area of the body affected should be flushed with generous amounts of plain water. This includes electrolyte splashed into the eyes.

Following the water bath, the injury should receive supplementary treatment at the plant dispensary.

Any electrolyte accidentally spilled on the floor should be neutralized with washing soda and the floor cleaned.

10. *Battery Repair*. Some of the larger users of batteries have their own repair facilities for the replacement of broken jars and internal cell repairs.

Here we show the proper way to remove a cell from the battery using a hoist together with the proper lifting device. Notice the rope sling. This affords protection to the cell and the worker as the stresses are gradually applied.

Pulling of cells by the worker himself is hard work and could result in serious back strain. Therefore, the method shown here should always be used.

11. *Resealing—Repaired Batteries*. This shows the battery after repairs have been made and the cell reinstalled. Here the battery is being resealed with hot battery compound. Care should be exercised in the heating process, the unheated compound at the top of the pan, should never be punctured with a sharp tool, as hot compound will shoot out causing a severe burn to the worker.

12. *Reburning Cell Connectors*. After cell repairs and resealing have been completed the final operation is to reburn the intercell connectors to the cell posts. This is usually done with an oxygen-acetylene burning outfit using a small burning tip. If this is not available, a carbon burning outfit is used.

This employs power from the cells themselves to heat the carbon tip. Before proceeding all vent caps should be removed and all hydrogen gas purged from the cells by use of a very low pressure air hose. Following this, damp cloths should be placed over the vent openings to prevent ignition of remaining gas.

Welding goggles should be worn to prevent damage to the eyes from the light of the carbon tip which is very intense. Only personnel trained in lead burning should be permitted to make such repairs to storage batteries.

13. *Telephone Batteries*. Let's refer back to the telephone installation. In this installation, we use what is called an anti-explosion vent. (White dome shaped item on top of cell.) This vent is designed to vent the gases produced on charge and in the event of an external explosion it prevents flashback and ignition of the gases inside the cell. It will not prevent an external explosion, but it will minimize the effects.

A similar design has been tried on industrial truck batteries, but because of the frequency of charging and truck motion, operating problems were encountered which did not make its adaptation successful.

This picture illustrates two things that battery personnel should not do.

1. This man is checking the electrolyte levels without wearing protective goggles.

2. He has one hand resting on top of the cell and apparently touching the cell posts. His other hand is resting on the rack, which in most cases is grounded. This is not too serious on a 48 volt system, but on a 120 or 240 volt battery a good shock would result.

Such installations as this should have sufficient ventilation to provide circulation of air so that the hydrogen concentration approaches no more than three per cent.

The amount of circulation or change of air will depend on room volume—number of cells in the battery and also at what charging rate the cells are maintained.

This precaution is only a problem when the battery room is closed off and small.

This is very rarely a problem in industrial truck charging rooms, as they are usually open and have adequate air change.

THE PROPER METHOD OF SELECTION AND USE OF HAND TOOLS

By EUGENE WOLOSZYN

Specification and Steel Application Metallurgist, Youngstown District Works
U. S. Steel Corp., Youngstown, Ohio

Hand tools used throughout the Corporation number in the thousands and are provided to the employees to enable them to do a job safely and efficiently.

In order to get some basic background on the manufacture and treatment of hand tools we have taken a twelve pound carbon double-faced sledge hammer as an example.

In general, this tool starts out as a two and one-half-inch round cornered square and can either be a carbon or alloy grade of steel. To become a finished product the tool must go through the following phases:

Shearing: The bar is sheared into seven-inch multiples.

Forging: The multiple is heated to the forging temperature and forged on the press to the shape of the sledge.

Machining: The rough forging is placed into the lathe and both striking surfaces are machined to the desired contour.

Heat Treatment: The machined sledge is selectively heat treated; by that we mean the two striking faces are heated above the austenitizing temperature for the specified time needed for transformation of the micro-structure. After being held at this temperature both faces are quenched in a suitable medium—usually water or oil is used depending on the grade.

The as-quenched structure is martensite, a hard brittle structure. In order to toughen this structure and lower the hardness to the desired range, the sledge is again heated, but at a much lower temperature, to produce tempered martensite. This is known as the draw or temper.

Inspection: After heat treatment, all alloy sledges are taken to the magnaglo tester and spot checks are taken on carbon sledges. This is a process using magnetic powder to detect fine surface cracks. These magnetic particles are coated with fluorescent material which glows under infrared light. If cracks are present in the sledge, the leakage flux causes a local concentration

of magnetic particles in the vicinity of the discontinuity. Some of the defects noted by this type of inspection are cracks, seams, forging laps, etc., which if present are usually reason for rejection and possible salvage.

Grinding: The last step in the processing is a light grinding of the striking surfaces on a fine abrasive belt to dress up the final product.

Published data and conversation with tool suppliers stress the fact that a good quality hammer can be struck thousands of blows against surfaces without spalling, providing the striking surface of the hammer meets the surface being struck squarely or at a low angle under 20 degrees. If struck against a sufficiently resistant surface with a blow close to the periphery of the hammer's striking surface, the highest quality hammers can be made to spall.

Most of our accidents involving hand tools are caused by spalls flying off the striking surface or surface being struck during usage. Spalling can be defined as a formation of a fragment by chipping. Many times the employee is unaware at the time of the accident that the spall has entered his body due to its speed and size. Data by one of our leading research laboratories report that a spall was propelled from a hammer during tests at approximately 300 feet per second. This was determined by the use of high speed films.

X-ray films taken out of the Youngstown District's medical files indicate the penetrating power of a spall.

A spall remaining in a rigger's body today resulted from a track maul being misused as a back-out hammer. The rigger was approximately four feet away from the struck blow when the spall penetrated his chest and collapsed his lung.

A spall lodged in a roll turner's lower abdomen resulted from using a blacksmith hammer to cold stamp a three-quarter-inch

stamp into a roll. Test results showed the hammer was much too hard.

A spall being carried around in a machinist's left hand flew off of a ball peen hammer when he struck a hand cold chisel trying to shear off a bolt head.

The penetration of a spall into the left arm, near the elbow, of a track laborer resulted from his using a track hammer to strike a spike claw bar.

Spalls penetrating a worker's body are generally not disturbed unless complications are encountered. Damage by surgery probing for the spall could possibly cause more harm than the actual wound. It is not difficult to visualize what could happen if a spall penetrated one of the vital organs such as the heart.

There are many reasons for spalling of hand tools, and the next part of this presentation will show actual laboratory investigations on spalled hand tools taken out of the maintenance metallurgist's files on hand tools.

The first group of these investigations will deal primarily with hand tools as received from the suppliers. The second group will reveal how tools become safety hazards after employees inadvertently abused the tools.

The first example is a back-out hammer which spalled after one day's service at our primary mills.

This tool was given a thorough laboratory examination, which included cutting a sample adjacent to the spalled area for microscopic examination. After mounting, polishing and etching the sample we found the micro-structure was not the desired tempered martensite, but bands of hard martensite, ferrite, bainite, carbides and tempered martensite. This indicates the striking surface of the B & O was ineffectively heat-treated by the supplier.

Our open hearth maintenance group encountered excessive spalling on two hand cold chisels during service. The striking and cutting ends of the two chisels were spalled.

Hardness values recorded on the one chisel showed that the striking surface had Rockwell "C" values of 26-28 and the cutting surface 45-49 "C". The other chisel had 35-37 and 41-46 "C" hardnesses in the same locations.

The hardness specifications for hand cold chisels in the proposed "Forged Hand Tool Specifications" are 45-49 "C" for striking surface and 56-60 "C" for the cutting surface.

It was our opinion that the failure of the two hand cold chisels can be attributed to the low hardness values obtained by the supplier during heat treatment.

Excessive spalling on the striking surface of a 24 oz. ball peen hammer was encountered by a pipe shop employee. The hammer was new and being used for the first time.

Rockwell "C" hardness results recorded on the striking surface showed 56-61; the range specified in the proposed "Forged Hand Tool Specification" is 50-54 Rockwell "C".

Micro examination indicated the tool was effectively heat treated but to higher hardness values, which in all probability resulted in the spalling of the hammer in such a short period of service time.

During a routine tool inspection a three-eighth-inch taper setting punch with a crack was picked up and submitted to the maintenance metallurgist. This punch is used to drive lead screw anchors into concrete.

The striking surface of the punch was a three-quarter-inch hexagon and had a crack extending the length of the punch.

Micro examination showed a seam .045-inch deep extending into a crack .312-inch deep. This surface defect opened up into a crack when struck during the actual setting operation. Check analysis of the punch revealed the steel used was an open hearth resulfurized and rephosphorized grade, which is not recommended in an application where the tool is being struck during service.

A machine shop apprentice using a sledge hammer on a back-out hammer to drive out body bound bolts was struck in the cheek by a spall from the driving end of the tool.

The driving end of a B & O and a surface decarburization on the spalled end measuring .030-inch deep leaves this area softer and susceptible to spalling.

A tool not properly dressed and used incorrectly was the cause of a spall entering an employee's body at the McDonald Roll Shop.

The roll shop hammer had insufficient chamfer and was used to drive a large identi-

heating stamp into a roll. This hammer was too small for this job and, since it was not properly dressed, the shock in striking the stamp caused the spalling action.

A double end box wrench made of alloy steel, which had been flame cut in two to make it usable in an inaccessible position, was involved in an accident. When the burned end of the handle was hammered a spall flew off and entered the worker's body. A longitudinal cross-section of the burned wrench handle was ground and etched. It revealed the flame cutting had resulted in a heat affected zone of martensite.

At Youngstown the mason department supplies the apprentice bricklayers their initial hammers, with subsequent hammers provided by the employees. These hammers were being reconditioned by the Blacksmith Shop.

Complaints of getting cracked hammers after reconditioning initiated the investigation of such a hammer.

Micro examination of a sample through the cracked surface revealed decarburization present at the cracks, which indicated the hammer was cracked prior to reconditioning at the Blacksmith Shop. The original crack apparently progressed during heating and quenching until the entire striking surface was cracked.

Visual examination of a hammer will not always detect cracks, but the use of magnifying glass or dye-check will "highlight" these cracks and the tool can be immediately scrapped.

Many times we have found that damaged tools were the direct result of employee abuse.

Two hammers were in use only one day, dented and spalled striking surfaces resulting to both.

Micro examination and hardness results indicated the tools were effectively heat treated to hardness values specified in the "Hand Tool Specification." It was determined later that the hammers were used to strike materials harder than the ballpeen hammers.

During the microscopic examination of a longitudinal section through the spalled area of the striking surface of a back-out hammer, we observed the presence of a "white layer" which originated in the spalled area and extended to the surface.

We submitted this sample to the Fundamental Research Laboratory at Monroeville, where micro-examination and micro hardness determinations indicated the "white layer" was untempered martensite.

An article, "Spalling of Hand Hammers," published by Battelle Memorial Institute, reported the presence of the "white layer" on spalled areas of hammers investigated by the Laboratory. The authors identified the "layer" as untempered martensite formed at the time the damaging blow was struck. The fresh martensite results from localization of the shear energy along a plane and generates sufficient high temperature to form austenite. On cooling, the austenite transforms to martensite.

A hazardous condition existing at our manganese crusher at the open hearth stockhouse brought about a specific case of development by the safety director, maintenance metallurgist and tool manufacturer.

At the manganese crusher, open hearth labor used a ten pound sledge hammer to break large pieces of manganese so that they could be placed in the crusher. Hammers in use at that time spalled so badly in an eight-hour turn that they had to be scrapped.

Our first step was to get two alloy and two carbon sledges to evaluate material specifications. One of the alloy sledges was given a radius contour instead of the normal chamfer to determine the effect contour may have on this application.

We placed these four sledges into service, and records on their use were maintained by the open hearth labor foreman.

The spalled condition was noted on the striking surfaces of all four sledges. The alloy sledge with the radius contour gave 576 hours of service as compared to 48, 72 and 168 hours experienced by the others. We eventually had this sledge reconditioned twice by the manufacturer, and the service ability of the radius-alloy sledge in service hours was in excess of a 20 to 1 ratio over the original carbon sledges used.

After this favorable experience with a radius contour, we searched for technical or theoretical data to explain or substantiate our change from the normal chamfer contour used on most tools. We found this most difficult, even though some of the tool manufacturers such as Warren, Tamco, Bedco

and Cunningham were actually selling tools of this design.

Questioning representatives of these firms revealed that this contour change had occurred through the years, with no definite reasoning behind it other than it resulted in better tools.

The Corporation's maintenance metallurgists' committee has a subcommittee on forged hand tools. This subcommittee is now preparing a hand tool specification, which should help materially in controlling the quality of hand tools being purchased by the Corporation.

This subcommittee has also presented a proposed research project on hand tools. This program would evaluate the effect contours may have on spalling and the amount of radius that would be optimum in this respect. Other phases to be investigated would be photo-stress examination of striking surfaces during actual service for stress concentration patterns and evaluation of various shapes such as round, hexagon, square and octagon.

Accidents attributed to the use of defective hand tools and the excessive number of defective tools picked up during the safety inspections conducted by operating and safety personnel pointed out the need for a better method of reconditioning our hand tools.

The following procedure was recommended to be followed in the redressing of machine shop ballpeen hammers, double faced sledges and hand chisels:

Inspect: Thoroughly inspect using magnetic particle and/or dye penetrant method prior to any major redressing. Tools having any deep-seated defects that cannot be removed by normal amount of grinding should be scrapped.

Any questionable tools should be tested for hardness by the maintenance metallurgist for agreement with specified hardness levels. This would also determine if the tool is still within the allowable limits of established wear tolerances.

Redressing: These tools should be redressed by grinding to established radii. A template which has been distributed to personnel doing redressing helps them achieve the desired contour.

It is very important that the actual grinding be done in such a manner that the surface does not become overheated. Color changes to deep brown or bluish-purple indicate over-heating has occurred and must be removed prior to being placed back into service.

Re-inspection: All redressed tools should again be inspected by the magnetic particle and/or dye penetrant methods prior to their release into service.

At this point we should like to stress the importance of training the employees to submit their defective hand tools soon enough so that reconditioning does not become a major job. Submitting spalled tools in particular is most important considering the possible presence of the "white layer" discussed earlier in this presentation.

It is also important that the redressing responsibility be given to one individual in each unit. Experience gained by this man will enable him to provide a consistent and uniform redressing without the inherent danger of overheating.

Responsible personnel should always be on the lookout for newly designed or treated tools that are being played on today's market. These tools should be thoroughly investigated before approval is given for their purchase and use by our employees.

As an example, our storeroom received a shipment of seven-eighth-inch hexagon cold hand chisels with a newly designed striking surface. Our secondary mill maintenance group questioned the use of this tool and submitted one to the safety director, who in turn brought it to the laboratory for a check.

The striking face of this chisel had a flared contour. We cut the striking surface of the chisel longitudinally, ground and etched it to show the contour. It showed that the striking surface would be more conducive to mushrooming and spalling due to the abrupt change of section and the inherent weakness of the upset forging flow lines.

Some time ago a pamphlet was published in which a safe-ending procedure was described. It consisted of preparing the end of the tool, depositing a collar of bronze-welding rod and grinding it to the finished shape. They also advocated preparing used tools for safe-ending by cutting the damaged ends by using a cutting torch. If the length of the chisel was too short it was to

be built up by using a steel welding rod. The actual bronze-welding technique required the base-metal temperature to be from 1600-1700 degrees Fahrenheit. The paper concluded that there should be neither a marked increase or decrease in the hardness of the struck end of tools safe-ended.

It was the consensus that this procedure using such high temperatures would create and not prevent safety hazards. Quality tools require a specific heat treatment which is governed by the grade of steel used and must be given under controlled conditions to be effective.

In an effort to publicize the mistreatment and incorrect use of tools causing accidents

in the Youngstown District, a pamphlet was printed listing case histories with appropriate photographs. We gave it the title "Weapon or Tool" and it was distributed to each supervisor in the district.

It is my sincere hope that this presentation has given you a new viewpoint on the common hand tool. Properly specified, used correctly and reconditioned to recommended procedures, it enables our employees to do a job quickly, safely and efficiently. On the other hand, the common hand tool can become a dangerous weapon causing serious accidents if the tools are of poor quality, mistreated, used incorrectly or not properly reconditioned.

SAFE PRACTICES IN MANUFACTURING PROCESSES IN THE SEMICONDUCTOR INDUSTRY

By R. E. BURTON, JR.,
Supt. of Industrial Relations
Western Electric Co., Allentown, Pa.

I am pleased to say that the manufacture of semiconductors at Western Electric's Allentown Works is not a hazardous occupation. I will add, however, that it could be quite hazardous were it not for the emphasis on safety given by our engineers in designing and specifying the facilities to be used, unceasing training in safe habits carried on by our supervisors, and constant practice of common sense safety habits by all employees involved.

This material will cover some of the general elements of semiconductor manufacture as well as some specific operations, will point out the potential hazards involved, and show the steps taken to remove or minimize the hazard.

First, semiconductor manufacture requires the use of a considerable amount of hydrogen, primarily as an atmosphere in furnaces. As most of you are aware I'm sure, the hydrogen flowing out of these furnaces is harmlessly burned to prevent concentrations of an explosive nature from accumulating. To maintain these fires, a gas pilot flame

is used. In our plant piping system the "pilot" gas supply is a separate loop completely independent of the main supply system so it will not be disrupted should it become necessary to shut off the main supply because of emergency.

Supervisors, machine setters and other key personnel involved in operations using hydrogen are required to take a special training course in "Handling Gases Under Pressure." This course is designed to teach proper sequence of operations in starting up and shutting down gas operations with particular emphasis on theoretical emergency situations.

In the hydrogen supply piping system (which by the way is color coded a bright red to prevent mistakes that might otherwise be made by pipefitters working on adjacent pipes) all connections are brazed to prevent leaks. Just in case there is a leak, however, hydrogen alarms located throughout the plant continuously monitor the air and are actuated by traces of hydrogen well below the danger point.

In addition to signalling, the alarms automatically turn on "purge" fans to quickly exhaust the contaminated atmosphere and bring in fresh air. Routine tests using small gas cylinders having a known percentage of hydrogen are used to insure proper operation of the alarm system.

Acids, caustic chemicals and many flammable solvents are also used throughout the plant. Special color coded containers and storage cabinets are provided to maintain an optimum degree of safety in the storage of chemicals. Maximum quantities of each chemical that may be stored by the using person in the operating area are established by the responsible engineer and audited by the plant protection organization. Antidote cabinets are located in strategic areas and plainly marked as are showers. These will not prevent accidents but they may well spell the difference between a minor and a major one. To the best of my knowledge not one of these showers has been required in all the years we have been in operation, but it is still comforting to know they are there.

Where handling of acid is required, normal protective clothing is used. We have adopted special clothing for our plating room personnel which for us is a significant innovation. The clothes are cuff-less and are designed to prevent operators from unknowingly carrying harmful chemicals, such as cyanide normally used in gold plating operations, out of the plating room.

Proper and safe disposal of chemical wastes is another item for consideration. Acids are no particular problem as we have a plant-wide acid drain system of PVC pipe which feeds into a neutralizing basin and thence into the sewer. Waste solvents are something else, because of the potential fire hazard they can create. Waste is collected in containers ranging from 5 gallon cans to 55 gallon drums located in the using areas. These are in turn dumped into an underground storage tank which is pumped out as required by a commercial scavenger. In no case is a container of waste solvent permitted to stand overnight. At the end of the shift all must be dumped into the storage tank.

So much for some of the general features. Let's take a germanium transistor

through its significant chronological stages and see some of the safety problems encountered.

Germanium dioxide is reduced to metallic germanium in a hydrogen furnace. Heavy asbestos gloves provide protection for the furnace tender. The germanium is purified by a process known as "zone leveling" and grown into a rod of single crystal structure having the desired impurities to give it a specific semiconductor characteristic. Orientation of the crystal structure is checked by means of x-ray diffraction. Exposure of the operator of this equipment is monitored by means of a dosimeter with a maximum allowable level of 100 milli-roentgens per week. The operating area for this equipment is enclosed by lead-lined walls to shield against possible stray radiation.

Next, the germanium rod is cut into slices and the slices in turn cut into wafers. Although the material is unique, cutting machines are similar to those used in many machine shops and normal safety measures prevail.

Wafers then go to the assembly area where one of the toughest operations from a safety standpoint, is that of etching. The etchant is generally a solution of hydrofluoric and nitric acid. An uncluttered work area, safety glasses, aprons and rubber gloves, plus proper safety indoctrination of the operator, minimize the hazards. Minor acid burns of the hands, which were at one time a problem, have been virtually eliminated through adoption of a glove testing procedure much like that used by service stations for locating leaks in inner tubes.

With all the safety engineered into facilities, the human element is still present. Safe working habits must be constantly stressed among all personnel. As a degree of insurance to see that this is done, part of the job responsibility of each first line supervisor is the requirement that he hold a safety meeting with his employees each month.

There is a saying in the semiconductor shop that devices are never clean enough or dry enough. We adopt a similar philosophy that operations are never safe enough. It, in effect, challenges all of us to be continually alert in seeking methods to make a safe job even safer.

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FOOD & BEVERAGE INDUSTRIES A NEW CONCEPT IN REHABILITATION

By ROBERT W. WILL
Dir., Minneapolis Rehabilitation Center, Minneapolis, Minn.

The Minneapolis Rehabilitation Center began work with its first client in September, 1960. It is the only institution of its kind in the upper Midwest, geared to serve the needs of persons in the Twin Cities, the State of Minnesota and surrounding areas, on a non-profit basis.

Sole purpose of the Center is to rehabilitate persons who are incapacitated because of combined problems of medical, vocational, social and emotional nature. Its function is to apply coordinated skills of physical-psycho-social therapy to regenerate the self-sufficiency and productivity of stricken clients.

The Center was designed to support and extend the work of other agencies in cases which require concurrent treatment of a combination of physical, emotional and social problems. The Center is equipped, for example, to deal with the all-too-familiar post-accident case where satisfactory return to productive living is prevented by lack of emotional adjustment. If a case does not involve two or more of these problems it is better served by other, single-purpose organizations, such as family service agencies, mental health clinics or vocational rehabilitation services.

Referral of clients to the Minneapolis Rehabilitation Center, therefore, is exclusively from other agencies and services. Moreover, while the Center undertakes immediate management of cases referred to it, general control of the case is retained by the referring agency. Upon discharge of a Center client, case management returns to the referring agency, but the Center maintains a supportive role if necessary; for example, by providing services needed to help the client master new vocational and social situations he faces.

Land for construction of the Center was provided equally by the Center's two continuing sponsors, The Minnesota Society for Crippled Children and Adults and the Sister Elizabeth Kenny Foundation, at a total cost

of \$141,000. Construction costs were covered by grants of \$725,000 from the United Hospital Fund and \$339,000 from the federal Hill-Burton fund.

Upon completion of building, support from the federal fund and from UHF ceased. The two sponsors, however, have agreed to provide \$35,000 each to cover annual deficits from operation.

Deficits occur because fees charged to referring agencies for the Center's services are based only on the actual cost of operation. Individuals requiring service but lacking a sponsor will be charged for services according to ability to pay.

Primarily, the Center's largest initial "customer" for services is the Minnesota Division of Rehabilitation. Additionally, other institutions including insurance companies and workman's compensation groups are expected to employ the Center's services.

It is difficult to state precisely an optimum number of clients to be handled by the Center. It depends entirely on the degree of complexity of each case. It should be fairly accurate to say that the full staff can handle from 100 to 130 clients per day. The average stay of a client is approximately six weeks. None are "in-patients," but arrive at the Center and depart daily according to a schedule arranged by the staff.

Full staff of the Center will average about 60 persons, including part-time services of a Medical Director and a Psychiatrist. Staff members include directors of vocational, social and psychological services, vocational counselors, work evaluation supervisors, placement consultants, case workers, group workers and office personnel.

Operation of the Center, under its Board of Directors, is headed by the Executive Director, assisted by the Rehabilitation Coordinator.

The Minneapolis Rehabilitation Center is an independent, non-profit corporation.

Basically, need for the Center stems from the fact that individual existing agencies—large or small, metropolitan or rural—while providing intensive medical treatment, ordinarily do not have a volume of vocational and psycho-social case requirements sufficient to justify extensive staffing in those areas. The Center provides comprehensive services to enlarge the abilities of all those agencies.

The Center's initial contact with a client is through the referring agency and the Center's rehabilitation coordinator. The latter obtains complete case history data, duplicates it, and circulates it to an intake committee consisting of the coordinator as chairman, director of vocational services, director of social services, director of psychological services and medical director. A client is usually interviewed by the directors of vocational and social services, and by other specialists if the case warrants it.

Upon study, if the intake committee observes that the case requires extensive services of a particular nature before the client can fully take advantage of the Center's combined services, it will be recommended back to the referring agency for specific treatment.

If it appears that the client can begin treatment immediately, his case is accepted for one week of intensive evaluation designed by the Intake Committee to determine the full scope of the problems involved. This evaluation includes psychological testing, plus social and vocational study, resulting in a definitive outline for a corrective program. Upon acceptance, a case worker and a vocational counselor are assigned to work permanently with the client, constituting his case management committee.

After the week's evaluation, a staff review committee, made up of the intake committee, case management committee and referring agency representative, thoroughly evaluates all data gathered. Upon the committee's de-

cision that the Center can contribute substantially to the client, a corrective program in the psycho-social and vocational areas is structured in detail.

If concurrent medical service is required, it will be arranged through the Kenny Institute, the Curative Workshop or other appropriate resources. If a major social or emotional problem will prevent the client from taking immediate advantage of the Center's program, a social service or mental health agency will first be recommended to the client and the referring agency. When accepted by the Center, a client begins a corrective program developed to help him achieve a realistic vocational objective within a period of time consistent with the client's potential. It is not the Center's purpose to remove serious emotional or social problems, but to modify them so they will not seriously handicap the client's vocational opportunities.

The corrective program, devised by the staff review committee, is implemented by the case management group under the direction of the rehabilitation coordinator and with continuous consultation of the medical, vocational and social services, psychiatrist and psychologist. The case management committee meets once daily to coordinate knowledge of the case, to suggest minor program modifications and to reinforce treatment through close coordination of various staff members' efforts.

During his last week at the Center, a client's case management committee presents to the staff review committee a progress report and recommendations for the client's future activities. The senior committee develops this material so that when the referral agency reassumes case management it will understand fully the problems involved and what is required for proper follow-up. The Center may assist the referral agency to find a suitable vocational opportunity for the client and stands ready to assist him as long as is desirable.

A GROUP DYNAMICS APPROACH TO SAFETY PROBLEMS

By A. F. ROMIG

Manager, Training and Safety, Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

Mr. Romig explained the group conference method or "66" technique developed by Don Phillips, President of Hillsdale College, Hillsdale, Michigan. He explained the discussion steps to the group and stressed the importance of determining action, through group dynamics, on a single question at a time. Sample questions which illustrate this point are offered.

Mr. Romig then conducted a group conference along the Phillips "66" technique. The chairman of the tables reported on the "best answer" as follows:

Question 1. What experience at this National Safety Congress will have the greatest impact on your safety program next year?

Answers:

1. The renewal of enthusiasm through the exchange of ideas.
2. The scope and immensity of the Congress gives a better indication of the importance of the movement and the many services and help available from so many sources.
3. The Congress suggested a need for more safety training "in depth."
4. The individual context and experience of others was most helpful.

Question 2. What experience or idea has done the most to alter your personal attitude toward safety?

Answers:

1. The realization that different approaches are needed to sell top managers, particularly of smaller firms, and to help professional safety men.
2. The importance of doing more about off-the-job safety.
3. The need to introduce more creative safety thinking from the company president on down.
4. Recognizing the need to stimulate and promote more interest in safety.

5. Recognizing the importance of accident prevention to production.

Steps in "Discussion '66'" after forming groups of six:—

1. "Will your committee of six first get acquainted; then select a chairman whose job will be to encourage each group member to speak; and a secretary-spokesman who is to record and later report the ideas of the committee."

2. "Will the secretary-spokesmen raise their hands? Please keep your hand raised until you get one of the (five by eight) index cards now being distributed—and on which we are asking that you keep a record of the discussion." On the back of this card can be printed:—

"To work as a committee

A. You will need

1. To get acquainted—know the others in your group.
2. A chairman—who encourages everyone to speak.
3. A secretary-spokesman—who records and reports your group's ideas.

B. After the question is stated by the

leader, it is advisable

1. To make certain that each member understands the question.
2. To take a minute of silence for each person to screen out his best idea.
3. To have each person state his best idea before there is any discussion.
4. To make certain that the spokesman has recorded each idea.

and finally—

5. To discuss the ideas as interest dictates."

3. Now, give the exact question to be used for discussion. Allow time for it to be written.

4. "This question requires an answer from each of you, individually. Will the secretary-spokesman record each response on the back of their cards. Later we shall want to collect all of the cards."

5. "After each member of your group has responded, the chairman can encourage discussion on the basis of these recorded statements. This means, Mr. Chairman, that each should give his answer before any discussion takes place. No names are to be recorded."

6. "You will have about six minutes in which to record and discuss your answers."

7. "Mr. Chairman, would you borrow the card from your secretary-spokesman and read the remaining rules of the game to your committee members. Then go ahead."

8. After four or five minutes, start to determine the approximate length of time needed to finish the assignment. Then, give one minute warning, and ask the chairman to make certain that all have shared. At the end of that minute stop the discussion.

9. Now, ask each committee to take not more than two minutes to screen out its best idea. "Will the secretary-spokesmen please check the one selected?"

10. You are ready for reports, according to the plan which best suits your meeting. And finally, at the close of the discussion, collect all the spokesmen's cards and tell the use to which they will be put.

Sample questions for use in
"Discussion 66"

1. To get acquainted:

A. "What one experience of your life might be most interesting to this group?"

2. To raise questions or ideas before or after a scheduled presentation by speaker of panel:

A. Before: "Mr. _____ is to be our speaker next week. His subject will be _____. His qualifications and experience are _____. To help him prepare for his presentation, what particular phase of this subject would interest you most?"

After: "What one question would you most like to ask in order to round out your information on this

particular subject?" "What additional suggestion would you offer which might contribute to the group's knowledge of this topic?"

3. To canvass attitudes and to evaluate:

A. "In what one way do you feel that this particular policy (program, demonstration, etc.) might be improved?"

B. "In what one way do you feel that our morale might be improved?"

C. "What in your opinion is the most important goal toward which we should be working?"

4. To build agenda or make a program:

A. "What one suggestion do you have for inclusion in our next agenda which would insure your attendance and, in your opinion, the attendance of others?"

B. "What one subject if included in future programs would be so meaningful to you that you would give up almost anything else in order to be present?"

C. "If but one item of business could be handled tonight, what would be your first choice?"

D. "What one problem concerning your work with the organization would you most like to have discussed?"

5. To get action:

A. "In view of the discussion, what specific action should we now take that would be so meaningful to you that you would be willing to give a part of your time to it?"

B. "If our group could sponsor but one activity for community betterment (art, etc., etc.) what would your suggestion be?"

6. To exchange experiences:

A. "What one experience along the line of this topic would you offer which you feel would be most helpful to the group?"

B. "What additional fact of greatest significance would you add to help us round out our information about this particular subject?"

C. "What is the best program idea (activity, undertaking) that you have

shared in or heard about?" (Which might contribute most to the group?)

7. To nominate officers:

A. "What one person in our organization would you be most proud to call 'Our President' (Our Secretary, Treasurer, etc.)?"

8. To initiate thinking on (class) presentation or assignment:

A. "What, in your opinion, is the greatest implication of today's presentation (assignment) in terms of your daily life (or, the material thus far covered; etc.)?"

9. To improve relationships:

A. "In your opinion, what should be our first step to make this a better working unit (team) (staff)?"

11. "What is your best suggestion for improving our relationships within our own organization?"

C. "What is your best suggestion for improving public attitude toward our group?"

10. To evaluate—and also canvass attitudes:

A. "What, in your opinion, was the outstanding accomplishment of the year?"

B. "What is your best suggestion for making these meetings (another program, or activity) more purposeful (productive)?"

C. "In what one way might we best improve our program (meetings) (or, our approach to problems)?"

D. "In what one way do you believe that the national (or, state) office could serve you better?"

MEAT PACKING, TANNING & LEATHER INDUSTRIES GET ALL OF THE FACTS

By NORMAN J. KIRK

Welfare Mgr., Canada Packers, Ltd., Toronto, Ont., Canada

This title, "Get All of the Facts," suggests that an accident occurs, the facts are examined, and corrective measures taken.

I would like to project this business of "get all of the facts" ahead to that period of time before the accident occurred to see how we can prevent the accident from happening in the first place.

Continuing with this thought, I suggest we leave out those areas where it is difficult to set down exact methods to prevent accidents. These intangible areas might include:

—communicating safety to people,
—making people aware of accident situations,

—getting supervision to take the interest that they should in accident prevention, and I am sure you can add many more.

There is, however, one specific section of

accident prevention where you as a safety man can exercise a great deal of control.

I am referring to that area of accident prevention where the premises are examined carefully for hazards and employers' actions are studied for unsafe work habits.

In discussing safety inspections, I do not wish to conjure up in your mind the vision of a government inspector making a routine inspection of the premises—rather other means of effective inspection within your control.

Perhaps I can throw in an idea or two that might be of use to you in uncovering unsafe situations.

To illustrate the value of inspections, I would like to describe an unfortunate incident that occurred at one of our creameries, demonstrating how a thorough safety check might have prevented an accident.

One Friday night in a small Ontario town, one of our creameries remained open to accommodate farmers coming to town. As the accountant had work to catch up, he remained after hours to look after customers and work on the records.

About 6:30 p.m., the accountant's wife came by and asked her husband to keep an eye on their two-year-old son for a few minutes.

As the accountant carried on with his work, he heard a yell from the back of the office. Rushing to the spot where the shout originated, he discovered the child had taken a drink from a pop bottle. Unfortunately, the bottle contained sulphuric acid used for test purposes in the creamery. Despite a valiant effort by the medical profession, the child could not be saved.

Now, what was wrong here and what would a thorough plant inspection have turned up?

1. A pop bottle should never have been used to house a dangerous acid.

2. Even if a pop bottle was used, it should have been stored in a locked cupboard, out of the reach of casual visitors and, in particular, children.

In addition, the accountant should not have been assigned a baby-sitting roll at the office where he could not watch the child constantly and, of course, children should not be allowed to wander through either the plant or office.

It is easy to look back and say what could have been done to have prevented this accident.

It is a fact that if this unit had followed instructions in regard to self inspections, the accident would never have occurred. Each of our plants and units is required to make a thorough self inspection every three months and confirm to head office that the inspection has been made. If this unit had followed the safety inspection "check list" used as a guide, and had complied with that section dealing with the care of acids and other corrosives, the improper handling and storing of sulphuric acid would have been evident.

From the central safety control point at head office, it is essential that the self safety check be carried out. We believe this is one tangible safety measure that can be carried out religiously by each unit.

At small units, the manager and the superintendent do the job.

At larger operations, the forman inspects his own department or the inspection may be carried out by the plant safety committee. The inspection check list we use is directed towards packing plants and fertilizer and feed units.

There is a second safety check we employ and this is done once per year.

The safety director from the main plant visits units which come under the jurisdiction of the plant.

The value of these checks lies in the fact that a person familiar with safety practice visits a plant which is strange to him. This independent inspector is able to spot safety hazards that are taken for granted by those who work with the conditions day by day.

As an example, some years ago while on a tour of units, and while visiting a creamery, I noticed that the employees used as a regular route between the plant and the office an opening between the wall and a butter churn. If you are not familiar with a butter churn, it contains a large protruding loading door. When the churn was in operation the pathway became a very dangerous area as the loading door came around and closed the opening. It was apparent that if the churn was started up and an employee decided to go through the opening at the same time, a serious accident could result. This condition had been taken for granted by the unit for years and when the situation was explained to them they were amazed that they had not spotted it themselves.

Not only at this creamery but at all creameries, the area around the churn was blocked off.

This is a case of accepting a situation through long association with it and never realizing the potential danger.

I would like to discuss a third inspection method and this one I am sure is quite novel.

In the southern part of the province of Ontario, the safety representatives from most of the packing plants meet regularly each month throughout the fall, winter and spring. Meetings are held at a different member plant each month.

The day's program includes an inspection of the plant by the group, and lunch and an afternoon discussion of common accident

problems. A highlight of the discussion is a description of lost-time injuries occurring at the various plants during the preceding month and suggested corrective measures.

I would like to deal specifically with the plant inspection.

First of all, it would be impossible for a group of twelve or more individuals to be all looking for every hazard. To overcome this difficulty and make the inspection more useful, a series of inspection forms were devised, each form covering a specific safety item.

The areas covered include mechanical hazards, protective equipment, miscellaneous, electricity, unsafe practices.

Each member of the group is handed a different report form and looks for the specific safety hazards on his sheet. For example, the man with the form covering electrical hazards would concern himself with this subject only.

To follow this further, let's consider the member who is watching for mechanical hazards. His form indicates he should be on the alert for such things as operating condition of pressure vessels, kettles, tanks, grinding wheels, stuffers and rotors, mechanical machinery; proper guarding of fans, belts, pulleys, gears, motor couplings, pinch points, etc.

As the members go through the plant, each one indicates on the form supplied to him the location of the department and the particular hazard noted.

These reports are handed to the safety man of the home plant and he in turn takes corrective action.

I believe this has been a valuable form of plant inspection, particularly in respect to new operations and operations which had been underway for a long time but had no specific safety program.

Firstly, the inspection is done by people who are familiar with packinghouse operations and safety problems.

Secondly, the group has sufficient status so that management of the plant visited is willing to go along with practical suggestions made.

Generally, at the next succeeding meeting, the representative from the plant visited the preceding month reports on corrective action taken to make his plant a safer place in which to work.

Meat Packing, Tanning and Leather Products

We are always looking for tangible accident prevention methods.

What better approach is there than the various plant inspection methods discussed.

I have not tried to tell you how to make an inspection of your plant and what to look for—each of you knows how to do this job.

I have endeavored to throw in one or two different concepts of inspection and results obtained from their use.

At the beginning of this paper, it was suggested that "get all of the facts" can be applied before the accident happens. Perhaps some of the methods suggested will help you achieve this end.

SAFETY INSPECTION CHECK LIST

Four times a year, a safety inspection should be made at your plant. The inspection should be made at the following times:

- Between January 1st - March 31st
- Between April 1st - June 30th
- Between July 1st - September 30th
- Between October 1st - December 31st.

We are not asking for a written report to be mailed to this office but will check you periodically to see how you are coming along with this important part of our safety work.

When making your inspection, the following check points should be kept in mind:

- Floors and Other Walking Areas
 - (a) Floors kept clean and free of grease.
 - (b) Free of items that should not be there.
 - (c) In good repair.
 - (d) Stairways clean, free of obstructions and well lighted.
 - (e) Are stands in good repair—surfaces slip resistant?
 - (f) Handrails in place and in good repair.
 - (g) Ramps, runways, loading plates, kept in good condition and stored safely.
 - (h) Ladders in good condition.
 - (i) Tank and bin ladders, out-walks -- in good order and with proper protection.
 - (j) Tanks, bins, manholes and chutes covered when not in use.
- Falling Objects
 - (a) Piles solidly made and not built too high.
 - (b) Safety shoes worn by people handling heavy objects.
 - (c) Tools and other objects kept in a safe place.
- Trucks and Truck Handling
 - (a) Trucks, in use in plant, in safe and good mechanical condition.
 - (b) Do employees use trucks in safe way?
 - (c) Truck handles guarded.
 - (d) Are trucks loaded properly—load balanced and truck not overloaded?
 - (e) Proper care when approaching blind corners or areas.
- Moving Machinery
 - (a) Is machinery stopped before oiling, repairs or adjustments made?

- (b) All moving parts, chains, pulleys safe-guarded.
- (c) Do operators receive full safety instruction (particularly on skinning machines)?

Handling Material

- (a) Workers handle packages safely.
- (b) Shipping areas free of congestion.
- (c) Doors and "automatic opening" doors kept in good repair.
- (d) Sharp edges of doors, machinery removed.

First Aid

- (a) Sufficient first aid equipment and qualified first aid attendants.
- (b) Do employees obtain immediate first aid?
- (c) Proper lifting techniques used to prevent strains.

Burns, Scalds, Electricity

- (a) Hot pipes insulated.
- (b) Hot water and steam hose maintained in good condition.
- (c) Acids, alkalis, cleaning materials used with utmost care and stored in a safe place.
- (d) Electric wiring and cables in first-class condition.
- (e) Are all electric tools, motors, machinery grounded?

Knives and Knife Handling

- (a) Knives guarded and kept in clean, sharp condition. Steels guarded.
- (b) Sheathards or sheathes used.
- (c) Safety gloves, arm guards, aprons used where needed.
- (d) Men spaced out to avoid one cutting the other.

Falling Objects

- (a) Overhead rails maintained in good order.
- (b) Switches in good working condition.
- (c) Safety dogs used where needed.
- (d) Rollers, hooks, shackles, chains and block and tackle equipment in good condition.
- (e) Trees and racks in first-class condition.
- (f) Hard hats used in areas where there is a danger of falling objects.
- (g) Are elevators, pent house, pit and electrical devices on elevators in excellent condition?

Eye Protection

- (a) Do workers wear goggles on jobs requiring their use—welding, grinding, chipping, bone sawing, white washing.

Miscellaneous

- (a) Safety belts used when employees doing overhead work.
- (b) Masks and breathing aids used where needed.

SMALL BUSINESS & ASSOCIATIONS

THE WHY AND HOW IN INITIATING AND DEVELOPING AN ASSOCIATION ACCIDENT PREVENTION PROGRAM

By IVAN F. LeGORE

Safety Dir., Portland Cement Assn., Chicago

Part of the business of anyone in business is to improve everybody's chances of working without getting hurt. That is as true of smaller businesses as it is of bigger businesses. The trouble is that the managers of smaller organizations don't think much about it or do much about it, while the managers of bigger businesses do.

One of our nation's biggest problems is to reach several million smaller firms, smaller organizations, which do little to prevent injuries at work. The owners and operators of those enterprises are busy people—hunting up business, scheduling production, making delivery deadlines and meeting payroll. The boss is chief cook and bottle washer; among other responsi-

bilities he has to be personnel manager, purchasing agent, sales manager, dividend collector and loss absorber.

He wouldn't know very well what you were talking about if you told him a safety engineer could do him a lot of good. He'd tell you he couldn't use one and couldn't afford one and, besides, he can't recall any serious preventable accidents they'd been having in his place. Safety work is one of those frills the bigger companies have along with a lot of other things. There aren't enough hours in the day, and days in the week, for the boss to do all the things he should as it is.

The majority of smaller businessmen don't know they have safety problems, don't

know that safety work pays dividends, and don't know how to improve their chances for business success by preventing the wasteful mistakes called accidents. They don't know how to save big fat dollars on a totally unnecessary item of overhead.

It is also a fact that the individual small businessman isn't likely to find out about these things on his own initiative. He may have debit insurance rates and be burdened with costs that add up to inefficient operations, a poor industrial and public relations and delayed deliveries which he can ill afford. Most small companies don't directly pay their medical and compensation bills; their insurance carrier takes care of that for them. Therefore, they seldom know what these direct losses from accidents are, much less understand the indirect losses from accidents that may be, and usually are, more serious.

In the aggregate, the accident problem of smaller firms is a big one. Firms that do little to control work accidents usually have more accidents than firms having safety programs, and that means that smaller firms generally have higher accident rates and higher insurance costs. Reliable surveys bear out that fact. In general, companies paying \$300 a year premiums—and there are hundreds of thousands in that category—are experience-rated and to some degree receive a debit for poor accident experience or credit for good experience. So all but the smallest can reduce their workmen's compensation insurance through the reduction of injuries.

There are cases on record where favorable accident experience has so affected insurance rates and other costs of doing business that a "safe" competitor beats out an "unsafe" competitor. Moreover, even the smallest company's experience contributes to the accumulated experience in its industry and in its state, so its own experience affects it by influencing the overall insurance rate for its group.

The small employer doesn't realize that such things as occasional eye injuries or cuts and bruises should be regarded as warnings that the next mishap might be the big one. He needs to be reminded that mismanagement which results in general inefficiency also causes accidents which in turn cause injuries and hindrances or inter-

ruptions to the work. He should be reminded that his experience with so-called minor injuries is a tip-off that something is wrong; and that something can lead to serious trouble and expense. Most accidents stem from failure to see and correct simple, commonplace causes.

So safety work should be encouraged, not as a frill or something added as a fringe benefit, but safety work should be encouraged as a part of the job, as inseparable from production, an integral part of everything done. It doesn't cost much in time or money, anyone can do it with the right kind of coaching, and it pays big dividends. For safety work not only prevents undesirable things from happening, it reflects sound planning and performance according to plan, it adds to productivity—and who in the world wouldn't welcome that kind of a benefit? A neat, well planned, orderly, well-run, safe job tends to encourage efficient work habits, boosts employee morale and public good will, and it helps the business keep running smoothly.

These are things Mr. Average Employer ought to know for his own best interests. You know them and I know them, but he isn't likely to find out about them by himself. How can we get him to know these things and do something with them?

The Department of Commerce tells us that there are some 16,000 voluntary associations in the United States. More than 4,000 of these represent Chambers of Commerce; some 12,000 represent trade, professional and technical associations. Each one embraces a segment of our daily life. Members of these 12,000 business leagues employ upwards of 68 million people. The 3 million employers that these voluntary associations represent sign the payroll checks that pay the grocery bill, the doctor, the dentist, the landlord and the merchant. They attend some 75,000 organization meetings on the national, regional, state and local levels involving their associations. Hundreds of thousands of business leaders attend those meetings, conferences and seminars.

Glenn Sanberg, who is executive vice president of the American Society of Association Executives, says:

"If we were to harness one-hundredth of the potential in this vast group on the American scene, we could, I believe, reduce

the terrible cost of accidents, both in money and manpower, by one-half overnight. Suppose at every meeting of an association one simple idea could be driven home to those attending—What a difference it would make. One idea—accidents are avoidable. What would happen, for instance, if 1,000 associations would make it their business to spend one-tenth of their conference program in creative planning for accident prevention?

He knows what would happen, and so do we. The records are full of startling examples showing hundreds of thousands of lives and millions of dollars saved through association-sponsored safety work.

Association executives are in a uniquely favorable position to show their members how to save money enough through accident prevention to pay their dues to the association. They know the leaders of their member companies. They have their confidence. They know their problems. They can get them together to share experience and provide mutual aid.

The members of a business association do their business through experience-sharing for mutual aid. And that is exactly the way successful safety work is done—through experience-sharing and mutual aid. The members look to their association for answers to problems, for new ideas, for direction, guidance and inspiration. If the association doesn't assume leadership in their safety work, who will?

Association executives who have assumed such leadership as one of the services of benefit to their members have found that accident prevention is a low-budget activity that is effective in small organizations as in larger ones, and that it becomes an increasingly important activity in terms of the human values involved. An increasing number of associations are finding that the smaller employer can control his hazards if he wants to, and that he can be led to want to control them.

Who else but his association can give the manager of a small plant or organization the same kind of perspective on his section of industry as the manager of a big organization gets from his own safety department? Who else can as effectively convince him, in his own interest, to make use of the knowledge and the techniques and the materials that are at hand for him to use on controlling the hazards of his business? Who else but the people he knows best, the people whom he trusts, the people

and organizations with whom he is on a footing of experienced and successful collaboration? The association is his outfit; his associates in it are his folks; it is his axe that the association is always grinding.

The association can get its member to see his problem and, having seen it, to make a reasonable effort to solve it himself. For safety is a job an employer has to do for himself. There are not enough safety engineers, inspectors or supervisors on earth to do the job of controlling unsafe conditions and unsafe work practices in all our small organizations, even if their managers were willing to contract for their services and had the money to foot the bill. But divide the cost of an association's information center on safety work—helping members to recognize and understand their own problems and to apply the lessons of industry-wide experience in solving them—by the number of member company organizations, and you have a service costing each of them pennies per day.

The small employer has the initiative to do his own safety job, or he would not be an employer. He will do his own safety job only when he wishes to do it. He will want to do it only when he believes he has adequate reasons for doing it. There are plenty of reasons—the success of his association in the field must lie in making them acceptable to him.

Perhaps that covers a great deal of the why of an association accident prevention program. As for the how in initiating and developing such a program, I can best tell you about the program I know best—that of my own organization, the Portland Cement Assn. Our safety work started almost a half-century ago and has steadily expanded to what National Safety Council representatives have said to be, "A position of the highest national importance." The staff of the Council has cited our work as an example to others initiating safety programs, and we have been helpful in every way that we could in their getting started in this field. If some of what I say sounds like bragging, I'll take refuge in what that eminent baseball philosopher, Dizzy Dean, used to say: "Bragging ain't bragging if you can prove it." I can prove it.

The Association and its member portland cement manufacturing companies are pio-

neers as well as eminent leaders in the important field of occupational accident prevention work. Since the inception of the Association, in its present form in 1916 safety work has been sponsored by the accident prevention committee, one of three standing committees appointed by the chairman of the board of directors and responsible to the board. Our constitution and by-laws provide that the president shall direct the promotion of the accident prevention activities of the Association, which indicates the importance accorded this phase of the Association's activities. The safety director reports directly to the president. The various company officials and executives who make up the accident prevention committee roster represent an excellent cross section of the safety thinking within the membership.

This is said in support of the point, which has been proved repeatedly, that there is best assurance of success in a safety program if top executives take an active part in it. Safety work brings all levels and all elements of an organization together in the common cause of making the business successful. The pioneer accident prevention committee told the executive committee of the board they believed that disabling injuries and fatalities were unnecessary to the manufacture of portland cement.

They obtained unanimous approval of a course of action to help the members reduce the number of accidents and aroused the entire membership to attack the problem of helping employees protect themselves on the job. Through experience-sharing for mutual aid, our members conserve manpower and equipment resources and improve productivity by anticipating hazards and hindrances to the work and providing against them, contributing to orderly operations.

Let me say at this point that for 45 years our Association has been a member of the National Safety Council. In taking part in the activities of the Council, we share our experience in solving safety problems and we benefit from the experiences of the other members. We strongly recommend Council membership to our members and most of them belong.

Our program had its origin chiefly in humanitarian motives and with the idea that accident prevention is good business. Safety

work makes good business sense, good social sense and good moral sense.

The returns are many. In the past decade alone, the injury frequency rate dropped one-third and the injury severity rate plunged 60 per cent, producing many benefits besides reductions in the manual rates for insurance which follow improved safety records. Methods improvement is a part of safety improvement. Morale is high up and down the line, workers and executives alike taking great pride in achievements that have made cement the safest heavy industry in the country, according to National Safety Council records.

In the Council's complete list of 40 heavy and light industries, cement ranks sixth. Our lowered frequency and severity rates, the reduction of which in heavy industries like cement, steel and glass is always a major problem, are now comparable to the average rates for all industries. Cement workers used to be rated up for life insurance, but not any more. Our workers get ordinary life at standard rates. Blasters and explosives handlers get life insurance at the second substandard rate as against third and fourth substandard rates for those occupations in other industries.

If time permitted, I could cite many startling examples of what has happened when other associations have caught the spark of safety service. They are on record at the Associations Division of the National Safety Council and are yours for the asking.

Now for more about the "how" in initiating and developing an association safety program, let me distill into about three major factors the things any association can do with a fine chance that they will be effective. Perhaps this is an oversimplification, but if so, so be it. So far, we have made the points that accidents can be stopped; it is profitable to stop them, financially and from the standpoint of morale; accident prevention does not cost much, paying for itself many times over; safety know-how is time-tested and can be used by anyone. Like any other kind of work, safety work requires consistent direction so that it will be done efficiently and persistently—otherwise, individuals must by trial and error become expert in recognizing and solving their safety problems. While

management may tolerate supervisors' trials at accident prevention, rarely can it afford their errors.

There's an old saw to the effect that there are three kinds of people: people who know where they've been, people who know where they're going, and people who have no idea where they are! Leadership that knows where it's been and where it is and where it needs to go is indispensable.

Surveys, questionnaires and accident reports among the association membership develop the need for accident prevention work in much the same manner as other needs of the members are discovered. Evaluation of the membership's experience in the light of the data shows what is most urgently needed in order to improve their accident experience. Needs are revealed in studies of accidents reported, in correspondence and visits with operating executives, in meetings of the association's accident prevention committee and in such regional conferences as may be held of plant managers and key supervisors. Procedures and forms for doing this are available from the Council.

Let me give you one example from our Association of the benefits of an accident reporting system to let us know where we are and what our needs are. Each month the disabling injuries reported by our 180 member company plants are summarized, without identification, in our Accident Round Table with commentaries as to how they should have been prevented. That means that each month's Round Table gives each plant team of supervisors and employees the benefit of 15 years' plant accident experience! This means of sharing accident experience was started years ago, and the safety progress made in our industry proves its worth. Of course, shared safety knowledge stops accidents only when people are wise enough to learn the lessons that mishaps have taught other people the hard way.

It should be understood that accidents won't be prevented from the office of your association. The people who make safety programs successful are the employee whose responsibility it is to get daily jobs done right. It is the association office's first responsibility to keep that fact fresh in everybody's mind. It takes ingenuity and

persuasiveness to get people to recognize and understand their own safety problems and to apply the lessons of experience in avoiding accidents. But those qualities of promotion are the stock in trade of any association employee who is effective in his work of furthering the interests of his members.

Promotion ideas are to the safety man what advertising ideas are to the sales manager. The problem is one of motivation, of getting messages across in such ways that the prevention of accidents will be interesting and important. Safety promotion can be dull, stuffy and dreary if we simply scold and view with alarm and point to the horrible things that go on. But the accident prevention concept can be reduced to practical, realistic, liveable, down-to-earth principles translated so that the average fellow on the street, in the plant or in the office will buy them.

Often a bad job of selling safety is done because we don't know people well enough. Safety is actually a vital, dramatic way of furthering the way of life in America of which we are so proud. Safety habits mesh in the whole pattern of activity of capable workers, good parents, responsible citizens. We can never stop improving our knowledge of how to promote it any more than an association executive can stop improving his know-how in promoting effectively the other business of his members and their employee.

What do you promote? In every telling way you can think of, promote these general ideas:

1. *Accidents are mistakes*, therefore wholly undesirable. The person who disables himself trying to get the job done has done something that is not to his credit, for he can't finish the job he started. He was dull or reckless, not smart enough to look ahead, plan ahead and use his head. Recklessness makes no sense, requires no brains and no skill. Risking one's future is stupid.

Collectively, a good plant safety record reflects competent leadership and capable workers. There is no better indicator of the competence of an operating team than their ability to get the job done without the mistakes and errors in judgment that lead to accidents. Employees' families take pride in championship safety performance as their

men do. In the celebrations and affairs marking outstanding safety achievements, we give due recognition to the family stake in and contribution to the record.

Every wife and mother, every son and daughter expects the head of the household to return home from work all connected up, just as he was when he left for work at the start of the shift. In so doing, their men didn't let them down. And living up to others' expectations is an important manifestation of an individual's, and an industrial team's, worth and ability. Happiness does not come from doing easy work but from the after-glow of satisfaction that comes from the achievement of a difficult task that demanded our best.

Desire to avoid personal injuries is strengthened by setting up a goal of accident-free operation and inspiring people to work toward it. The challenge to prove competence by avoiding accidents appeals to the spirit of competition and cooperation—competition for an outstanding record of performance and cooperation with teammates in achieving it. The association is in an excellent position to set up and administer a trophy competition for outstanding safety work.

Care should be taken to avoid the mistaken idea that safety is separate and apart from production. Actually, safety is an integral part of the job, any job, an essential to good workmanship, an inseparable part of any successful undertaking. In driving a car, a person doesn't do a "steering job," a "braking job," or a "signaling job" separate and apart from the one endeavor that must be performed satisfactorily for him to get to his destination safely. At work, a person doesn't do a "quality job," a "production job," or a "safety job" separate and apart from the one job at hand. Whatever the task, all three elements must be combined for it to be done satisfactorily.

2. *Safety is a choice*. That's another general idea to promote in every ingenious way you can find in developing and maintaining sound thinking and good teamwork for accident prevention. Alertness and the right choice of work practices keep plant teams accident-free. Good attitude is the most important factor influencing the performance of competent workers and drivers.

Studies show that accident makers are

aggressive, intolerant of others and discourteous; resent authority; have an exaggerated opinion of their own importance and abilities; seem unable to respect the rights of others; often act impulsively and take chances. "Man is arrogant in proportion to his ignorance," is an old saying. The worst places to be arrogant or excitable are at work and in traffic.

Everyday living involves a very great number of choices and decisions, many of them critical from the accident standpoint. Choices are made between being tolerant and intolerant, firm or permissive with respect to what is right and safe, respectful or disrespectful of others' rights and welfare, thoughtfulness or impulsiveness. For most plants, supervisors and experienced employees know how to eliminate physical hazards and unsafe methods and practices. The big problem is to get them to apply what they know, to avoid the short cutting and chance taking that lead to disabling injuries and damage to equipment. Failure to find and eliminate dangers breeds accidents. Failure of supervisors to instruct in what to do, how to do it, and the reasons for doing it that way creates many of the problems, mistakes and misunderstandings that lead to accidents and loss of production time. Operating men need to be reminded of this regularly.

The prevention of those unwanted occurrences, called "accidents," reflects sound choices in planning and in performing according to plan. Safety work not only saves someone, or prevents something untoward happening, it adds to productivity. Many familiar developments, such as the Westinghouse air brake, were originated principally for safety purposes but have contributed greatly to efficiency. Shear pins, fuses and relief valves are fail-safe examples.

Preventive maintenance is a fail-safe function that anticipates failures and institutes corrective measures before breakdowns can occur. Putting blocks under jacked-up loads makes fail-safe sense; so does staying out from under suspended loads. Another choice is between good and poor housekeeping. Neat plant grounds and orderly building areas, besides being safer, are evidences of self-respect and pride on the part of capable plant teams.

3. *Safety should be personalized*. Here is another idea that should be strongly pro-

model. Recognition of outstanding safety performance goes to the plant team, but the fact is that the team's successful record is made possible by the competent performance of every individual on the team. Successful safety work requires group effort, but it also demands individual responsibility and accomplishment. The slogan — every man his own safety director—is based on a sound and fundamental truth.

Mass safety education utilizes posters and films, messages and get-togethers. Such influences help to maintain general safety awareness. But safety teaching does not become fully effective until each employee knows the hazards of his job and how to avoid them. There is a need for personalized training that teaches the individual where the dangers are that he must avoid and what he must do to avoid them. Such safety training takes into account the worker's own rate of learning, his interests and worries, his competence and his limitations. Interviews with him provide the employee with frequent opportunities to make safety suggestions and to bring up any problems he has on his mind.

In striving to make safety education more effective, more universal and forceful, we become more and more convinced that a basic part of our effort must be to build good citizens. Evidence accumulates that the thoughtless, ineffectual worker and the thoughtless, ineffectual driver and the thoughtless, ineffectual parent are the same person wearing different hats. He probably was a thoughtless, ineffectual youngster, and he needs guidance if he is to keep out of accident trouble.

The great and growing need is for leadership by all intelligent people to make safety an all-day, everyday way of life. It is they who know how to use sound living principles as guides to self-reliant, self-possessed, self-controlled and capable behavior—always and in all ways. It is they who translate safety knowledge into programs; they who make the programs work.

A leader exercises judgment in handling affairs and dealing with responsibilities. He conceives and develops ideas; he also accepts and adapts good suggestions and puts them into operation. His personal qualities include patience, self-control, perseverance, self-reliance and a sense of values. He has

the discipline of character to say "yes" and "no" to men and proposals, not out of blind obstinacy, but with the firmness derived from weighing alternatives. His goals include good citizenship and good workmanship.

Cement industry employees have proved that accident prevention effort on the job works—that education, engineering and enforcement can prevent the waste and tragedy of accidents. They believe that safety should be no less a personal thing away from work. There is no less need for common sense when an employee goes out through the plant gate. He should have no less sense of responsibility for preserving his own life and the lives of others. We encourage men to improve their safety awareness and habits in the time they are on their own, making it more likely that their services will be available to their employer uninterrupted by disabling injuries sustained anywhere. We are convinced that safety habits mesh in the whole pattern of activity of capable workers, good parents, responsible citizens. Safety work contributes to the self-discipline of capable people. It promotes an understanding of and more ready compliance with authority, that leads to the acceptance and fulfillment of personal responsibility. Failure to take personal responsibility is a critical problem in programs dealing with the prevention of accidents of all types.

Answers to problems are found by minds that stand off and look; that consider the relationships of things to each other; that see where things might go wrong and how they should be straightened out before accidents can occur. Answers are found through experience-sharing for mutual aid, whether the discussion of safety problems takes place among a few persons in a single department or plant or among the representatives of a number of plants or companies.

It is to the everlasting credit of our Association that we have always been in the vanguard of those hard at work to reduce accidents. Our reputation as a pioneer and leader in safety work is a satisfaction to us. It is one that we must extend as well as cherish. I hope this analysis and the highlights of the thinking and activities directed toward the solution of the safety problem may be of benefit to other associations.

TRADES & SERVICES

PUBLIC LIABILITY FROM INCIDENT TO FINAL DISPOSITION

This session was moderated by Raymond C. Ellis, Jr., manager, Member Relations, Variety Stores Association, New York, and was attended by representatives of department stores, chain stores, insurance companies, and safety consultants.

There was considerable discussion on minor accidents and nuisance claims, particularly regarding liability when broken glasses or damaged clothing was repaired or replaced or when first aid was given by anyone other than a professional. It was agreed that a detailed report should be given and that an immediate check of the physical conditions involved be made.

Dr. Murry Paul of Carson, Pirie Scott and Company, Chicago, described his company's accident prevention program which included:

An effective accident prevention organization and program which includes a safety committee representing all stores with a committee in each area.

He pointed out the importance of having the company president and vice president frequently attend the monthly safety committee meetings.

Accident hazards are removed immediately and receive prompt attention from executives and managers. Their program combines safety with fire prevention and includes an emergency evacuation plan with frequent drills in which an entire floor is evacuated.

To stimulate interest they have breakfast meetings of the committee on a semi-annual basis.

Public liability cases are carefully handled

with consideration given to future liability and legal action. The nurses prepare a comprehensive report which includes a maintenance report, reports from witnesses both public and employees, and photographs if possible. The company doctor calls and arranges to send the injured person where his or her doctor wishes; hospital, clinic, etc. If necessary, one of the store personnel accompanies the injured person and this tends to create good public relations.

Insurance company representatives agreed that "no case gets cheaper by sitting on it!" Borderline cases are settled promptly and a monthly report on claims is furnished to top management so as to give information on the importance of making improvements to reduce hazards.

The representative of a large chain store stressed the importance of communications between store managers on the costs of accidents which are translated into lost sales and profits to convince top management that more accident prevention is necessary.

On falls in the stores, the company provides immediate first aid with additional treatment at the doctor's discretion and the customer's expense.

The point was raised regarding customers who refused treatment which raises complications if a report is not made on the incident.

Inquiries regarding the claimant's condition frequently led to the question of the company assuming medical costs but it helped determine whether the insurance claim department should be involved.

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GLASS and CERAMICS SECTION

MY BROTHER'S KEEPER

By PAUL J. BROUWER, Ph.D.

Partner-in-Charge, Rohrer, Hibler & Replogle, Cleveland, O.

To find something vital and significant to say to you who have spent so many months and years thinking about safety in your companies is indeed a challenge. I am only hopeful that a combination of my background as a psychologist and my gross ignorance of the specifics of safety work may combine to yield an insight or two which you will find interesting.

One purpose we have for our next few moments: let us explore how we strengthen our resolve to be psychologically free from accident through relaxed awareness of accident possibilities. Thus, I would hope we can share together some understandings of the basic psychology of "accidentitis" and try to pin down some of the implications of these understandings, not alone for each of us who is personally responsible for safety programs but also for our supervisory forces who must do what they can to insure safe living on the job.

I have asked myself, as I am sure you have asked yourselves, why is it that we need to be everlastingly hammering at safety? One would think that except for the small fringe of people who are neurotic or psychotic enough to enjoy hurting themselves or others, people would want to live safely and would feed the steady barrage of instruction and warning which is hurled at them. Somehow or other the need for safety needs constant emphasis. It falls in the same category as crime prevention, church-going, giving to community funds, and what have you. Apparently, as human beings we are so put together that the evils within us—the tendency to be careless, the disposition to be thoughtless and selfish—need constantly to be fought.

Thus our problem of developing keen, consistent safety consciousness is made most intense by human nature itself. I have concluded, as no doubt you have long since concluded, that powerful forces operate against safety consciousness, forces inherent

in the individual and hence forces that we cannot hope to eliminate—we can only hope to counteract through equally strong forces pressing us toward safety consciousness.

If this kind of sentiment is reminiscent of the theologian's dramatic picture of evil and good in never-ending conflict, let it be so, for in actuality I think our conception of our efforts to make our companies as safe a place to live as possible must be as basic and as dramatic a conception as the fight between good and evil. This is an eternal conflict, a never-ending war, and it means that the programs we institute and the gimmickry we develop, no matter how effective, will never solve the problem because the problem is *unavoidable*. We can only reduce the accident rate.

Thus, if we are constantly waging war against forces within human nature itself in our efforts to develop the posture or attitude of safety, our problem becomes the psychological one of dealing primarily with attitudes and dispositions inherent in human nature.

Interestingly enough, the good part of our human nature is responsible for your being in your jobs. You are your brother's keeper or you would not be here. You do have some feeling of responsibility for your fellow man.

Safety programs through the years have called on four broad approaches through which to express the feeling of responsibility for the other man. Now let's examine briefly each of these four with the question, how is the approach likely to be effective, knowing what we do know about human nature? Perhaps such a brief examination may highlight for us those emphases in our safety programs which are psychologically most effective.

Historically we have used, first, injunction and exhortation as means of influencing human behavior. Such familiar highway slogans as "drunk drivers go to jail" or

"drive safely—we love our kids" or "drive carefully—the life you save may be your own" exhort and enjoin us. Billboard advertisements and bulletin board posters in continuing series of exhortative reminders are common practices.

Are these effective? Who knows? We have no way of scientifically testing the impact of such devices. We do know, however, that like the old preacher's hellfire and damnation exhortations they tend to gradually fall on deaf ears. You can only threaten somebody about so long before he doesn't hear you. So this kind of exhortation or warning or threat, whatever you want to call it, loses its impact. The evil in human nature, which we are trying to counteract, is too strong to be affected by threats and promises.

Secondly, we have also historically used explanation as an approach to safety consciousness. We explain to the child that a hot stove burns and that a sharp knife cuts. We explain to the employee that safety shoes prevent crushed toes and that safety glasses prevent loss of sight. Wherever we can, we explain the nature of the physical phenomena which we live with daily, on the job or off, in order that people can intelligently cope with it.

Certainly, explanation is necessary. But somehow or other this in itself is not sufficient because people still have accidents—preventable accidents—although they know better. A truck driver in Cleveland knew that the handbrake was insufficient to hold his truck on an incline; he should set the airbrake as well. But this knowledge did not prevent him from failing to set the airbrake, so that the truck slipped back and crushed him against the wall. Knowledge in and of itself is insufficient to promote safety consciousness, although certainly knowledge is necessary.

Third, we historically have tried to take the accidents out of the material things we deal with by providing protection. We put a two-handed grip on a punch press so that a man cannot get a hand in the press as it comes down because both hands are required to release it. Or we provide a safety-belt for the window-washer. In many ways, we have developed devices which protect the human being from himself. Obviously, however, any protective device is doomed to only

partial effectiveness, for the window-washer still has to attach the belt and the welder still must put on his own helmet.

An accident by definition is an unexpected occurrence. The prevention of accidents, therefore, is a matter of anticipating the unexpected.

A fourth approach, historically, has been to help people to anticipate the unexpected and thereby prevent accidents. Here we are working on the good that is in people. We are working on people and with people. We are recognizing the fundamental principle that preventable accidents are most often in the person and not in the thing.

For example, if you place a bottle of poisoned liquid on a low shelf in a medicine cabinet in the presence of a four-year-old, you know that you are risking an accident. A four-year-old enjoys climbing and exploring. You can therefore hardly call his drinking the poison an accident. In the first place, the lethal effect on his young body of the poison is nothing unexpected. The properties of the poison and the properties of the body interacting together produce death. This is known and fixed and factual.

It is equally predictable that a four-year-old is curious, loves to look into places, such as medicine cabinets where he is forbidden to look, and enjoys climbing on the wash bowl. This too is known and fixed and factual. So when the child does these things, he is behaving in a predictable fashion.

The factor in human nature that prevents the four-year-old from getting the poison is the insight of the parent. The parent understands the nature of the poison and the nature of the four-year-old, and he can predict that if these two get together there will be inevitable and dire results. The parent prevents accident by anticipation.

By the same token, if you have seven children sleeping in one room, heated by an oil stove that is old and dripping oil and the windows are closed, you can predict trouble; and trouble they did have in Elyria, Ohio, where the oil had leaked onto the rug, spontaneous combustion occurred and seven children burned to death. This is not accident! It is an expected occurrence, granted these conditions.

So, as we work with people on safety consciousness, do we not try constantly to teach them, stimulate them, inspire them, if

comes injected with feeling and then it becomes a matter of conviction.

Specifically, how can we translate intellectual perception into feeling and conviction? Again, we have to leave to our respective ingenuity the specific ways and means; but let me give a wild-eyed suggestion or two.

I wonder how many of you have ever talked at some length with a number of people in your companies who have been significantly free from accidents? The approval you would feel toward such a person, the feeling of warmth and positiveness that you exhibit, could well make him say to himself, "By George, I feel really good about what he has complimented me on and I'll try to continue to be a pace-setter in a program of safety."

Or again, could you in your capacity as safety director ridicule and shame the man who did something thoughtless and selfish and thereby ran the risk of an accident? (Of course, choosing your man so that he doesn't respond by hating you but by hating himself.)

I think that psychologically we are justified in using any and every means at our disposal—ridicule, approval, scorn, praise, chastisement, award, flattery, rejection—you name it and use it—anything that will help to inject feeling into the intellectual perceptions.

It goes without saying that the feelings must be genuine rather than put on. The very problem that we are attacking at this point is the problem that arises from living with techniques and ceremony and rites. We need to translate ceremony into meaningful,

significant personal experience; we need to undergird our intellectual understandings, for example, of what safety really means with the underpinnings of strong conviction and belief. I do not need to tell you these things because you have the convictions or you wouldn't be here. But our employees and associates need to be continually experiencing through us and like-minded people the stimuli to feeling responses that come only from a personal involvement.

One more word: While it is true that people in a group may have an emotionalized experience on occasion, such as when there is a mob or revival type of evangelistic meeting or something of that sort, by and large the feeling that we are trying to generate arises from man-to-man, person-to-person relation.

Far better that any of your foremen would talk only with five people personally for five minutes about safety than to talk to 50 people simultaneously for 25 minutes. And this means for practical purposes the generation of feeling must come from employer-employee, supervisor-subordinate, man-to-man experience. This is a personalized thing.

In summary, let me reiterate that we are psychologically sound in promoting safety programs through injunction, explanation, and protection, and that these are necessary to provide the framework of our effort. But that the tapping of resources of desire to live safely requires a generation of attitudes. And that these attitudes can arise best from participation on the part of the individual in meaningful, personal-feeling experiences.

ELECTRICAL HAZARDS IN THE GLASS INDUSTRY

By JOHN A. BERSETH
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Pittsburgh Plate Glass Co.
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The Glass Division of the Pittsburgh Plate Glass Company is engaged primarily in the manufacture of flat glass and flat glass products. The two basic products pro-

duced are polished plate glass and flat drawn sheet or window glass. These products are used as such in the familiar glazing applications. In addition, the basic prod-

ucts are fabricated for use in automobiles, aircraft, insulating windows, or building specialties.

To adequately explain electrical safety considerations, it would probably be helpful to briefly describe the basic manufacturing processes. The first step in glass manufacturing is preparation of the dry batch. Ingredients such as sand, salt cake, limestone, and soda ash are accurately weighed and thoroughly mixed. This material is conveyed by belt or bucket to the melting furnace and heated to about 2750°F. The application of heat melts down the solid ingredients to form a liquid glass.

Window or flat drawn sheet glass is produced by drawing vertically from the liquid mass to produce a sheet of desired thickness with a natural polish or fire finish. At the top of the drawing machine, the product is completely formed and cut to desired size, ready for commercial use.

The production of polished plate glass is a considerably different operation. The melted batch is drawn from the furnace horizontally by a pair of water cooled rolls. This continuous sheet of glass is not transparent due to the roughness imparted by the roll surfaces. The continuous sheet of glass is then carried on a roller conveyor through an annealing chamber. Following the annealing operation, the glass is mechanically ground with graded sand particles and rotating cast iron discs. This operation is followed by polishing with an abrasive applied to rotating felt discs. The polishing procedure imparts transparency and luster to the glass.

Older plate glass operations grind and polish on a continuous conveying system made up of large tables. This requires each side of the glass to be ground and polished separately. The installations of recent years are provided with "twin grinders" which grind both sides simultaneously. After twin grinding, the glass is moved to the table type conveyor for polishing.

In the following safety discussion, it is necessary to emphasize that these principles apply only to the Pittsburgh Plate Glass Company. I am not able to state these concepts as those of the flat glass industry. No detailed information on manufacturing equipment or processes is exchanged among

corporations as such communication is forbidden by legal decisions.

The application of electrical equipment to serve the glass division operation offers many challenges to provide safety and reliability. The following are the items that must be fully considered in our installations:

1. Protection of life
2. Protection of plant property
3. Protection of uninterrupted productive output

In all electrical applications, we are required to provide an installation that is as free of danger and hazard to personnel as is humanly possible. This requirement must apply to those who install, maintain, or operate the equipment. The nature of glass production and its consequent need for reliable electrical service make stringent requirements for safety and reliability in the equipment itself.

The electrical requirements for producing polished plate glass are different from sheet glass due to the amounts of electrical energy required. The plate glass operation requires much more energy due to the mechanical grinding and polishing operation. Due to the difference in power requirements, the operations will be discussed separately.

A prime requirement for producing polished plate glass is an extremely reliable source of electrical energy. This is vital to the safe operation of the melting furnace and necessary for continuity of operation in a facility representing high capital investment. The melting furnace operates at about 2750°F. The furnace and rolling apparatus must be continuously supplied with cooling water and cooling air. The melting operation is carried out on a 24-hour, 7-day basis. Once brought to full operating temperature, the furnace will probably remain in this condition for periods approaching 3 years.

This process requirement dictates many features of the main substation, receiving power from the electric utility company. The plants are served with purchased energy at primary voltages ranging from 25,000 to 138,000 volts. All are supplied with at least two separate sources. Where possible, these sources are over geographically sepa-

This metal clad air breaker equipment has recently been challenged by the high interrupting capacity, current limiting, low voltage fuse. These appear to have excellent characteristics for the protection of equipment and offer attractive cost savings. We are using some of this equipment, but are moving slowly as our safety experience with the air circuit breaker has been excellent.

Distribution from this low voltage switchgear is by means of cable in steel conduits, or the new interlocked steel or aluminum armor construction. We have lately used 4 conductors on these circuits. Three phase conductors and one full sized neutral are used. The grounded neutral is run to the distribution point and is provided to insure a low resistance ground path for fault current. This insures adequate current to trip the circuit breaker instantaneously in event of a ground fault.

In the plate glass operation, the greatest use of the distributed power is for electric motors. The control of these motors 10 years ago did not prevent any more complication than pushbutton or travel limit switches. For that reason, control circuits were supplied at 600 volts. The advent of the need to supply automatic operations with the installation of many relay and logic functions has led to the adoption of 115 volt control circuits. This provides greater safety to operator and maintenance man and permits the use of much smaller relay and limit switch components.

The extensive use of automatic operation has necessitated the installation of machine tool type control panels. We have a standardized construction that separates the motor switching elements from the relay or logic control. One panel section is devoted to motor disconnect, short circuit protection, and motor contactor. A separate section is used to house all logic relay elements. For trouble shooting, the maintenance man need have no exposure to 480 or 600 volts if the difficulty is in the relay section or at a switch on the production machine.

In producing the rough rolled plate glass, the rolling machine cannot be permitted to stop. Serious and costly damage to rolls, gears, and refractory would be the result of such a failure. For this reason, these

loads are supplied with direct current. The direct current is supplied by mercury arc rectifier or motor generator. For absolute continuity of service, a large standby battery is provided. If the utility power should fail, this battery will supply all the vital furnace auxiliary motor drives for about one hour. With multiple service to the plants, failure of supply for more than this time is of low probability.

In the large plate glass operations, emergency lighting has been provided by the familiar self contained battery and lamp units. These are strategically located throughout the plant. They are for personnel safety only. Failure of utility supply stops production of all items except the melting and rolling operation. Our experience over the years has indicated total power failures are not of a frequency or duration to require additional precaution.

The previous discussion was based on a plate glass operation. Similar situations are found in the sheet glass operation but on a smaller scale. This is due, as previously noted, to the smaller use of electrical energy.

The main substation is provided with multiple circuit supply to provide service continuity. Switchgear is provided with the same safeguards as the plate operation. Since transformers are not larger than 1500 KVA, no differential protection is warranted. Fire protection for transformers is by physical isolation of the units except in instances of unavoidable congestion. Here the fire fog water system is applied to minimize hazard to adjacent equipment and structures.

Loads are served at 480 volts using the grounded neutral system. A direct current installation, with a standby battery is used to serve motors which cannot be permitted to fail. These motors serve the melting furnace and the machine which draws glass from the furnace.

Further protection against failure of utility supply is provided by a standby alternating current generator. This is required, since the sheet glass plant electrical loads are not large enough to justify more than normal utility supply.

In the utilization of energy the same methods are employed as in the plate glass operation regarding switchgear, motor wiring, motor control, and other similar items.

A third activity of the Pittsburgh Plate Glass Company Glass Division operation is concerned with the fabrication of sheet and plate glass. This involves the manufacture of automobile windshield, side lights, and back lights. Also, items such as double glazed units, glass doors, airplane glass, electrically conducting glass, ceramic coated spandrel glass, glass with heat reflecting coatings, and other similar products.

In fabricating these products, the glass generally must be brought to elevated temperatures of about 1200°F. This requires a furnace. Most furnaces are electrically heated and are of our own design. Safety features are the protection of heating element terminals to avoid accidental contact by personnel, use of proper insulating material to prevent failure, providing equipment to prevent overheating, and the provision for rapid shutdown in any emergency. The latter feature is provided by permitting the operator to de-energize the equipment, but not permitting him to re-energize without proper maintenance inspection. This is enforced in that restoration requires entrance to a substation and the manual operation of a breaker.

The preparation of glass for these operations has developed many needs for automatic devices. This requires extensive use of our standard machine tool type control panels and the necessary interlock to insure safe operation of cutters, grinders, and washers.

One operation that makes for an interesting application of electric energy is the welding of glass sheets. This process is used in the fabrication of an all glass double glazed window. Two sheets are welded together with an air space between to form an excellent thermal insulating glass window. The welding is performed with 60-cycle current at potentials in the neighborhood of 18,000 volts. This requires safety interlocks to prevent accidental contact by the operator

with energized welding electrodes. It also requires circuitry to limit current flow to safe values and prevent excess voltage from flashing over the glass surface. This welding is performed with the glass at 1200°F and, therefore, requires the use of refractory materials which are considered insulators even at high temperatures.

To complete this discussion of the electrical safety features in the Glass Division, I will briefly review a few problems common to production of plate glass, sheet glass and fabricated products.

Portable tools always are of concern, since grounding of the case is absolutely necessary. In new installation outlets at 110 volts, 1 phase are provided using the 3-wire plug. This provides a means of grounding. Outlets for welders and other large tools are provided at 480 or 600 volts, 3 phase. These use plugs requiring 4 conductors, the fourth being a ground conductor. Even though these facilities are provided, it is difficult to prevent the making up of adapters so that conventional plugs may be used with tools. The operations must be very attentive to such violation of safe practice.

A reliable fire alarm system must be installed for each plant operation. This system will be provided with adequate numbers of manual pull stations and will also be integrated with sprinkler flow alarms, annunciator drops at a central location and coded audible signals which locate the fire area in order that help can be promptly dispatched.

This discussion has reviewed the major factors in the Glass Division's Engineering approach to electrical safety and is a presentation of our present practice. However, achievement of safe practice requires constant vigilance. Therefore, we are in continuous examination of all principles to produce installations that will protect life, property, and production continuity.

IMPORTANT HUMAN FACTORS IN SAFETY

By HUGH L. RUSCH

Vice President, Opinion Research Corporation, Princeton, N. J.

Safety is a subject about which many millions of words have been written and spoken. Our final authority on word usage, namely, Webster's New International Dictionary—the unabridged edition—has almost three columns, each 10½ inches high by 2½ inches wide, devoted to safety. Starting with the word "safe," and going on with such items as "safety arch," "safety belt," "safety catch," "safety factor," "safety island," "safety lock," "safety match," "safety pin," "safety razor," "safety switch," "safety valve," and ending with "safety zone," there is almost more dictionary space devoted to this subject than any other item in the entire book. Even such a basic item in human needs as the word "food" occupies less than a column in the big dictionary.

The comprehensive nature of this 49th annual National Safety Congress and Exposition, here in Chicago all of this week, with people in attendance from all over the world, during which hundreds of thousands of words will be spoken and written, is further evidence of the importance of the Safety problem.

Someone may even ask the question—"Are we perhaps saving and writing too much about safety?" The answer to that question is self-evident—an emphatic "No!"—particularly when we stop to consider that we continue to kill nearly 40,000 of our citizens each year in traffic accidents alone.

Or when we consider that last year, one of the safest on record, injured workers lost 38 million man-days of work. If you add the time that these workers will be off in subsequent years, as a result of their disability, the lost man-days, according to our Department of Labor in Washington, reaches the staggering total of 160 million. Compared with the man-days lost due to injuries, the man-days lost by strikes in 1960—deplorable as that is—was only 19 million.

Safety surely belongs in the hierarchy of human needs, as illustrated on our first chart.

Chart A
Hierarchy of Human Needs:

1. Physiological needs

- (a) Air
- (b) Water
- (c) Food
- (d) Procreation

2. Safety needs

- 3. Social needs
- 4. Esteem needs

5. Self-realization needs

The protection of life and limb from bodily harm really ranks along with our need for air, water, and food, does it not?

And the human being is still the most important factor on this earth. We have built almost-human robots, but they still are not quite human. Those almost human computers are excellent examples. But, as Professor Baumol of Princeton University recently said to me, referring to those complex computers, "Somebody, somewhere, and in some way, must still tell that machine what to do before it can begin functioning." After all, every machine that has ever been built has come out of someone's mind. And, quoting Charles Lindbergh, "The mind therefore must be bigger than the machine!"

But now returning to the subject of the many millions of words that have been spoken and written about safety, which I mentioned at the outset, I would like to direct our attention to that problem, and to explore that picture with you as the main theme of my message here today.

In conducting this exploration with you, I would like to draw on the research programs of our employee and public opinion index for industry. This is a comprehensive opinion-measuring system, established in 1943, which is serving over 80 leading corporations and associations throughout the country. A number of you are acquainted with our index.

The work consists of finding out what's in people's heads, and how they feel and

act about the problems and issues of the day. Included are international, national, state, city, and county issues, and, of course, the subject is safety.

Practically all of the work is done by the personnel interview method, and with a national staff of over 1,400 field interviewers, a nation-wide survey of 5,000 to 6,000 interviews can be conducted in a couple of days.

Just as the industrial world has established, over a period of years, very fine physical and chemical laboratories to obtain great benefits from the forces of nature, we believe there is need for another laboratory, which we call, for want of a better term, a research department for better human relations. This laboratory deals with such things as having a greater concern for people and their well being, not only around the bargaining table but in every phase of their work in business and industry, including safety. Such a laboratory should take its place beside our big physical and chemical laboratories; we like to look upon our index as just such a laboratory.

Safety has been explored quite extensively in the index research programs, and I would like to report to you some of these findings. They bear directly on the subject I have been assigned, and I think you will be interested in seeing them.

Let's look first at the extent to which companies communicate with their employees about safety. The employee publication is a very important source of news and information for employees, and we have analyzed the content of a sample of 100 representative employee publications, using typical three month periods, over a period of years. A large majority—well over 80 per cent—of these publications run articles on safety, as we note here:

Chart B
Employee Publications Dealing with Safety News

(Based on a sample of 100 representative employee publications over a period of three months in each year.)

1958.....	83 per cent
1959.....	83 per cent
1960.....	84 per cent
1961.....	88 per cent

Glass and Ceramics Section

These articles deal with safety in the home, and at play, as well as at work in the plant. Where the articles have been presented in an interesting manner, with a novel slant, we have found that readership scores very high.

Delving further into the quantity of information on safety included in the employee publication, a content analysis—based on actual measurements of the amount of space devoted to such articles—shows that four per cent of the total goes to safety and health. Some other subjects get more space, as seen in the following Chart C, but even four per cent is indeed a large amount.

Chart C
Content Analysis of 100 Representative Employee Publications

(Published during a typical three month period)

	Per cent of Total Space Given to Each Subject
Personals or social news	21 per cent
Employee promotions and awards	17 per cent
Company products	11 per cent
Recreation and sports	9 per cent
Special department news	7 per cent
Safety and health	4 per cent
Company financial reports	3 per cent
Company expansion	2 per cent
Employee benefits	1 per cent
Other	25 per cent
	100 per cent

Considering that there are approximately 9,000 employee publications in the nation, with an estimated total annual budget of \$300,000,000.00, the four per cent represents a total effort of approximately \$12,000,000.00.

It is also important to note that employees give top management a high vote of confidence on safety. As we note in Chart D, a very large majority of 82 per cent of employees say they are very sure they can depend on top executives in their company to make working conditions as safe as possible.

Chart D

Employees Give Top Management a High Vote of Confidence on Safety

"Very sure I can depend on top executives in my company to..."	Percent of Employees Saying This
Make working conditions as safe as possible	82
Keep the company growing, moving ahead	80
Run the company efficiently	79
Look out for shareholders	79
Protect employees from arbitrary firing	69
Keep promises to employees	67
Provide steady work and avoid layoffs	60
Deal fairly with unions	47
Advance the most deserving employees	45
See that employees get fair share of company income	44

On this point top executives get a rating even higher than on a number of other attributes of good leadership.

Drawing on the index survey, "Progress Sharing—A Powerful Theme to Increase the Following for Management's Leadership," we note further that company management gets a very favorable vote on plant safety. A total of 61 per cent of the employees in a national sample of manufacturing companies say that management has done most to make progress on plant safety, compared with only 31 per cent naming labor unions, and only 8 per cent naming government, as we note on Chart E.

Chart E

Management Scores High on Making Progress on Safety

(Based on 500 personal interviews with a national sample of employees of manufacturing companies in cities with populations over 25,000)

"Which has done most to make progress on..."

	Plant Safety (Per cent of employees saying this)	Wages (Per cent of employees saying this)
Company Management	61	24
Labor Unions	31	63
Government	8	13

Contrasted with the high scores on plant

safety, note that the company management score on wage progress is only 24 per cent, and labor unions get the lion's share of the credit on this, with 63 per cent of the employees so voting.

This subject of the employee's opinions about the company's concern for safety was also explored in our survey entitled "The Index Productivity Quiz." In it we have a challenging correlation of safety and high productivity, which I believe will be of definite interest to you. This productivity quiz, incidentally, has proved to be a good research tool for measuring employee attitudes critical to good operating performance.

Our productivity study was conducted in collaboration with nine participating companies, whose headquarters are located throughout the industrial northeast of the nation, all the way from New England to St. Louis and Minneapolis. One company was selected from each of the following industries:

aircraft and auto parts, building materials, food, metal fabricating, metal products, railroads, rubber products, shoes, steel.

We interviewed a total of 1,597 employees in 18 plants of these nine companies. First of all, we note that the employee gives his company a high vote of confidence on safety, as brought out in Chart F.

Chart F

Employees Give Their Companies a High Vote of Confidence on Safety

(Random sample of 1,597 employees in 18 plants of nine companies)

"My company is working very hard to improve safety and reduce lost-time accidents."

I	I	No
Agree	Disagree	Opinion
Per cent	Per cent	Per cent
83	15	2

"As my company has grown and prospered, employees have gotten their share."

I	I	No
Agree	Disagree	Opinion
Per cent	Per cent	Per cent
47	50	3

A total of 83 per cent of these 1,597 employees say "My company is working very hard to improve safety and reduce lost-time accidents," whereas only 15 per cent dis-

agree. On the other hand, only 47 per cent of them agree with the statement, "As my company has grown and prospered, employees have gotten their share"; 50 per cent disagree with this.

In selecting the 18 plants, each of the nine companies was asked to pick one "high productivity" plant—where they knew that output per man-hour was high—and then one "low productivity" plant. This gave us paired comparisons on a long series of questions, which were asked the employees, including the question on safety, the results of which we just saw in Chart F. Among the employees of the nine high productivity plants, 89 per cent say that "My company is working very hard to improve safety and reduce lost-time accidents," but only 77 per cent in the nine low productivity plants say this, as we note in Chart G.

Chart G

Employees in High Productivity Plants Give Their Companies More Credit on Safety Than Employees of Low Productivity Plants

(Random sample of 1,597 employees in 18 plants of nine companies)

"My company is working very hard to improve safety and reduce lost-time accidents."

Nine High Productivity Plants

I	I	No
Agree	Disagree	Opinion
Per cent	Per cent	Per cent
89	10	1

Nine Low Productivity Plants

I	I	No
Agree	Disagree	Opinion
Per cent	Per cent	Per cent
77	21	2

Each pair of plants makes the same products, and each uses similar machinery. Hence the comparison made in Chart G is valid. While we cannot say that this definitely proves increased safety results directly in increased productivity, we feel, however, that there is indeed a correlation between efficient operation and safe operation, as the employee sees it.

Let's now explore how employees feel concerning the amount of information they receive from their companies about many aspects of their jobs, including safety. This was one of the objectives of a study con-

ducted in five companies, one from each of the following industries: chemical industry, electric power utility, gas utility, manufacturer of earth-moving equipment, oil producing and marketing. A total of 3,786 employees were interviewed.

One of the conclusions of this survey was that top executives are not very knowledgeable about which phases of company operations the employee wants more information, and about which he does not. Many of the topics that communications executives and managers consider only secondary or unimportant targets, we find that the majority of employees select as subjects on which they want more information.

For example, among the five companies, Company A executives seriously underestimate employees' information needs on 10 out of 20 topics. Company B executives misread the market on six out of 15 topics; Company C executives, seven topics out of 16; Company D executives, six out of 17 topics.

But the reverse is also true. We found overemphasis on information employees consider unimportant, or where a saturation level has been reached. Safety information is an example of this. Most managements rank safety a must of employee communications.

But in every collaborating company where employees had the opportunity to state their information needs the majority said, "We get enough information on safety," as we see in Chart H. A total of 67 per cent of the employees in the five companies say this. And the consistency of the data is clear because this figure varies only from 64 per cent of 69 per cent in the five cases. Only about one employee in four wants more information on safety—between 25 per cent and 30 per cent.

Chart H

What Kinds of Information Do Employees Want from Their Company?

(Based on 3,786 interviews with random samples of employees in five companies)

Safety at work—at play—at home	Want More Information	Get Enough Information	Not Interested
	Per cent	Per cent	Per cent
	27	67	6

Company plans for the future—predictions of company's growth.

Want More Information	Get Enough Information	Not Interested
Percent	Percent	Percent
75	21	4

Yet management must keep the safety problem alive in employees' minds. The solution is not to stop communicating on safety, but to bring the information supply more in line with the employee demand by linking safety to other employee needs.

"THE HOUSE THAT BILL BUILT"

We have an excellent example of an outstanding article on safety in an employee publication that received very high readership and made a powerful impact on the employees. It appeared in the monthly employee publication of the Bell Telephone Co. of Pennsylvania, which is called *The Telephone News*—a 9"x12" magazine with around 60 pages.

The article, written by Mr. David H. Dumigan, assistant editor, proves how creative imagination and good execution can lift a more or less accepted subject out of a humdrum pattern and get real reader interest. Bell of Pennsylvania employees get safety information through many channels, and hence might be expected to be bored with more of same. By focusing on safety in the home, the editor gave new currency to the idea of safety consciousness.

The first page of the article showed Mr. William Boyd of Camden, Del., a cable splicer with Bell of Pennsylvania, in the workshop of his home, and displayed prominently the gate he had installed to keep his two small children from getting hurt with sharp tools. In another photograph we saw Bill and his wife Ruth examining the tacking she had placed on a throw-rug to give non-skid qualities to one of her latest crocheted creations.

In still another photo Bill was installing a light switch on a stair rail post to provide adequate lighting for people who use the stairs. Falls on stairs account for more than half of the nation's home accidents.

This article, which ran about 12 pages, with many photographic illustrations, received the highest readership scores of thousands of employee magazine articles that we

have tested in hundreds of such publications. A total of 84 per cent of the employees who received this issue of *The Telephone News* could prove they had read some or all of the article. The average readership score for typical articles in employee publications runs only about 12 per cent.

A total of 65 per cent of the Bell employees could play back from memory, about a week after they received the magazine, some ideas from the article. A total of 19 per cent could play back ideas contained only in the photographs. The playback shows that many employees could recall as many as half a dozen specific safety hints.

Among the supervisory people at Bell of Pennsylvania, the readership scores were even higher—a total of 89 per cent read some or all of this article. The idea playback from the text only was 74 per cent among supervisors.

Hence, we conclude that people do not feel saturated with news advocating safety; provided such information is presented in an interesting manner.

We have come to the same conclusion about communications concerning highway traffic safety, based on a comprehensive survey which we conducted under the sponsorship of the Pure Oil Co. and the American Trucking Association Foundation. The findings strongly suggest that straight safety reminders—exhortations such as "You must drive safely"—are no longer very effective. But safety information linked up with suggestions on how to improve driving skills—how to drive on icy roads, and who has the right-of-way in traffic circles—do register with and motivate drivers.

The title of this study was "Centering Traffic Safety Around Drivers' Motivations." It was aimed at answering two important questions:

1. Do mass communications motivate people to become safer drivers?
2. If so, what approaches are most effective?

The project included a canvass of existing material on traffic safety, broad and extensive interviews and group discussions with traffic safety experts, law enforcement officers including judges and local and state police, and a group of professional drivers

such as chauffeurs, taxi men, and bus and truck drivers. A comprehensive written questionnaire with 76 questions was then used in interviewing a representative sample of adults, and also a representative sample of teenagers.

The study revealed many new facets of the American driver's mind. It shows him to be very sensitive to the problems relating to safe driving in general, and the role of mass communications in particular. He feels that existing communications can very definitely be improved.

It is impossible of course, in the time allotted here, to present any more than the very top highlights of a survey of this magnitude, and I will try to do that. A digest of the study has been published by the Pure Oil Co. and the ATA Foundation, Inc., and I believe copies are still available.

Let's look first at what people say about important highway traffic issues and problems of the day, some of which are being debated in traffic forums, traffic courts, schools and legislatures. In Chart J we have recorded how adults as well as teenagers vote on some of these issues. The questions were worded exactly as they appear on the chart.

As to whether driving is a privilege or a right, we note that a large majority, 34 per cent, of adults, and a still larger majority, 94 per cent, of teenagers, say that it is a privilege and not a right, as we see under the first question in Chart J.

The movement which is under way requiring drivers to take periodic tests in order to retain their license gets high approval from both adults and teenagers: 72 per cent of adults and 86 per cent of teenagers vote.

On the question of whether teenagers are the most reckless drivers, there is sharply divided opinion as might be expected, as we see in the third question in Chart J. However, the vote is not unanimous; about six out of ten adults agree. But it is also of interest to note that about one out of six teenagers condemns his own age group as being the most reckless.

When it comes to increasing the number of police cars in order to make the highways safer, only minorities of both adults and teenagers approve of such a move.

Chart J OPINIONS OF ADULTS AND TEENAGERS ABOUT IMPORTANT HIGHWAY TRAFFIC ISSUES

	Percent Who Agree
1. Driving is a privilege not a right.	
Adults	34
Teenagers	94
2. Every driver should have to take a road test every 5 years.	
Adults	72
Teenagers	86
3. Of all drivers, the most reckless are teenagers.	
Adults	57
Teenagers	18
4. The only way to make highways safer is to increase the number of police cars.	
Adults	38
Teenagers	22
5. They should take the license away from people who get caught driving while drunk.	
Adults	96
Teenagers	78

Going on now to another area of inquiry in the interviews, the driving public itself seems to visualize mass communications as an integral part of solving the traffic safety problem. In Chart K are the replies to three questions that test people's reactions to safety communications. Note that on all three statements the respondent had to take an opposing view to a frequently repeated cliché. These three statements did not actually appear in the order here listed; all statements on a given topic were distributed throughout the entire questionnaire.

As we note in Chart K, approximately two-thirds of each group—adults as well as teenagers—evaluate favorably our safety campaigns.

Chart K
EVALUATION OF SAFETY
CAMPAIGNS BY ADULTS
AND TEENAGERS

	Percent Who Disagree
1. Safety appeals along the highway are a waste of money. Few drivers pay attention to them.	
Adults	64
Teenagers	58
2. Safety promotion material from insurance companies is mostly for the sake of publicity and doesn't do any real good.	
Adults	69
Teenagers	68
3. Once you hear one safety campaign, you've heard them all. They're all alike.	
Adults	63
Teenagers	67

Exploring the question of giving publicity to accidents as a means of reducing them, we note an interesting reaction in the minds of drivers, as brought out in Chart L. On the first question, we see that people think that accident reports in the newspapers are helpful in improving safety; about seven out of ten of both groups so vote. However, as brought out in the second question in Chart L, drivers usually feel "This can't happen to me!" when they see a picture of a traffic accident.

Chart L
HOW ADULTS AND TEENAGERS
FEEL ABOUT THE PUBLICITY
GIVEN TO TRAFFIC ACCIDENTS

	Percent Who Agree
1. Accident "box scores" in newspapers remind people to drive carefully.	
Adults	73
Teenagers	66
2. When the average driver sees a picture of an accident he usually thinks "That can't happen to me."	
Adults	56
Teenagers	60

This point of view also seems to be verified by other testimony that we obtained from the interviews, namely, that every person considers that he (or she) is not an "average" driver, but definitely above average. Nine out of ten adults in the study rated themselves above average in driving skill. They say they're better than average also at obeying traffic laws. Another interesting point is that among those adults with some record of a traffic violation—about 15 per cent of the total—100 per cent rated themselves above average in driving skill.

As all of the evidence, which we have here briefly highlighted, shows, people approve of mass communications as a means of improving safety, but the evidence also indicates that the approach to the communications job, as well as the communications themselves, can be vastly improved in their effectiveness.

On traffic safety, because most everyone feels that he is above average in driving skill, perhaps the first step is to establish—diplomatically, of course—that he does not know all the answers. Show him that some new things have come along since he took his driver's license test, perhaps 15 or 20 years ago. For example, who has the right of way at the traffic circle—the fellow who is in the circle, or the fellow who is about to enter?

The evidence also makes very clear that simple exhortation, or preaching, is not very effective. The message must be presented in an interesting manner with a new and novel slant.

Summarizing the entire presentation now, in a few capsule sentences if possible, the points listed below that follows seem to be evident from our studies bearing on the important subject of safety. These points apply to people's reaction to safety programs, whether they are working in a large industrial plant, puttering around in their homes, taking the car down the street a few blocks to the grocery store, or driving along at 60 miles an hour on one of our super highways.

1. Safety is a basic human need.
2. Industry has been talking about safety in large volume for many years.
3. Employees give management a high rate of confidence on safety.

4. Safety and productivity are linked together.
5. Greater communications skill is required in talking to employees about safety.

6. People approve mass communications for improving highway safety.
7. More effective approaches to the mass communications job must be found.

SAFETY WITH GLASS

By E. C. OSTRANDER
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Swissvale, Pittsburgh, Pa.

This title can take in a much larger field than we propose to cover here. Glass is not only useful, but absolutely necessary to our present state of civilization. All of the contributions of glass to our well-being and safety would take much too long to tell here.

For instance, a Dutchman named Anton Van Leeuwenhoek ground some glass lenses, made a microscope, and observed microbes. One hundred and fifty years later, more or less, we have Louis Pasteur bending over the same instrument, and who knows how many lives have been prolonged! Modern medicine is dependent on the microscope and many other items of glass.

With very few exceptions, the glass we are going to discuss here functions only as it is seen. The items made of this glass are signals; signals with meaning for safety. We define safety as "freedom from danger or hazard." We strive for safety in two ways:

I. We Eliminate the Hazard.

In general, we do this by making a building fireproof, putting the manhole cover back on, or, in the hospital operating room where a few added degrees of radiant temperature could damage exposed brain tissue, we filter the rays to exclude the infrared or heat ray; and, at the same time, give a high level of illumination. Tl's also keep the operating team more comfortable and efficient.

Again we eliminate the hazard when we use glasses which transmit invisible light, either ultraviolet or infrared. A pilot's cockpit may be illuminated with ultraviolet light which will fluorescent the instrument panel so that the instruments can be read

as you read the dial of your night clock. At the same time, the pilot will not be seen by an enemy observer, but will have visual security.

A more recent method of illuminating the cockpit of a plane is with deep red light which provides security and still leaves the eyes of the crew dark-adapted.

The invisible infrared light is used in a way similar to the ultraviolet. The headlights of an army vehicle will flood the road with infrared light. This light is picked up and thrown on a screen similar to a television picture tube. The driver can maneuver his vehicle by what he sees on the screen, but no light is visible. This eliminates the hazard.

II. We Lengthen the Odds.

The second way we strive for safety is to lengthen the odds. With signal glassware, we do this in six different ways.

1. By warning—Often there are obstructions which are hazards to airplanes—things like water towers, radio masts, or high tension lines. These are marked with obstruction lights in a prescribed way, thus giving warning.

Again, as planes come into a large airport, it is necessary to stack them up, each at a directed level to await his turn to land. On each plane above and below the fuselage is a rotating beacon light.

Deep in a mine, the cars which remove the mineral have lights mounted on them to give warning.

Ships and watercraft of all kinds have port and starboard lights to give warning and show their direction of travel. The hazards of the sea lanes are marked with signal glass.

2. By defining or pointing out areas of safety—Exit lights in hotels or theaters mark safe ways to leave.

Runway or taxiway lights on an airport mark the safe lanes for landing or taxing the plane.

3. By creating order, we lengthen the odds. We have traffic systems based on time at every important intersection of streets or highways. You wait your turn. Or more recently we find automatic counting devices which change the time cycle of the traffic signals to favor a heavy flow from any direction.

On the railroad, the system works according to conditions. The train is stopped if there is a stalled train ahead. The signal along the right-of-way is duplicated in the cab with a smaller facsimile of the signal.

4. By improving visibility with street lights and floodlights, we make our streets safer.

5. By indicating lights, we inform the observer that the toaster is on, the wheels of a plane are down, that the fluid level in a pressure system is correct, or that a fire is burning in the stove.

We have rendezvous lights on planes so that a bomber pilot can find his refueling plane.

6. We have certain other glass items that contribute to safety.

Suppose a man falls overboard from a vessel, his shipmate tosses a life buoy cylinder over after him. This contains a battery, a mercury switch, a light source, and a lens. As the buoy floats upright, the mercury switch closes, and a beam of light streams over the waves. The man swims to the light and is supported by the cylinder. A boat puts off from the ship and finds the man at the light.

Swimming pools are illuminated under the surface by lights which permit the bottom of the pool to be seen. This can't be done with floodlights above the surface because of reflections.

III. Required Properties of These Glasses.

1. Color and Transmission.

The color must be quite precise. We have working limits, of course, to take care of variations in thickness, and variations from melt to melt. But to the average observer, the color looks the same from, say, traffic light to traffic light. Transmission of the

light through the lens must be high to give more punch, and to demand your attention.

2. Refraction.

This property of glass is its light-bending power. It varies mainly according to the composition of the glass. A lead glass is denser and will bend the light more. The design of a lens must take into account the refractive power of the glass.

3. Design.

The proper design may add strength to the glass item, may lower wind resistance by streamline effects, may be a compromise necessary to fabricate the item, or may be a means of cutting down the weight, as items used on an airplane. The most important function of design, however, is light distribution. A traffic lens on a four-lane highway must reach up the road far enough to give warning in time to stop. This means a narrow, powerful beam. A traffic lens in the city may control more pedestrian traffic than vehicular; therefore, the beam must spread so that it can be seen over a wide area. The lens design controls the distribution of light, with the help, sometimes of reflectors.

4. Coefficient of Expansion

This property of glass is the rate of expansion on contraction with change in temperature. If the expansion is small, the glass withstands heat shock and is said to be heat resisting. Consider how some pieces are tested in use. A 200 watt bulb is put under a runway light. When equilibrium conditions are reached, the temperature of the glass will be greater than the boiling point of water. It's a real shock when a sudden shower drenches the glass. But the glass does not break.

5. Tempering.

Most of the qualities of glass are the result of the design or of the composition. However, we temper to make glass stronger by heating to a point where the glass will flow under stress, but will not deform of its own weight. We then chill with streams of air. The surface shrinks as it is cooled by the air. The inside flows to relieve stress. Then the inside of the glass shrinks as it cools, putting the surface in compression and making it stronger against heat shock and impact. Since glass normally breaks only when a surface is in tension,

it follows that the surface compression must be overcome before the glass will shatter.

6. Resistance to Weathering.

The composition of the glass must be such that the surface will not be affected by weather nor the color by sunlight or any other natural agent.

7. Freedom from Flaw or Error.

The signal glass item must be free of any flaw which would compromise the signal or cause failure of the glass in any way. The dimensions shall be within the tolerances specified, and the appearance shall be as near perfect as possible.

IV. Conclusions.

A. We have shown three instances where a hazard was eliminated with special glasses.

1. By elimination of the infrared or heat ray while illuminating with visible light.

2. By elimination of the visible rays while illuminating with infrared light.

3. By elimination of the visible rays while fluorescing the dials on the instrument panel with ultraviolet light.

B. We have shown how the odds are lengthened in six ways.

1. By giving warning of the presence of stationary or moving objects.

2. By defining or pointing out areas of safety with runway and exit lights.

3. By creating order with traffic signals, either railroad or highway.

4. By improving visibility with street lights or floodlights.

5. By indicating a fact or condition with panel lights or sight glasses.

6. By special applications as in the life buoy or swimming pool lights.

C. We have discussed the properties of color, refraction, design, rate of expansion with change of temperature, and the effect of tempering or heat treating. We spoke of the need to withstand the effects of weathering and, of course, there must be freedom from any flaw.

We all have traveled here more safely because of glass signals for safety.

ROUND TABLE DISCUSSION — GROUP NO. 1

Discussion Leaders: H. V. GARDNER, Corporate Safety Dir., Owens-Illinois, Toledo, Ohio

J. H. GATRELL, Personnel Mgr., Blue Ridge Glass Co., Kingsport, Tenn.

Recorders: ROBERT W. MOULTON, Safety & Plant Protection Supvr., Ball Brothers Co., Inc., Muncie, Ind.

E. S. KNEPPER, Supvr., Training & Safety, Hazel Atlas Div., Continental Can Co., Inc., Wheeling, W. Va.

The first question that was thrown out for discussion was: "How do you develop safety rules for your plant?" (From here on questions will be identified by preceding them with a question mark, and suggestions with an "S".)

S—First, ask supervisors, clear them through the safety committee. Clear through union committee members.

?—Did unions go along or resist?

S—In most cases, unions will cooperate most wholeheartedly.

?—After development, what did you do with safety rules?

S—Put in booklet form and distribute. Get all new employees' signatures, indicating that all have seen them and read them. Give copy to all new employees and obtain signatures. Post on bulletin board for present employees. Have basic rules written into labor contracts.

?—What do you do to keep them up to date?

S—Review them periodically at safety meetings and/or also discuss at safety meetings.

?—What happens if a safety rule is violated?

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S—Penalty for first warning; second, three days off; third, discharge.

The second question thrown out by the chairman:

?—What kind of training is necessary to develop proper safety attitudes on the part of foremen?

S—Build in with incentive plan.

S—Have business agent discuss safety rules with the plant manager.

S—Build into appraisal system.

S—"Holler" loud enough to get results.

The next major question was:

?—How do you keep foremen interested?

S—Each time there is a serious accident the foreman should be called into the plant manager's office with the safety man to discuss the accident.

S—We don't give adequate discipline and, more important, we don't give credit for a job well done.

S—Training by supervisors to employees on the job (tailgate sessions).

S—Make part of production.

S—Plant manager brings general foreman in to review safety reports prepared by insurance men.

S—Best procedure is for the plant manager to say, "This we will do."

S—Have maintenance men sit in on safety review meetings.

S—Most rely on supervision and safety committee to observe unsafe acts.

S—Costs should be published only to supervisors. They are more important than frequency rates and severity rates.

S—Fit into a production bonus plan; if workmen's compensation costs are paid they will affect each supervisor's pay.

?—Should the safety engineer report to line or staff?

S—Under industrial relations we can get closer to having safety as part of production.

S—It can work either way, depending on many things, i.e., size of plant, type of organization, work situations, people, etc.

?—Discuss the safety director's duties.

S—A general discussion followed. Most safety men have various duties. Various

representatives discussed their duties and line of reporting.

?—Does anyone here have authority to hold up production until guards are installed?

S—Very few have authority but this depends on the strength of the individual as a safety engineer.

S—Coordination with engineering — nothing is more permanent than temporary guards.

?—Discuss new theories on reaction from silicone dioxide on the lungs.

S—Dr. Usher, Owen-Illinois Glass Co.'s medical doctor, commented that there is more than silicones to worry about in most states. Chronic bronchitis is compensable.

?—How much exposure time must there be before dust is a contributing factor?

S—Dr. Usher commented that there is a wide range of factors affecting susceptibilities of lungs to disease.

?—How is safety supervisory training done and what materials are used?

S—Make safety a part of all training sessions.

S—NSC home study course.

S—Insurance carries supervisory training course.

S—Personal contact training.

S—Supply canned talks to supervision.

S—Use supervisory safety manual published by NSC. Have foremen share the instructor's responsibilities.

S—R-T discussion as part of production meetings.

?—What do you do about a so-called illegitimate back case?

S—Take all cases to court. After the trial, after the claimant is granted a 50 per cent disability, management can say, "We do not have any jobs for people who are 50 per cent disabled." This is one way of preventing future claims.

S—Management should file suit before the employee does.

S—Make certain that the company establishes a record of honoring all legitimate claims and insist on dismissal for those for whom there is proof positive that the claim is illegitimate.

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S—Get doctor's agreement and signature that the man can do the job. Industrial engineer should submit job description to the doctor to assist in his decision.

?—What is the opinion of the courts versus commissioners?

S—Here, there was a lengthy discussion

with the conclusion that, depending on the state or location, one may be preferable to the other.

?—If an employee has an agreement pending and the doctor says he is capable, do you let him return to work?

S—A definite yes.

RUBBER SECTION

OFF-THE-JOB SAFETY AT WORLD BESTOS

By J. R. SPEERS

Plant Manager, World Bestos Div., Firestone Tire & Rubber Co., Newcastle, Ind.

As you know, directly and indirectly, off-the-job accidents cost many concerns millions and millions of dollars each year. It is our feeling that any program that stresses off-the-job safety not only will help our employees and their families, but will certainly improve the efficiency of our working group.

Any accident that disables a skilled worker, wherever it may take place, costs his firm money in the loss of skilled manpower, in the time spent retraining a replacement, and in increased medical costs.

It is our understanding that America's labor force last year suffered work accident fatalities that numbered less than half of those killed in traffic, home and public accidents.

The annual economic loss totals more than 13 billion dollars and about 86 per cent of this damage comes from non-work accidents.

Therefore, you can see that every industrial concern has a big stake in the off-the-job safety program for their employees.

We at World Bestos have been conducting off-the-job safety programs in December and in May of each year. Our program for off-the-job safety for May, 1960, was presented to our Firestone group at our regular meeting during the annual safety conference of all Firestone plants in Chicago last year.

At that time, it was suggested that I present the program that we had worked up to you.

Our plant, the World Bestos Div. of Firestone Tire and Rubber Co., by nature of its products, is a small plant in comparison to the balance of the Firestone subsidiaries. Consequently, being a small plant, having approximately 325 employees, we are somewhat limited as to staff and many of our staff members wear several different hats.

At the time of our off-the-job safety program, we were also running an off-the-job safety program at all Firestone subsidiaries, which is known as the "safety check program".

This program is initiated by the Firestone Tire and Rubber Co. for the purpose of checking employees' automobiles to make sure that they are safe. I am sure that you are familiar with this type of check, as many communities in our country have this program, or a similar one of their own.

In addition to our employees' cars being checked, we also offer to check the cars of employees of other local industries and the high school, and you can see that with our people doing the work of performing the checks on automobiles, it takes part of our staff to complete the safety check program.

When you look around for a committee or a chairman to work on the off-the-job safety program, with the small staff that you have, you sometimes are puzzled as to how to get these jobs accomplished.

I decided, at the time, that probably the best thing we could do to really put life behind the program was to pick a committee of men from the various fields in our plant and put them in charge of the off-the-job safety program.

We, therefore, picked the following to head up this program: a production foreman, a manager of our development department, our plant engineer, our buyer from the purchasing department.

As you can see by the fields from which these men were picked, while they would have knowledge of safety and its processes, they were, nevertheless, not trained experts in the sense that a safety director would be, nor would they have his background.

However, this off-the-job safety committee took over the job and set up a promotional scheme and program that I feel is

one of the best ever put forth for an off-the-job safety campaign.

This program was designed to make every employee well aware of the hazards of off-the-job accidents and to drive home to the members of his family the important part they play in making the home and its surrounding community a safer place in which to live.

This program was timed so that safety off-the-job would be uppermost in their minds before, during, and after the Memorial Day weekend. This was done in order to make every possible effort to keep our employees accident-free during this period.

The following is what was used to make employees more safety conscious:

1) Each employee was given and asked to wear during the contest a mechanics cap upon which was imprinted, "I am pledged to off-the-job safety."

The budget for these caps was nil due to the fact that the manufacturer of the mechanics caps had shipped them to the World Bestos Div. in error, and had not imprinted them for their intended purpose.

He advised that we should scrap them rather than return them and he would furnish new ones to the purchase order he had been given.

Our men, seeing this opportunity to get a promotional item for nothing, asked to have the caps and they stenciled them with the words, "I am pledged to off-the-job safety." The workers used these caps to the very best of benefit.

2) The committee arranged for displays throughout the factory which would accent the most common household and off-the-job accidents. These displays all carried display cards and drawings explaining what steps could be taken by the employee to eliminate these hazards from his home. These displays included:

A) Child in abandoned ice box. (A life-size doll represented the child inside the box and a plastic cover enabled the employees to see inside the ice box.)

This came at a very opportune time, as there was a rash of this type of fatality throughout the nation where children had crawled into abandoned ice boxes in numerous communities.

B) Broken step ladder. (Broken side rails, loose steps, no safety braces or safety feet.)

C) Power mower. (With guards removed and carelessness in operation.)

D) Child suffocated in plastic bag. (A life-size doll used inside a baby crib, wrapped in plastic laundry bag.) You will recall that this was about the time that there were also a considerable number of fatalities occurring from such conditions.

3) Two large signs, twelve feet by four feet, were erected, one at the entrance of the plant for the employees, and the other on the edge of the company property along the busy city street for the general public. These signs read, "May is World Bestos Off-The-Job Safety Month."

4) The committee drew up plans for an off the job safety contest and set up prizes which would tend to promote family participation. These prizes were:

First prize, Westinghouse electric toaster.

Second prize, charcoal grill.

Third prize, electric skillet.

The contest required both the employee and his family to participate as follows:

A) Required to make a complete safety check of their home in order to correct the ten most common hazards as listed by the National Safety Council, as these contributed to more than four million off the job accidents each year.

B) Take home from work each day the daily safety slogan and copy the same on their contest forms. (Ten days in all.)

C) Employee and wife (or husband) must sign a certificate at the end of the contest that the members of their family have remained accident-free during the period of the contest.

5) Mailed to each employee:

A) General information on safety and the causes and effects of over four million home accidents each year.

B) Information sheets and contest rules.

C) Contest entry form which contained:

1) Check list of the ten most common hazards as listed by the National Safety Council.

2) Blanks for the daily slogan contest.

3) Contest rules.

Rubber Section

4) Certificate for signatures of employee and family that they had remained accident-free during the contest period.

6) The committee contacted the New Castle city officials as follows:

- A) Mayor.
- B) Police captain in charge of local first-aid unit and ambulances.
- C) Editor and photographer of local newspaper.

These men were taken on a personal tour of the plant, shown the displays, and the program was explained to them in detail. The committee asked for and received their cooperation in carrying our safety messages to the citizens of New Castle.

7) Arranged local publicity through newspapers and radio, directed at letting the community know what the people at World Bestos were doing for safety in their homes. Here we used extreme care to make sure that our plant workers were brought into this publicity, regardless of what it was.

We were able, through the committee's efforts, to set up di-plays at the plant without any cost to our company whatsoever.

For example, the committee salvaged an old stepladder with broken side rails, etc., out of the junk pile and beside this display they made a 22 inch by 28 inch display card with a drawing showing a man falling from a defective ladder while painting. The safety slogan here was, "Fix Up Before You Paint Up."

Then, the committee found the oldest, most defective power mower they could locate in the community for the next safety display, and here again, a 22 inch by 28 inch card with a drawing of a child's foot pressing the release of the mower. The safety message here was, "Stop The Mower Before Making Adjustments."

On the next display, the committee went to the local junk man and got from him at no cost an old ice box. The committee borrowed a life-size doll and placed this inside the ice box, and then placed a plastic door on the ice box to replace the regular door. This was done to enable everyone to see inside the box, and along with this ice box was a display card showing a drawing of a child trapped inside, and he was crying the safety message, "Please Remove All Doors From Old Ice Boxes."

The last display, again, was one of importance, especially at that time, and was of a child suffocating in a plastic bag. The committee borrowed a child's baby bed and placed therein a life-size doll wrapped in a plastic bag. In large letters over the display was the following: "Don't Let This Happen to Your Child! Destroy All Plastic Bags."

Also, about this time, the committee worked out a deal with the local theatre wherein they got the theatre to supply them, at no charge to the company, sufficient tickets to the theatre to be used as prizes when the committee called an employee's home on each day to find out if they knew the previous day's safety slogan, which had been posted on the safety bulletin board.

This was done to accent and insure the safety slogan's getting home to the employee's family. This was set up to keep the whole family talking safety, and we printed up some small cards and attached these to the employee's pay checks on the day before the contest started. The cards read:

"If we call, will your family know the slogan? Each day during the hours of 11:00 A.M. to 12:00 noon the committee will phone the homes of five employees. If anyone present in the home can repeat, word for word, the safety slogan of the previous day, we will send them two free passes to the theatre. Enter the slogan daily on your contest entry blank and keep it near the phone. You may be a winner."

Each day the committee then would pick at random five names to be called, (three from clock, two from salary). When the phone was answered, the committee would say:

"This is the safety committee of World Bestos calling. If you can give me yesterday's safety slogan we will send you two family passes to the theatre. You have 30 seconds to answer."

If they gave the answer, the committee congratulated them and sent them the tickets. The committee would suggest they be ready in case they were called again.

Each day, then, the committee would post in the safety booth near the prizes the list

of names called and whether or not they could answer with the safety slogan.

This created a great deal of interest and I think almost everyone in New Castle knew our previous day's safety slogan.

During all of this safety program, we received very fine cooperation from the local paper in getting the safety message not only to our employees, but to the citizens of New Castle, and the acceptance of this program was very good.

We also received from the city of New Castle and its mayor a letter thanking us for the off the job safety campaign as conducted by the World Bestos plant, wherein he stated that he was sure that our program was a big factor in keeping the accident rate in our city to a minimum during this period, and that if other industries in New Castle would follow our example, New Castle could be made one of the safest cities in the country.

Just prior to the Memorial Day shut down, all of our employees were handed what is known as a teaser card, which stated:

"Notice!—Layoff."

Then in small print:

"Of accidents during the memorial day weekend. You read this notice because

you thought it meant your job. Read it again—it may mean your life."

This was handed to the employee on his last working shift before the holiday weekend by his foreman, and it is needless to say that this notice received quite a bit of attention from the employees.

The purpose of this teaser card was to shock them into thinking about safety just before they took to the highways for the weekend.

At the end of the contest, forms and certificates were accumulated from the employees and the judging was done by individuals not connected with the safety program. The winners of the contest were then given their prizes. These prizes went as follows:

First prize: Employee of maintenance crew.

Second prize: Production employee, asbestos sheet packing operation.

Third prize: Production employee, heavy duty brake block unit.

Really, everybody was a winner somewhere along the line by participating in our off-the-job safety campaign, but the real big winner was World Bestos, who was able to report to the parent company in Akron that we had no off the job accidents during the campaign period.

PRODUCTION AND ACCIDENT PREVENTION ARE PARALLEL AND PARAMOUNT

By JIM LOW

Staff Speaker, National Association of Manufacturers, New York, N. Y.

The only reason you are here learning new accident prevention techniques is that you feel you haven't reached perfection . . . that you have the belief that nothing is good enough . . . that "good enough" is seldom "good" and never "enough."

You believe we have made progress in creating safer conditions, yet some additional tool or tools must be used to reduce the figure of thousands of on-the-job lost-time injuries.

You believe that a record shouldn't be simply something to stand on—rather to build on. I challenge you to use your most important tool—*Leadership*—to help people reach the goal of a safe, rich life—not just seeking after rich living. In order to help them, you must recognize their basic, human needs—must remember the *four fundamental wants of people*:

1. a sense of belonging;
2. recognition;

3. new experiences;
 4. security. (Not just economic, but emotional, spiritual and psychological.)
- In order to find the greatest satisfaction, we must not forget these eleven fundamentals of leadership:
1. Remember the "three R's" — be Ready; be Reasonable; be Right.
 2. We must know our business.
 3. We must remember the rule to "Be Yourself!"
 4. We must be able to sell.
 5. We must be willing to take responsibility with authority.
 6. We must know our organization's policies and objectives.
 7. We must learn to express ourselves effectively.
 8. We must have a knowledge of our economic system.
 9. We must be able to inspire.
 10. We must have character, integrity and consistency.
 11. We must use the Golden Rule.
- I challenge you also to set an example by the way you live. Always remember the lesson in this verse:
- I'd rather see a sermon than hear one —any day.
- I'd rather one should walk with me than merely show the way.
- The eye's a better pupil and more willing than the ear.
- Fine counsel is confusing, but example's always clear.
- The best of all the preachers are the men who live their creeds.
- For, to see the good in action is what everybody needs.

I can soon learn how to do it if you'll let me see it done;

I can watch your hand in action tho' your tongue too fast may run.

All the lectures you deliver may be very wise and true,

But I'd rather learn my lesson by observing what you do;

For I may misunderstand you and the fine advice you give,

But there's no misunderstanding how you act and how you live.

There is no place in employee-human relations for that disease called complacency. Safety is your business and it's a good business—but never let yourself get so bogged down with "busy-ness" that you forget this important function of your business:

I challenge you to remember that:

The best verse hasn't been rhymed yet;

The best house hasn't been planned;

The highest peaks haven't been climbed yet;

The mightiest rivers haven't been spanned.

So, don't worry and fret, faint-hearted;

The chances have just begun;

The best jobs in safety haven't been started;

The best work hasn't been done.

I challenge you to keep in your mind, your heart and actions the theme of this National Safety Congress, "Safety Everywhere . . . All the Time"; to believe that production and accident prevention are parallel and paramount; that your goal will be closer, depending upon your use of your tool—*Leadership*.

THE INDUSTRIAL NURSE'S ROLE IN THE SAFETY PROGRAM

By REGINA KNAPP, R.N.
Head Nurse, General Tire & Rubber Co., Akron, Ohio

The role of the Industrial Nurse has many aspects and it would take much time to clarify the exact position the nurse should have in planning and executing a safety program in industry, but she definitely should be on the team. The nurse and the safety man touch directly on every person in the plant—they cross every organizational line and have the broadest field of all for communications.

I believe results obtainable from present safety measures have reached a plateau and limited progress can be expected from this avenue of approach.

I do not like the fatalistic concept of accident proneness as a cause of accidents. I believe psychological factors are more often the cause of Industrial Injuries. Future gains depend upon the medical team. There is no one in industry better qualified or in a better position for psychological counseling than the Industrial Nurse.

Today with the increase in productivity per person, there is a shift in the nature of work being done; there is a definite swinging away from manual labor. Automation demands thinking, understanding and directing of machines. There is less wear and tear on the muscles and bones and more demands on the nervous system. The sound body is the product of the sound mind.

Three words keep milling around in my mind when I attempt to formulate the Industrial Nurse's role in this particular phase—men, minds and machinery; impossible to separate yet equally impossible to coordinate perfectly. I believe it is this area of imperfect coordination that results in accidents. We cannot arrive at total success in weeding out the why's in this area but there are some things we can do to narrow the margin of the unknown.

It is not easy for me to decide which comes first: men, minds or machinery but from personal experience, I will start with machinery.

I recall an experience in my early days of industrial nursing. An employee came to the dispensary with a badly bruised toe. Following the pattern of obtaining the history of the injury while repairing the damage, I asked, "How did you do this?" He answered "I dropped a pallet on my toe." My answer to him was ignorant and abrupt because the only pallet I knew anything about was the pallet in a person's mouth. From his reaction to my stupidity, it was apparent to this employee:

1. This nurse knows nothing about the machinery with which we work.

2. This nurse is not interested enough in the employee's to find out about our working environment.

An industrial nurse cannot hope to be a part of any safety program without a working knowledge of the types of potential accidents in her plant. She need not know how to operate the machinery but must know what kind of injuries can be caused by them. Then she will know the areas in the plant where the most accidents are likely to occur. From this understanding, she quickly recognizes too many injuries in a relatively safe department. Properly maintained machines, always operate in a prescribed manner so when an accident occurs, we must turn to the human element for the cause. With this knowledge, the next step is to contact the safety department and report on the undue frequency.

This approach creates a good working relationship between the medical and safety department. It is rarely possible for the safety department to correlate minor injuries with a department or an individual without the help of the nurse.

Minor injuries disrupt the production in any department. A quick check can be made into the situation by the safety department. No report by itself gives the answer but we already know it is more often human than mechanical failure that causes accidents.

PLAN NOW--

TO ATTEND THE 1962 NATIONAL SAFETY CONGRESS

Celebrating the 50th Anniversary of the NATIONAL SAFETY COUNCIL

WHEN: October 29 through November 2, 1962
WHERE: Conrad Hilton Hotel, Chicago

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Industrial Subjects Sessions

INTEGRATING ACCIDENT PREVENTION WITH PRODUCTION

By THOMAS A. SULLIVAN
A. O. Smith Corporation, Milwaukee, Wis.

We would like to offer the experience of our Granite City plant as a case study in the integration of accident prevention with production.

We have tried to present facts to you and not draw conclusions. If these facts can give you clues as to steps you can take in your own plants to tie accident prevention into your production processes this is the most that we believe can come from such a study. We would be the last to claim we have discovered any panacea for the complex subject of plant safety.

This case study is interesting because it was a new plant in a new area for A. O. Smith Corp. The exposure volume is significant, about 3,000,000 manhours per year.

From the beginning we had a safety director, who is still there. He is a staff man and must get all action through the operating people.

At the start-up of the plant two problems developed which complicated our problem immediately.

Certain automatic assembly equipment was not ready when product deliveries had to be made.

Our competitors were not ready to produce at all so we had to carry the entire requirements of our customer for the first few months of our operation.

As you might suspect, this required the hiring of green workers and green supervisors and made the training problem almost insurmountable at the beginning.

We have tried to put our whole story on this chart. It looks complicated but if you will follow along with me we will take it one step at a time.

The chart is divided into four areas:

The accident frequency data.

Production demands and union relationships.

Management action.

Safety and housekeeping.

Accident and frequency data show the number of lost time accidents per month since the plant began production in Sept. 1954. You will note that we have identified injuries to maintenance men separately from production people as the nature of their exposure is different and may be of some significance. For example, in 1959 and 1960 every other accident was in maintenance, although the hours of exposure of the production people is 10 times that of the maintenance men.

The frequency rate is a 12 month running average.

Production demands and union relationships are grouped together as things over which the management of the plant did not have complete control.

The start-up of new models in the summer of each year should have an adverse effect on safety because new equipment is present and men are back from a layoff of 4 to 6 weeks and presumably "out of practice." An examination of the chart does not disclose such a trend. Rather the accidents seem to bunch up in the later months when the heat is on to produce at peak efficiency. However, the data is not conclusive here either.

The effect of union activity on safety, while at first appearing adverse—after the union certification in 1955—does not show any discernable pattern. The accidents occurring after the major work stoppages in 1956 and 1957 do not seem to be related to the stoppage any more than to the model changes which occurred shortly thereafter.

In fact, it looks as though the formation of the Union-Management Safety Committee in 1959 had a major favorable effect on accident frequency. The frequency rate for the two year period since April 1959 is 0.78 per million manhours of exposure.

Management actions—There were four manufacturing superintendents during the period on the chart—identified as A, B, C and D. The frequency rate for each was: A—3.47; B—1.20; C—3.15 and D—1.53.

Making allowance for the start-up problem which seriously affected A's record, it looks like B had the best record and C the poorest. I would like to venture my opinion here that the attitude of the manufacturing superintendents toward housekeeping and safety had a major effect on the record of this plant.

There were three managers during the period on the chart. The frequency rate for each was: 1—3.08; 2—1.88, and 3—0.00.

The Monthly Management Plan of Action Meetings starting in February 1958 have had important results. The safety director presented safety projects to the manager and his entire staff and got their backing. A time table and plan of action was set up for each project and progress compared from meeting to meeting.

The need and approval for two engineering studies developed as a result of these staff meetings were safety of welding fixtures and a fighting survey—especially on the second shift. The welding fixture study not only corrected some serious safety hazards, but also resulted in a corporate-wide manual on "Engineering and Designing for Safety."

Safety and housekeeping—In 1956 the safety director began issuing safety procedures. These are tabulated in Exhibit I attached. They also are shown as P on the chart. It is to be noted that there was a flurry of them right after the Management Plan of Action Meetings started and again after the Union-Management Safety Committee started.

The two most significant procedures were: Eye protection, issued June, 1957, and Investigation of near injuries, issued April 1958.

The eye protection procedure eliminated policy confusion on border areas such as locker rooms, aisles, yards, etc., and signaled the beginning of a strict eye protection enforcement campaign.

The investigation procedure was an outcropping of the Management Plan of Action Meetings and became an effective communication device on hazardous conditions.

It is the belief of our safety director that good housekeeping is an important factor in developing a safe plant. This belief he demonstrates in a practical way by continually developing programs to improve housekeep-

ing practices. On the chart you will note that they started back in October 1954 and continue on a regular basis up into 1960. It will be interesting to look at Exhibit II which lists these programs. You will note how the operating supervision are tied into the program.

These, then, are the facts that seem to have some relation to the safety record of this plant which has twice earned the National Safety Council's Award of Merit and has twice earned the A. O. Smith Corp. President's Safety Award in competition with twenty other divisions of the company. Perhaps in studying this data you can form your own conclusions and find some application to your own problems.

EXHIBIT I GRANITE CITY PLANT HEALTH AND SAFETY PROCEDURES

Description	Date of Original Issue
Plant and Fire Brigade.....	Feb. 1956
Sickness and on the Job Injuries.....	Jan. 1957
Receiving Plant Visitors.....	Mar. 1957
Cutting and Welding Permits.....	April 1957
Fire Safety and Prevention.....	April 1957
Safety Eye Protection.....	June 1957
Gate and Bundle Passes.....	July 1957
Oxygen and Acetylene Cylinders.....	Nov. 1957
Press Repeat Control.....	Mar. 1958
Flammable Liquids.....	Mar. 1958
Safety Locks and Tags.....	Apr. 1958
Investigation of Near Injuries.....	Apr. 1958
Power Truck Maintenance.....	Apr. 1958
Tornado Alert and Evacuation.....	Sept. 1959
Portable Grinding Wheels.....	Sept. 1959
Compressed Air.....	Oct. 1959
In-Plant Railroad Safety.....	Nov. 1959
L.P.G. Equipped Power Trucks.....	Jan. 1960

OTHER GENERAL BULLETINS
Basic Winter Driving Rules. Released annually
Heat Exhaustion Released annually
Accident Costs Issued as needed
Points of Safe Conduct..... Issued as revised
*Key Programs

EXHIBIT II GRANITE CITY PLANT HOUSEKEEPING

October 1954—
The first step toward orderly housekeeping was the establishment of safety lines to identify aisles in the production area of the plant.

November 1954—
Housekeeping conditions were reported by plant patrolmen on their Patrolman Watch Reports. These items were occasionally organized into a housekeeping action report by the safety supervisor and sent out to all supervisors.

October 1955—
A Housekeeping Committee was formed to make housekeeping inspections, and report their findings to the supervisors involved. This committee consisted of the safety supervisor, plant superintendent, plant engineer, and production control supervisor.

February 1956—

The activities of the housekeeping committee were stepped up. Regular meetings were scheduled and other staff members were assigned to serve on the committee.

January 1957—
Housekeeping responsibilities were clearly defined by the Granite City staff and the safety supervisor.

April 1958—
The Manufacturing Superintendent assigned housekeeping inspection to area foremen.

May 1958—
Our housekeeping program was intensified. Color slides of housekeeping conditions in

the plant were reviewed by the Granite City staff after each inspection and then by all manufacturing and maintenance supervisors.

January 1959—
Management concentrated on improving the switch board area, compressor rooms, the propane farm system, pumphouse, and other isolated areas.

January 1960—
Elimination of all homemade employee's conveniences such as benches, shelter, salt-menders, etc.

July 1960—
Repainting all work areas and machinery, aisle lines and storage areas.

MODERN ROLE OF THE SAFETY SPECIALIST

By CHARLES A. CRAFT

George Fry and Associates, Management Consultants, Chicago

The subject of safety is not foreign to me or to virtually any layman. In fact, it has been pounded into us at every turn from the time we were able to walk and to understand. With all the exposure we have had, we should know all about safety. But, we certainly don't act like it! We're the ones (calling ourselves grown men and women), who are so "unsafety conscious" that we

—find ourselves in the middle of a busy intersection, after the light has turned to green w/ out having looked either way.

—neglect to connect the ground wire on a power tool.

—drive at 70 miles an hour on a toll-road, two lengths behind the car in front of us.

Suddenly it all became clear! I realized what this five-day meeting and the 103-page program was about. It's a dire plot! Half spend their time plugging up the structural and mechanical weaknesses to make us complacent so that the other half can spend their time bombarding us with posters and slogans to overcome our complacency. It may not be modern, but it's a good "racket."

Seriously, I suspect this is one of your biggest problems. The better you do your job, the more complacent we become, and the more we take you for granted.

When we talk about something being "modern," we imply a change has taken

place. I am sure we will all agree that, in general, our lives and our environment have changed—so much, sometimes, that it is almost frightening. To determine his modern role, a safety specialist is primarily concerned with changes that have taken place within his own environment, with respect to the specific company for which he works and the people with whom he deals.

Since as an individual you are, or should be, most familiar with the changes that have taken place within your own specific environment, it may be presumptuous for me to talk to you on this subject. But, in case some of you have not recognized the changes, or have interpreted changes to be more far-reaching than they really are, I will proceed with my analysis.

Each company, of course, is different and because of time limitations, we can consider business and industry only in general.

It has been my experience that major changes have and are taking place in industry. For purposes of my presentation today, I have divided the changes into two categories.

As the first category, in general, business has become more sophisticated, larger in size, more diversified, more market oriented, more cost conscious.

The net results of these changes is that business is becoming more involved and

more complicated. More time and attention are required for areas directly related to the major objective of maintaining a profit for the stockholder. Consequently, there may be a tendency to spend less time in areas not as directly related to the end objective.

I am including safety as one of these areas. I am sure that there are many who are ready to challenge the assumption that safety is not an important factor in the ultimate profit goal and probably rightly so. But, remember, I said not as directly related as other areas. I am not necessarily defending this condition, but am merely stating it as a situation that at least is understandable—a situation to which you have contributed personally by the excellent progress in reducing the accident rate.

There has been a second category of change in business which is just as natural today as it was when the very small business first grew into long pants—when the owner was unable to maintain a close day-to-day contact with the individual worker because of the company's size.

To counteract the tendency to neglect those areas that may appear to be less directly related to the ultimate profit objectives and to better fulfill their objectives, management is doing more planning and organizing, developing or taking on more staff specialists, and establishing more controls.

Yes, we do find major changes have taken place, and are taking place in business in general. It is logical to presume that there have been and will be major changes in the role of the safety specialist—changes to make him more modern and more up-to-date with the modern business world.

I can cite several changes in the technical role of the safety specialist. For example:

1. In a company that has grown to a multiplant operation, the safety specialist may find himself in a different role, because he no longer has close contact with the production floor.

2. In some cases, the apparent large increase in the amount of claims has resulted in more time required of the safety specialist.

3. Also, in some cases, opportunities for reduction in insurance rates have become more apparent and the safety specialist is being used more in this respect.

4. Because of these changes, the location of the safety specialist in the organizational structure may have changed.

I am not going to dwell on changes of this type for several reasons:

First, they are not universally applicable.

Second, I don't know enough about your business to discuss them intelligently.

And, third, they are, to me, in themselves, relatively unimportant.

What I believe is substantially more important is that, regardless of the specific change in his role, the safety specialist must fully understand the ramifications of the change. While remembering his basic purpose, objectives, and goals, he must take intelligent and responsible action. For example, he must understand that because of growth, diversification, and more complication in general, it is not surprising that top management is paying less attention to his area of activity. If this is taking place, he must understand that the good job he and others have done to improve the safety record makes it even less surprising.

He must further understand the part he plays in the second category of overall change: better planning, better organizing, and more and better staff specialists. Top management is doing more of this because it is the logical way to make up for the lessening of specific attention caused by growth, diversification, and increased complications. The safety specialist, in this situation, must realize that as a staff specialist, he is expected to see that his function is properly and completely fulfilled; this is the reason for being a staff specialist.

Furthermore, if he does not feel that his function is receiving the proper relative attention in the over-all plan and organization he is expected to say so. To become effective, as in the case of any important function, the function of safety must have a proper definition in the organizational plan, and the related responsibilities, and authorities must be clearly defined.

If this is not the case, and the situation is to the detriment of results, the safety specialist, as a specialist, is expected to "speak his piece" and not to assume that top management has thoroughly analyzed the situation and that this is their last word. I dwell on this because I have seen some weak organization plans from the viewpoint of safety, and, believe it or not, a surprisingly high percentage with virtually no mention of the subject. I am sure, in most cases, this was not the intent of top management.

One danger connected with a major change in his role is that a safety specialist, like anyone else, may be so impressed with the growth, diversification, and sophistication surrounding him that he tends to forget the basic purpose and objective of his function. Many things have changed, but I am sure that the basic purpose and objective of safety is not one of them. Regardless of the size, diversification, sophistication, or complications in a business, the man and the machine in the shop remain basically the same. Certainly the elements are shinier, faster, and sharper, but I wonder how much human nature has changed?

Some of us, in considering our place in the organization, become more concerned with its effects on our place in the sun, than with its fulfillment of our primary objectives. I cannot generalize about specifically to whom in the organization a safety specialist should report. Whether it be to engineering, to personnel or to the treasurer is, in itself relatively irrelevant. The basic consideration is to be sufficiently close to the employee and to the operations affecting him, whether by contact or by influence, to be effective and to fulfill the basic purpose. However, I would like to talk about your general position in the company organization.

I am reasonably sure that in the case of most of you here today, two conditions are common:

- You, as a safety specialist, are in a staff position rather than a line position.

Those in the line position have been given either in written form, verbally or inferred, "the responsibility for the safety of the employees reporting to them."

To a beginner in business, these two conditions appear to be at cross purposes and, unfortunately, many who have been in business for many years still fail to understand them. If you as an individual are having problems getting your messages across, this may be your trouble: possibly you have not given the subject enough thought or study.

To understand this condition, we must review some of the basic principles of organization. If you remember, I mentioned earlier that one of the changes that companies are making today to counteract the lessening of top management's attention to specific functions is to improve on and increase the number of staff specialists. This is one of the reasons for staff specialists, but there is a more basic reason.

There is, or should be, in your company, a direct line from the top production man down to the employee on the bench: a line of specialists in the field of producing a product. The man at the bench is the real production specialist and as we go up the line, the scope of supervision broadens as does the requirement to co-ordinate the actual production operation with other areas essential to safe, economical performance.

So, basically, we have a production line manned by individuals who are, in varying degrees, specialists in producing and in co-ordinating. These men are dealing directly, day in and day out, with equipment, materials, facilities and people for the fundamental purpose of producing products according to schedule. This is their forte, their specialty. And, in order to do their job effectively, they must have both responsibility and authority. Many would go even further and specify the need for full responsibility and authority.

Although most production line personnel have a working knowledge of supporting areas such as quality control, engineering, personnel, accounting, safety, etc., and some are at least semi-specialists in one or more of these areas, it would be impractical to expect them to be specialists in all of these areas, particularly with respect to the details. Nor could we expect them to have the time to perform the details involved.

The more basic reason for staff special-

ists is to supply specialized experience and time. How must they supply it? As a service to the line supervision? The line supervisors must retain the responsibility and authority, and too often, herein, lies the rub. Here communications and understanding often fail. Notice that I said "service" to the line supervision and not "servitude."

The staff specialist must function as a service to the over-all company as well. He must have an outlet through which he can recommend those changes important to the company as a whole without undermining the line organization—a large order, but a necessary and reasonable one if understanding, judgment, initiative, and ingenuity exist. In my opinion, at least half of the staff specialist's job is the same regardless of the specialty: namely, "working effectively with people in a service capacity."

I have been discussing a fundamental and basic phase of business. I apologize to you who have found it repetitive, who already have a clear definition of line-staff relationships, and who have no major problems in this respect. To those of you who do have major problems concerning your dealings with the line organization, I suggest that you question your understanding of the relationship as it has been established and your related attitudes and actions.

I am not putting the entire onus on the safety specialist. The line supervisor has a definite share in the responsibility for making the relationship work, and the arrangement may be relatively ineffective if top management has not supplied the necessary education, clarification, and cooperation. But, I think it is significant that I have encountered a greater number of sub-standard performances among staff specialists which were caused by a failure to adjust to this relationship than those

sub-standard performances which were a result of lack of education, experience, or ability.

It was suggested that I also discuss "how the safety specialist can be of greatest value to management." I believe I have touched upon this subject throughout my talk so I am going to close with a summary of major points.

To be of the greatest value to management, I believe the safety specialist should:

1. Be a specialist! Study the field, learn the technical aspects, be creative, develop approaches, and trade ideas.
2. Analyze the current place of safety in his organization, determine the existence or lack of clearly defined responsibilities and authorities, and suggest necessary changes to management.
3. Re-define the basic purpose and objectives of his function. Consider his position in the organization only as to how the purpose and objectives of his function can best be fulfilled.
4. Keep management informed of the status of the accident records, of the related cost to the company, of the planned programs for cost reduction, and of the progress being made.
5. Study and thoroughly comprehend line-staff organizational relationship and the reasons for this relationship. Realize that to fulfill the basic purpose and objectives of his function, this relationship must be effective, and that a large portion of his job is to make it effective. To do so he must:
 - be a student of human nature.
 - be understanding of the responsibilities and problems of those with whom he deals.
 - be humble but responsible, and dedicated.
 - sell himself as well as his programs.

THE PSYCHOLOGY OF ACCIDENTS

By JOHN MACIVER, M.D.

Asst. Medical Director, U. S. Steel Corp., Pittsburgh, Pa.

I should like to begin by locating what I have to say within a larger frame of reference. My overall philosophy of accident prevention is that it involves the whole person living within a total community within what has been called his "life-space." I would add the codicil that "no man is an island," that for the most part we do not live as individuals, but as groups, large and small, family groups, industrial groups, and all the rest. This total community—this life-space—may be quite safe, only relatively safe, or quite unsafe. No one would disagree with the assertion that we cannot be satisfied, despite our occasional triumphs, with the overall accident picture in our communities.

I am not concerned in this presentation with accidents in this total context. Rather, I want to "focus down" on one segment, the psychology and psychopathology of accident occurrence. Psychology I would roughly define as the study of behavior which is more or less normal or healthy or which "makes sense," as opposed to psychopathology, or the study of behavior which is more or less abnormal or unhealthy or which does not appear to "make sense."

It is in practice oftentimes difficult to separate behavior of the one sort from the other. In thus restricting myself I am eliminating vast areas of investigation and activity which have played a premier part in reducing the accident toll. This is the part played by engineers, chemists, hygienists, and public health workers in making our environments so much safer than they were in years past.

Let us imagine a community—and there are tens of thousands of them in this country—where great efforts and equally great sums of money have been directed towards the ultimate goal of a safe life for all—for child and adult, and older; for housewife and workman alike. And still the accidents occur. Even though they occur less frequently than before, the toll stands out in clearer and more terrible relief within the framework of our healthier communities

—communities, where for example communicable disease mortality is virtually a thing of the past.

We might conclude that if our results do not quite measure up to our efforts, perhaps we have been neglecting one or more aspects of the problems we face. I do indeed think we have been neglecting the human animal—the fellow who gets into accidents despite all our work, energy, teaching, and admonition. I might add that just about all of the safety specialists I have talked with in recent years seem to agree on this point: we must in the future, and beginning now, endeavor to get a clearer understanding of the psychology and psychopathology of accidents, especially all those accidents that from an engineering and rules and regulation viewpoint have no business happening.

I am not in the position to set down the answers to this great problem. The answers lie first in the recognition of the psychological aspects of accidents and their prevention, and second in the recognition that a great deal of sophisticated and expensive individual and team research will be required. All that I should like to do is to suggest a few leads or possible directions for thought and discussion. A favorite word among researchers these days is "heuristic," which means, that a stated point of view is not given with finality, but in the hopes that it will lead to statements which are more precise and which have higher truth-values. The heuristic approach is, of course, as old as Socrates, and it is this approach which I am taking.

As a student of human behavior who is a psychiatrist, I might say a few words about mental illness and its relationship to accidents. I am not impressed by any overwhelming relationship between mental illness and accidents with the dual exception of alcoholism and mental illness among the elderly. By no means do I wish to deny some correlation between accidents and psychological disease of every type. However, and I want to underline the following as

a most important point, when a task is hazardous in small measure or large, people with psychological handicaps tend to be selected out of these tasks by either formal or informal procedures; and further, it is my impression that such psychologically handicapped individuals show some tendency to select themselves out of hazardous positions. Where superordinate or peer group or self-selection is for one reason or another only weakly operative, then, of course, the correlation between psychological handicap and accident occurrence becomes stronger in proportion to the complexity of the task and the hazards which the task presents.

If this has validity, another important point follows. If in fact there is a complex and in part hidden selection process which works in favor of minimizing the probability of accidents, why do accidents occur in this selected population?

I would suggest that accidents tend to take place when for any number of reasons, an individual who is usually a safe operator temporarily falls into the psychologically handicapped group, but continues at the same task. It behooves us, then, to bring to light temporary states of stress, to recognize them in ourselves and others, and to take appropriate steps to withdraw from the task until the stress is dissipated. This, I suggest, is what I believe more or less permanently psychologically handicapped individuals tend to do on their own.

And now, a few words on "accident-proneness," so called. Many people in the safety field who have investigated this concept—I think that I can include myself in this number—have recommended that the term be dropped, at least for research purposes or where terminological precision is required. There is little objection on the other hand to using the phrase casually in a descriptive sense. I can assure you that "accident-proneness" as a specific psychological entity becomes pretty elusive when one tries to pin down what it really means.

Some have suggested that the term "accident susceptibility" be substituted. "Accident susceptibility" takes into account all the factors, not just the psychological, which tend to predispose an individual to accidents or to protect him from them.

Let me proceed to what I think of as

a special difficulty we face in accident prevention in the light of normal human psychology. Human beings learn many things from repetition. There is a conditioning process; habits are formed; and we are thereby enabled to acquire multitudinous patterns of automatic behavior. This is behavior which we carry through, as we say, "without thinking." These habits are positively conditioned by actual repetition of the unit of behavior. There also exists a negative conditioning process. This is well illustrated in Mark Twain's witty saying that a cat that sits on a hot stove will never sit on a cold one. Let me make it clear that I do not want to minimize unduly the importance of relevance of negative conditioning by pain or minor accidents or admonition from any of a number of sanctioning sources.

Rarely an individual is born without pain receptors—that is, there is a neurologically-based inability to feel pain—and opportunities for negative conditioning from the environment are severely reduced. Such individuals are severely handicapped and accidental injuries become a serious problem.

There are, however, two great difficulties with negative conditioning in accidents. These are 1) Significant accidents—while in the aggregate they occur in great numbers—are quite infrequent in the life of the individual. And since there are so many things *not* to be done and to be avoided, even though the deleterious consequence, the accident, may be months or years away, the human psyche does not stay impressed by the negative sanction. 2) Negative conditioning is not nearly so conducive to psychological automation as is positive conditioning and the resultant active habit formation.

I can illustrate the dilemma by a fictitious colloquy between a harried mother and her probably male child. Mother: "Junior, don't do that." Junior: "Then what shall I do?" And Mother, her patience exhausted, counters with: "I don't care what you do, but don't do that." The mother in this dialogue, with whom we can all sympathize, has not provided a positive program for her young hopeful's self-assertive and exploratory drives.

Positive conditioning—not what *not* to do but what to do—allows for repetition and the development of patterns of healthy auto-

matic behavior, for the realization of inward gratification, and at times for reward and approval from one's fellows. This is a most important point for safety education. As between the precept "Never put a knife into a toaster" and "Always lock out an energy-producing device before you work on it," the second statement is not only far more powerful and susceptible to generalization, it is positive and makes far more sense psychologically.

This leads me to another point on human motivation and mastery. As humans we yearn to mastery, and at times we do not shrink from facing hazard, injury, or even death in challenging an at-times unorgiving foe—our environment, the world we live in. Perhaps this is seen most clearly in our recreational pursuits, but I believe the tendency goes far beyond recreation and sports. Man has had some of his very greatest moments while wilfully facing danger.

By the rule of opposites, safety is often thought of as dull, and safety procedures as unworthy. To invoke the little boy again, mother says, "Junior, be careful, don't do that," and the boy, with a touch of disdain born of healthy self-confidence, says, "I can do it," and does it. This is mastery. So with the mountain climber who challenges the mountain because "it is there," or the

experimental pilot and the spacemen. The drive for mastery, again.

What many lose sight of is that there is no one more safety conscious or conservative than the men who are engaged in what might be considered perilous enterprises. As Shakespeare has Hotspur say, "Out of this nettle, danger, we pluck this flower, safety." The result of the popular confusion between mastery and foolhardiness is the tremendous paradox that it may well be more hazardous to cross Times Square against the lights than to shoot off into space. Our challenge in safety education is to give free rein to the bent for mastery while at the same time to clearly distinguish between being the master and being the fool.

I have touched only superficially on a few points in this complex field of safety psychology. I would not ask you to agree with anything I have said; by the same token I would be immensely gratified if anything I have said perchance leads to further thought and discussion.

Let us give more and deeper thought to safety psychology. Our reward for giving this subject the attention it deserves, and applying what we learn, will be communities truly healthier to live in than any the world has yet seen.

COMMUNICATIONS FOR SAFETY—HOW CAN WE MAKE OUR SAFETY MESSAGES MORE EFFECTIVE?

By LEE W. BAKER

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Essentially, it seems to me, the National Safety Council and its auxiliary groups are among the most "communicatingest" organizations that I know of. They constitute a regular communicating machine, you could almost say, on the subject of safety.

On the general subject of communication, I want to mention some information I gleaned recently from the *Social Science Reporter*. An article in that publication dis-

cussed a University of Minnesota study of 100 companies regarding the pattern of "dropoff" in communication from the top down. This pattern was shown: vice presidents understand 67 per cent of what they hear from the board of directors and top management; at the general supervisor level, 56 per cent of the same information survives; by the time it reaches the plant manager, the level is down to 40 per cent;

among foremen, it dips to 30 per cent, and among individual workers, the level of understanding sinks to 20 per cent. In other words, one out of five messages from the top gets through to the men on the line.

What is the reason for this heavy loss in communication? And what can be done about it?

According to the Minnesota people, top management does not have a good understanding of the attitudes, opinions, ideas and suggestions of the people at the bottom of the whole business structure. Downward communication is only going to be raised significantly in its efficiency when top management acquires a better understanding of these factors.

One way to reduce the loss, it is suggested, is to cultivate good listening habits in everyone in the business—top management, general supervisors, plant managers, foremen and individual workers.

The article also pointed out that in verbal communication the mind moves faster than the voice. Most adults think four times as fast as they talk. The average American speaks at a rate of 125 words a minute among his family and friends, 100 words a minute in front of an audience. Yet most of us think at a "cruising speed" of 400 to 500 words a minute.

As a result, most speakers have trouble holding their audiences' attention. Most audiences "think circles" around speakers, and many get lost on tangents. Thus learning from listening operates at an average efficiency of only 25 per cent. Two days after a talk, you've forgotten three-fourths of what you heard. Well, there are some interesting facts for you to think about while you're cruising along at 400 to 500 words per minute ahead of my talking speed.

From those observations on general communication, let us move to the more specific subject—and my real topic—communication for safety.

Briefly, to start off, I'd like to say a word about our objective in this kind of communication. What are we trying to accomplish when we communicate for safety? Primarily I think you'll agree, this is the point of the subtitle: "How can we make our safety messages more effective?" Our real objective is to communicate effectively

with people—to communicate in a way that has an effect—that leads to a desired action or result.

This means that effective safety communication is that which has a result in people thinking more safely, in people acting more safely, in people living more safely. From the standpoint of industrial safety, and that is the concern of most of you, I think, your objective is to communicate so effectively that you see a really obvious and practical result through a reduction in severity and frequency rates.

If we accept this objective, let's think about how we are going to carry on effective safety communication to gain the objective.

There are a lot of ways to communicate. Media—we usually say, when talking of the various means of communication—are the way to get safety messages, and other messages, across to people. These media can be subdivided by the method of communication we use.

The first category I call environmental media. This is an unusual name—perhaps. Here I include such things as:

1. The absence of mechanical guards on machines—the lack of adequate warning signs—when needed.
2. Also—in the employee environment—careless, unsafe, behavior on the part of the supervisor.
3. These, of course, are negative aspects of environment communications. They can be turned around for the positive effect. Thus, the installation of all necessary mechanical safeguards and warning signs indicate the employee is working in an environment managed by people who believe in safety. Thus, also, the supervisor who acts in a careful and safe manner—avoiding for example, the temptation to temporarily forget safety in the interests of expediency when faced with a rush job—communicates the attitude of safety minded management.

The other media are less unusual and more commonplace. There are the visuals—the banners over plant gates or across large shop areas; films, both slide and movie; special exhibits and displays, preferably easily portable, so they may be moved from

one location to another; then there are the items to be worn—buttons, pins and pocket protectors.

The next media category is a very large one—and certainly widely used in communications on safety—it is the written media, the use of printed materials. In this category are employee publications—the magazines and newspapers issued by most companies these days—pamphlets and folders, used as employee handout material—letters to employees and mailed to their homes—special safety reports, such as an annual record of figures, telling the story of the past year's accident trends and accomplishments—letters and reports to supervisory management.

Finally, there are the media of oral communications. These are the most common, occur more frequently than any other. And—if there can be a rating from the standpoint of importance—then I suggest that the oral media are the most important—can be the most effective.

There is more than one way I could substantiate this statement. One good reference source is a leading opinion research organization.

When information is the prime objective in employee communications, according to this report, printed media are best suited for the job. . . . these are the employee publications, letters, bulletins and others referred to a moment ago. These media lend themselves to repetition, they can be easily distributed, contents can be controlled and adjusted to meet a specific situation.

But . . . when motivation is the objective, and certainly this is important in consideration of safety messages, the word of mouth communications better fills the bill. Person-to-person channels are adaptable to the individual employee's interests—and they meet his desire for participation . . . provide a direct feedback channel for the employee to express himself.

In the oral or person-to-person category are safety messages conveyed to employees in group meetings. These may be conducted by the supervisor or by a staff safety representative. The oral communications between the staff safety representative and the supervisor are important in conducting a total safety program. Uppermost in importance, however, is the supervisor—em-

ployee relationship. From the standpoint of safety messages this is the prime oral communication—it follows that the supervisor-employee communication is the No. 1 of any media.

All other communications are really a support program, to reinforce this personal safety communication with the supervisor.

Now two quick observations—one favorable to those of you who are interested in more effective safety communications, the other posing an obstacle.

On the favorable side, most managers rank safety a *must* in employee communications. This has been reported in a national opinion survey. In my own company, we conducted a communications seminar earlier this year. In advance of this, we sent questionnaires to plant managers on subjects pertinent to the seminar. One portion of the questionnaire asked the plant managers to look over a list of 23 topics for communications and rank them as very important, important, not very important. We found the entire group of managers ranked only three topics as very important for employee communications. One of these topics was safety. Management does want to talk safety.

Now—about the obstacle. Survey reports show that when employees are asked to state their information needs, the majority say, in effect, that they are well enough informed on safety. Yet there has to be constant communications with employees on safety—to keep the subject alive in employee minds. A recommended way to overcome this obstacle is to find ways to link safety with other subjects. Instead of straight safety reminders—such as, for example, "Work Safely" or "Drive Safely"—safety information can be linked with useful suggestions on handling materials, operating machine guards, good housekeeping—or with suggestions on how to improve driving skills, such as how to drive on icy roads, or who has the right of way in traffic circles.

In connection with the use of media I can't refrain from mentioning—and giving a high recommendation to—the extremely comprehensive "Everywhere . . . all the time!" program of the National Safety Council. This program—originally developed by Allis-Chalmers people following the

inspiration and urging of Mike Biancardi—demonstrates how to use a variety of media to make safety messages effective.

We would all like more dependable ways to weigh the effectiveness of the media we use. The search for testing effectiveness goes on constantly by people who work in every field of communication. We're somewhat in the position that John Wanamaker of department store fame was in . . . you know, he revolutionized merchandising through advertising, but he frequently said, "I know 50 per cent of my advertising budget is wasted, but I can never be sure which 50 per cent of it is."

Even though we can't be sure . . . we must always keep trying to find out. Comments and reactions of supervisors, employee feedbacks, studies and surveys—all can be helpful in determining the effectiveness of safety messages.

I have for your consideration what I've called—and not very originally, I'll admit—ten tips for effective safety communications.

The first of these ten tips is—

1. Know your safety communications objectives.

Your safety communications ought to be aimed at the main causes of accidents. These causes, I understand—stem from the human elements of the employee and supervisor—and from the working conditions.

Your objective should be to eliminate all lost-time accidents . . . to reach that magic "zero frequency" figure and hold it, through information, education, motivation and inspiration. The humanitarian aspects of this objective are obvious. The economic aspects, while not so obvious, are equally important . . . not only in the reduction in compensation costs, but also in the corollary point that a safe operation is generally a more efficient operation.

2. Establish your safety communications channels all the way from top management down to the individual employee.

Your safety communications must come from the top. This doesn't mean the president or board chairman must sign each piece of literature, but it does require an open endorsement by top management of the objectives espoused in your safety communications. Once you have this executive

endorsement, your superintendents and supervisors have some assurance that they can communicate with authority on safety matters, just as they can on other matters of management concern. Nothing undermines a foreman's safety efforts more than the uneasy feeling that his boss is going to "chew him out" for spending so much time on safety.

3. Encourage your supervisors to be safety supervisors.

A good portion of your safety communications should be directed at the line supervisor, to assure his alignment on the "safety team." In a well-run operation, the supervisor may be running a department which has a lost-time accident as infrequently as once a year or less. He may tend to take his employees' safety for granted in these circumstances. Actually, with this type of safety record, the supervisor knows a good deal about the principles of accident prevention. But he needs constant reminders to keep these principles in application. A good point for him to remember is that safety is a management obligation and he, the supervisor, is the first line of management. The Bell Telephone System uses a slogan which has become a way of life for employees . . . "No job is so important that we can not take the time to do it safely."

4. Remember, good safety communications is a two-way street.

Just as other forms of employee communications require some provision for registering employee reaction and comment, so do your safety communications. Nothing could hurt your accident prevention efforts more than a "w. what?" attitude toward employee suggestions and complaints. The man on the job is often in a better spot to see and analyze hazards, and to recommend action before he or a fellow employee is injured. He must be convinced that his suggestions, his opinions are important safety communications.

5. Keep your safety communications flexible.

Naturally, any good communications program requires advance planning. And safety communications are usually timed to give vacation safety tips in June, winter driving suggestions in the fall, and so forth. But it would be a mistake to format an in-

flexible program which would not be adjustable to fit the existing conditions. If a rash of back injuries occurs, the campaign should shift to lifting and material handling, even though it may have been committed to electrical hazards in your original scheduling. A shift in the use of various communications media may also be called for, when it becomes apparent that certain efforts are less effective than it was hoped they would be.

6. Use sound approaches to tell the same message again and again.

Repetition of sound safety principles is the key to making accident prevention a way of life for your employees. These messages may be carried in different ways, from time to time, for variety's sake or to cover a portion of your audience which does not seem to be "getting the message."

But it is not necessary to "spin your wheels" looking for completely new and different treatment of accepted safety messages. It is not necessary to disguise a safety message as something else to make it palatable. Variety of approach should be used only to broaden the coverage of a message, or to remind the employee of what you have already been telling him.

Incidentally, I think a word of caution might be in order on safety communications: We must guard against the clever approach which completely obscures the point we are trying to make. There have been examples of this in television commercials . . . notably the Piel's Beer commercials which were very cleverly done. The "Bert and Harry" commercials won numerous awards from art directors and TV critics, but they did not make an appreciable contribution to the sale of Piel's Beer. I think the same rule should apply to safety communications—our objective is to prevent accidents, not to impress employees with our cleverness.

One more point on this subject of cleverness: There probably isn't a safety director alive who doesn't dream of the day he'll coin a safety slogan with the impact and appeal of "The life you save may be your own." I'm sometimes inclined to think our safety efforts today are too wrapped up in slogans . . . that we're too dependent upon slogans as a substitute for a well-rounded, effective communications program.

7. Tell the bad with the good.

This, like most of the other points, I've listed, is a basic tenet of employee communications. We don't like to talk about fatalities; we don't like to show that our frequency or severity rates are on the rise. But we must face these facts of life and communicate with our employees about them. When employees are given a two-color four-page report of a decreasing frequency rate, they're entitled to some form of communication when the rate takes a climb.

Some people shy away from comparative listings of frequency and severity rates. They feel that this makes one plant or one department "look bad" if its rates are higher than those of other departments or plants. It's true, it makes one department look bad in comparison with others. But failure to use these listings is failure to give credit to those departments or plants which are doing better than your company-wide average. In order to give credence to the good, you must also publish the bad.

8. Get employees into the act.

Employees want to feel that they are a part of the company's safety promotion efforts. Poster contests, monthly quizzes, discussion meetings are all part of the employee participation program. At Allis-Chalmers we've distributed silver dollars to employees who could correctly identify the safety "theme of the month," with additional dollars for the employee's supervisor when a correct answer was given, and even dollars for the employees' wives if they correctly answered a telephone quiz on the same theme.

9. Localize the message.

An advantage of monthly safety themes in multi-plant safety promotion campaigns is the volume printing and the resultant lower cost-per-unit of handout materials, posters, etc. This is offset, however, by a big disadvantage—if your monthly theme is electrical safety, the message may be pretty well lost on employees whose work is primarily concerned with material handling, or machining or any number of non-electrical occupations.

To compensate for this flaw, we have gone to a "library" of employee handouts on a variety of subjects. Some are of a

general nature. Some are of a very specific nature, of interest only to specialists in certain phases of our operations. But the result is that our supervisors can order the handout folders they think will be of greatest value to them in a given month. They are not saddled with printed materials on electrical safety while trying to combat accidents resulting from poor housekeeping practices.

10. Spend money on safety communications, but keep your program under a magnifying glass.

Like any other staff function, the safety department is under scrutiny by line people where costs are concerned. An old-line general superintendent is not going to look too kindly on an apparently fussy safety

promotion campaign at a time when he is being asked to cut his department's cost.

On the other hand, it takes money to do an effective job of communicating . . . printed matter, motion pictures, banners and other promotional materials cost money. In addition, employees' time costs money, when it means taking people off the job to view a new movie or to attend meetings and other presentations.

The best advice I can give you here is to forego the flashy materials and concentrate on good, tested communications devices—the employee publications, the posters, the handouts, and the other techniques, which your experience has shown to be effective communications. Be prepared to spend money when you have to, and to justify the expense if it becomes necessary.

SAFETY ENGINEERING—A MODERN CONCEPT

By JOHN J. AHERN

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- I. You can't steal second with one foot on first:
 - A. All progress involves risk.
 - B. Engineering and scientific progress have raised our standard of living beyond fondest dreams of our forefathers.
 - C. Each new conquest of nature's secrets accelerates industrial activity and adds to the burden of the safety profession.
 - D. Few timid souls
 1. Governors on cars
 2. Restrictions on reactors
 - E. Safety engineering must be ready to meet the challenge
 1. Move forward—we can never stand still
 - F. This means a higher degree of technical competence
- II. Approach
 - A. How does safety engineering meet this challenge?
 1. Education
 - B. Research
 1. Great impetus by ASSE Committee on Cooperation with Engineering Colleges in early 1940's
 2. Joe Stennett, chairman
 - 1) Suggested curriculum—graduate primarily
 3. Conferences with engineering administrators
 4. Schools
 - 1) Illinois Institute of Technology
 - 2) Texas A&M
 - 3) Georgia Tech
 - C. Phenomenal progress—very few engineering schools today without some safety instruction
 - D. Our goal—every graduating engineer safety oriented
 - E. Research
 1. Weakest part of our approach

2. Some improvement but the surface hasn't been scratched
 - Equipment
 - a. Safety shoes
 - b. Wire rope
 - c. Safety goggles
 3. Transportation
 - a. Seat belts
 - b. Highway construction
 - c. Aircraft crash
 4. Industrial
 - a. Very little on ordinary industrial accidents
 - b. Explosion features in ovens
 - c. Exotic fuels
 - d. Automatic Sprinkler Co.—fast acting sprinklers
 5. Accident analysis—lengthy reports on statistics
 - a. How many? — But why?
 - b. Let's not be record-keepers but be analysts
 - c. Statistics are only good if they can prevent future accidents
 - D. Intelligent application of present knowledge
 1. First—what is an accident?
 2. Heinrich "An accident is an event in which (a) the contact of a person with an object, substance or another person, or (b) the exposure of a person to objects, substances, other persons or conditions, or (c) the movement of a person causes personal injury or
- suggests the probability of such injury."
3. Webster: "An event that takes place without one's foresight or expectation, esp. one of an afflictive or unfortunate character; a casualty . . ."
4. Is this modern accident prevention?
 - a. Trim press—new job—old guard—fingers severed?
 - b. Is this an accident? Was it an unexpected event?
 - c. Only unexpected feature—turning!
 - d. Working on machine without locking-out. (same questions above)
 - 1) "Accident" marks our inability or reluctance to think through all the possibilities in an operation
 - 2) Better term: "predictable event"
 - e. Example: high pressure, airless spray guns
 - 1) Potential there from the beginning—good manufacturer — good development — no safety research
 5. Basically we are not doing as good an engineering job as we are capable of—nor are we communicating what we do know to the people who need the information

III. This meeting is an opportunity to take stock and by improving our performance to enhance the stature of safety engineering.

DYNAMIC SAFETY CRITERIA—AN ENGINEERING APPROACH

By WILLIAM A. McADAMS

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With world tensions at the peak they are today it may be a little difficult to focus our attention on the dream world of the future. But that is what I would like to do. I would like to paint a picture—a picture which may seem more like a fantasy

than anything else—but a picture which I believe will be a reasonable facsimile of our world of the next generation.

Most of us will be in this picture—probably in retirement—and we will have some trouble recalling just how things were back in 1961, because our whole pattern of work and play will be completely changed.

Our homes will be masterpieces of convenience with replaceable walls, luminescent ceilings, wireless appliances and completely automatic temperature, humidity and ventilation control. We will wear disposable lounge and work clothes and use ultrasonics to wash our fancy clothes and dishes. We will have specially processed foods in concentrated forms which will be cooked in minutes by electronic ovens.

Our morning mail will contain letters written only moments before and transmitted electronically to a neighborhood message center. Guided missiles will provide us with almost instantaneous transport of packages and freight.

Guided missiles will also replace our jets for long distance passenger travel. We will solve our local transportation problems by personal land-sea-air vehicles that can be keyed to automatic routing systems by dialing the point of destination.

We will be well on the way to controlled climate. This will be accomplished through the development of methods for retaining or dispersing the heat of the sun. We will harness the winds, the waves, and the tides.

Atomic energy will become our chief source of energy and we will use it for all forms of transportation. We will have compact atomic power plants in our homes and factories. We will also develop new sources of energy and methods for direct conversion of one form of energy into another.

Advances in medical science will all but eliminate the major diseases such as cancer and heart disease. Better and more complete medical records plus data processing equipment will make it possible to diagnose and prescribe treatment for illnesses with greater accuracy and more effectiveness. New techniques for handling injuries will reduce fatality and permanent disability rates.

Our progress in plant chemistry and biology will be equally spectacular. New fer-

tilizers and growing techniques will permit us to harvest huge crops from small areas in shorter growing cycles, and with a variety of substitutes for soil. We may even find a practical biological or biochemical generator to produce energy, food, and raw materials simultaneously.

As we continue to use up our natural resources we will be faced with all kinds of shortages in materials. We will solve these problems by new synthetics and, eventually, by modern alchemy in which we change basic elements to others of our choice by transmutation.

Maybe these predictions of things to come seem like delusions, but almost all of them are known to be technically feasible right now, and many have already been demonstrated at least on a small scale. Maybe we won't accomplish it all in the next generation, but the chances are good that we will do this and more besides.

It would be nice to say this wonderful world of the future will be devoid of safety hazards. Much as we would like this to be true, it is not a very likely prospect. Nevertheless, if we make our safety criteria as dynamic as our technology, every year ahead will be safer than the previous one.

Now, what do we need to do to develop the kind of safety criteria that will enable us to keep abreast of these rapid changes in technology?

Few men in the past have had the sagacity to see the scientific and industrial growth that was immediately ahead of them. As a result, advance planning has rarely been adequate even for relatively short periods, and we have grown accustomed to a constant race to keep up with the times. In this respect the performance in safety has been no better than in any other field.

Therefore, we must be future-minded. We must know where science is leading us and we must understand the fundamental principles involved. It is obvious that none of us can become expert in all of the many scientific disciplines, but we can learn enough about the new developments to visualize their future applications.

Once we have a basic understanding of the new scientific developments we can then begin to recognize the potential hazards of the future. The world I have described will be full of new materials, strange phe-

nomena, and unnatural forces of all kinds. There will be new poisons, new irritants, new noises, new vibrations, new radiations and new traumatic hazards which we will have to identify and deal with. We will have to know how the human body will react to each of these changes in environment before we can prescribe the proper criteria for safety. The earlier we comprehend the hazards of the future; the sooner we can prepare for them.

Safety is no longer an "after the fact" proposition. We used to pay little attention to hazards until someone got hurt. Later on it became common practice to seek out the hazards and to find the best ways to keep people from being injured by these hazards. Under this kind of a safety program the emphasis was on personal protective equipment, safety training programs, and special devices added to facilities and equipment after they were installed. There was little real safety engineering.

Now this situation is beginning to change. We have started to "blueprint" our safety. Consider the atomic energy industry as an example. From the very beginning, the scientists and engineers recognized the hazard of ionizing radiations and took them into account in all of their plans. Not only did they design the reactors to be safe during operation, but they provided built-in maintenance equipment and emergency devices as well. They also planned for safe disposal of wastes and for safe handling and processing of the radioactive products and by-products removed from the reactors. This philosophy of engineered safety has continued throughout the expansion of the atomic energy industry and it is the primary reason why there have been so few radiation injuries in the industry.

Our rapid growth in technology will give us tremendous opportunities to have "blueprint" safety. The technology itself will furnish us with unlimited new safety techniques which we can exploit to the maximum as present facilities and equipment become obsolete. Furthermore, the automatic systems of the future will be ideally suited for built-in safety devices.

This trend toward blueprint, built-in, safety does not mean that we should discontinue all of our traditional safety meth-

ods. We have only to picture the U. S. astronauts, Alan Shepard and Virgil Grissom, to recognize that the best of built-in safety will not always be enough. Shepard and Grissom were provided with quite a collection of personal protective equipment and were given thorough training for every conceivable hazard they might encounter. There is no question that personal protective equipment and training will continue to be important parts of our safety programs, but they will become, more and more, a second line of defense.

As far as protective equipment is concerned, most of that in use today will have wide application for many years ahead. However, some items will have to be redesigned and made more efficient. For example, I can see quite a need for respiratory masks in the next generation, but they will undoubtedly have to be equipped with canisters for different kinds of dusts and poisons than we have now.

Also if we can believe our space researchers, face masks may have to be designed for beards, because spacemen may not be able to shave. According to the experts, shaving soaps will harm the bacterial digestion system of the space ship and whisker fragments from an electric razor will create a major dust problem. Of course, there is a good chance that our expanding technology will solve this problem with a way to keep whiskers from growing.

There is one great pitfall in all of this talk about the novel and unusual hazards of the future. If we are not very careful, we will become so involved with the glamorous new problems, that we will overlook the familiar hazards that have plagued us for generations.

For example, every year 18,000-20,000 persons in the United States are killed by falls. The frequency rate has declined slightly over the years but the total deaths from this cause is about the same as it was half a century ago. It is also interesting to note that, in the atomic energy industry which I discussed a moment ago, more people are injured by falls off ladders than by the radiation which has been given so much publicity.

Thousands of other people are killed each year as a result of burns, suffocation, drown-

ing, falling objects and other accidents common in everyday living and largely the responsibility of the individual. Life in the future may be more comfortable, but many of these same hazards will continue to exist. So in the technological growth ahead, let us be sure to give attention to the commonplace.

One of the most difficult problems in establishing safety criteria is the determination of acceptable risk. Some persons will insist that we are never justified in taking any risk which may result in loss of a single life, but it is obvious that a world predicated on this philosophy would not only be stagnant, but it would be less safe at the same time. On the other hand, we are not justified in taking a risk if there is a practical way of avoiding it. It requires considerable good judgment to decide what is practical, and time and cost are probably the most important factors involved.

Let us consider the hazards of electricity as an example. Every year about 1000 persons in the United States die as a result of electric shock—a death rate of about 0.5 per 100,000 population as compared to about 21 for automobiles, 10.5 for falls, 3.6 for drownings, 1.3 for firearms, and 0.6 for poison gases. This is truly a remarkable safety record when we consider the extent to which electricity is used in the United States.

But are we willing to accept this death rate as an acceptable risk for the use of electricity? The answer is not a simple yes or no. We are constantly eliminating electrical hazards but we are also constantly expanding the use of electricity with more applications, higher power levels, and greater distribution of electrical equipment. The death rate has been going down, but we may soon reach a point where a further reduction can be achieved only by a significant increase in cost of electrical products and services, or by a delay in promising new electrical advances. In this case, the public will consider the alternatives, and decide if the risk is worth taking.

In our pursuit of the invisible and the unknown, the determination of acceptable risk will become extremely complex. We will not always be able to perceive the hazards, and we may not even be sure that there are tangible benefits ahead. There

are bound to be disagreements as to whether risks in a particular situation are justifiable, but I think we must accept the fact that we will have to take some risks—even some blind risks—to make any substantial amount of progress. After all, our aspirations for the future lie in our investigations of the things we do not understand now.

I am not suggesting that we plunge ahead carelessly without any regard for hazards. I think it is rarely necessary to do that. The first nuclear reactors were built for military purposes at a time when the country was at war and at a time when there was a good chance the enemy might produce an atomic bomb before we could. This was a case where we had to be first—and we were. But we were first—and safe—at the same time.

I believe that we can achieve most of the wonders of the future with no more risk than we have taken in the atomic energy field, but there will be situations where it will not be possible to do this without intolerable delays. The promising world of the future will surely be a safer world and we can afford to take a few short cuts to get there.

Now I have described a fantastic world for the next generation and I am convinced that we have an excellent chance to make this amount of progress. Several years ago David Sarnoff, the well-known chairman of RCA, made the statement that our technological achievement during the last 100 years was greater than in all the thousands of years that preceded. Certainly we should expect an equivalent achievement in the next 20 or 30 years, for knowledge breeds more knowledge and growth in knowledge is a geometric progression or more.

In the face of this progress we must reappraise our whole safety effort. In the course of doing this we must be future-minded and comprehend the hazards of the future.

We must blueprint our safety, but in doing so, we must not abandon our old-style safety, and we must give attention to the commonplace.

Finally, throughout all of this we must develop a proper risk philosophy.

If we do these things, our safety criteria will become as dynamic as our technology and we will be able to survive our progress.

MECHANICAL ACCIDENTS

By ROBERT P. BARROWS

Safety Dir., Underwood Corp., Hartford, Conn.

We do make progress in the ever-present war against industrial accidents, but slowly! Take for example the case of germ warfare. It was right after World War I when we first started hearing reports from the scientists about germ bombs which could annihilate an entire city's population through pestilence. With each passing year, the science prospered and the threat grew worse. Yet, despite all this progress, even today we are faced with germ warfare in only one area; on the screens of our television sets.

I have been able to develop some information concerning mechanical hazards at Underwood Corp. in Hartford which I believe you will find helpful.

The accidents we are going to talk about will all contain an unsafe mechanical condition, but will often be augmented, or even triggered by a thoughtless action, an unsafe act, of an individual. It is well to keep in mind that substantially 88 per cent of all industrial accidents arise from unsafe acts and about 11 per cent from unsafe mechanical conditions. . . . By eliminating the mechanical hazard, we not only prevent the 11 per cent but make important inroads into the 88 per cent caused by improper acts.

For the purpose of our talk this morning, I would like to break down mechanical accident situations into five categories. First we will discuss the "point of operation" accident, then, those associated with machine set up and repair; next "power transmission" accidents, those arising from materials handling and storage operations, and finally "process control" injuries.

Now, as we talk about these five areas of mechanical accidents, we will be talking about guarding a great deal. Guarding is in many respects like the industrial engineer's "one best method." Those with an I.E. background know that there is really no such thing as the one best method. Any method is the best one only until a better one can be found. Omniscent perfection is unobtainable in methods work. The same is

true for mechanical guarding. There is no such thing as a perfect guard, nor is there any guard that cannot be improved upon.

In developing any guard, we first look over the work place, watch the operation, study the machine tool, look for the hazards and then determine mechanical means of minimizing them. But this is only the very first step. Improving that guard means calling on all of the talent available for improvement. The next man that comes along to look at your idea may have just enough of a different outlook to come up with a substantial improvement. So never become over-sold on the ultimate superiority of your own guards.

Now let's look at some examples of the five types of accidents and see if we can develop some general rules from the specific solutions offered.

Specific Examples

As I mentioned, the first example will be concerned with "point of operation" accidents. Our first case deals with a drill press injury, more specifically, burr removal using free hand methods. In all metal working operations, it is generally necessary to remove the accumulation of flash or excess metal which builds up on the far side of a punched or drilled hole. Such de-burring jobs are usually very fast light operations where only a minimum of effort is required to break the burr. Often it becomes desirable to hand-hold the part as it is brushed against the working surface, rather than going to the cost of locating it in a fixture each time. In this particular injury, however, a common twist drill was being used as a burring tool. The part caught on the drill, tore out of the operator's hand, spun one revolution and struck the back of her hand.

Injury in this case resulted in lacerations and contusions to the middle and ring fingers of the left hand. Various solutions are available to prevent recurrence. Dial or automatic feeding of the parts or special fixturing of the part might be feasible

depending on production costs. The cheapest and easiest way would be to use a safer tool. Use of a sleeved drill, a burr, or a Weldon tool would maintain high production rates and yet protect the operator.

The next accident involves milling cutter guarding and two-hand controls. Actually there was no accident here but a "close call" incident was reported by a time-study observer. Here the operator was running a two-sided miller. The first piece was loaded on side A, the fixture jaws were closed mechanically and the milling cut started, thus automatically opening side B where the operation was repeated. Because of the single switch used to activate the machine, it was felt that greater safety was needed. As a result of the investigation, full enclosure guards were developed, and two-button control was substituted, requiring that both hands be out of the machine before it could be activated.

As a result of this change it was no longer felt necessary to stop the machine after each cut, and as a bonus for this improvement, an 1100-dollar per year savings in production cost was realized. The company fared well here in terms of a reduction in the cost of operations. The operator fared even better, inasmuch as this task was made less fatiguing and also considerably safer, thus reducing the level of tension.

The next example concerns non-standard operations of a power brake. This improvement came as a result, not of an accident, but of a potential accident turned up by an inspection committee. Here the operator was cutting steel strip stock to various predetermined lengths, using the single start button furnished by the manufacturer to activate the shear. Because of the varying nature of the stock in terms of width, thickness and length of cut, barrier guarding became very difficult. The guarding requirement was for relatively universal application, easy set-up and low cost. Such guarding requirements are not unusual.

Many safety directors find themselves faced with the proposition that 85 per cent of company profits are derived from about 15 per cent of the tooling. These tools are usually high performance multi-stage tools which can absorb relatively high costs for proper safeguarding without budgeting diffi-

culty. The problem arises with the much larger number of low production tools. Some of these tools may make a contribution to gross earnings of only five to fifty dollars per year. Yet they must be retained in the line because of customer demand, need within the product, or other reasons.

Here guarding becomes a more difficult problem from the financial standpoint. It is unprofitable to spend 250 dollars to guard a tool which possibly contributes only 25 cents to net profit. This is where the universal guard comes into play. Such a device would be permanently attached to a machine, not a tool. It can be rapidly re-adjusted as various tools are placed in the machine. A type of universal guard proved to be the answer to this power brake problem. Attaching a pull-out device to the lever arm of the brake, which was connected by wristlets to the operator's hands, it was possible to maintain an adequate degree of safety without a profit-cutting investment in hardware.

Machine Set-Up and Repair

Our next area of discussion is machine set-up and repair operations. Here we are getting away from the very repetitive easily guarded operations, but rather a collection of very unrelated tasks. However, by studying accident trends, we see that injuries here result from rather similar portions of activities. Take for example the screw driver that slips and causes a laceration of the hand. We see this injury cropping up time and time again. Generally, there is no injury or at least no serious injury. But each time, it happens because of the same two causes. First, the screw driver did not properly fit the slot. Secondly, the operator was not sufficiently aware of application of pressure and safe placement of his other hand or body part.

Preventions here can be obtained by:

- 1) Regular inspection of screw drivers for condition and training of screw driver users in proper fit, and
- 2) Development of risk awareness in the use of a screw driver.

The first goal could be much more easily attained if there were specific standards to work to, but unfortunately, although the screw driver is probably the most common hand tool in daily use by millions of our

citizens, there is not an accepted standard at the present time governing the width of screw slots or the dimension of screw driver blades.

The next accident concerns the use of an adjustable wrench. Here the wrench slipped while the operator was tightening a bolt, causing his finger to strike a sharp edge. In this case the result was a serious abrasion and contusion to the right little finger necessitating several days' lost time. The solutions to the problem are several.

First, special purpose tools, such as end wrenches, rather than adjustables would eliminate the mis-adjustment problem. However multi-purpose tools certainly have their place. The requirement is to properly indoctrinate the need for accurate adjustment and maintenance of condition. The second requirement is training in the proper use of tools, so that pressure is exerted in the direction of the shank rather than outwards from the jaws.

Power Transmission

Next we come into the area of guarding shafts, spindles and other power-transmitting hardware. The first example concerns the guarding of powered rindles on drill presses. Currently most of these machines are being built so that most revolving and reciprocating parts are pretty well guarded at the factory. But many machine tools in use today are far from being new. Also adaptations to special use require removal of the furnished guards. Consequently, a potential for hair and scalp involvement injury is developed.

I am happy to be able to say that a search of our records showed no recent injuries that the guard was designed to protect against. Hair nets, of course are another possible answer to this type of injury, but we have found that they are quite unpopular and therefore it is difficult to maintain 100 per cent enforcement. We find it is easier to remove the apple from the Garden of Eden, rather than to hang up a sign saying "Do Not Eat."

The infedding end of power roll conveyors always poses potential hazard if unguarded. On a floor conveyor used for removing cartons of finished machines, we discovered, following installation, a point where a foot could be inadvertently placed and drawn in under the conveyor. Installing

a steel shield was quick and inexpensive. It did not interfere with operation in any way. Yet it meant the elimination of a potentially serious accident which could have occurred at any time.

Material Handling and Storage

Our first example in the area of material handling involves the loading of a trailer truck. Here gravity fed sections of a portable conveyor were set up inside the trailer to facilitate the loading of finished machines. The operation was safe in all but one instance. The regular dock board used to bridge the small space between the platform and the truck had been temporarily removed. A make-shift piece of boiler plate was obtained and used in its place.

After completing the loading, the operator forgot the makeshift condition. He backed out dragging the last section of conveyor with him. Since there was no curb on the boiler plate, he missed his footing and stepped off into air between the truck and the platform. The space was only about eight inches wide. His leg slid down its full length and the conveyor landed in his lap. He suffered from very painful strain to the groin and abrasions to the thigh and stomach. A more proper awareness of the danger of make-shifts would have made this trip unnecessary.

Storage of grinding wheels can become a delicate problem. At Underwood, many of our tool grinders like to maintain their own inventory of grits and shapes of wheels dressed to their own particular "feel" or taste. This is socially desirable, since it contributes to pride of workmanship. However, storage of these wheels at the workplace can constitute a problem. If they are not carefully protected against shock, cracks can develop which can cause a wheel to explode when it is started up.

Consequently, special storage racks were developed for each tool grinder so that safe storage could be maintained. These racks, of course, do not reduce in any way the need for the other grinding safe practices, such as the use of front guards, vision shields, safety goggles, and the need for "ringing out" a wheel with a wood mallet prior to each installation.

The third item under material handling concerns an operator who was checking out an overhead conveyor on a trial run, prior

to installation of the guarding. He moved under a descending section of conveyor to more closely inspect the action of one of the moving carriers. While thus preoccupied, the next carrier came along and struck this maintenance man lightly on top of the head, causing him to lose his balance, fall against the wall and onto the floor.

This was not a serious injury in itself. In fact it was hardly more than an incident. But it served to put everyone concerned on notice of the potential hazard of even temporarily unguarded conveyor.

Control-of-Process Type Operations

We next come to the area of process type operations, such as electro-plating and heat-treating.

The first case concerns the handling of highly corrosive acids in carboys. For many years, we have been purchasing our sulphuric and nitric acid in wooden cased glass carboys. No unusual incidents had been reported until one day we heard that a trucker, while setting a carboy down from his hand truck, heard the glass begin to crack. He stepped back away from the acid so that the only loss was from parts and equipment damaged by the acid and time spent in clean-up. However, a cursory investigation of alternate methods turned up a new piece of equipment which could prevent a repetition with more serious results: a polyethylene liner contained in a steel drum. This new type of carboy makes possible better handling methods and more efficient storage with no added cost and, most important, no potential breakage.

Conclusions

We have now seen the specific examples. What can we develop from these in the way of general rules? I would like to suggest the following, starting with the simplest possible rule, and proceeding to the more complex:

- A. Change the Operation
 - Eliminate the job
 - Alter the part design
 - Change the method of performance
 - Improve the job layout
- B. Improve the Tooling
 - Automatic parts feeding (vibration, air, etc.)

- Improved loading devices
- Better handles on fixtures
- Easier nesting
- Reduced cutting surface
- C. Keep the Operator's Hands Out
 - Remote feeding devices (dual, slide, chute, automatic)
 - Barrier guards (covers, duckboards, etc.)

Two hand controls

D. When Guards are Necessary

1. Make them simple and cheap. The fewer the parts, the fewer the failures. Obvious purpose discourages misuse.
2. Let them help the operator. They should not make the job more difficult or awkward.
3. Don't build in booby traps! Avoid additional pinch points such as machine part that closes on guard when cycled, or hole between truck and platform.
4. Design them to be fail-safe. Plan for one in ten thousand or one in a million failures. Design guards so the operator is still safe when the failure occurs.
5. Plan two independent mechanical or other devices. Require simultaneous failure of both to result in incident.
6. Keep up the good work. Use the three "e's" of safety, engineering, education and enforcement. Once the guards are developed, (engineering) and the operators are taught their use (education), be sure to take advantage of the third "e" (enforcement).

Summary

Safety only starts in the safety office. Desirable follow-through requires effort on the part of everyone. Make sure that you are taking full advantage of all of your allies in the accomplishment of the safety effort. Some of your allies will be found in the line, for example the plant manager, the foreman, the set-up man or mechanic and most important, the operator himself.

Utilize fully the available staff organization. Such specialists as the time study or methods engineer, the tooling engineer, the

tool maker, and the machine repairman, even the janitor, can make invaluable suggestions to improve the safety effort in terms of better guarding. Just as the twelve Disciples were fishers of men, a good safety coordinator is a fisher of ideas to make operations safer.

You can never afford to have the superior attitude which says, "Joe, with his routine

job and low I.Q., sure can't tell me anything about doing this job." Maybe Joe, from his vantage point has made the one observation necessary to turn a good guard into an excellent one. Take the time to listen to the people that want to tell you something. It never hurts to give people recognition, and their advice will help you in avoiding the safety head-boggle.

REVIEW OF SIGNIFICANT ACCIDENT CASE HISTORIES, ELECTRICAL ACCIDENTS

By HERBERT J. METZGER

Safety Dir., Orange & Rockland Utilities, Inc., Nyack, N. Y.

Electrical accidents occur in many varieties, some of which are spectacular, most are not. This talk could have been made very interesting by describing and picturing spectacular high voltage accidents and their results. This type of accident and exposure is confined principally to a comparatively small part of our population, utility men and others who deal with these voltages.

We are here not to be shocked or entertained but to learn more about the business of preventing injury and death. We must therefore deal with the type of accidents most likely to occur to the greatest number of people. These are not spectacular but the results can be deadly.

The daily use of millions of appliances by practically every man, woman and child in the country produces a field of exposure greater than that of the automobile. It is a compliment to the built-in safety of these appliances that the death rate from all electrical accidents, including high voltage, is only about one fortieth of that caused by automobiles.

In spite of this inherent safety, misuse of appliances and ignorance of the characteristics of electricity can be the cause of accidents.

As I do not know the extent of your familiarity with electrical behavior, I must assume that in an audience of this size, it will range from complete understanding to none at all.

I hope therefore that I may be given the liberty of departing from technical accuracy in order to try to make certain points clear.

Electricity is a form of energy and as such it will perform work, useful or destructive. A hammer will drive a nail or smash a finger, electricity will drive a motor or cause destructive effects in the human body. It is all a matter of control.

Unlike most other forms of energy, it is not perceptible to human senses at a safe distance so we must assume that certain equipment and wires possess an electrical charge or potential.

The earth is considered to be at ground potential and we can think of it as a receptacle for electricity, with unlimited capability to accept electrical current from any source of higher potential. We should consider any conductor of electrical energy to be at higher potential than the earth.

Electricity is kept within safe and useful bounds by insulation or isolation. When insulation fails or contact is made with another conductive body, that body becomes charged or raised to the potential of the conductor. If it is also connected to some body of a different potential, the earth for instance, a current will flow.

This is what happens when a fault occurs in an electrical appliance. The frame of the appliance becomes charged and a person holding it, and at the same

time in some manner electrically connected with the earth, as for example through plumbing will form a conductive path and receive a shock.

Let us look at a few such accidents. First, a case history taken from an insurance company file. The victim was engaged in installing sheet metal covering over the lagging on a pipe at a power station. He had been working from a wooden scaffold but had shifted to a sitting position on an eight-inch steel pipe. It was a hot day and it is probable that his clothing was damp from perspiration. An electric drill, one-quarter-inch capacity, was handed to him by another workman. He put it in place to drill and pulled the switch trigger. Sparks flew from the drill and the victim stiffened. A co-worker pulled out the extension cord and lifted the victim back to the scaffold. Artificial respiration was started at once but was ineffective.

Upon examination after the accident, evidence was found that the bushing which normally took the strain of the cord was broken and had been ineffectively repaired. The strain thus transferred to the binding screws probably pulled one of the power wires loose, causing it to make contact with the drill housing.

This drill was fitted with a three-wire cord with the green grounding wire properly attached to the case. After the accident, this wire was found to have broken off at its connection with the case. This probably occurred when the drill fell after the accident.

The three-wire cord was properly connected to a three-wire grounding type male plug. The three-wire fifty-foot extension cord was equipped with a three-wire female receptacle at one end and a three-wire male plug at the other. It was plugged into a three-wire grounding receptacle.

Why then did this accident occur? Closer examination of the extension cord revealed that it had been lengthened by splicing twenty-nine feet of two-wire cord into its middle, leaving the green grounding wire open for that distance. Had this grounding wire been continuous the potential on the faulted drill case would have been reduced to a safe level and the

circuit fuse would have blown, cutting off the current.

It was a clear case of safe and proper equipment being made deadly by poor maintenance and makeshift alterations.

Case number two, from a newspaper clipping. A young man was electrocuted while operating an electric drill in a church under construction. He was standing on the top rung of a ladder, supporting himself by hooking his arm over a small metal I-beam and brought the drill close to his arm. His employer, standing on the floor, said he saw a blue flash and heard the youth scream. He pulled the plug of the drill and the victim fell off the ladder into his arms.

The coroner said that the self-grounding device on the drill may have been circumvented by the way the victim was holding it. He also said the tool worked perfectly on later examination.

I mention the coroner's remarks as typical of uninformed investigation. This tool must have been faulted, and could not have been properly grounded, which is frequently the case on construction jobs. Further, a faulted drill, isolated from the ground, may still operate perfectly. I wonder if this drill is still in use, waiting for another victim.

Here is a somewhat similar case. A man was doing some alteration work on his house, in the course of which he was installing a four inch sheet metal duct in an attic room. His wife on the lower floor heard his electric drill running and became curious after several minutes as to why the drill should be running so long without any sound of other movement. She investigated and found her husband stretched across the attic beams, the running drill still in his hand. She pulled the plug and called for help but her husband was dead.

This accident may be reconstructed from the evidence found.

On test, the drill was found to have a very high resistance fault from the windings in the case. There was no third, or ground wire, attached to the frame. It is not known how long this fault had existed as the tool could have been used indefinitely in this condition so long as the case and the user remained isolated

from ground. Working in the attic on a wooden floor, he might have been considered reasonably safe even with the faulted condition of the tool.

There was a slight burn on the tip of the drill and another on the duct, which was grounded. This would indicate that he had attempted to drill a hole in the duct and a small flash occurred causing him to pull the drill back quickly. Being in a kneeling position, he was thrown off balance and grasped the duct for support, forming an electrical path from the drill case to the grounded duct. It was hot in the attic and his perspiration lowered his skin resistance to a minimum. He had a small second degree burn on the palm of his right hand.

The exact nature of the fault in the drill was not determined but could have been from a loose strand of wire, insulation breakdown or even a drop of perspiration in the right place.

Another clipping relates that a woman using an electric massager in a bathroom was found dead on the floor near the sink. Another faulted appliance and a grounded victim.

Illustrative of a fairly common type of accident is this description. The victim was found in the bathtub. The coroner said that she had probably plugged in an electric razor and was holding it in her hand when she leaned over to feel the temperature of the bathwater. The force of the resultant shock caused her to fall into the bathtub. She apparently then dropped the razor into the tub and was electrocuted.

We hear once in a while of a person being electrocuted when an electric appliance such as a heater or a small radio falls into the bathwater. You may perhaps wonder how this can happen when the water is already grounded. The truth is that a bathtub is a glass-lined vessel and therefore is insulated. The only grounds are the drain and plumbing fixtures. An appliance dropped into one end of the tub charges the water, causing a flow of current to the drain fitting at the other end. If there is a person in that water, part of the current will flow through his body, perhaps enough to be deadly.

I have one more clipping, this one associated with higher voltage. Two accidents, resulting in three fatalities were reported in this article. Both were crane contacts. In the one case "authorities reported that both men were tossed from the cab by 2400 volts of electricity." I find this hard to believe as it is rarely that the man on the crane is injured unless he tries to get off.

The resistance of the machine, upon which the man is riding, is usually so low as to form a protective bridge around him. If he tries to get off, he will probably become a conductor between the charged machine and the earth. Even if he jumps off, which is the safest way to leave, there is the possibility, in some cases, of receiving a shock from two points of contact on the earth itself. In the other case, police said DeBouno jumped into a length of sewer pipe being lowered into an excavation and grabbed a steel cable attached to the crane.

"The crane came in contact with an overhead power line and the electric current passed through DeBouno."

The information given here is very sketchy and an accurate analysis is not possible. We can only know that all three men in some manner became conductors between the charged cranes and the earth.

Important lessons can be learned from a study of these accidents.

A very small current, as low as fifty milliamperes, may kill.

Practically the entire electrical resistance of the body is in the outer layer of skin. This resistance is very high when the skin is dry and cold and very low when it is warm and moist.

Under conditions of low skin resistance, and good contact, a potential as low as fifty volts could cause death. Low voltage contacts resulting in a small current through the heart muscles may result in ventricular fibrillation and almost certain death.

The belief that electricity takes only the path of least resistance can be deadly. Electricity will follow all conductive paths from one potential to another in direct relation to the conductivity of each.

A properly connected protective ground-

ing conductor can reduce the potential of a faulted appliance to a safe level and may cut off the current by blowing a fuse.

What protective measures can we take? All electrical equipment should be kept in top condition by frequent inspection and skilled maintenance. Extension cords and makeshift portable lights should receive particular attention. Makeshift wiring and repairs should be avoided not only because of the danger of shock, but also because of the fire hazard involved. All non-current carrying parts of fixed electrical equipment should be grounded through a low resistance grounding conductor.

All portable tools and appliances, particularly if used in damp locations, should be equipped with three-wire cords and a grounding-type plug.

Extension cords for use with such appliances should be three-wire, with ground-type plugs and receptacles. All new installations or replacements of receptacle outlets should be the grounding type. In locations where portable tools are likely to be used, such replacements

should be made at once. If necessary to use as an adapter to a two-wire receptacle, the grounding pigtail of the adapter should be firmly attached to a good ground.

Generally speaking, the bathroom is no place for electrical appliances. When used, bodily contact with plumbing fixtures should be avoided and no electrical appliances should be touched while in the tub. Some appliances such as electric razors cannot readily be grounded. These are usually encased with non conductive materials. This protection may be lost if the appliance becomes wet.

Isolating transformers with six or twelve volt output are available for portable lights in wet or otherwise hazardous locations and should be used where much work of this sort is done.

Never permit your body to make contact with two electrical conductors or with an electrical conductor and any conductive object connected with the earth.

Modern electrical appliances and tools are safe when properly used and maintained.

SAFETY IN MULTI-PLANT OPERATIONS

Presiding: LEWIS R. MORRISON, Corporate Mgr.-Safety, ACF Industries, Inc., New York City

MULTI-PLANT SAFETY ADMINISTRATION WORKSHOP

ROBERT H. ALBISSER, Safety Mgr., Merck Chemical Div., Merck & Co., Inc., Rahway, N. J.

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DMITRO A. PATRICIAN, Administrator, Accident Prevention & Safety, Radio Corporation of America, Camden, N. J.

Morrison: The Multi-plant Program at the National Safety Congress started about 1954. This is either the seventh or eighth session. Don't be surprised at the infor-

mality—panel members sometimes ask their questions of the audience. Mr. Albisser will begin with a discussion of the problems of measurement.

Albisser: We must measure our safety performance to know how much to budget and how we are performing. (At this point Mr. Albisser turned to the blackboard and presented figures showing a hypothetical company's compensation and medical expenses, including the insurance company loading, fire damage (again showing the insurance company loading), and off-the-job injury expense. This he compared to the industry average. He pointed out that the costs of safety administration should be added to one's own company expenses before comparing to the all-industry average.

Barnako: A program that is effective across the board is what is wanted—one bad department or one good one can change the total result and distort the picture. We have a plan of evaluation which we use to size up the effectiveness of distant operations. Here are the main points of the plan:

1. Safety meetings.
2. Indoctrination of new employees
3. Personal contact.
4. Job safety analyses.
5. Personal protective equipment.
6. Tools and equipment.
7. Accident investigation.
8. Reports and statistics.
9. Signs.
10. Inspection.
11. First aid training.
12. Gas training.
13. Safety codes.
14. Safety literature & posters.
15. Equipment & process developments.
16. Outside contractors.
17. Off-the-job.
18. Forms.
19. Office safety.

Some of our men who travel and rate plants use a chart which gives an arbitrary rating showing four grade levels from "good" to "poor."

Others use a more subjective type of report. They submit a verbal statement of what needs attention. These reports enable me to understand what is going on and get behind the frequency and severity figures.

O'Donnell: We have more than 23,000 employees from coast to coast who work in

a variety of types and sizes of operations. They all claim to be unique. However, we believe there is one thing they have in common—safety is a management function. I once heard a manager tell the supervisors under him that he had been refused a raise because his safety record was bad, so no raises were in prospect for the supervisors themselves until their record improved.

We use safety contests in the different operations in which the units either compete against their own previous record or on a point system.

We believe our main job is to supply technical assistance and a "needle." This is the best way to get local management to do its safety job.

Patrician: We sometimes have noticed a breakdown in communications. We have had this situation: a safety man complains that he has no support from management. The same management of which he complains asks "what more can we do?"

To bridge this gap we require a progress report prepared quarterly. This report shows:

1. Accident trends—a clear and accurate picture.
2. Outstanding accident causes—it provides target areas and focuses attention where the attention will do the most good. Some reporters have a tendency to list too many causes as "outstanding."
3. Include accident costs—let management know what accidents are costing.
4. What is being done to control exposure.
5. Obstacles preventing progress.

We give these instructions to reporters on how their reports should be prepared:

1. Make it brief.
2. Submit it periodically.
3. Exclude irrelevant matter.
4. Include exhibits.
5. Summarize the contents.

QUESTIONS

Q. to O'Donnell: How is the pay raise withheld from a supervisor who has a bad record?

Answer: The manager considers the safety record as part of operating efficiency. This is not a company-wide policy. It is not formal.

This questioner then directed the same question to Mr. Albisser.

Albisser: Our company has incentives. Safety is a factor in the appraisal of performance, and this is a well known fact in the company.

Q. to Albisser: Are your costs allocated to the branch plant?

Answer: Yes.

Q. to Albisser: Is equipment (such as sprinklers, etc.) part of your safety administration expense?

Answer: No.

Q. to Albisser: Do you pay the entire cost of off-the-job accidents?

Answer: Some of our off-the-job accident victims get full pay and others get $\frac{3}{4}$ pay.

Q. to Entire Panel: What is being done to develop a serious injury index?

Barnako: We are using it.

Albisser: We are using it.

Patrician: Severity and frequency are meaningless to us. We have thrown out severity—it is a matter of luck. We concentrate on accident prevention, not lessening of injury. We use an "all-injury rate." We base it on injuries per 100 employees. An employee, for this purpose, is 40 hours of work a week. An employee, if he should work 60 hours in one week, would count as an employee-and-one-half.

Barnako: You can get into trouble with an all-injury rate. It can be overdone. There are infections that are reported late, and unreported accidents.

Morrison: Every injury that requires more than two calls to the dispensary is counted in our company.

O'Donnell: You need a firm measure in a scattered operation—it is hard to control otherwise.

Q. to Entire Panel: We had an accident that apparently had no cause and there was nothing to correct. A woman fell on a clear, unobstructed floor with good traction. How do we charge it? The woman was out for five weeks.

Albisser: As a disabling injury.

Q. to Barnako: Do your traveling central office men evaluate the safety men in the field?

Answer: We don't hire and fire them, but we can't help making personal judgments

about their efficiency. We judge what a man is trying to do. Sometimes local plant management can hold back the effectiveness of a potentially good program.

Q. to Entire Panel: I look upon extremely low frequencies with suspicion. Some of these plants can't possibly have such records if they experience rain and snow, use parking lots, and their people have to walk on floors. Do you believe the Z-16 has gone too far? Is the frequency rate reliable?

Patrician: One of our plants that had 17 million man-hours without disabling injury, after it went on an all-injury rate, went down near the bottom of the list.

Albisser: I'm happy about the present method, but we do need some emphasis on severity.

Q. to Entire Panel: How do you relate safety to production?

Volunteers from the audience answered:

"We relate it to feet of oil well drilled."

"The brewing industry relates it to barrels of beer."

"One company shows it in cents per share of stock."

Q. to Barnako: How long does it take your man from the central office to evaluate a plant of, say, 20,000 people?

Mr. Barnako called upon Mr. Nolan, who was in the audience, to answer the question since he had recently evaluated such a plant. Mr. Nolan replied that it took approximately 3 days the first time, and he now thinks he can do the job in one day.

Q. to Mr. Barnako: If the evaluation is unfavorable, what action does the plant manager take?

Answer: Evaluation is for the safety office; we talk to the plant manager, but don't show him the report.

Q. to Entire Panel: How is the best way to make use of the services of insurance company engineers?

Answer: (By member of the audience) Our insurance company engineer discusses problems with the plant managers, and gives us a copy of his report.

Q. to Patrician: If there is more than one major cause, how do you direct attention to the cure?

Answer: We attack the high-cost areas

first. There is an unfortunate tendency to go overboard on isolated serious injuries. We had a broken leg caused by a fall on some pebbles in the parking lot. The large sum that was spent resurfacing the parking lot could better have been spent isolating electrical hazards.

Q. to Barnako: How close is safety to research and development?

Answer: Very close. We see reports, and sit on committees that give us information on hazardous projects about to be attempted.

Morrison: We ask for reports on capital expenditures to detect where research and development is beginning.

Barnako: The purchasing department can tip you off on this.

Albisser: In our company the safety department meets with the director of the development laboratory once a month.

Patrician: Plans are approved by the safety administrator and the plant engineer.

Q. to Both Panel and Members of the Audience: Should the safety man be an engineer?

Answer: 1. We will be here all week answering that one. 2. We must take a human approach—I am always pleased to see an author in the NATIONAL SAFETY NEWS advocate a human approach.

Albisser: 3. If you phrase the question with the word *should*, the answer is "no." If you phrase it with the word *can*, the answer is "yes."

ARE THERE TOO MANY SAFETY RULES?

By J. E. NICHOLS

Dir. of Safety, Reynolds Metals Co., Richmond, Va.

When an unsafe condition gets into proper position with respect to an unsafe act, most of us in safety work know that an accident will result. In the course of our daily work all of us are confronted with many different kinds of safety conditions and many different kinds of unsafe acts. All of them need to be controlled or eliminated in whatever ways we can devise.

The unsafe conditions are usually the physical conditions of plant and equipment. They are countless in number and may exist because they were created when the plant was designed and built or later remodeled, or they may have been created by the natural wear and tear on facilities which are in production. We usually find that it is easy to become aware of these unsafe physical conditions, through inspections, through information from others and from the occurrence of accidents which they have caused. They are usually not too difficult to correct and control by repair or maintenance, or by engineering revision.

There is rarely any thought of using a "rule" to control unsafe physical conditions. The proper control of dangerous fumes contaminating the atmosphere in which our employees may have to work is

not usually a "rule." It is engineering revision. Similarly, we do not think of a "rule" as being the best answer to a stairway with slippery treads.

Most of us learn early in our careers as safety engineers that people do not always do the expected thing under a given set of circumstances. How to control the unsafe acts of human beings is the question that keeps safety engineers on the payroll. There are many ways of accomplishing the necessary results in control of unsafe acts of people. One of these ways is by the use of rules.

The degree of success which a safety engineer achieves is largely measured by the degree to which he can control the unsafe acts of people under conditions which cannot always be predicted. There are safety programs which have been effective using a large number of "rules" and there are others which have been effective with very few rules. There must be some point in between at which the optimum of effectiveness is reached with just the right number of rules.

Just what is a safety rule and what does it do that cannot be done better by other means? Haven't we all been tempted at

times to devise rules for action which we thought would accomplish something for safety that couldn't be done by other means? And then we called this a "safety rule." Haven't we all sometimes wanted to fire or lay off an employee for a few days when he is caught violating some common sense safety practice? Haven't you felt sometimes that if only you could make a few more safety rules in your plant and be sure of their complete enforcement, it would be easy to produce a zero frequency rate every month?

Evidently some safety engineers have believed that rules were the answer to accident prevention. In one rule book, of several years ago, which I have in my office, and which came from one of our great corporations, here are two examples of safety "rules":

"Short cuts must not be taken over dangerous places where other ways are available."

And another example from the same course this being their rule No. 4007:

"Employees must look in each direction before stepping upon, crossing or standing too close to tracks."

This one, from one of our safety rule books originating in one of our plants several years ago, reads:

"Do not work with tacks in your shoes."

It is evident that the thinking about what a safety rule should do has varied quite a bit in the past. The need for rules is governed by different conditions under which accidents could occur. One of these conditions is the intelligence level of the employees with whom you are dealing. For example, a different approach is necessary for the staff of a laboratory doing research than for employees doing underground mining.

The degree and kind of hazard encountered will also affect the number and kind of safety rules that are used. For example, the manufacture of very fine metallic powders can usually be done with safety only when a complete and rigidly enforced set of specific rules of procedure is in effect. No such set of rules is necessary for general office employees, however.

We would all probably be happy to get along with safety instructions rather than safety rules, but sometimes just plain instructions, no matter how carefully given, do not seem to be quite enough to insure getting the idea across. So we make our instructions more forceful and perhaps call them "rules" and in addition, there is usually a penalty attached for their violation. It is the penalty, apparently, which makes a "rule" out of the instruction by making it painful or costly for the employee to forget or neglect it, all this of course, assuming that he can be caught if he does not obey the rule, and assuming that the penalty will actually be assessed.

It is these two "ifs" that really cause this entire subject to be discussed here at this safety congress. If we could always catch those who violate our safety rules and if they were always punished in accordance with the penalties prescribed in the rules, the problem would be greatly different, and so would the entire profession of safety engineering. Since this matter of enforcement is to be discussed in a later part of this program, I shall not touch on it now.

I would like to discuss further, however, the matter of safety rules and how they apply to human behavior. Have you ever violated a speed law or parked in a no parking zone? Have you ever smoked under a sign reading "No Smoking"? I shall not ask for a showing of hands—I merely ask that each of you examine your own conscience in this matter.

Our daily lives are circumscribed by such a mass of rules, laws and regulations, both written and unwritten, that it is doubtful if any of us can pursue our ways of ordinary daily existence without breaking some law everyday, either knowingly or unknowingly. It is said of one of our fifty states that there is a law on the books which was designed to prevent train wrecks where one set of tracks crosses another. When two trains meet at such a crossroad, the law prohibits either train from moving until the other shall have moved on!

We almost seem to be at such a crossroads and facing such a deadlock in some of the safety programs which are in effect today. With a large number of rules, trying to control human behavior, the inevitable result has occurred: We build up more and

more resentment against rules as they are put into effect, and finally we try the natural escape of disregarding those which we can without getting caught.

In accident prevention, the use of too many safety rules is the use of a crutch and a substitute for something that takes more ability and ingenuity—instruction and training. Teaching, convincing, demonstrating and selling of safety to employees is as yet the best known way of securing from them the kinds of reactions wanted when the emergency arises, or when a non-routine situation develops. It is my belief that there is no good substitute for teaching employees that their own safety is largely their own responsibility.

There are some situations, of course, in which the needed instructions must be so emphatic and positive that they should probably be called rules and have penalties attached. These are few in number, probably

less than ten altogether and they apply mostly to special situations.

On the sturdy and reliable DC-3 airplane there are 15 items on the "check-list" which the pilot and co-pilot must check together before takeoff. On the new all-jet DC-8 there are 76 of these items! You may call them rules if you wish or just safety precautions, but few of us would want to see the list decreased in either airplane.

The real trick then comes in knowing how to make your plan secure the results you want from, by the use of the fewest possible "rules" rather than by the opposite course of trying to formulate a new rule for each new hazard as it causes an accident or each newly found unsafe act of an employee. The safety engineer who is unable to make safety effective in his plant may be the same safety engineer who is relying too heavily on a long list of "don'ts"—with penalties.

ACHIEVING AND MAINTAINING RESPECT FOR COMPANY RULES

By JAMES F. VAN NAMEE
Administrator, Accident Prevention Services
Westinghouse Electric Corp., Pittsburgh, Pa.

There are many things which require serious consideration if a business is to be operated successfully. The management of safety is one of the most important of these items, along with cost and quality.

We in Westinghouse recognize that the safety and well-being of our employees is dependent upon the degree to which the prevention of accidents is aggressively pursued. Success in accomplishing this has an important effect upon the ability of our workers to perform efficiently while on the job.

Among the many features essential to optimum safety performance is the establishment and application of practical and enforceable safety rules. The rules and regulations that govern orderly conduct in a factory do not differ materially from those imposed by society in general. They

are merely adapted to the needs of a particular situation.

The word "rule"—as we use it in the term safety rule—is defined by Webster as "the usual method or way of doing something; as, it is the rule to rise at seven."

As stated previously, rules—safety and otherwise—are essential to the orderly conduct of business. Without them we would operate in a state of utter confusion. With them we have a roadmap that can be used to guide us down the highway of orderly and safe operating practices.

In order to generate respect for safety rules—it is essential to recognize that most Americans possess a basic resentment against rules and regulations. They feel that any regulatory mandate infringes too much upon their freedom to satisfy

follow rules, it is impractical to expect that workers will comply.

Generally speaking—any rule that can withstand an honest appraisal of its worth is enforceable and is worthy of respect. The comments made concerning some of the shortcomings of safety rules are intended to point up some of the general areas of fault that contribute to workers having a lack of respect for them. Consequently, if you are finding a general disregard for your plant's rules—may I suggest that you take a hard look at them to see if you find similar symptoms of weakness.

Another important thing is to acquaint employees with the nature of the rules they are required to observe. In short, these guides to action must be sufficiently publicized to make them part of the "working knowledge" of every employee.

While the educational approach will lead to the observance by a large segment of the work force, unfortunately, there is always a small minority that will insist upon violating rules. Thus, where education fails, supervision must be prepared to take proper disciplinary action.

I believe that the following statement—made by Emile F. du Pont of the Du Pont Company—sums up the whole story concerning enforcement of safety rules.

"We believe strongly in the philosophy of preventive safety rather than after-the-fact correction. We place great stress upon safety violations rather than upon injuries as such. We are tough toward willful violators, as we are more interested in eliminating the chance for injury by working safely without violations of good practice than in setting records. Where we are reasonable but firm on violations, a safety consciousness is gradually developed among the entire work force."

This brings us to the all important problem of enforcement and discipline. If rules are to be enforced they must—as has been said before—be clear and known by the employees. They must be fair and undiscriminatory—and they must be uniformly applied—otherwise you may find them contested by union representatives.

The need for acceptance of safety rules by union representatives is mentioned because under the terms of some labor-management contracts a company may find that improper rules can become a basis for the

filing of a grievance—or even arbitration. Two examples will illustrate this point.

A union local in Trenton, New Jersey, filed a grievance against management's newly inaugurated rule which required 100 per cent compliance with an eye protection program. The following statement is taken directly from a report that the union local made to its membership concerning the outcome of action taken on the grievance:

"The 100% eye protection program—the union argued that many areas in the plant did not require safety glasses. Management insisted and have modified their program accordingly. The areas and jobs not required to wear glasses are—purchased parts crib, receiving docks, salvage building, main stock crib, overhead crane operators, steel bay area, yard area, parts checker, tool room, mixer, waste material disposal operations, car washing activity and drivers not working in production areas."

"Management's unilateral promulgation of a safety rule presents an arbitrable grievance."

On a question brought against a company by the Oil, Chemical and Atomic Workers' Union an arbitrator said: "The company had issued a regulation which the union challenged, requiring all employees to wear hard hats and toe guards. The company argued that it had the unquestioned unilateral right to establish reasonable safety regulations—such as those being challenged. The union contended that safety regulations involving special protective devices, which employees were required to wear, constituted conditions of employment for which the union had been recognized as the sole and exclusive bargaining agent. The union held that these were matters for joint consultation between the parties in the first instance and subject to review in the grievance procedure in the event that a job was described and classified in a manner with which the union did not agree. The arbitrator held that although the employer ordinarily has the right to determine for itself rules for protection of employees, there are circumstances in which the union may challenge the imposition of certain types of rules as well as the reasonableness of particular rules and that the union's protest in these cases presented an arbitrable grievance under a contract which defined a grievance as any disagreement between the company and union involving interpretation or alleged violation of contract."

While I do not wish to invade the subject of discipline, there are a few precepts concerning discipline that also may have a bearing on the respect tendered to safety rules. Briefly they are:

First: Disciplinary action under some labor-management contracts may be subject to arbitration. When such is the case—remember that an arbitrator may determine whether there was just cause for the discipline, and also whether it was overly severe.

Second: The burden is usually yours to prove that your rulings are proper—and that the penalty given wasn't too severe.

Third: Discipline and discharge are serious matters. Consequently, be sure to have the answers to such questions as: "Did the employee know he was violating a rule?"—"Was his violation intentional?" and "Were previous violations condoned?"

Fourth: Discipline must be the same for bargaining and non-bargaining employees.

From the foregoing discussion, three basic principles emerge as being the basis for creating and maintaining respect for safety rules. They are:

1. The rules themselves must not be at fault.
2. Employees must be educated concerning the needs for the rules—and the benefits to

be derived from compliance with them.

3. When all else fails, enforcement and discipline must be resorted to, but on an equitable basis.

In summarizing this discussion, I would like to stress that:

First—Safety rules are essential to the attainment of both production and safety objectives.

Second—Ways must be found to make employees want to abide by safety rules.

Third—The rules must not be unreasonable or improper—for if they are they won't be respected or accepted by the workers—and without acceptance they are doomed to failure.

THE CONSTRUCTIVE USE OF DISCIPLINE IN SAFETY VIOLATIONS

By STANISH C. RIDDLE

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One of the too many things aggravating the world situation today is the different interpretations applied to identical words by various persons or cultures. I want to consider the term, "constructive discipline," with a common and single interpretation of its meaning and implication.

First, let's look to Webster, who says,

"Construct (verb) 1. To put together the parts of something. To build. 2. To set in order mentally, to arrange."

"Discipline—1. Training (to train). 2. Punishment—(to punish). 3. Orderly Conduct. Synonyms are—educate, teach, chastise and correct."

Second, let's toss out these words and concepts: *punishment, to punish and chastise*. They have no place in our philosophy. We are not running penal institutions! We are operating business organizations where we are attempting to *instruct* our employees to perform their assigned duties to the best of their ability and with the least possible hazard to themselves and their co-workers.

Third, now, let's look at what we have left from Webster's definitions:

1. To put together the parts of something. To build.

2. To set in order mentally.

3. To arrange.

4. To train.

5. Orderly conduct.

6. Educate, teach and correct.

Fourth, from these concepts, let's construct our definition of "Constructive discipline"—to arrange by educating and correcting to motivate our employees to conduct themselves in an orderly fashion, both mentally and physically.

What this means is that we must strive to reach the minds of our employees and move them to conform to the standards of conduct as represented in the Ford Motor Co. safe practices rule books. This is not always an easy matter, for a man is not a simple organism, like some of the lower animals. A man can be very complex.

He is what he has lived. He is what his ancestors have been.

Keeping this in mind, we must consider that, just as no two individuals have identi-

cal fingerprints, so too, no two individuals have identical thinking processes. Because this is true, we must remain very flexible in handling this matter or discipline.

We must keep in mind that the old days when a "straw boss" kept order in his crew by developing the hardest knuckles, the biggest biceps and the loudest mouth, are long gone. Possibly a few cases of straw bosses also developing the widest toothless grins might have had something to do with this. Seriously, though, we do not believe that physical or severe mental or emotional force has any real place in today's application of corrective discipline to industrial employees.

The concept of discipline at the Ford Motor Co. is that it must be *corrective*. This concept also dictates that only as much corrective action be applied as is necessary to result in the desired correction. In other words, it is the expressed philosophy that all personal feelings be divorced from the case and only the *facts* are to be considered. This is what we mean by the term, "constructive discipline." Discipline that is *constructive* through reasonable and fair *correction*.

We do not mean to imply by what we have said up to this point that we do not want our supervisors to maintain control over their employees. To the contrary, it is insisted that they do. It is insisted that they be firm. Point No. 6 of the 14-point Ford Motor Co. Safety Program states, "Maintain firm plant discipline." Please distinguish between firm and harsh. These two words are poles apart in our philosophy.

As a matter of fact, if you think of it in the right light, being firm and insisting on strict adherence to the requirements of safety rules is actually being kind to an employee. Being kind to him to the extent that you force him to avoid having an accident. He may not appreciate your kindness in applying corrective discipline when it is merited. It is, nevertheless, kindness of the first water.

Speaking of the 14-point Ford Safety Program, points No. 4 and 5 are also worthy of note here. "Sell safety to the new employee," and "Re-sell safety repeatedly." It might appear that there is a discrepancy of terms here. Is there really a conflict

between "selling" an idea and using "discipline?" We think not. Remember what Webster says? Discipline is education. Selling, too, is education. Therefore, Selling is a form of discipline.

Regardless of what we call it, or how we define it, it means nothing unless it is applied.

I am reminded of a story I read sometime ago in a magazine. The story told of a rather large company that had been experiencing numerous serious accidents and injuries to employees with an ever-increasing frequency. According to the story, this went on for several years. (Hard to believe, but that is the story.) Numerous meetings to find causes and remedies were held but always wound up with someone saying that they hoped the "bad luck" would make a turn for the good, soon.

Finally it got to the point that someone at the top decided to bring the thing to a head. He called the managers of the various departments together and told them that it was up to them to find ways of controlling the situation or he would find someone who could. Rather drastic but a very effective form of discipline.

It turned out to be very constructive, as well. The top man's ultimatum finally made them realize that, far from their running the organization, the organization had actually been running them! Finally jolted out of their false sense of job security, each manager passed the jolt on to his subordinate supervisors. Each man was told to tender his resignation right then if he didn't think he could stop his employees from injuring themselves.

"Wow! The bosses are really mad now," they all thought, as they started scratching heads in search of ideas. It didn't take much scratching to come up with the idea of opening the safety rule books that for so many years had lain uncopied in the desk drawers. One after another got the bright idea of starting to insist that the rules must be adhered to.

There were no changes in normal work procedures, no supervisors lost their jobs. The supervisors just started to supervise within the framework which already existed in the organization. The foreman started to be the "boss" and exercised his almost forgotten responsibility to discipline

employees who violated the rules. Accidents fell off sharply and other benefits were also realized. Morale was strikingly improved, absenteeism decreased and not too surprisingly, there was also a significant increase in productivity.

Let's go back again to Webster. Remember—he says that discipline also means "to teach." Ford Motor Co. accepts this meaning wholeheartedly and considers the teaching and training of its employees to be one of its most important functions. Sure, we realize that our prime function and reason for existence is to serve our customers with a top quality product at a price they are willing to pay.

But, to do this we must have a *trained, disciplined* work force, at all levels of the organization. For the purpose of this discussion, however, we are considering only how this policy affects our program to prevent accidents, with particular emphasis on the enforcement of safety rules.

In order for established safety rules to have any meaning, it is a prerequisite that the persons to whom they are to apply, have a thorough knowledge of their context and meaning. This is accomplished through a very thorough system of training for both supervisors and hourly employees.

These training techniques take many forms, and include:

1. A six months training period for new supervisors.
2. One-hour weekly training meetings with required attendance by all supervisors.
3. Frequent contacts between supervisors and plant safety engineers.
4. Wide distribution of safety rule booklets, to both supervisors and hourly employees.
5. Requirement that all supervisors of hourly employees hold weekly safety talks with their employees.
6. Indoctrination program for new employees which requires that the supervisor go over pertinent safety rules with the new man to insure he understands them. A check sheet and card which the employee signs must be returned to the safety office for each new employee.

But that is enough of detail. I think

you have the idea that the Ford Motor Co. has an excellent training program and does a good job of educating its employees on how to do a good job safely. We have given our employees the knowledge, now we must see to it that they use that knowledge to the best advantage—to the advantage that employees will not suffer accidents and injury from someone's disregard of safe practices established and spelled out in the rule books.

Let us take a quick look at how "constructive discipline" of a progressive nature works in cases which demonstrate the principles we have been discussing.

First, consider a simple theoretical case. Suppose that one of the plant safety engineers observed an employee working at a machine while he was not wearing his safety glasses, as is required of all Ford Motor Co. employees. The safety engineer contacted the employee's foreman and verbally informed him that the employee was exposing himself to the hazard of a potential eye injury.

Thereupon the foreman, knowing the employee has just returned from lunch and merely has forgotten to put safety glasses back on, approached the man and reminded him to do so. The man, being a cooperative individual, did so, with thanks to the foreman for reminding him. (This man knows which side of his bread has the butter).

This man required very little correction since he realized that the eye protection rule was for his benefit. Just a word of caution was all the discipline (motivating education and correction) that was needed in this case and that was all that was applied. Mission accomplished!

Let us now consider a little more complicated and still theoretical case. Again, the plant safety engineer reported a worker, not wearing the prescribed eye protection, to his foreman. This individual was resentful and expressed himself bluntly, indicating he did not want to comply with the rule requiring him to wear safety glasses.

In this case the foreman realized that positive action was needed to change this individual's thinking. The foreman, therefore, called the man into the department office and, explained to the employee that the Ford Motor Co. safety rule requiring all employees to wear approved types of

eye protection was established to prevent serious eye injuries, himself included.

The man was then informed that because his record did not show any previous citation for rule violations the disciplinary action report resulting from this case would show that he had merely been given a reprimand and warning without the loss of any time. The warning indicated that he had been informed that any subsequent violations of the rules might result in increased corrective action on a progressive scale.

Here again, the case was dispositioned with only enough "constructive discipline" to arrive at the desired correction of the employee's attitude and performance.

This program of scaled action to fit the case is carried out through the whole range of cases which might occur. Each succeeding time that it is necessary to apply disciplinary action to an individual employee, his previous record is taken into consideration. In those cases where it is clearly evident that the previous actions have not resulted in the expected improvement in the employee's attitude and behavior, additional motivation is applied, each step being progressively more severe.

In a few very serious cases, the end result may finally be a discharge. I am glad to be able to say that very few cases go to this extreme. The lack of extreme cases indicates that the system of progressive actions takes hold and does the job somewhere along the line before the final stage is reached.

Since a disciplinary penalty is imposed solely to obtain improvement of future behavior, follow-up is important in determining whether it has been effective, or whether further action is necessary.

Up to the present time we have dwelt extensively on the techniques utilized in the "constructive use of discipline in safety violations." Now, let's give a little consideration to the end results of such actions. This is the meat on the menu. This is the payoff. While we do not, by any means, give our company program of "constructive discipline" the whole credit, we are sure that it played a very important part of the recent accomplishment of the Cleveland Foundry of the Ford Motor Co. in establishing a new all-time National Gray Iron

Foundry Best Record of 3,421,133 man-hours of exposure without a disabling injury.

We also are sure that this technique of using discipline for *corrective* purposes played an important part in the record of our two Cleveland engine plants. These two plants have, within the span of less than ten years, posted periods of over 3,000,000 man-hours of exposure without disabling injury on *several* separate occasions.

The use of "constructive discipline" can never be the answer to all problems. It can, however, help in the efforts to create a *safety awareness* in our employees which we all are striving for. Safety awareness? Now there is a term I like! Turn that over on the tongue of your mind for a minute! Get the taste of it? Let me give you an example.

Recently, while I was walking through an aisle in our foundry at Cleveland, an hourly man walking in the same direction but some distance ahead, noticed a small length of pipe lying in the aisle where it had apparently fallen from a passing scrap truck. The man, with scarcely a pause, stooped down, picked up the pipe and tossed it into another scrap truck and continued on his way. It was done in such a casual manner it appeared to be an act of habit.

That is what we want! We want safety so ingrained in our employees that they exhibit similar thoughtfulness in all their actions. Thoughtfulness that is a *habit*! And there is no contradiction of terms in *this* instance.

Here was living proof of the "safety awareness" we are striving for. Here was evidence of one of the factors which helped the foundry set a new record, helped the foundry exceed the old record, which had stood for five years, by a margin of well over 300,000 hours. Here was evidence that, properly motivated, employees can be moved to consider the "other fellow's" welfare as well as their own.

This man's action may well have prevented the next man coming along from taking a bad spill. Such patterns of thought can cause a man who, in the past, had been guilty of leaving a guard off a machine, to now pause to replace it upon completion of his job. Development of such *safe* work habits can truly make a man become, almost unconsciously, his "brother's keeper."

We do not know whether this man had ever had occasion to have "constructive discipline" applied to him. We have no way of determining since the man was not identified. We like to think, however, that this is the sort of attitude which can be developed by the technique of applying discipline in a corrective sense, rather than in a punitive sense.

You all know what happens when you push a pendulum. You give it a push and it swings right back at you. If you give a man a push he also has the same reaction; he has a tendency to take a swing at you in return, in one way or another. It is our thinking at Ford that much more can be accomplished by *leading* a man onto the right road by correcting his errors in a constructive manner. This leading, nevertheless, must be firm to avoid being misunderstood as weakness.

Someone says, "Nuts! There are some guys you can't reach with anything but a big club and a size 14 boot." There may be some truth in this statement, but, (and that is a *big* but) these cases are few and far between and we should not fall into the trap of accepting this as a dump for all of our problem children. It costs money, a *lot* of money, to train employees to perform today's complex jobs. It costs money, a *lot* of money, to have our employees suffer industrial injuries.

It is our job to save our employers from the unnecessary expense of discharging errant employees. It is *also* our job to save our employers from the unnecessary expense

of accidental injury. It is even more our job to discharge our moral responsibility of preventing the human misery to the employee and his family which invariably results when the bread-winner is laid low because he or his fellow-employee failed to heed the safety rules.

In nearing the conclusion of this discussion, let us remember that the old days of the woodshed as a symbol of discipline are gone and past. More enlightened thinking and the teaching of experience has opened a better door. A wider portal with brighter vistas; "constructive discipline," based on correction, not punishment.

It is a prime tenet of psychology that the human animal has a greater tendency to remember pleasure than pain. How many of you can remember the occasions on which your Ma or Pa beat the bejabbers out of your little hind-end? I'll bet not one of you can, or, at most very faintly. On the other hand, I'll also wager that many of you can still clearly remember the old swimming hole, how much fun you used to have at the County Fair or many other pleasures of your childhood.

Not that we mean to imply that applying even "constructive discipline" to our employees will be a pleasure to them. Rather, we should attempt to remove as much of the pain as possible from our corrective action to lessen the tendency to forget unpleasant experiences. *Educate, teach, correct* that's the ticket. Punishment for punishment's sake belongs to the Dark Ages.

SAFE APPLICATION OF ELECTRIC CONTROLS ON MACHINE TOOLS

By F. C. PEREGOY

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By definition, machine tools include all power-driven equipment performing cold-working of metal by progressively removing metal in the form of chips. The National Association of Machine Tool Builders has classified some 200 types of machine tools under five basic functions—turning, boring, milling, planing and grinding.

Authorities agree that injuries from machine operation are likely to be more severe than injuries from other causes; and more likely to result in permanent disability. For example, Accident Facts shows machinery to be the source of 10 per cent of all injuries, but the source of 19 per cent of permanent disabilities.

Material in reference books emphasizes that although many machine injuries result from lack of proper guards, the majority have their sources in unsafe practices; and that, therefore, is the area requiring concentrated attention.

Safe working procedures—operation, adjustment and repair of machines only by trained personnel, and supervisory responsibility for enforcement of established policies—are the weighted important factors in such reviews.

Other literature, stressing the soundness of correcting unsafe conditions first, provides lists of safeguards, such as drill vises, spring-loaded chuck wrenches, chip shields, tool guards, stock tubes, enclosed tanks for cutting-compounds, pinch-point guards, enclosures and ventilation.

However, it is most difficult to find informative material on the subject of providing protection against machine-tool injuries through use of adequate electrical controls. Although progress has been made through the years in the development of machine tool safety, the incidence of high severity in injuries dictates the need for closer examination of the problem. Perhaps there is no better place to start than to consider the feasibility of applying electrical controls for more efficiency and greater safety.

To prepare this article, many technical publications were reviewed. Although they covered the techniques of manufacturing without mentioning safety, safety is inherent in their operation because the operator is removed from the danger point. While safety handbooks serve their purpose adequately, there is an ancillary field ready to be explored: the field of technical publications on programming for machine control.

However, certain control methods developed in recent years mark beginnings in this direction. One of these is programming and control of machine tools by means of magnetic tapes.

Manual control of a machine tool means that both the tool and the operator are subject to physical limitations and to human

error—in interpretation of prints, in setup, in process of operation, in misjudgment of distances, in adjustment to light changes; and to other variables. Such problems repeat themselves for each run.

However, with the use of tape controls, decisions and checks are made at the time the tape is prepared. And so, errors and scrap go down; there is no fatigue problem; lead time is reduced; tooling is simplified; manufacturing time is cut. Such control permits infinitely repeatable precise machine operation, besides providing the optimum in personal safety. Manufacturing cost savings more than pay for the system: even one-shot parts are accurately and economically produced with such controls.

Additional accomplishments include the introduction of contactors to replace switches; the use of volt-meters and indicator lights for machine control; load meters and overload devices.

There is still a problem, that of a high incidence of permanent disabilities. Much effort has been devoted to mechanical guarding and safe procedures. Striving to improve machine tool safety, we must realize the limits of the past approach and the room for human error.

In an age when hospitals can wire patients to record pulse, respiration, blood pressure, temperature and heart action, cannot the individual safety engineer and organized safety groups probe more deeply into modern technology and demand a wider application to machine tool control?

References

Material was developed for the foregoing article by reference to such volumes as the National Safety Council Accident Prevention Manual and Accident Facts; Joint Industry Conference Electrical Standards Machinery (Monthly magazine of engineering and production); the National Electrical Code and its companion Handbook. Also manufacturers' descriptive literature including: Westinghouse Freese and Cysak Controls; Tripco Company catalog of safety switches; Security Controls, Inc. Bulletin 600.

Acknowledged is the cooperation of W. R. Blewett and E. Roberts, Safety and Manufacturing Engineering and Tooling Departments, Air Arm Division, Westinghouse Electric Corporation.

THE ASA DISABLING INJURY FREQUENCY RATE IS A GOOD MEASURE OF SAFETY PERFORMANCE

By E. R. WALLACE

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Shortly after World War I, the U. S. Bureau of Labor Statistics published Bulletin 276, "Standardization of Industrial Accident Statistics." A revision of this bulletin was requested by a resolution adopted at a National Conference on Industrial Accident Prevention in Washington in 1926. The resolution requested that the American Engineering Standards Committee, which is now the ASA, undertake this revision by means of a sectional committee. A sectional committee was organized and on it were representatives of the various national associations concerned with safety, as well as representatives of many other international and national organizations, including insurance companies, petroleum groups, steel groups, metal groups, departments of labor, accident commissions and various departments of the U. S. Government, as well as many state agencies. Other industrial groups were represented as well.

As a result of the work of this committee, the ASA Standard Z-16 was developed and was originally approved in 1941.

Prior to this time, there were many suggested methods of compiling accident statistics for use by the safety engineer. The one common denominator that has held true through the years is the method for calculating frequency of industrial accidents which, even though we all know it well, I am going to quote for you:

"Frequency is the number of disabling injuries times a million divided by the employee hours of exposure."

There is hardly a safety engineer, inspector or even neophyte who cannot quote the formula for frequency.

Since the establishment of the ASA Standard Z-16, many other methods of compiling accident statistics have been developed by one company or another. Most of us in safety have tried to evaluate these

other methods in an attempt to determine values from them which might better serve our needs in accident prevention work. However, we have found that our comparisons are made to the established standard with which we are all so thoroughly familiar.

The main point of contention and the main point of discussion in any appraisal of accident statistics in relation to the Z-16 code are that of the determination of what a disabling injury is.

"A disabling injury is a work injury which results in death, permanent disability, permanent partial disability, or temporary total disability." (The definitions of disability are found in Section 1.2, Page 6, Z-16.1)

If one is to use accident statistics as a basis for winning contests, for creating a pseudo-safe atmosphere among the employees and management, or to prove on paper that their organization has a better safety program than someone else, it might be possible to interpret the ASA Z-16 code definition of disabling injury in such a way as to give a frequency rate which can accomplish all the previously-mentioned points.

However, if the Z-16 code is used as a good measure of safety performance by an industry and the safety organization, and if the evaluations of their injuries are made on a basis which, I am sure, the original ASA Committee felt was just and honest, the Z-16 code could become an effective tool in accident prevention work.

There are many safety engineers who feel that, because they have been associated with their industry and the accidents therein for a number of years, they can make an instant appraisal of those places where the greatest effort in safety should be placed. This may be true; however, I recall sitting with a safety engineer of a large chemical industry not too long ago who, with a certain degree

of amazement, asked, "How come in a chemical industry we have more finger injuries than we have chemical injuries?"

If this question is an indication of what is going on in the minds of many safety engineers, it appears that some of us are not using our statistical analysis to its best advantage.

The beauty of a standard such as Z-16 is that comparisons can be made by the segments of an industry, even though those segments may vary in employee population from four or five men to units of several thousand. This type of comparison can be shown on a chart.

Such a chart, for departments of a large industry which vary in size from approximately 30 men to approximately 2500 might show department "C" as having a very high frequency rate in the year 1959 and an extremely low frequency rate in the year 1960-61, the other departments having slight variations over a three-year period.

As an example of the effectiveness of the Z-16 code as a measure of safety performance, I am going to tell you something about department "C."

It is a chemical manufacturing area of a little over 200 employees. It makes proprietary mixes of both dry and liquid chemicals; it fills, packages, blends, mixes, receives, ships and does everything else a normal manufacturing plant does, including its own maintenance. In 1959, the frequency rate took a bounce upward; the severity rate traveled up as well. As a result of the statistical analysis made in accordance with the ASA Code, it was readily determined that this area was one in which concentrated efforts should be put by the safety engineer responsible for the area. Such concentrated effort was put to use within the department, using the statistical information as a criteria for discussion with top management. It was established that economically, as well as from a humanitarian standpoint, increased safety emphasis must be placed.

In previous years when the frequency rate had risen, attempts had been made to sell management on the fact that increased emphasis should be placed on safety; however, because we did not have the statistical backing to be able to show economic justification, because we were unable to prove

production loss, because we were unable to show the potential of increased production with an adequate safety program, we had no more than token safety emphasis within the department.

Today, however, the picture is completely reversed. The management is aware of their accident record; they are jealous of that record; they are not using the record in any other way than to increase the morale of the employees within the department; they are concerned with the maintenance of the record on the basis on which it was established. They know that disabling injuries included in their frequency rates are evaluated on the true and honest basis as established by the ASA Code; they know that lost time is calculated as established with the Z-16 code and so in the employees; and, this is an important point. In order to use effectively the statistical information of a code such as the Z-16, it is important that the personnel within the department or industry be advised as to what the statistics mean.

Department "D" is a department of approximately the same number of employees. This department, over a period of six years, has maintained a notoriously bad accident record.

It follows without saying that, under conditions such as these, this is the next place where greater emphasis shall be placed on safety performance, philosophy, safety engineering, and last, but not least, accident prevention.

To set an entire safety program on the compiling of statistical information alone and to feel that job is done is a rare, ineffective way of preventing accidents; however, in order to utilize the Z-16 code as a measure of performance, one must evaluate the criteria for determining disabling injuries — must evaluate with the greatest degree of honesty and then, following the analysis, must establish an accident prevention program in keeping with the facts which can be found. In doing this, a safety engineer cannot only utilize his current figures, but he can also pull from his records his accident reports, of years past, evaluate these on the same standard basis, and show by a chart, by graph, or by any other known statistical means, the trends over a period of years. If this is done, and

the standard becomes established as a useful tool, then performance can be measured and measured well.

In two departments where the records have been maintained according to ASA Standards over a period of six years, it is easy to see those places where safety programs were instituted, where safety engineering was effectively utilized; where changes in safety philosophy on the part of personnel are apparent. Such information in the hands of your boss can be a second measure of safety performance—your safety performance. I am sure that every safety engineer in this room is responsible to management for the reduction of accidents within his industry. Management measures safety performance on the basis of the facts that we give them as well as on the basis of compensation costs with which they are already too familiar. In order to establish our effectiveness as a member of the management team doing our job in the prevention of accidents, we must have established criteria for reporting to them our day-to-day, week-to-week, and year-to-year progress in the prevention of accidents. The ASA Codes, of which there are many, have long since been established in the minds of management as the basis for evaluation of their position with others in the manufacturing business or the evaluation of types of material, of procedures and practices, the purchase of supplies, and other miscellaneous parts of the business world.

It seems logical to have to present to management in language that they understand and know, reports of performance on the basis of long-established standards which have stood the test of time.

There are those who feel that in order to maintain active interests or, in order to show improvement to management or to their employees, that it is necessary to change our methods of recording and compiling statistics. This may be necessary in some cases; however, change or modification of a standard statistical system can result in a false sense of security perhaps, in confusion on the part of the employees, and management as well and can result in no permanent gain.

Some years ago, an industry with which I am very familiar, established a statistical procedure for reporting injury experience

which was somewhat different from the ASA Standard. This method used weighting factors for average number of employees, for types of injuries, for practically everything under the sun. The reports were somewhat unwieldy to prepare; the interpretation of those reports was practically impossible for anyone less than a statistician. Because in each case, in order to obtain full evaluation of the statistical evidence, one would constantly be required to refer to the weighting factors. The employees could not understand the new system; however, they were favorably impressed in the first months or so because the charts prepared from this statistical evidence with those weighting factors were able to show an improving line on the graph almost constantly. The accident reports of this industry were analyzed according to the basis of the ASA Z-16 Code, and some startling information resulted. It showed that, by eliminating the factors, both frequency and severity fluctuated greatly over the period checked. It showed that their record was not the constantly improving record, and it showed that there was need of more than a new system chart to improve the safety of that industry.

Arthur P. Johnson, Vice President in charge of Engineering, American Mutual Liability and Insurance Company, in the May, 1961 issue of "Standards Magazine," published by ASA very appropriately summarizes my comments:

"Statistically, the total picture is much improved; however, fatalities and serious injuries are continuing as a result of accidents in which physical factors have not been brought up to a safe standard. This is of serious concern to employers as well as to employees. More and more, third-party suits for very high damages, alleging negligence by failure to make the operation safe, are being filed following industrial injuries. In these cases, evidence of failure to comply with codes and standards can be very damaging. Accident prevention, it should be remembered, is a process of management aimed to prevent recurrence of accidents. It is urged that management use standards, especially American Safety Standards, as criteria for the safe control of work environment and operations."

The ASA Disabling Frequency Rate is

a good measure of safety performance; the employees can understand it; management can understand it because it is the kind of information with which they are most familiar; the safety engineer can understand it because it establishes standards and limitations which, if used properly, can be the greatest assistance to him in his accident prevention work.

In order to play the game "according to Hoyle," we must have these standards. Deviation from the standard makes a new game.

Z-16.1 is no longer a research project. It is a regular code for day-to-day safety evaluation—for active safety engineers.

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A MORE DYNAMIC APPROACH TO THE PREVENTION OF BACK INJURIES IN AN INDUSTRIAL ENVIRONMENT

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Under this "wastebasket" term—the sore back—fall many common medical diagnoses and fancy National Safety Council classifications. Mark Twain's remark that, "Everybody talks about the weather and nobody does anything about it," might seem to apply to this sore back problem. However, as we know, this is not entirely true. In the field of medicine there is not a single large medical meeting presented anywhere without at least one discussion centering around the mechanisms and treatment of back complaints.

It is safe to say that almost everyone in this room has had a sore back. For reasons of understanding, let us define some terms so that we will be better able to understand each other. First, the disabilities in the back—with concern to safety people—can most simply be divided into two classes:

- (1) Those due to injury.
- (2) Those due to injury.

Those conditions due to injury we speak of as sprains, strains, bruises of ligaments, muscles, and joints. Those not due to injury can be wear and tear of age, or perhaps inflammation of muscles or tendons, best known as rheumatism.

From a safety man's standpoint, I think

it would be important to classify back complaint, emphasizing four points:

1. There should be some accident or some unforeseen event which suddenly occurs or produces a definite sprain, strain, or other recognizable injury. For example, a bruise.
2. Such an accident should lead to an immediate, or almost immediate interruption of the ability of the back to perform its usual work.
3. A thorough examination of the back would reveal some sign, or demonstrate some functional disturbance.
4. This disturbance should bear a logical connection to the accident or event as reported.

The term *strain* indicates stress greater than that which the supporting elements of the back are normally able to withstand. The fleshy tissues of the back are endowed with strength, elasticity, and vigor according to the development of each individual. When an abnormal stress is applied, whether suddenly or slowly, and the tissues are stretched beyond their normal resistance, this gives rise to pain, soreness, and disability.

Again, from a safety man's standpoint, occupational back strain as a result of fatigue is not usually classified as an injury.

However, as a medical entity, it is frequently seen and recognized.

When we refer to *chronic strain* we mean that an abnormal state has existed longer than the time estimated for the usual repair of the damage to the back. The word *strain* is a term applied when a joint has suddenly been twisted or wrenched and the ligaments around this joint have become torn or separated. Sprains are a more serious condition than strains, and the disability and time for improvement are much longer.

One of the most popular diagnoses made today is the rupture or protrusion of the intervertebral disc. This simply means that for some reason the padding between the bodies of the vertebra is pushed out of its normal position, causing some pressure upon the nerve roots. When this happens, there is pain, muscle spasm, and notable disability. Treatment for this condition is long-termed and quite involved.

Another perplexing term that we come upon in the medical discussion of the back is the *lumbosacral instability*, which in most practical terms means that there is a weakness in the cornerstones and/or the cement of the cornerstones of the base of the back. This leads to chronic soreness, weakness, and subsequent disability.

Most medical forms of treatment for back conditions are directed toward one end—that is, to allow the body to repair itself. This is done by restriction of the use of the back, medication, rest, and support.

In our location, our experience can be divided into three phases:

1. First, we were offered an unprecedented opportunity, by the building and opening of a new plant, to observe, examine, and collect data on the physical work required for a perplexing variety of jobs. Not only the physical work required for the job, but, more importantly, how the man on the job was actually performing this work. Observation such as this can be made only one way, and that is to see it firsthand; not once for two minutes, but repeatedly at varying intervals.

2. Second phase: the Medical Department collected patients, while the Safety Department collected the case histories of back accidents. Our data and observation

were sorted and studied. Engineering methods were used to devise improvements in the mechanics of the job. Patients with back complaints were instructed individually on proper back care and advised to tell others of their painful experiences.

These first two phases are completed, and we have learned much from working through them.

In a third phase, prevention, strong emphasis must be placed on education and group participation; the effects of which will reach beyond the plant and work situation.

In an attempt to bring all the medical information and experience into focus under one study, the medical department did what was called "The Statistical Evaluation of 215 Back Cases in the Medical Department, Oct. 1957—April 1960."

TABLE I

Total number industrial cases.....	130
Total number non-industrial cases.....	108
33 per cent industrial back injury	
44 per cent non-industrial back injury	
61 cases filed for Workmen's Compensation	

We see of the 215 people followed, approximately half were industrial injuries; the remainder occurred outside work. Of the 130 people who reported that they injured their back while at work, 61 (or less than half) were filed on through Workmen's Compensation.

It is important to remember, we were able to take care of more than half of the industrial injuries in the first aid area, using simple treatment measures. We will say a great deal more about the fact that half of our number of cases were injured outside the plant.

By listing the 10 departments having the largest number of cases, a finger is pointed to sore spots.

TABLE II

Ten Departments Having Greatest Number of Cases	
1. Dept. 108	11 (Assembly)
2. Dept. 102	10 (Machining)
3. Dept. 103	10 (Machining)
4. Dept. 104	8 (Machining)
5. Dept. 113	7 (Assembly)
6. Dept. 105	6 (Assembly)
7. Dept. 106	5 (Machining)
8. Dept. 110	5 (Machining)
9. Dept. 107	5 (Machining)
10. Dept. 101	5 (Assembly)
Totals	
Assembly	29
Machining	42
	71

In our pre-employment examination we ask the question in writing, and then again during the examination, "Have you ever experienced a sore back?" If the answer is yes, we ask, "Has this been severe enough to restrict your work activities?" Regardless of the answer, these people have been hired.

More recently, we have been asked these questions: Do people who have told you, at the time of pre-employment examination, that they have already experienced back trouble often have recurrences? How severe will their recurrences be? Will they demand jobs that are of a restrictive nature?

TABLE III
Comparison of employees who gave history of back trouble prior to employment as compared with those now having permanent physical (Class II) restrictions.

Previous history	57
Permanently restricted	10

When we compare the employees who gave us a history of back trouble with the total number who have permanent physical restrictions, we see that out of the 235 cases, 26 people are permanently restricted Class II.

Of these 235 cases, 57 people said that they had had back trouble. Of this 57 people, 10 people are permanently restricted (Class II)—that is 1 in 5.

TABLE IV
Comparison between those having previous history of back trouble prior to employment as compared with workmen's compensation cases.

Previous history	57
Total number compensation cases due to back complaint	61
Previous history and compensation	13 (21 per cent)

In this table, if we compare those having a previous history of back trouble, prior to employment, with workmen's compensation cases, we note: Those giving previous history were 57. Total number of compensation cases was 61. Those giving a previous history and becoming compensation cases later in employment were 13 (or 21 per cent).

I think it is logical to say that people with past history did substantially contribute: (1) to permanent restrictions—1 in 5, (2) to compensation cases—1 in 4.

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TABLE V
How Long For Common Conditions

Average length of treatment for muscle strain	11.6 days
Average length of treatment for lumbosacral strain	21.9 days
Average length of treatment for disc (surgical)	106.4 days
Average length of treatment for disc (medical)	36.5 days

In this table you will see the average length of treatment of muscle strain, or lumbosacral strain, of disc disease that demanded surgery, and of disc disease treated medically.

A disc that will require surgery can return to some type of productive labor in three months, providing rehabilitation happens to be popular in your plant. If the disc seems to respond to conservative measures (that is, without surgery), you can get him back in two months.

TABLE VI
Warning of a Pitfall

Time for recovery of workmen's compensation cases cannot be compared with industrial back injuries not compensated, nor with non-industrial back injuries, because of the factor of severity. Those patients having the most severe, complicated, and protracted back injuries are filed on under Workmen's Compensation. The more simple, uncomplicated back injuries receive routine supportive treatment in the plant first aid and are not filed on. No comparison should be attempted.

At first glance, I thought we could compare workmen's compensation cases with home injuries, and draw some conclusions. Safety people, management people, and now medical people must be concerned with the amount of money spent on compensation cases, and the time required for recovery of compensation cases. The time for recovery for workmen's compensation cases cannot be compared with industrial back injuries not compensated, nor with non-industrial back injuries, because of the factors of severity.

Earlier, in the tables, we called your attention to the fact that we filed on less than half of those people who had industrial back injuries—that is, we filed on the severe ones. We took care of the ones that were not severe and would clear up in a logical time anyway. So, those patients having the most severe, complicated, and protracted back injuries were filed on under Workmen's Compensation. The more simple, uncomplicated back injuries received routine supportive treatment in the plant

first aid and were not filed on. No comparison should be attempted.

TABLE VII
Average Length of Treatment of Compensation Cases

Muscle strain	21.6 days
Disc	75.3 days
Lumbosacral strain	31.6 days

TABLE VIII
Average Length of Treatment of Industrial Back Injuries Not Compensation

Muscle strain	7.1 days
Disc	5.8 days
Lumbosacral strain	10.9 days

This table we present as a composite of facts (another warning of a pitfall) and not as a comparison: The length of treatment of compensation cases varies for muscle strain, disc, and lumbosacral strain, also for the average length of treatment for industrial back injuries not compensated. This may give us a picture, or perhaps an index of severity.

TABLE VIII
Back Cases 1960 Recurrent

Industrial	19
Compensation filed	15
No compensation filed	4
Non-industrial	26
	47

Now to be up-to-date, let us briefly review our experiences of 1960. Recurrent refers to some of our old buddies who have been re-injured and need further treatment at our gentle hands. Please note that industrial is now 19 and non-industrial 26.

From experience and from analysis, I have come to believe very firmly in the

TABLE IX
New (Acute) Cases

Industrial	49
Compensation filed	29
No compensation	50
Non-industrial	36
	85
Total cases 1960	132
Industrial	68
Non-industrial	64

third phase. You can see from this presentation that half of our back injuries happened in the plant and half away from work. So if we set about and spent all our time correcting all of the conditions in the plant that might cause any back trouble, and if perfection were reached, we would be able to show only 50 per cent improvement. Certainly we should—and we have—through individual training and through improved engineering techniques on the job, attempt to help this 50 per cent.

To achieve real success in the saving of manpower and in the lessening of pain and morbidity, we must have a group collective action. We propose to do this through an educational program of lectures (both medical and safety) and through printed material sent out with the plant newspaper and through management conference. We must train these people in groups, teaching them the mechanism of their back and the care of this system, and doing this in such a way that they will carry it from work and into their lives at home.

This has been the problem, the analysis, and the proposed answer.

SAFETY'S ROLE IN PREVENTING BACK INJURY

by CHARLES W. BOGGS

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One of the fastest-growing clubs in America today is the "Aching Back Club," an organization with millions of reluctant members. Thousands of industrial workers join this club every week by trying to lift subjects too heavy for them or by failing to lift properly. There's no waiting for membership. It takes no longer to qualify than it does to bend over and tie your shoe. Admission is free.

Many safety people are of the opinion that back injuries will occur regardless of what they do, so little is done to eliminate the cause of these injuries. There are causes, though, that can be eliminated. In tackling this problem at our plant, the first thing I did was to make a survey of all our compensable back injuries from January, 1957, through December, 1960. From this survey we found that our assembly

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area accounted for the greatest number and that lifting typewriters from the work bench to the monorail conveyor or vice versa, was our leading cause. The next two leading causes, lifting pans of parts and handling machine fixtures, etc. occurred in our machining area. After reviewing all the facts and figures we decided to concentrate our efforts in these areas.

A typical work station on our assembly line has the work bench and roller conveyor the same height with a monorail conveyor directly above the roller conveyor. The carrier on the monorail is located 45" from the floor. When handling, the typewriter has to be held away from your body with the heavy part (motor area) away from you. There is a reason for this and it was one of the bad things about our original arrangement. To keep the typewriters in proper alignment the operator has to keep the keys away from him when handling.

This type of assembly line has been basically the same since 1950 when our plant was located in Kingston, N. Y. As a result of a study made there by the Liberty Mutual Insurance Co. we lowered the monorail conveyor 3 inches when we set up our new line at Lexington. We also became more conscious of the placement of people in regard to the location of female employees along the line.

You will recall that our leading cause of injury was lifting the typewriter to or from the monorail conveyor.

We found that the main reason for this was that employees were not following good lifting practices, such as waiting for the typewriter to be directly in front of them before removing it, and were not turning their feet, but only their bodies.

Realizing that as long as employees had to lift the typewriter we would continue to have injuries, we took our problem to plant engineering. In the fall of 1960 a "push along line" was installed into one of our three assembly lines. This initial installation was put in an area where most of our back injuries were occurring. We haven't had a compensable back injury in this area since the installation of the new line.

In January of 1960 we came out with a new model typewriter called the Model C. We were soon having injuries at our cover

operation where the typewriter had to be lifted twice; once to put the cover on and then again to be put back on the pallet after the cover was installed. Because of the design of the new cover it was hard to get a firm grip on the typewriter when lifting it back on the pallet.

As a result of a suggestion submitted by an employee performing this operation the pallet used to transport the typewriter on the roller conveyor was changed and locating stops were installed on the bench. This eliminated all the lifting, as the pallet is now pulled off the roller conveyor to the bench, cover installed, and pallet and typewriter are slid back in the conveyor.

Following the typewriter on through the line we realized that we had one more area that required a lot of lifting, our packing area. Here four people were required to lift all the typewriters that came down the assembly line. A change was made in the layout of this area whereby only one person was required to lift but this person had a lot more lifting to do as he had to lift each typewriter and place it in a carton.

We realized this was a problem at the time the layout change was made, so a temporary lifting device was installed. Now the operator would not have to lift the typewriter. This operation has been changed so that the operator now lifts only the carton (one pound) instead of lifting the typewriter, which weighs approximately 30 pounds. This device was designed by our engineering department and built by our apprentice toolmaking school.

The only other area in our assembly operations that had given us any trouble at all was a sub-assembly operation that required an employee to lift power frame baskets weighing approximately 40 pounds from a skid. Although these baskets aren't too heavy, they sometimes stick, and an employee lifting the top basket is lifting above his elbow height. One of the recommendations made by Liberty Mutual Insurance Co., in the survey mentioned earlier, was that a person should not have to lift repeatedly above their elbow height. (The range of elbow height is given as between 34 inches and 45 inches, the average being 40 inches.)

For this reason, the first thing we did was restrict the height of these baskets to

three feet high. Now the employee lifts below his elbow height. After restricting the height of the baskets we went to our materials handling department and requested that equipment be purchased to handle these baskets. With the equipment now in use the operator moves the skid of three baskets to his bench, performs one operation while the parts are in the basket, then removes the parts and places them on his bench for the next operation. He then places the parts on small pallets to be moved up the line on the roller conveyor. The only lifting involved now is removing the empty basket from the top of the pile. After removing the empty top basket the equipment can be raised bringing the next basket to bench height.

Before we leave the assembly area, I would like to mention the chairs used here. Our plant engineering, medical, and safety department investigated several styles of chairs, so that we might select the safest and most comfortable chair for our operations.

In the machining area, we have the usual material-handling equipment used when lifting, but we still have to lift many articles manually in the course of a day. We found from our survey that the biggest source of trouble here involved the lifting of pans. Although we have a rule that the total weight (pan and parts) are not to exceed 75 pounds, we found some instances where this was being overlooked, and some pans weighed as much as 150 to 200 pounds. In most cases the rule was being followed, but because of the size of the container being used it could only be lifted partly to stay within the 75-pound limit.

We had to use more containers, which naturally took up more floor space. As a result of an investigation carried out by machining, safety and material handling personnel, a smaller container has been put into use. Now we can fill the smaller container full, and with most parts it will not exceed the 75-pound limit. It also takes up less floor space.

Lifting problems in the machining area have been solved by the use of belt conveyors, and air lifts.

In one instance an employee developed back pain because of the awkward position he had to assume while performing his

operation. Investigation showed that he spent most of his time in a bent position. This was solved by raising the saw and table so he could work more comfortably.

Another source of help that may be overlooked is the purchasing department. Many purchased parts remain in their original container until the parts are used, so the container has to be handled somewhere along the line. By having the purchasing department notify vendors to ship parts in smaller containers, keeping the total weight around 75 pounds, it is possible to handle these containers without too much difficulty.

Here's an example of what I'm talking about. We used to receive main springs in cardboard barrels that weighed 300 pounds each. We now receive them in cardboard cartons, weighing 74 pounds. Each carton contains four smaller boxes weighing 18 pounds each. Although the cost of the springs were increased slightly, we eliminated many handling problems in the plant that more than overcame the increased cost.

In trying to solve our back injury problems we followed three basic steps:

1. Recognized that we had a problem.
2. Analyzed the problem for the how, when and where.
3. Used one of the E's of safety—Engineering.

Now we come to another E of safety and one I believe to be the most important—Education. As I pointed out in the beginning, people can become members of the "Aching Back Club" without too much difficulty. We can find out all the statistics, take care of all the engineering problems, and people will still hurt their backs if they don't understand the problem. Therefore we have to educate them, and this is what Dr. Martin and I have been working on. We have taken small groups of employees from the high-injury areas and, by using slides, we have discussed the basic structure of the back, how it works, and the importance of good posture when sitting at a work bench. We feel that if the employee has a chance to see how his back is constructed, and what it can and cannot do, they will be more conscious of good lifting habits.

Education must not stop at the plant gate. We know from experience that if we elimi-

nate all the problems in the plant we would still be left with 30 per cent of our problem because of the back injuries that occur off the job. Therefore it is important that we extend our education program into the home.

Even though many believe that the back problem is here to stay and there is nothing we can do about it, I hope I have been able to give you some idea of what can be done if you really want to lick the problem.

HUMAN ENGINEERING AND MATERIAL HANDLING SAFETY

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"Human Engineering" in its broadest meaning, or to use the modern term "Ergonomics," aims at the optimum use of the human being to serve the community and the individual in the best possible way. Ergonomics is the science which studies the "laws of work," emphasizing the capabilities and limitations of mankind, physically as well as mentally.

Technical developments are often so far advanced that the capabilities of the user, rather than the potentialities of his equipment, limit the performance of the two working together. Disregard for the human limitations results in an alarming number of fatalities and injuries caused by his own inventions. Because accident prevention is our goal, recognition of the pathological man-artificial environment relationship is paramount in order to undertake steps to cure the situation.

The industrial hygienist, safety engineer, physiologist, psychologist, industrial physician, traffic engineer, law maker, and gadgeteer, just to name a few, have in many instances devoted a lifetime to making the artificial environment a safe place in which to live. However, the magnitude of loss payments prove that much more ought to be done. The problem is basically simple: we have obviously a mismatch between man and environment and we must do something about it to improve the situation.

Ideally, we first must know man, machine, and environment before we can even try to

match them. The modern approach to this problem is basically to adjust the machine or the artificial environment to man and not man to the machine or environment. The latter approach may be acceptable to the armed forces where the human criteria, out of necessity, are different from peacetime standards.

The artificial environment and the machine are secondary to man. Disregard for this basic human requirement will create a health hazard. Research, as I see it, must and can contribute in a significant way by gaining knowledge necessary for the application of the principles of Ergonomics. Acceptance of the fact that better understanding of accident causation will result in better accident prevention, is of extreme importance to our society. The ultimate goal of Ergonomics is the determination of work procedures, machine designs, and environmental controls that will result in loss prevention.

It seems to me practical to concentrate safety research activities to a certain degree to those areas which have proven time after time to be significant accident producers. These areas can be selected simply by studying national accident figures, or our own statistics. A recent study made by our loss prevention department over a period of two years reveals e.g. that 23.8 per cent of all high cost workmen's compensation accidents are related to manual materials handling and are responsible for about 20 per cent of the total cost. These figures indicate

the need for better understanding of causation of accidents as a result of pushing, pulling, lifting, bending, twisting, carrying, etc.

The plant physician, as well as the safety engineer, would be greatly helped if we could supply him with answers to numerous questions such as: How much can the average man lift? What is the maximum daily allowable energy expenditure of woman? Is pushing more efficient than pulling? What is the proper relationship between the slope of a ramp and the total weight of the hand truck and the load? Many of these questions can be answered today because the research procedures and tools are available.

It is my privilege to discuss and to demonstrate a method which has been proven to be of great importance in the study of some of the human factors in material handling and equipment design.

One of the favorite tools of the physiologist interest in ergonomics is his equipment to measure metabolism. Because of the importance of this equipment, I have spent a good deal of time and effort in developing an instrument which will measure work efficiency more satisfactorily than most commercially available equipment. I would like to discuss this new instrument, called the "Differential Flamoxymeter." It enables us to obtain an accurate, continuous determination of the oxygen concentration in gas mixtures, information basic to the evaluation of metabolism and human efficiency.

Description of the Differential Flamoxymeter

In considering the development of a method to determine oxygen quantitatively and qualitatively in gas mixtures, it seems logical to utilize chemical or physical characteristics of oxygen, which are in degree, or essentially, different from other gases. Therefore, the fast oxidation of combustible substances as it occurs in a flame seems especially appealing because this reaction does not take place without oxygen in the majority of circumstances. Furthermore, the physical phenomena which accompany combustion will provide us with a variety of choices for quantitative measurements. The instrument must be designed in such a way that the oxygen concentration

of the gas sample is correlated with the chemical or physical characteristics measured.

A priori we did not expect satisfactory results from a method in which the heat production of a flame would be affected by minor changes in the oxygen concentration in the environment of the flame. One may expect that the limiting factor for the combustion under these circumstances will be the rate of supply of combustible material rather than the concentration of oxygen in the sample.

To make oxygen the limiting factor in the combustion we simply can "reverse" the flame. Because combustion is a physico-chemical process in which the combustible component is as essential to the reaction as the oxygen, it makes no difference whether a combustible gas burns in an environment of oxygen or whether oxygen burns in an environment of combustible gas. Therefore, if we were living in an atmosphere of hydrogen, we would call oxygen a combustible gas and the gas company would supply our gas ranges with oxygen.

By utilizing a reversed flame for the determination of the oxygen content in gas samples, it will be possible to produce heat in direct proportion to the oxygen content of this sample. In order to obtain this direct relationship, one must provide an excess of the combustible gas in the environment and at the same time one must keep the flow of the sample gas toward the flame at a constant rate. Under these circumstances, the instrument is specifically sensitive to oxygen and not to other gases. Notwithstanding the simplicity of the principle of the reversed flame it was found to be extremely time consuming to develop an accurate, sensitive, and practical instrument for the determination of the oxygen content in gas samples.

A differential method, using two flames, was chosen because it had some advantages over the utilization of a single flame, as will be explained later.

As combustible gas, hydrogen was found to be the best environmental gas of the group tested and has been used without experiencing any difficulty. FIGURE 1 presents a sketch of the essential parts of the Differential Flamoxymeter. Chamber A is kept under a constant low vacuum by means

ture, pressure and humidity of the patient's air. This is accomplished by means of a simple analog-computer in which we feed manually three variables: (1) Barometric pressure, (2) Dry bulb temperature and (3) Wet bulb temperature. The meter reading of this computer indicates the air flow correction necessary to compensate for the deviations from "standard" conditions of the patient's air. (Dry air at a temperature of 0° C and 760 mm Hg). Under these circumstances the patient's air supply is the equivalent of e.g. 3000 liters of air per hour, at 0° C temperature and 760 mm Hg pressure.

The flamoximeter indicates the percentage changes in oxygen in this standardized air flow, which now becomes an absolute measure of the volume of oxygen (under standard conditions) consumed by the test person per time-unit. Accepting a fixed respiratory quotient, which is permissible in metabolism determinations, based upon oxygen uptake, we now can express the difference in oxygen concentration of air going towards the patient and of air coming from the patient, in calories per unit of time.

This a priori correction of air flow makes time consuming calculations after the experiments are terminated, unnecessary and this is especially advantageous for field trials.

As I have mentioned earlier, I would like to demonstrate to you the importance of the evaluation of energy expenditure in the study of materials handling problems.

I have chosen, as an illustration, a very simple lifting experiment in which my associate will lift a box weighing 10 pounds every 4 seconds over a vertical distance of 1 foot. If he continues to do this work for 1 hour, his total work output will be $60 \times 15 \times 10 \times 1 = 9000$ ft./lbs. or about 29 Calories per hour.

We will see that his energy expenditure (to compare with "input") far exceeds this output value, because the human engine has a relatively low efficiency. The human efficiency, however, is not a fixed value and its magnitude depends upon a multitude of factors, some of which we will discuss today.

First we will "hook up" the test person with the Differential Flamoximeter while he is in sitting position, and we will notice

that his "rest" metabolism is about 75 Calories per hour. This value is somewhat larger than his so-called "basal metabolism." The basal metabolism is to compare with the energy expenditure of an idling engine. It is more realistic to calculate the efficiency of work after the basal metabolism has been deducted from the measured energy expenditure values.

We are now ready to start with the actual lifting experiment. We will notice that our instrument shows an almost immediate increase in energy expenditure, but we also will notice that it will take some time before a steady state has been reached. The total energy expenditure reads now a constant value of about 120 calories per hour or about 45 Cal/hr after deduction of the rest metabolism. We previously calculated that the actual output is approximately 29 Calories per hour: An efficiency of only $\frac{29}{45} \times 100 = 6.4$ per cent.

We now will repeat this experiment, varying only one factor and see what will happen to the efficiency of this test person under these circumstances.

In the previous experiment, we placed the box on a table which is about 30" high. The lifting took place, therefore, between 30" and 42", as measured from the floor.

In the second demonstration, my assistant will lift the same box at the same frequency and over the same distance of 1 foot, but starting the lifting from the height of 18" from the floor. The external work is still as in the first experiment, 9000 ft./lbs. or about 29 Calories per hour. The Differential Flamoximeter, however, indicates in the second test a higher energy expenditure and we read now a total metabolism of about 170 Cal. per hour. After subtracting the rest metabolism we find that the cost of this work is about 95 Cal. per hour. The efficiency is now reduced to $\frac{29}{95} \times 100 =$ about 3 per cent.

This simple demonstration reveals the importance of the area in which materials handling takes place. If time permitted also to vary the weight of the box, we could demonstrate that the efficiency of lifting could be made about 85 per cent by increasing the weight of the box to about 40 pounds and by starting the lift at approxi-

mately 4 feet from the floor. (Variables such as sex, age, body weight, height, etc., are purposely excluded from this table.)

This type of studies reveal that the human efficiency for many industrial activities has an optimal value if the circumstances are selected correctly.

This means that independent of the work output, certain design-environmental or other factors influence the energy expenditure of men. One of our goals is to find situations in which men work at this top physiological

efficiency or, in other words, expends the least amount of energy for his daily industrial physical work. This approach will reduce fatigue and stress, and consequently, injuries related to fatigue and stress. Much work has to be done in this field before we will notice the full effect of Ergonomics on the reduction of losses.

It is my firm belief that ergonomics will be of great help to the army of safety experts in their battle against our mutual enemy—accidents.

SAFE HANDLING OF LOW LEVEL RADIOISOTOPES

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Radioactive materials continue to find increasing application and acceptance in modern industry. If you presently do not have radioisotopes in your plant, there is a strong possibility that at sometime in the near future you will. We are going to talk about some of the problems you, as safety engineers, will be confronted with when that day arrives.

The problems of control of radioisotopes may be reduced to essentially three factors: removal, or reduction of the hazard to lowest practical levels, guarding the hazard, and protecting the worker. Any program to use radioisotopes should be reviewed with the intention of applying controls in the above order.

A recent news note in a nationally circulated magazine (Life, 9-22-61) best illustrates the need for an adequate control system. Alarming amounts of radioactive contamination were discovered in a dozen laboratories at a Canadian university. The contamination was accidentally discovered by a graduate student while attempting to calibrate geiger tubes in the university's old physics building. Lab after lab proved to be contaminated. University officials and a decontamination unit of the Canadian Army were rushed to the scene. Subsequent investigation disclosed that the labs had been used by Ernest Lord Ruth-

erford and his associates between 1896 and 1907.

Lord Rutherford conducted much early research in radioactivity and is considered to be the father of atomic physics. In those early days little was known of the harmful effects of radiation, and a more relaxed view of laboratory cleanliness and order was permitted than could possibly be tolerated today. The legacy of Lord Rutherford's work habits has suddenly been handed down to us; and it points out a condition which we will not be permitted to pass on to our grandchildren, even accidentally. The law and common sense now dictate that you maintain strict control over the use of radioactive materials.

Radioactive materials, may appear in your plant virtually unannounced. Usually in micro-microcurie amounts incorporated in devices having little, if anything, to do with radiation work. Certain wave guide tubes used in radar installations are an example. Radium 226 is not covered by the Atomic Energy Act of 1954, and devices containing this material often only require registration with the proper state authority after being received. What control measures do you have which notify you when such materials are received? I am not implying that presence alone con-

stitutes a hazard, but rather that a lack of knowledge of intended uses of these devices; and more important, their ultimate disposition may indeed constitute a hazard.

Obviously the need for concern is greatest when you become involved in programs deliberately designed to utilize radioactive materials. These programs usually require licensing by the Atomic Energy Commission. Meeting the requirements of the A.E.C. at the time of application does not insure the elimination of problems after the actual work has started. The Commission, in Washington, can only act on what it reads; you must act on what you observe first hand. The forms in which radioactive materials will appear, and the uses to which they can be put are limited only by the imagination. The amount of control required may vary, but one thing is certain, a system must be established which will permit the required flexibility to do the job without sacrificing safety requirements.

Reams of material have been published documenting the potential hazards associated with the handling of radioactive materials. More reams of material—laws—have been published purporting to effectively control the use of radioisotopes and reduce hazards to acceptable levels. It is not my intention to discuss these laws, but rather to indicate how, within the framework of the law, an effective radiation control program can be administered.

An effective radiation control program requires the issuance of a policy statement of intention to control radiation. The statement should contain nothing which might later be subject to interpretation, and it should fix responsibility for control. Of uppermost consideration should be the health and welfare of employees and the public. All else is secondary.

Effective control of radiation begins in the design stages of the facility or equipment. A knowledge of the type and amount of radioisotopes to be used, and the effects that this will have on location, environmental restrictions, shielding and handling requirements is necessary. Here is the place to provide as much built-in safety as possible.

Selection of suitable personnel who will work directly with radioisotopes is of the utmost importance. Every effort must be made to provide for employment of individuals who are mentally and physically suited for this type of work. The medical department should establish standards for physicals at employment and determine the need for periodic re-examination. A positive system for reporting and clinically observing actual or suspected over-exposures to radiation is indicated.

Training programs and information courses are needed which will provide personnel with an understanding of the hazards associated with handling radioisotopes. All personnel should be trained in emergency procedures, including the use of radiation detection instruments. Emergency procedures should be clearly written and posted. To reduce the possibility of misunderstanding concerning the handling of radioisotopes a separate and distinct series of safety standards should be adopted and enforced. No one should be released for isotope work until he has demonstrated an understanding of the established safety requirements.

Documentation of all occupational radiation exposures is necessary. It is of utmost importance that these records be accurate and up to date. Individuals transferred from other companies should be required to supply documented previous radiation histories. An alternative to this is to assume that the individual has received the maximum allowable amount according to his age. The importance of always wearing personal monitoring devices cannot be over-emphasized.

Film badge programs are usually best administered by outside concerns who specialize in this field. They are usually prepared to provide rapid, accurate exposure records and, in addition, provide legal responsibility for their determinations.

Within the limits of whatever security restrictions you may have imposed upon you, it will be to your advantage to keep the appropriate civil authorities in your community posted. If the local fire company were to respond to an alarm unaware that it might have to deal with radioactive material, considerably more harm than good could be the result.

Constant surveillance would finish the list of general requirements. If radiation protection is to be your responsibility, be especially alert in this area. Under pressure from all directions to get the job done, you can't depend on the individual worker to always adhere to the best principles of radiation safety. Few accidents have as short a reaction time as an over-exposure to radiation. Even fewer have anywhere near the publicity value. The true facts in the case can easily be lost or distorted before anything worthwhile is learned, or corrective measures taken.

Research laboratories usually have more complex radioisotope programs than straight industrial application users. I will describe the program of one such laboratory.

The Atomic Energy Act of 1954, Title 10—Part 30, paragraph 30.24 requires among other things, that a committee be established "which will review and approve, in advance of purchase of radioisotopes, proposals for such uses and has appointed a radiological safety officer who will advise or be available for advice and assistance on radiological safety problems."

The committee's purpose is to establish and maintain accepted radiation safety and health standards. The committee must have absolute authority to pass on all matters concerning the safe use of radioisotopes, and to reject or modify any request for their use if, in their opinion, such use would jeopardize these standards. The committee does not sit in judgment on the relative merits of the work itself.

The plant physician, safety engineer, representatives of the various departments and a specialist in radiation protection are members of the committee. The medical doctor is responsible for establishing and maintaining a sound medical program and his presence on the committee insures adherence to strict medical consideration of all problems. The presence of the Safety Engineer prevents the sacrificing of sound safety principles as an expedient short-cut to a fast solution to a problem. This trick is not unique to the field of radiation as you well know. The representatives of the various departments often supply special knowledge which eliminates problems which otherwise would not have come to light until too late.

The work horse of a safety committee is the radiation safety specialist who should be someone technically qualified to give advice in this area. In addition, his duties will include most or all of the following:

1. Provide initial contact service for individuals wishing to use isotopes.
2. Discuss the overall program, evaluate the potential hazards, and provide necessary information to insure selection of proper isotopes by balancing radiation safety and health requirements against the job to be done.
3. Determine the background and training of the requester, with regard to previous isotope experience.
4. Provide for instruction as the case may indicate.
5. Examine the area in which the work is to be performed, and evaluate the potential hazard with regard to area personnel, equipment and environment.
6. Outline the personal protective equipment which will be necessary for the job.
7. Outline the work procedures insofar as radiation protection and waste disposal is concerned.
8. Supply necessary guidance for radiation requirements to be included in the normal request.
9. Arrange for full isotope group meeting to consider the problem, supply copies of request in advance of meeting for adequate consideration.
10. Record minutes of meetings.
11. Order radioactive materials. This is the only person authorized to do so.
12. Receive materials; again, the only person who can do so.
13. Store materials in a tamper-proof area. Test for leaks. Maintain inventory records.
14. Distribute radioactive materials as needed; label containers, areas, equipment.
15. Perform startup and regular surveys to insure proper procedures are being followed.
16. Dispose of radioactive waste through government-authorized channels.
17. Maintain correspondence with AEC and state boards.

18. Keep the full committee informed of all happenings of interest in this area.
19. Maintain radiation exposure records.
20. Conduct environmental surveys as indicated by the type of work performed.
21. Maintain professional contact with experts in the field.
22. Maintain contact with professional societies to insure knowledge of advancements in the field.

The committee's responsibilities cannot be overestimated. A decision to permit the use of isotopes is not lightly made, and cause for concern exists right up to the time that the material is finally disposed of.

In every field of endeavor the problem of dealing with people is important. This is especially true where you start talking radiation. The individual requestor often feels that you are being unnecessarily restrictive; you're standing in the way of progress. His associates in adjacent areas feel that you're too liberal and aren't exercising sufficient control. The manager is concerned with increased costs. Everyone wonders why so strict medical requirements if everything is so darned safe. And finally, if the project gets big enough,

the community starts to wonder about all that radiation floating around.

The solution to the problem of radiation lies in strict control of all sources of radiation and their use, based on current laws, and an understanding of the presently accepted theories of effects of radiation.

References

- A complete list of useful publications would fill a book; however, the following should prove useful to anyone about to become involved with the use of radioisotopes:
- Federal Register (reprints) Title 10—Atomic Energy, Chapter I, Parts 20, 20 & 21, USAEC, Washington 25, D. C.
 - Handbook 48: Control & Removal of Radioactive Contamination in Laboratories, National Bureau of Standards.
 - Handbook 51: Radiological Monitoring Methods and Instruments, National Bureau of Standards.
 - Handbook 55: Permissible Dose from External Sources of Ionizing Radiation, National Bureau of Standards.
 - Handbook 73: Protection Against Radiation From Sealed Gamma Sources, National Bureau of Standards.
 - Safe Handling of Radioisotopes, Safety Series No. 1 (1958), International Atomic Energy Agency, United Nations, New York, N. Y.
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 - Radiation Hygiene Handbook, Hanson Blatz, McGraw-Hill.

SAFETY RULE ENFORCEMENT—A KEY TO ACCIDENT PREVENTION

By RICHARD R. WILEY

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In all of the many diversified activities of a large industrial organization like our Bethlehem Plant of the Bethlehem Steel Co., there are certain common basic principles. One of the most important is the principle that work should be done without injury to personnel. And one of the important elements in carrying out that principle is the development and enforcement of safety rules. The rules themselves are necessary, but unless they are followed—and followed consistently by everyone—they are simply a nice expensive collection of words.

Making sure the rules are followed is what is meant by "enforcement." By definition,

"enforcement" is "that which gives force, energy or effect; a putting into execution."

Our session is on "The Dynamics of Supervision." Again, by definition, "dynamics" is "the motive and controlling forces of any kind, and their mode of action."

My endeavor, therefore, will be to touch on some aspects of our program relating to modes of action, and those measures which give control, force, energy and effect to our safety rules and accident prevention program.

With this preface our stage is set, and the program begins. It must begin—I'm sure you will agree—with education, for education

is the impartation of knowledge, skill and discipline of character.

John Ruskin had this to say about people and education: "Education does not mean teaching people to know what they do not know. It means teaching them to behave as they do not behave. It is a painful, continual and difficult work; to be done by kindness, by watching, by warning, by precept and by praise, but above all by example."

At this point I would be surprised if everyone was not thinking to himself—"old hat stuff," because we should all know this general concept. But is it equally true of our employees for whose safety we are responsible? Specifically, do we, in our respective operations, employ every possible practical technique for promoting enforcement among our personnel at all levels? Or do we simply make a few standard selling approaches and go on the hopeful, but woefully mistaken, idea that all employees have been adequately schooled in safety? Then, with unjustifiable finality, we dust off our hands with the proclamation, "Well, that's that!" Make a mark on your calendar on the day that we agree that our enforcement cannot be improved. That is the day we start slipping.

You can have as much safety as you care to be responsible for. You can have little or none if the consequences do not bother you. After an accident happens it is easy to say, "The man knew better." We all realize, I'm sure, that it more realistic to swallow our pride and accept the fact that the man would have known better had he been better instructed.

To dodge responsibility is easy; the difficult part is to dodge the consequences of dodging the responsibilities.

The thought of simply talking to you about safety—whether principles, modes of action, or whatever—reminded me of the college professor in English composition. He would refer to a certain bit of work as "an unfinished Indian arrow"—long, polished, lots of feathers, but no point! To avoid being guilty of that very thing, it seemed to me that a maximum of specific action techniques and a minimum of theoretical principles is best.

In order to better identify and better acquaint you with our Bethlehem operation, let me lay a little groundwork.

Industrial Subjects Serious

The plant attains a force of 22,000 employees working 43 million hours a year. The average disabling injury frequency for the past ten years has been 0.64.

A successful program in any plant, regardless of size or nature of work, can result only with the unlimited backing of top management and the acceptance of responsibility by all levels of supervision. Our program begins here.

At a regular time each month, a general manager's staff meeting is held. The general manager's staff meets with all superintendents and their assistants. For one hour we discuss and illustrate with pictures the overall safety experience of the plant, and superintendents who have had serious accidents in their departments give an explanation of these to the group. Projected pictures of the re-enacted incident add realism and interest, and promote understanding for the responsibility and necessary preventive measures.

Within the next three days, 38 departmental safety meetings are held according to a fixed schedule. The superintendents meet with all of their foremen and cover all of the material presented at the first meeting. The foremen in turn pass the pertinent information on down the line to the men. Here again, to be at all effective, the message must be presented with enthusiasm. It was Emerson who so rightly said that nothing great was ever accomplished without it.

In order to develop in the foreman a keener perception of his operations and the importance of his function of supervisor in preventing accidents to the men, the job safety analysis program was adopted. This three-column worksheet is a detailed study of an operation by the supervisor in consultation with the workers for the purpose of determining how it is now being done, what the associated hazards are and how the operation itself can be improved to eliminate, minimize or control the hazards. When analysis has been completed and approved, it becomes a matter of record and is the only acceptable method for performing that particular job.

Rules and regulations are very necessary for safe conduct. We have 60 different booklets called safety codes. The green ones represent department codes. In addition, many workers are given other codes relating to

their specific jobs within the shop, such as crane operators, welders, and so forth. Violators of the provisions of the codes are subject to disciplinary measures up to and including discharge. Our supervisory safety code is designed intentionally on a broad basis as a guide for departmental safety programs and codes, and it outlines those things which should be covered by them in detail.

Certain other standards or guides are posted on bulletin boards. For example, an eye protection standard is designed to leave nothing to the imagination as regards the required eye protection. It specifies by picture the minimum type protection necessary when exposed to any conceivable job with eye hazard. It leaves no room for excuses for anyone.

All of us recognize the fact that the most effective way to sell any program is to offer constant reminders in the form of proof of the need and value of an item. We have been highly successful in stimulating interest through the dissemination of information on a variety of incidents.

A simple, letter-size "Safety News Bulletin" is promptly prepared on any incident of significance and interest, and run-off in quantities of about 1200 copies. These are sent out for complete plant coverage so that every foreman has a copy to use as material for his five-minute safety contact with his men. In order to insure that every man is aware of the incident, as well as being a follow-up reminder, copies are also posted on all bulletin boards.

The manual or mechanical handling of materials exacts a heavy toll in injuries to the fingers and hands and presents an infinitely more difficult problem than that of protecting the eyes. We do, however, provide hand hooks in great quantity and rigidly enforce their use when taking up, guiding, or setting down crane lifts of bars or similar materials subject to shifting. This program, although requiring constant education and enforcement, has been extremely successful.

An illustrated program on the subject of pinchpoints is presented at a safety meeting. We have developed a number of programs on a variety of subjects. The presentation consists of about 20 color slides and a prepared 15-minute commentary. In order to create realism, actual case histories are used. Visual aids, properly presented, are well re-

ceived and quite effective. It leaves an employee well informed and with no excuse for an unsafe act.

Supervision must recognize the fact that in order for a man to be safe around crane lifts there is considerably more to it than controlling his acts with respect to pinchpoints. The old adage, "A chain is no stronger than its weakest link," is a literal fact. In respect for this, we have an extensive chain maintenance program. All chains are sent to a centralized shop for periodic annealing, inspection and repair. In an average year about 8,000 chains are serviced and each one machine proof-tested before being returned to service. Each chain bears its own identification number and has a complete history file card. This chain servicing description is offered only as a typical example of a great number of rigidly enforced procedures employed to guarantee maximum safety.

In a typical year about 82,000 respirators are disassembled, washed, disinfected, dried, repaired, reassembled, packaged in cellophane bags, sorted and returned to the departments. The pick-up and return is done daily. A total of 17,000 pairs of goggles were similarly processed. The function of this central servicing is to encourage the willing use of this vital protective equipment.

Training of physically qualified men in symptom recognition, oxygen mask rescue and first aid for men exposed to gas is maintained at a high state of preparedness. Two scheduled two-hour classes per day, five days a week are held at either our central training school or under actual field conditions. Nearly 4,000 men participate in this training annually. Each trainee undergoes a refresher course every six months.

Any program, to be effective, must be policed. Therefore, every six months the school records are carefully reviewed and an appropriate form letter—either "satisfactory" or "unsatisfactory"—is prepared and submitted to each department superintendent advising the status of training.

The teaching of first aid is an essential part of our safety program. In addition to its general concept of providing emergency treatment and preparing the injured for transportation, it is also of intangible value by indirectly and subconsciously imparting thoughts of safety to both participants and casual observers as well.

Industrial Subjects Sessions

Our general plant minimum requirement is that 10 per cent of the shift personnel be qualified first aid trained men. This means certification by the U. S. Bureau of Mines for the successful completion of the 15-hour course. All foremen are also required to have this same training.

Here again, as in gas training, we continually check on the adequacy of the training. A supervisor from our central safety office conducts test drills at the rate of 28 per month among the departments. This means that every department is examined every other month.

When an employee is injured, no matter how slightly, we insist that he report to his foreman for referral to a dispensary. Four copies of the form shown are prepared, two of which accompany the injured to the dispensary. Three times daily all pink copies are collected by the Safety Department and immediately examined. This system keeps us currently informed of most incidents, and puts the departmental supervisors in a position whereby they must investigate the incident in order first, to prepare the report form, and second, to be able to provide additional information which is often requested.

A safety program is not any one thing or any one person. Rather, it is an aggregate of a great many things requiring the efforts of every person. This is to include a vast number of things, a few of which were touched on here—protective equipment, devices, controls, rules, regulations and procedures—and the enforcement of them to maintain effectiveness. Were it not for these techniques our personnel would, naturally, care far less about safety in general. Infractions do occur, however, and violators must be dealt with accordingly.

A typical discipline report for a safety violation is on the subject of hand hooks which were mentioned earlier. It reads "Man placed hand on lift of two and one-half inch liners to guide same, while placing lift on buggy. Explained to man that we insist on safe practices being followed, as all of these are for his protection. Pointed out to man that he was holding hand hook in his left hand while guiding lift with his right hand. He had the proper tool but was not using same." Discipline: "Warning."

In an average year we have occasion to

impose 357 formal written safety disciplines against employees' records. Of these, 83—or about one-fourth of the total—include time-off penalty, which in the average case amounts to slightly less than 10 hours.

Common sense reasoning will convince most employees that a safety rule should be followed. There might always be the small minority who insist upon ignoring the rules. Experience indicates that with such people disciplinary action must be taken. If corrective action is not taken, the regulation soon ceases to exist. It is the constant training and correction which in the end becomes self-discipline.

If the man on the job fails for any reason to follow known safe practices, he is taking a chance. If we in management condone his unsafe practices, then we too are taking chances, the only difference being that our chances are more serious since by condoning bad practices we are actually teaching disrespect for regulations. Consequently, we cannot excuse a poor accident record by accepting unsafe acts if we have failed in our duty to enforce safe procedure.

We believe that the many standards and procedures in effect at the Bethlehem Plant, a few of which were presented here, all play a significant part in the difficult role of developing proper attitudes on the part of all employees, including supervision.

The problem is to impress indelibly, through enforcement, on the mind of the individual that there is an approved safe way to carry on most activities. The various modes of acting are limited only by one's imagination and the unrelenting effort of enforcement to maintain liveliness.

The three essentials to safe practices—knowledge, skill and desire—can be developed through these media. The thorough preparation of the procedures can give us knowledge. The faithful application of them will develop skill. The rigid enforcement of their provisions will create desire. This last matter I associate with personal safety contact—those little five-minute discussions between the supervisor and the employee.

Personal safety contact in its conventional form is, to my mind, an artificial and unconvincing way to discuss safety unless the material is related to the daily doings of the supervisor or the worker. A supplemental approach to the general personal contact can

readily be based on an on-the-spot correction of something that an individual or group is doing incorrectly. This is dynamic enforcement. Simultaneously, to find a theme for a safety contact will be a challenge to the supervisor to detect a fault—and correct it!

To illustrate my point, I'll ask each of you to search your memory for an occasion when you listened to someone's remark or lecture on the subject of driving precautions on the highway. Can you recall such a session? If so, do you remember what was said? If not, I can assume that you were not impressed.

Now, another question. Have you ever been personally apprehended by the law? If so, can you ever forget what you did and what was said to you? I can now assume that you were impressed! A personal contact of this type is really personal and is most convincing. To the vast majority of individuals it creates a healthy respect for the law while creating a desire to abide by the rules and regulations.

The creation of a desire is commonly

known as "habit." Horace Mann, an American educator of a century ago, very aptly described it thus: "Habit is a cable. We weave a thread of it every day and soon it cannot be broken." This, in a nutshell, is what can be achieved through continuous enforcement of required practices.

We of Bethlehem wish to exchange ideas with our industrial compatriots. We hope to be helpful; we also hope that we can be helped. The problem of enforcement is a common one. Diversified action is the key. The task is simple, but not easy. There remains nothing but hard work.

In closing, I think it fitting to quote one of our superintendents who, in response to a general survey question on what more we could do to improve our plant safety program, said this: "Fundamentally, our program is complete. Perhaps what we need now is more backbone and less wishbone!"

This can be done in the very best American tradition: *enforce the rule, but never rule by force.*

DAMAGE CONTROL—A NEW HORIZON IN ACCIDENT PREVENTION

By FRANK E. BIRD, JR.

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The anticipated goals of the Accident Damage Control program at Lukens Steel Company in its planning stages five years ago were: first, a reduced injury rate and secondly, cost improvement. While both of these goals have exceeded all expectations, it is primarily the cost improvement aspects of the program that will be emphasized in this presentation.

While safety men can base the complete justification for their safety programming on the injury prevention potential, it is naive to underestimate the influence and role that sound economics can play in the further extension of safety efforts.

Cost improvement results were obtained last year at Lukens by the practical application of a very simple concept we have all ascribed to for many years—the fact that injuries can be prevented by controlling ac-

cidents. The larger portion of this presentation will reveal the programming methods involved.

Reference to our Company's Annual Report for 1960, that was sent to all stockholders and employees, reveals the economic highlights of plant operation. After all other distribution of the Lukens sales dollar was made, \$1,430,892.00 was made payable to stockholders in dividends and \$3,517,383.00 was retained to be reinvested in our business. Keep these two figures of one and a half million and three and a half million in mind in considering another small paragraph involved with this financial picture: "The first year's organized experience with a relatively new industrial safety approach to the area of accidental property damage was completed in 1960. The program's contribution to cost improvement

was estimated to be a half a million dollars."

To avoid confusion at this point, let me emphasize that the program required to produce this one year achievement took five years of careful planning and development. This planning and development began with the complete acceptance of the concept that engineering out all accidents, whether or not they involve personal injury, could only result in an improved injury performance at reduced operating costs.

The fact that a common denominator between personal injury and property damage exists is borne out by the accident relationship known as the Heindrick Theory. Statistics have indicated that for each disabling injury, 29 minor injuries occur; while 300 accidents (with no personal injury) that may or may not involve property damage have also resulted.

Suppose we consider a hypothetical accident case to show this relationship of property damage to personal injury—

1. A moment of decision (mule sitting down while hitched to vegetable cart).
 2. The approach—an un-aie act (farmer striking mule).
 3. Resulting in accident which may involve property damage (mule kicking wagon, vegetables and farmer into the air).
 4. Personal injury or both (mule heehawing while farmer looks on wrapped in bandages).
- To more effectively achieve our main objective of reduction in injuries to our employees, it was logical that greater emphasis be given to the control of all accidents. In addition to the humane aspects that had always been a vital concern, the economics involved with the anticipated all-accident approach indicated that any additional time and effort required would be more than justified. The four basic control methods to be described are:

- 1) Reporting;
- 2) Investigation;
- 3) Analysis;
- 4) Remedy.

Let's first explore the development of our reporting system in all accident control, since any accident prevention program is only as strong as its ability to discern the true nature of its problems. The first

method of reporting is through employee compliance with our revised general safety rules. In October 1956, a broad revision was made in our rules to include the reporting by all employees of any accident resulting in personal injury or property damage.

General safety rule No. 2 was rewritten to read: "Report immediately to your foreman or supervisor any condition or practice you think might cause injury to employees or damage to equipment."

The key to our whole program, general safety rule No. 5, was rewritten to read: "Whenever you or the equipment you operate is involved in any accident that results in personal injury or property damage, regardless of how minor, you must immediately report it to your foreman or supervisor. Get first aid promptly in a company dispensary."

In order to assure the success of the program, known violators of this rule have been equitably disciplined. Approximately six employees have been given time off from work for gross violations (since the adoption of this rule in 1956) while written and verbal warnings have been used more widely.

Fully recognizing the natural reluctance on the part of employees and supervisors to report the fact that they were involved in damaging company property, a simple report form maintained by the foreman of each repair shop serves as the same control to our accident damage program as dispensary records serve our injury prevention efforts. A damaged equipment repair tag was next introduced and required to be used by all employees whenever equipment was sent for replacement or repair as a "reporting" control to further pinpoint accident location, time, date and apparent cause.

One of the most effective methods of control is the investigation of each accident in order to determine corrective action and prevent recurrence. Mass collection of facts obtained from good accident investigations, properly correlated, formed patterns of common occurrence that were used effectively for further control. A new standard practice including personal injury and property damage was adopted as a tool to attain desired goals in proper accident investigation.

Essentially, the supervisor or foreman in whose area of responsibility the accident occurs is responsible for conducting a thorough investigation and submission of this official supervisor's accident report form. One form is used to cover personal injury, property damage or both. Since identical controls are used to prevent accidents whether they be personal injury or property damage, no conflict presents itself in the application of this two-purpose form and its broadening effect on the total accident control outlook of supervisory personnel.

Just as the disabling injury provides ammunition for drawing upon more extended management effort, so by standard practice any property damage accident of one thousand dollars or more is dealt with in the identical manner of a disabling injury. An immediate notice of serious property damage is delivered to all superintendents and managers. The superintendent concerned is required to hold a formal hearing of all persons involved in order to determine adequate remedial action. The results of this hearing are promptly forwarded to the manager, who then calls a final review meeting which includes the superintendent, key supervisors and myself.

This opportunity for top management to actively demonstrate its concern for accident prevention tends to keep everyone more aware of the accident problem and their individual responsibilities to maintain effective controls.

It might be useful to look at a few typical accidents in order to realize the importance of the remedial action resulting from these investigations. Accident No. 1 involved an ingot being lowered into No. 48 pit. The crane operator struck the front top of this pit with his ingot dog causing a key section to break off. The direct costs for brick replacement and repair were \$200. However, in order to make the necessary repairs this entire pit had to be shut down. Rehandling of the ingots that remained in the pit, reheating, rescheduling, and four hours of pit delay time added tremendous indirect costs.

Accident No. 2 involved our 206-inch Mill ingot buggy. The mechanical department personnel were changing rolls in our S & R Mill using a large "C" hook to grab the roll and pull it out. Electricians did

not tag the pulpit control that operates the ingot buggy. The operator sent the buggy down to service the 206 Mill (this buggy services both of our mills). Because of insufficient clearance between the buggy and the "C" hook assembly being used to remove the S & R Mill roll, a collision occurred that bent the main frame of the ingot buggy.

Three turns were required for temporary maintenance since permanent repairs would have required eight to 10 days of down time. The direct cost of temporary repair was \$1,250. It is interesting, however, that permanent repairs have still not been made because of the extended down time necessary. The maintenance bills for repair and replacement of wheels, axels, and collector shoes occurring as a result of the bent frame has continued for months, and is tremendous. On six occasions, two turns have been required to do this work.

Accident No. 3 involved an ingot dropping on our 206-inch steel yard crane scale. Although the replacement scale part cost \$175, it was necessary to ship the entire scale back to the factory for repair. During the week required for repair, all slabs formerly weighed on this scale had to be trucked to a scrap supplier's yard outside our plant and then returned for preheating. Delay time was estimated to have cost at least 40 times the direct costs of the accident.

Accident No. 4 involved a load dropping and destruction of a travograph machine. The old machine was originally purchased for \$6,000; however, a \$25,000 premature capital expenditure for the purchase of a new machine has been proposed.

Accident No. 5 involved a plate shears. The shear crew was trimming plates and allowed scrap to accumulate in the scrap trough. This caused the upper knife block to jam on the downward stroke and fracture the shear housing. Direct costs for repair were \$2,000.00. However, 15 turns of work were lost along with line slowdowns and customer delays. The indirect costs were estimated at \$12,480.

These typical accidents that actually occurred point out the tremendous cost involved in accident damage as well as the importance of an organized preventative program.

The more management is explicitly made aware that people will be hurt or property damaged through certain acts or conditions, the greater the possibility that action will be taken to prevent it. The accident analysis phase of our damage control program pinpoints specific items damaged repetitively and the agencies involved. Supervision concerned are thus equipped to place concerted effort on single specific objectives.

A detailed quarterly analysis is furnished to all key management personnel and includes a comparison of all accident damage costs this year to date to that of last year. It helps maintain a continued awareness of particular departments, agencies and items needing attention. A colorful barometer on the cover gives flash indication of action necessary on the report contents.

Just as compensation is considered a direct injury cost, damaged equipment repair or replacement is considered our direct costs for property damage. In order to show the big potential of cost improvement, our total costs include indirect costs estimated at a four-to-one ratio of direct costs. The estimated total costs of accident property damage for 1960 exceeded one and one half million dollars.

A breakdown by the agency or act inflicting damage revealed crane involvement with well over 60 per cent of our property damage accidents. Four departments stood out as shareholders in the greater majority of all damage costs. Further analysis revealed the cost of accidents by items damaged. A severity rate in dollars per unit of hourly rated manhours of time is used in our plant to indicate trends in control performance. Accident damage severity is expressed as direct costs per million hourly rated manhours worked. (All cost figures used in the remainder of this presentation are rounded off to facilitate understanding and retention.)

The severity rate for 1959 was \$62,000 per million hourly rated manhours worked. For all program purposes this was our base year. The 1960 year end damage severity rate of \$45,000 was substantially below the previous year's rate.

To realize more fully the cost improvement aspects of this comparison, let's examine more closely the 1960 accident

rate of \$45,000 per million hourly rated manhours worked. This was an improvement of \$17,000 per million manhours worked over the 1959 performance. Recognizing these are direct costs we are using, let's translate this into total cost improvement for the calendar year. This improvement per million manhours worked multiplied by the millions of hourly rated manhours worked revealed the direct cost improvement for the year. The value of our total effort becomes more evident when we apply the four-to-one ratio to determine indirect costs. By adding both direct and indirect costs, the larger figure of one half million dollars becomes a total estimated cost improvement for 1960.

Here are some new program examples of accident repetition highlighted by the analysis phase of the program with action taken that helped to bring about this cost improvement:

1. One door was damaged ten times in less than one year. (The door has been widened; piling in the loading area inside the door more effectively controlled.)
2. One railroad gate was broken 30 times in 1960. (The gate has been relocated and has not been damaged since.)
3. Better than 75 per cent of all narrow gauge railroad rolling stock maintenance is due to accident damage. (Spuds and ingot dogs have been redesigned, numerous procedural changes made.)
4. The guard railing on the top of seven shears were struck and badly damaged by material handling devices 38 times in one year. (Using solid plate guards instead of pipe railings and rounding of railing corners has greatly reduced catch points at these locations, reducing damage at least 50 per cent.)
5. At least 80 per cent of all cable replacement in the melting department is due to accident. (Methods have been changed, guards placed on sheave wheels, practices altered and inspection methods improved.)
6. The glass panel in this door was broken seven times in 1960. (It is now standard practice to use plastic in place of glass in shop doors throughout the plant.)
7. One thousand six hundred spindles on hand grinders were replaced in 1960. Investigation revealed that at least 25 per

cent of this was due to the unsafe practice of striking the locking nut to loosen it in order to remove the wheel. (All grinders are now provided with a special band wrench; the knowledge gained through the accident investigations also brought about improvement in the spindle quality and design, which has also reduced breakage substantially.)

8. Two thousand one hundred and six incidents of stators on hand grinders required repair and replacement in 1960. Accident damage investigation revealed that a minimum of 50 per cent of these "burn outs" was due to an unsafe practice of the operator. When the wall fuse would blow because of a "heat up," the common practice was to pull out the hot plug and connect to a cold plug and continue to use the grinder until it burned out. (We are now supervising better, testing local heat warning devices and new grinders.)

9. Thirty two oil lines on various pieces of equipment were damaged severely in 1960. (Standard practice is now to place all these lines in hideaway locations.)

10. One water pipe in the pickling department was damaged four times in one year. (There has been no repetitive damage in six months since the relocation of the pipe.)

To motivate key management personnel even further, an accident damage control chart is posted in a most conspicuous position in our superintendents' conference room where the general manager points to weekly trends each Friday. A weekly publi-

cation called *Safety Facts* is distributed weekly to all supervisors in our plant. The lower left side of this report gives personal injury facts, the lower right side gives property damage facts. A *total safety performance* rating is given each department in the right hand margin. This rating includes an evaluation of housekeeping, protective equipment, communications, actual injury experience, personal injury and property damage investigation.

It is the opinion at Lukens that the addition of damage control to our injury prevention program more truly represents a positive program approach to total safety. A final reason for the justification of this approach is the fact that a company desiring to earn 3 per cent net profit after taxes would have to sell six and a quarter millions in additional annual sales volume to compensate for accidents costing \$6,000 in damage per week.

In closing, I can say with a great deal of pride that this tremendous economic drain on our company's pocket book from accident property damage is fast coming unto control. Our safety personnel point with particular pride to the fact that ground will soon be broken for the construction of a new electric furnace.

In addition to the normal rewarding feeling that comes from any service to fellow man, they now realize how substantially their staff efforts contribute to the economic health and growth of their company through this new dimension in accident prevention—*total safety programming*.

TRAINING THE PLANT DEFENSE CORPS

By JOHN E. TWOMEY
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With the threat of a nuclear attack, it became evident to the management of our company that a program would have to be established to provide for the protection of personnel, continuity of production and continuity of management.

Although all three are essential to an effective industrial defense planning program,

it was recognized that planning measures for the protection of personnel should receive primary consideration. This article will therefore focus on the personnel protection phase of our program with the main emphasis being given to emergency and disaster training.

In addition to stimulating a sense of re-

sponsibility on the part of the individual for his self-protection, it became clear that significant new dimensions in training employees in activities essential for their survival would be necessary. In organizing the training effort a three-pronged approach was decided on—expand existing protective forces—create new type protective forces—train employees in special action required to minimize blast and radiation injuries.

Before describing this three-phased personnel protection program in more detail, I would like to briefly describe our scope of business activities, as they greatly influenced the kind of training problems we were confronted with. Our primary function is the manufacturing and supply unit of the Bell System. We have manufacturing plants in fifteen metropolitan areas and thirty-three distributing houses located in or adjacent to major cities.

In addition our defense work on Nike, Titan, Dew Line, etc. further complicated our protection problems for employees based over a wide geographic area. Excluding our subsidiaries, we have approximately 140,000 employees. Because of the wide dispersion of our business operations, we realized that we had a more difficult job to develop appreciation for self-protection and to train workers in appropriate protective measures.

The first area of our personnel protection program on which we concentrated was the expansion of existing plant protective forces. Our major effort was to stimulate increased participation in first aid training and to form these people into teams with designated areas of responsibility. These teams were then set up to supplement the existing "cot" or "stretcher" crews that we use in normal emergencies.

Our objective was to train 10 per cent of our people in first aid. This objective has been generally obtained; as a matter of fact, some of our locations have more than 40 per cent of their people trained in this vital area of personnel protection. This is particularly gratifying to us because all of the training is given out of hours. The first aid teams devote several hours each year to practice exercises. These exercises, which are conducted during regular working hours, serve to train the employees to act as a team and also provide a more realistic test of their skills in a simulated emergency environment.

The fire crew was another protection group that was expanded. Where needed, fire auxiliaries were trained to supplement existing fire crews. In establishing a program of this nature it must be assumed that there will be no help from the local fire department, since the holocaust following a nuclear blast will be greater than anything ever before anticipated or experienced.

The second major phase of our personnel protection program was the creation of new types of protective forces. In this area rescue squads were established to remove the injured from the debris. With the help of the Civil Defense people a group of our employees received expert training at Olney, Md., in the techniques of removing the injured from buildings destroyed or damaged by natural or man-made disasters. These people returned to their locations and passed their training along to others who were then organized into rescue squads. Special equipment was assembled for training and other equipment normally used in maintenance work was designated for training and emergency use.

Under this second phase of our program, we also organized radiological monitoring and detection squads. In establishing our radiological training program, we brought together a small group of employees skilled in training techniques or with a technical background. These people reviewed the problem and prepared an Instructor's Guide and a Problem Book to facilitate training. A Radiological Monitoring and Detection Manual was also prepared for the squad members to be used as a guide and reference to aid them in performing their responsibilities.

Originally we purchased several sets of instruments and borrowed others from local Civil Defense units for training purposes. We recently completed the purchase of radiological instruments for each of our working locations. Each set of instruments, manufactured in accordance with Civil Defense specifications, consists of one geiger counter, one medium range survey meter, one high range survey meter, four dosimeters and one dosimeter charger. These instruments will be used to retrain our present monitors and train others as the need arises.

The third and final component of our personnel protection program is training our employees in the special action necessary to

minimize blast and radiation injuries. This includes such items as warnings, warden organization, shelter drills and shutdown procedures.

We receive our warning primarily by the bell and light system furnished by the local telephone companies. The warning is disseminated by various means—bells, horns, whistles, sirens and in some cases by public address systems—and is readily recognizable by the employees.

Our warden organization is generally made up of supervisors to whom people would normally look for direction. Our wardens are trained to see that employees move quickly to their assigned shelter areas, check to be sure that prescribed shutdown procedures have been carried out, and take any other steps necessary to minimize blast damage.

Shelter drills are conducted periodically. Drills of this nature are one of the best means of keeping our employees aware of the continuous need to prepare themselves to handle disasters effectively. Workers who are conditioned to shelter drills will show considerably more control when faced with a real disaster than those with little or no training.

While on the subject of shelter drills, a word about our shelter areas is in order. Specific areas in our building have been designated by our engineering organization as shelters and are well marked. Providing adequate fallout shelters poses a big problem and at the present time a survey is being made of our various buildings to determine the amount of protection that they will afford against radioactive fallout in the event of a nuclear attack on this country.

To aid us in this work, the Office of Civil and Defense Mobilization conducted a two-day fallout shelter survey workshop at their operational headquarters in Battle Creek, Mich., for 22 of our building engineers providing us with the necessary information, procedures and techniques for making such a study. These surveys, when analyzed, will enable us to determine the most suitable shelter areas for our employees. The important thing in any shelter program is that some positive action is better than none, as more people will be in areas outside the blast zone where fallout will be a major problem.

The fourth and last item of training employees in special protective action is the establishment of shutdown procedures. We have established detailed procedures for shutting down operations as quickly as possible when a warning is sounded and individuals with the responsibility for taking action have been trained in the necessary steps that are to be taken at that time. Where possible the actual shutdown of equipment takes place; however, if this is not feasible we conduct simulated shutdown procedures by tagging the equipment. These drills occur simultaneously with shelter drills for the rest of the employee population.

Although we have made progress in our personnel protection program, further work is necessary. We still need additional equipment for our various squads and the problem of providing refresher training in all phases of the job is a continuing one. We are presently reviewing the possibility of acquiring additional Geiger counters to be used by our first aid squads in monitoring the injured, to be sure they are relatively free of radioactive particles, before being brought into the receiving area. Another item that is receiving close attention at this time is the creation of decontamination squads to remove radioactive fallout particles from our manufacturing areas, machinery, and equipment so that we can get back into production at the earliest opportunity.

One of the big problems in personnel protection training is to have the workers recognize their responsibility and participate in the training that is made available to them. This requires a continuous educational program of providing them with information on the threat and the steps that can be taken to counteract it. The recurrent international crises also have helped to maintain this interest; however, one of the big problems is to overcome the apathy that is still prevalent.

One of the best ways to be sure that the individual does what he should about civil defense while away from the job is for his employer to demonstrate the awareness of the peril and doing something about it at the work place. This is accomplished by conducting shelter drills and other defense activities in which the employees participate while on the job. There are also many excellent publications that can be passed out to the employees which detail the steps necessary for survival.

If an attack comes, it will be "survival of the fittest;" it is therefore in the best interests of employee and employer to real-

istically face the problem of survival and cooperate in an active industrial defense program.

WHAT DO WE EXPECT OF THE SAFETY ENGINEERS?

By G. W. HARPER

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Before launching blindly into a detailed discussion, it seems to me that the third word in the title must be defined. Who is this "we" that is asking the question? To clarify this point I suggest that the "we" which we have in mind is that of top management. It might be both enlightening and valuable to discuss this subject from the standpoint of "we" being the safety man; in other words what do we expect from our fellow safety engineers. This might be very interesting indeed, and if carried to an extreme might even lead to bloodshed. However, I believe you will agree that we must approach this question keeping in mind that we had best understand what our bosses expect from us.

At this point, I could of course, refer you to several textbooks on industrial safety, and to the federal government's *Dictionary of Occupational Titles* and quote what has been written on the subject during the past forty years. While this might be enlightening in a historical sense, I believe sincerely that it would fall short in providing an adequate and useful answer for us.

Without taking your time to read the detailed list of what I consider to be a well done summary of the duties and responsibilities of the safety director, as outlined in fourteen specific items in Chapter 2 of the *NSC Manual of Accident Prevention for Industrial Organizations*, I want to pick out the action words from this listing. In these fourteen points we find the following: formulating, administering, reporting, advising, recording, investigating, supervising, training, delegating, correlating, inspecting, contracting, complying, initiating, and last, but not least, directing.

Now you will note that I have, up to

this point, not given any of the objects along with the above words. There are two main reasons for this. In the first place there are several objectives which have been and can be attached to each activity. Let me explain what I mean. For example, take the word "recording"—recording of injury cases, recording of unsafe practices, and the recording of the minutes of supervisory safety meetings, are possibilities.

But we will return to this train of thought in a moment. The second reason for not including types of activities is that I should like to pursue another line of thought as a foundation of further discussion.

Before attempting to pin-point what is expected of the safety engineer in detail, I think it would be well to review the areas of knowledge or the tools of the trade of safety engineering. A good many years ago, Joe Stennett, writing in the *National Safety News* had an article which was titled "The Double 'C' of Industrial Safety." In it he pointed out that the double "C" of industrial safety included the first "C," control of environment, and the second "C," control of behavior. Before a safety engineer can begin to do his job he must have knowledge of methods and procedures in both of these areas.

At this point I should like to refine and clarify these two items. For a number of years I have given a talk and a portion of it has been devoted to this phase of our present discussion. In it I have outlined some areas of information, study, and knowledge essential to accomplish the com-

"The Double 'C' of Industrial Safety by J. C. Stennett—*National Safety News*, December, 1959.

plete job of industrial safety engineering. The areas are defined in answer to the question, "What are the tools for the safety job?"

Item number one states that "A safe environment is obtained through engineering." A few of the tools with which we, as safety engineers, must have in our kit, include machine guarding, heating, light, ventilation, material handling, electricity, welding, materials processing, and a host of others. As you can see all of these areas concern the engineering background and tools essential to creating, maintaining, and controlling a safe environment.

Item number two covers a part of the second "C" and states "Safe acts and practices are obtained through training." Some of the tools in this kit are orientation or induction training, plant or general safety rules, job safety training, job safety rules, fire training, first-aid training, supervisory training and management conferences.

Item number three, in the talk I referred to previously concerns itself with a supplementary set of tools to reinforce the second "C." It states that "Safe attitudes are created and enhanced thru promotional activities." In this area in our kit of tools we find such items as posters and bulletin boards, contests, awards, certificates, stunts, campaigns, plant publications, signs, and suggestion systems. Let me be very explicit about this kit of tools. None of them ever directly prevented an injury but the whole kit contains supplementary and supporting activities. That "attitudes" are important is a fact that I am sure cannot be disputed.

It is evident in U. S. Steel's program, "knowing is not enough." Motivation is essential. May I insert at this point, that some safety programs, I have known about, are made up of such a high proportion of promotional elements, that the other two sets of tools are all but forgotten.

Now, let me summarize. Our top managements expect the safety engineer to have fundamental knowledge in the three basic tools of safety: engineering to make a safe environment; training, to eliminate unsafe practices; and promotion, to foster safe attitudes. The ways and means, of obtaining this knowledge through higher education, and as a continuing process, are the topics covered later in this program.

To quote a phrase already used, "knowing is not enough." The safety engineer is a doer. This fact was illustrated earlier by the list of action verbs. But this same listing covers such a diversity of activities that many safety engineers have jumped on their white chargers and galloped off in all directions. Many times to the detriment of their own jobs, and also to the safety movement in general. In all fairness, it must be said that these individuals have been few in number in recent years.

Let us now turn our attention to what management expects of us as safety administrators. In approaching this question I would for a moment or two like to dwell on the negative side; that is, a few of the things that they do not expect safety engineers to do.

I would like to direct your attention to a recent article in *Factory Magazine* titled "What's Wrong With Safety Management?" Let me say at the outset that I hope all of you will read this article, and I am sure you will be as angry as I was. Why will you get mad? Because there is so much truth in the article. Let me make just a few quotations to show what I mean.

The responsibility for making safety work must rest with first-line supervision. Safety men must learn to live as staff specialists, nothing else.

The management approach needs fewer, but better safety men.

Awards are absolutely worthless. Safety function has too often become a hiding place for "klunks"—men who are neither managers nor experts.

Here's where the safety expert comes in—as a staff specialist.

There is food for thought in these articles and I trust that you will all read it. But now let us turn to the positive side of the picture.

Russ De Reamer, writing in the *A.S.S.E. Journal* highlights what has been said before. "In the past the industrial safety specialist has been the doer. In the future he will be the catalyst, the advisor, the teacher who precipitates safety action on the part of live managers."

"What's Wrong With Safety Management"—by Lawrence F. Milien, *Factory Magazine*, September, 1961.

"A.S.S.E. Must Prepare Today For Tomorrow"—by Russell DeReamer, *Journal of the American Society of Safety Engineers*—January, 1960.

Along with this change in the type of activities we find a new challenge in the job that we must do. Just last Tuesday, Dr. John Grimaldi¹ called these to our attention when said—

First we must convey that safety is not a doctrine of risk avoidance. . . . It would be more appropriate instead, to emphasize that safety is controlled risk taking. In this concept the professional work of the safety specialist is implementing risk control so as to limit accidental harm to people, products and material. Prevention is not the key here, but limitation of hazards is. An effort to control hazards may produce their eradication, but not always.

There is much more that needs to be said on this subject, that I feel would be of help, but time does not permit. So in conclusion, I should like to summarize the major points I have made.

1. We must change our perspective and direct our energies toward a newer and higher goal—that of accident and hazard control—and stop becoming "follow-uppers."

2. We must realize that we can be more effective if we accept our role as staff safety specialists—safety consultants, planners, etc.—and stay away from the firing line.

3. We must equip ourselves with the

"Safety Engineering in a Changing World"—by John W. Grimaldi—at National Safety Congress—1961.

"Get Safety out of the Personnel Department"—R. G. D. Anderson, *Occupational Hazards*, March, 1961.

basic tools of our trade and know when and how to recommend their correct use in the control of hazards: i.e., in the control of environment, in the control of behavior, and in the motivation of safe attitudes.

4. We must emphasize the planning and control functions of our work. We must plan the safety programs, provide the necessary means to measure its application, be alert to the areas of weakness, provide assistance and technical information when and where needed and give leadership in safety work on the job and in other areas of our daily living.

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DESIGN SPECIFICATIONS FOR A SAFETY ENGINEER

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With the growth of any profession there is always the need for that introspection called "soul searching." In the rush to get the job done we need to pause and ask the most humbling of all questions, "Where are we going and how are we going to get there?"

Certainly before we spell out the necessary ingredients to concoct the ideal safety engineer we must agree upon the end product. Doubtless there are countless versions

of the role of the safety engineer in our society. These role images will vary depending upon the viewpoint taken. Management, labor and the safety engineer himself will have different concepts of safety engineering, just as they will view the safety function itself differently.

For purposes of delineating this discussion and to pursue the main purpose of this address, namely the basic requirements of the safety engineer and suggestions for his ad-

vanced training, we shall stipulate the safety engineering role, "as the minimization of the losses associated with accidents and industrial hygiene hazards." To fulfill this role three prime skills—analysis, interpretation and communication—are required in the safety engineer.

While knowledge is essential as the backbone of any profession we must not confuse knowledge with understanding or the accumulation of facts with progress. Possession of knowledge is no guarantee of professional competence. Technical knowledge is indispensable to a scientific profession but at the same time detailed knowledge can be worthless without the skills to properly employ it or the ability to convince people that its fruits are worthwhile.

We don't want the modern safety engineer to be a walking encyclopedia—a roving handbook without the wisdom which must mediate knowledge. In fact, the exponential rate of growth in technology prevents anyone from being completely informed. This has led to specialization and subspecialization in engineering and still it is virtually impossible to keep abreast of a field.

The universal safety engineer—competent in all fields perhaps never existed even in early days of the safety movement. It is certain he does not exist today. Ionizing radiation, occupational noise, automation, the introduction of bizarre processes and exotic materials have forced the safety engineer to be concerned not with knowledge per se but with the problem of knowledge acquisition relative to a given problem.

The challenge of technology in the 60's has forced engineering educators to put less emphasis on technical details and more on skills, creative engineering and professional attitudes. While one has difficulty teaching an attitude he can imbue a student with the responsibilities of his profession and attempt to show him how he appears to others outside his discipline. The engineer must recognize that his assignments come from non-engineers and his results are used by "non-engineers." The safety engineer would do well to remember this in attacking accident problems.

In terms of knowledge requirements the safety specialist (at this point we should recognize that an engineering background is not the only preparation for success in acci-

dent control) must first know the process and operations for which he is responsible. This is just as important as the physical laws upon which engineering is founded. The safety specialist must also have knowledge of the vicissitudes of the accident phenomenon and the environments which precipitate accidents. He must be able to recognize the hazards in an operation before they result in accidents. He must be aware of pertinent safety codes and safety regulations.

Since he is a coordinator in many cases, the safety specialist must have some knowledge of cost accounting, compensation laws, union contracts, medical aspects of accident control, etc. These knowledge requirements are familiar to you all and as such the preceding statements are not very profound. What I do think is often overlooked is the emphasis in analysis, interpretation and communication.

The problem solving skills of the safety specialists are demanded with every accident in the plant and, indeed, with every man-machine operation. Such analytic skills are also required each time a new process is introduced since the safety specialist must know how to anticipate problems before they occur.

There is an obvious parallel between the criminologist and the accident investigator. Each must attempt to reconstruct conditions before the occurrence of the crime or accident. *Proper accident investigation is not something anyone can do.* It requires a trained mind—an inquisitive nature and a student of human behavior. This last point is one in which more training is needed.

All of us consider ourselves dilettantes in the behavioral sciences. In understanding accident causation, however, this is not enough. Too long have we left the psychologist in the laboratory and limited his discipline to research. The 20th century safety specialist must be familiar with learning, motivation, emotion, attitude, fatigue, boredom as well as sensory and motor skill capacities. These are not erudite subjects for the university climate. They are aspects of human behavior which impinge on the accident phenomenon.

Consider how slow the recognition of human engineering has been in the safety field. How many accidents have been ascribed to

operator error or carelessness instead of to the fact that certain kinds of equipment have been designed so that operator error is inevitable. Consider forklift accidents. Driving a forklift truck violates man's learned response from the automobile. With rear wheel steering, backing errors are common for the novice driver and even the experienced driver if he is in a stressful situation where he reverts to old learned responses.

A great per cent of the male population can't apply the forklift's brakes without striking the knee against the steering wheel unless braking is done with a slanting motion. I might add that present day autos have this same drawback. The auto industry has only in the last six to eight years begun to design cars for operator comfort and safety and I fear we have a long way to go. Thus, it is imperative that the safety specialist study the fruits of applied psychology if he really expects to properly analyze accidents.

The safety analyst must also recognize the danger signs of employees working in environmental stress. There is considerable evidence to suggest that sub-quality output, slight decreases in total output and a higher frequency of unscheduled breaks will occur during early stages of environmental stress such as heat, light, noise, airborne contamination, etc. This stage is followed by more direct quality errors by the operator and also increased susceptibility to accidents. Finally physiological damage and occupational diseases result with increased environmental stress.

Since safety is not a criterion in its own right but rather is intimately tied into production, the safety specialist must understand the principles of work design so that accident prevention complements production. In this regard, a safety specialist should be trained in methods improvement and work simplification. With very few exceptions, building safety into a job should increase output. None of the principles of motion economy, for example, contradict a principle of machine guarding. Indeed, the future of safety may depend on the justification of safety on the basis that it facilitates production *not* on the basis that accidents are costly.

It is precisely in the area of problem

analysis that the disciplinary training of engineering is useful. In safety, one must be able to organize facts, isolate the contributing factors, propose hypotheses and test them in the work environment. It is here that creative engineering is most pertinent. One must be forever curious in accident studies, for curiosity as Samuel Johnson put it, "is the permanent characteristic of a vigorous mind."

The fantastic complexity of the accident phenomenon obviates the application of simple homespun accident prevention remedies, such as the use of the ASA causal classification system. The safety specialist must be alert to new hazards, to new solutions, and to new ways to safeguard the operator. He can not afford to be straight-jacketed in this thinking.

Second to the analytic skill requirements of the safety specialist is his role as interpreter. He must be able to interpret the significance of accident findings to management and the worker. He must be able to interpret accident prevention measures in terms of company savings, better product and increased employee morale. He must be skilled at both descriptive and inferential statistics. The former will permit him to measure his progress and properly evaluate safety effectiveness in the firm. The latter will enable him to differentiate between real and chance changes in the safety level of the organization.

As a rule, safety specialists are mired in statistical averages and have little appreciation for the pitfalls that averages are prone to supply. How many safety specialists can perform or even interpret a statistical analysis of accident data; for example, the relationship between first aid and LTA accidents. Statistics are neither the work of the devil nor a panacea. They simply provide specialized interpretation of data.

An interpreter in the language sense is equally fluent in two or more languages. In safety, the specialist must be able to translate management policy into safety programs and translate accident data into management action. In addition, because of his unique position as coordinator in the firm, the specialist must be able to translate engineering into maintenance terms and vice versa. He must be able to translate medical recommendations into protection for the worker.

Moreover, the constraints as represented by safety codes must be related to the realities of production. Those interpretive skills must be mediated by wisdom and a sense of magnanimity, neither underplaying nor overplaying the function that safety must play in the company operations.

Finally, juxtaposed with interpretation is communication. Unless the safety specialist can make his findings and their interpretations known to management and the worker his efforts are wasted. To most safety directors this is the area of their prime concern, especially in their communication with management.

We often forget, however, that safety communication must be lateral, as well as vertical in the firm. Other staff functions are intimately bound to the safety functions since accident prevention measures are very likely to affect quality control, production control, methods and time study, sales, and accounting. Communication involves establishing channels and organizing the messages to be used in these channels.

Effective oral and written communicative skill is one of the real weaknesses in modern engineering education. Almost without exception our graduates complain that they wish they could have taken more English and speech courses while in college. To the safety specialist, communication is a constant challenge and a difficult art.

For example, he must convince his superiors that their support is indispensable and at the same time not inculcate the attitude that he does not have control of the situation. To the worker he must establish his authority and at the same time solicit from him assistance in combating accidents.

The safety specialists must above all else establish by means of the written and spoken word a sense of awareness and responsibility towards safety, from the hourly laborer to the plant manager. Unless the plant community considers safety a part of each individual job and is aware of accident producing situations it is questionable how much the most capable safety specialist can accomplish.

Up to this point we have outlined the general specifications for the ideal safety specialist. While none of us may ever reach perfection we can through self-education better equip ourselves for the challenges of

our work. Rather than emphasize more detailed knowledge I would like to suggest eight areas of advanced study which will assist the safety specialist in these functions of analysis, interpretation and communication. These areas of study might involve reading, safety seminars, advanced courses sponsored by local ASSE chapters and topics for ASSE national meetings.

I. *Work Simplification*—including work measurement, principles of motion economy, methods analysis and operational analysis. This ability to analyze elements of work is the foundation of job safety analysis.

II. *Human Factors Engineering*—The fundamentals of the design of man-machine systems for human use. This involves consideration of the cognitive, anthropometric, sensory and motor capabilities of man and their effect on equipment design.

III. *Descriptive Statistics*—The ability to organize data in meaningful ways and the subsequent ability to present accident data in clear and concise forms.

IV. *Inferential Statistics*—ability to draw proper inferences about statistical data. Of paramount concern here is the distinction between chance and real changes in accident statistics and the testing of hypotheses concerning accident causes and the relation between accident prevention efforts and changes in safety effectiveness.

V. *Environmental Stress and Its Effect on Worker Behavior*—included here are those environmental factors which not only accelerate accident producing situations but those which at the same time undermine quality output such as thermal stress, noise, lighting, airborne contaminants and toxic chemicals.

VI. *The Psychologically Safe Climate*—This is an area of psychology that has been abandoned in the past for emphasis on accident prone theory. Here we refer to motivational, learning and attitudinal factors which facilitate alertness and concern towards safety.

VII. *Creative Thinking*—one of the lost arts in engineering today. Because no two accident problems are the same we must develop ingenuity and unconventional solution methods. Creative thinking is a skill that can be developed as brainstorming sessions have demonstrated.

VIII. *Effective Communication*—The

ability to express concisely and completely our findings in safety and to spell out clearly the recommended action to management in terms which they can appreciate and understand.

What is needed is the development of these typical areas by talented individuals within and outside of our society and the publication of this material so that it is available

to the individual safety specialist. Lastly it should be clear that knowledge and skill are no guarantees of success in accident prevention if we fail to be genuinely motivated in our concern for our fellow man. If we truly possess this concern, face up to our own inadequacies and continually strive for self improvement, we will be a credit to ourselves and to our profession.

PREPARING THE SAFETY ENGINEER AND UPGRADING PERFORMANCE

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A hasty review of the literature reveals that we have been probing and discussing this subject for at least 10 years, and the question that first occurs to me is, "Why this recurring interest in this theme?" What are the needs that impel us to review and discuss this material and to seek new answers on frequent occasions in all of our professional meetings.

I believe there are four needs. Discussion of them will give us an opportunity to review some of the literature concerned with preparation of the safety engineer. In addition, I should like to present to you seven additional ideas concerned with preparing the safety engineer and upgrading performance. With this brief preview let us begin with the first need which motivates constant stirring and review of this question.

First, there is a need to clarify the question of whether a safety engineer must first be an engineer. I shall not discuss this issue, but merely refer to some of the literature, such as the 1956 item entitled "Preparing Tomorrow's Engineer and Safety Specialist"; or the 1958 item on the "Safety Engineering Profession"; or the fine paper by Heimreich, "Can Safety Stand On Its Own Feet"—a paper dating from 1953. At the 1953 Congress, there was a paper on "What Shall We Teach the Safety Engineer of Tomorrow"—in 1959 the question was discussed, "What Is A Safety Engineer?"—or the fine article in the current

issue of the Journal entitled "Engineering as a foundation for Optimum Safety Success."

One of our needs in our recurring discussion of this theme of education of safety personnel has been the need to clarify this question of the role of engineering training for safety engineers.

A second need has been to develop a university curriculum for preparing safety personnel. This has given us a fine paper at the congress in 1958 by Tom Rockwell, "Removing a Blind Spot in Safety Education." Or in 1955, a survey, entitled "The Safety Engineer in Industry." Or a paper from 1956, entitled "Recognition of Safety as a Profession." And dating all the way back to 1952, a fine booklet by Cutter and Elkow, entitled "Training For Industrial Accident Prevention," to which I shall return in a few moments.

I believe there is still a third reason why safety engineers find a need to consider and reconsider the kind of knowledge and training that goes into their job. I believe by such discussions we seek to avoid being swamped, being drowned, by the immensity of the knowledge and skills that seem to be unavoidably inherent in our job. We sense a need to know all things and yet we are aware of the fallacy of seeking to know all things, and are aware of the fallacy of creating an image of the safety engineer as a man who knows all things.

We have sought the core concepts around which to integrate our body of knowledge, to integrate our work, to integrate our safety personalities. The very vastness of the things we deal with, in chemistry, in physics, in engineering, in medicine, of plant layout, in industrial engineering procedures, in psychology, in teaching, in motivation, the very vastness of all this surrounds us with a chaos through which we seek guide posts.

This need gives us such papers as one in 1953, entitled "What The Safety Engineer Expects in the Safety Program"; or one in 1959 seeking guidance on policy, entitled "Safety Management Policy"; or in 1952, "The Place of Safety Engineering in Industry"; or in 1959, "What A Plant Manager Expects Of A Safety Engineer." We have sought guidance in the chaos of the knowledge and the skills of our job; we have sought to avoid being swamped by again and again asking ourselves what should be in our education and training.

Fourth, I believe there is another paradoxical need which motivates us to look at our training and background—the need to avoid being narrowed to the special aspects of our immediate job—to avoid becoming specialists in one plant, in one industry, or perhaps in just one department or phase of safety in a plant or industry.

On the one hand, we have the need to avoid intellectual chaos and on the other hand we have the need to avoid intellectual tunnel vision. This has given us such papers as the 1958 paper on "What is Wrong with Safety Engineers"; or in 1959 a paper entitled "Toward the Profession of Safety Program Management"; or in 1960, "Today's Safety Engineer"; or in 1960 again, "Our Society Must Prepare Today for Tomorrow."

These four thoughts provide a hasty review of some of the literature that exists on these topics. It may be comforting to you to know that whatever you are seeking here today and whatever you may acquire here today, can be augmented by the devoted efforts of many people extending back over many years. I believe we shall continue for many years to probe these questions, for by probing them we find personal guidance, personal integration, identification in our special role. We harness

ourselves and we harness concepts to the tasks of safety that surround us.

The American Society of Safety Engineers was the first organized group with an expressed belief that safety could be achieved by orderly application of principles. We still struggle to define ourselves and our body of knowledge. It is interesting to be aware of the fact that others deal in the same life-preserving and property-protecting tasks that we ourselves are in. But their identity has been different, their specialty has been different, the patterns of their thinking has been different.

Others have found it necessary to organize in groups and societies whose patterns of thinking are not satisfied in the things we have identified in the American Society of Safety Engineers. Just hastily there are the Fire Prevention Engineers, the Institute of Traffic Engineers, the Council of Safety Supervisors, the Campus Safety Association, the American Industrial Hygiene Association, and I am sure there are others.

I can perhaps close off this portion of my comments by referring again to the booklet by Dr. Cutter and Dr. Elkow, published in 1952 by the Center for Safety Education at New York University. In this 64 page booklet, Part I is entitled "The Industrial Accident Prevention Specialist and His Functions." Part II, "Training for Safety in Engineering and Technical Schools." Part III, "Training in Accident Prevention in Non-Engineering Colleges, Schools and Departments." Part IV, "Recommendations for Training in Industrial Accident Prevention." Those of us who seek for guidance in this field need not seek in vain.

Let us then consider some other aspects of preparation: the safety engineer and upgrading performance. Let us consider it from the view of the practical safety engineer doing his job, perhaps aware of the need to avoid both intellectual chaos and intellectual tunnel vision, and desiring further education and guidance to upgrade performance. The following seven ideas may have some merit in your thinking:

1. *Build your self-improvement around the specific hazards of your operation.* Define what it is you need to do in order to do your job better and seek opportunities for that kind of education. Do you have lad-

ders or flammable materials, window washers, an outside construction crew, explosives, or special hazards to which you might well give self-directed educational endeavor?

For example, one frequently overlooked is the trucking operation, which exists in many industries, and which at present tends to be growing at a rather rapid rate. What skills and knowledge do you need to reach out and exert an influence over that? Does your company have a sales organization, perhaps spread over a very wide area, directed by a sales manager whose sole concern is sales, and all of whose salesmen are driving passenger cars over which you have little influence?

This is what I mean when I say, "Build your influence, build your self-improvement around the specific hazards of your own operation." This I think is illustrated in a tale told to me by a safety director, who received a phone call about an explosion in a chemistry lab. Before he rushed over, he hastily thumbed through some chemical data sheets, and upon arrival was able to explain to the amazed chemist exactly what had happened, why it had happened, and how to prevent it. He said all of this very ruefully, for he realized that he was playing the role of the safety engineer as knowing all things. He knew that this is a satisfying role when you can get away with it, but you seldom can.

The real point of the story is that he was prepared to deal with the hazards of his chemical labs. It would require a chemical engineer to know all the facets that need to be known about the wide variety of chemicals that exist in most any of our industrial operations.

I submit that it would be a tall order for the safety engineer to seek to be a half-baked chemist. He performs his full function as a safety engineer, however, when he contrives procedures whereby he knows whenever a new chemical with unknown potential is brought into the plant. This gives him the opportunity to exert control and preventive measures. Self-directed improvement can usually be pointed by the specific hazards of our own operation.

2. *Through the literature and standards available, a flow of materials should cross your desks from the standard sources.* I mention this point because so frequently

a safety engineer mentions a problem, not knowing that a standard exists that would be helpful to him or that literature on it exists for pass-out materials for his supervisors. This again does not mean that we become all-knowing in studying all these things, but that we know what is available from the American Standards Association, from various insurance companies, from the National Fire Protection Association, National Safety Council, heating and ventilating engineers, industrial hygiene publications, chemical data sheets, and special publications pertinent to our industry, be it trucking, mining, petroleum, utilities, or whatever.

I believe it is a fair statement that you do not have a problem, you do not have any need for knowledge, that has not been reduced to writing and expressed in a pamphlet or a book somewhere. My point here is: keep your channels open to a flow of this material, learn to scan it hastily so that you know what is there, learn to read some of it and learn to study certain further choice items.

3. *Study your position and the position of safety in your organization.* This idea relates to the next one I am going to mention. My thought can be illustrated by this situation:

A safety man had been attached to the trucking department in an organization because that was their problem when they brought him in. He had, however, a sizeable background in industrial safety, felt the need to extend his influences further throughout the organization, and found himself strategically in a very poor position to exert influence throughout the organization.

It is further illustrated in a company I consulted with, in which it became a question of some import as to just where and to whom a potential safety director should report. The standard academic answers were there, but for reasons that would be difficult to understand without knowing the internal workings of the company, it just would not work in this case.

The idea is illustrated in a situation in which the safety director just isn't attached anywhere. He literally reports to no one. The person who hired him changed to another position, the safety director literally

did not know whom he reported to, and no one understood him to be a subordinate. He was a free-floating safety engineer. He was the most advisory safety engineer I have ever seen, and also in a position of least influence.

Can you extend your influence throughout the organization? Can you make it reach the sales department, the high-powered brains in the research department, the driver on the highway, the outlying plant in the other city, or the boss's son? We need to understand our position and the position of safety in the organization, in its total functioning, in order to advance and exert our influence for good.

4. *The fourth point is an old cliché of safety, to fix safety as a line responsibility—where it belongs.* It has been my observation that management does not expect this; is quite confused as to the functions of safety, even when they define it in words; is often rather vague in its application and, most importantly, that it is a long and difficult task to really imbue a whole organization with the idea of line responsibility for safety. I believe the whole philosophy, theory, and practice is revealed in a little vignette of the safety director who described a scene in which he stood talking to the plant manager one morning when the assistant plant manager walked up. As the assistant approached, the plant manager nudged the safety director and pointed at the shoes of the approaching assistant and said, "Look! No safety shoes—give him hell!" The safety director calmly shrugged his shoulders and walked away with the comment, "He doesn't work for me."

I believe these last two thoughts—to study your position and the position of safety in your organization, and to fix line responsibility for safety, are important in the development of the safety engineer. Your success and your skill in dealing with these last two items, I believe, make the distinction between safety management and safety inspection for some other lesser expression of safety control.

5. *Make the safety post a stepping-stone upward.* I believe this point has overlooked implications. It applies to you—it applies to your subordinates—and in a large organization it has special meaning for safety supervisors assigned in the field. As it applies to

you, let me suggest these thoughts: I believe that a man who leaves safety work for some higher responsibility in his company is not lost to safety—he is rather in a position of doing more for safety.

His higher position, with his safety background, makes him highly receptive to the safety needs of the organization; and his higher position puts him in a more influential position to accomplish something in it. I do not believe the cause of safety suffers when a safety man moves to a higher responsibility in his company.

This idea of making safety a stepping-stone has a special pertinence in many organizations which have gone through a rugged phase—a phase of rapid growth, of immaturity and development, of acquisition of other companies, of difficulty in applying good management procedures and hence good safety procedures. I have seen such organizations influenced by strong, competent safety men, who did a terrific job in safety and inculcated throughout the organization a deep awareness of safety fundamentals.

The more successfully they accomplished this task, the less it needed a man of such high competence and salary. I have seen such men become, shall I say, the victims of management's awareness that their tasks, now so well integrated throughout the company, could be done by somebody at half the salary.

I have seen other men in this same situation, perhaps more fortunate, who used safety as a stepping-stone. As they did this tremendous job for safety they also developed around themselves a set of related tasks—tasks in claims, in insurance and compensation, in wage administration, in pension programs, in any number of related tasks which are a developing part of the efficiency of the organization. I talked to one such man this week, who recently gave up the title of safety director to take on a higher title that encompasses all the tasks that he developed while still safety director. He now has reporting to him a safety director at perhaps one-half or one-third of his salary.

Safety suffers when highly competent men, who have staked their prestige, their status in the company, on masterful safety performance, suddenly have the rug slid out from under them. On the other hand,

safety gains when that safety engineer advances himself, exerting a stronger influence throughout the whole company, including his influence on safety.

This idea of safety as a stepping-stone applies to your subordinates. You may lose a man as you develop him to another company, or to another department, but let him go; let work in safety be seen and recognized as a stepping-stone upward deserving the best abilities and the most aggressive performance.

A special version of this applies in large organizations where at the plant level, or at the district or division level, safety supervisors are assigned by the line authority. These men are not usually professional safety men as you and I know them, they are not a part of the central safety staff; they report directly to the line organization.

In such positions you are apt to find one of two things: Sometimes you find an incompetent hiding behind the desk, left there because he is not wanted anywhere else, and he seems to do the least harm at the safety desk. Or sometimes you find an opposite picture—a capable, aggressive man who has done a fine job in safety and is left there because he has done a good job, while other promotional opportunities are passed on to other men. It is well to review the role and the functions and the prospects of safety supervisors in these positions.

These men are in a position to study the working of a whole operation, to travel throughout it, to know all its people, to deal with all of its people. It is a most wonderful opportunity for growth. We will get better safety performance in these safety supervisory posts when it is recognized that a post in safety is an opportunity for a step upward in the organization.

6. *Seek out courses and training opportunities to fit your needs;* become acquainted with the variety of courses available. Just thinking out loud—in a 150-mile radius of Chicago there are supervisor courses, courses in safety fundamentals, courses in plant ventilation and in industrial hygiene, in industrial security, in arson investigation, and I am sure there are many more. Know the sources in your own area of the kind of further preparation you need. This doesn't mean that the precise

package you want is always available, but the opportunities for the precise preparation you desire are available somewhere.

7. I suggest that each ASSE chapter should sponsor a professional-level course. When I mentioned this to George Harper he suggested two courses: one for safety engineers and safety personnel and the other for front-line supervision. I agree with him. I shall, however, at the moment, speak only of courses for professional safety personnel. Each chapter should seek out and establish university contacts. You will eventually find someone or some university or some department of the university that can work with you in putting on a program that will be helpful to you and to your chapter.

Let me offer four suggestions from my own experience in organizing and putting on these courses: (a) Put them on for yourself; don't develop them as a noble service to some other benighted soul who needs your help. Serve yourself. Serve your own chapter. Serve your own industry, and you are apt to find in the process that some other benighted soul is interested in what you're doing and will attend in greater measure than if you aim at him specifically.

(b) Put on your courses at the highest professional level. In part, this is an expression of the previous point, in that the greatest need for safety education is in the numerous small plants who have no safety director, who have little awareness of safety as an organized activity, who think of safety in terms of 5-600 dollars a year as insurance premium. These people we need to reach, but if you try to reach them directly, they will not come. If you put on a high-level course deserving of your attention and your earnest participation and attendance, and then promote it among these lesser folks whom you wish to reach, you will reach a higher percentage of them. This has been our experience.

(c) Work in fundamentals, even though your program is at a high professional level, because you wish to serve some folks who have less experience than you. Fundamentals are really worked in by the definitions and instructions given to your teachers rather than by the selection of titles themselves. Regardless of title, safety fundamentals, with forethought, by instruction to your speakers, can be worked into the

highest professional course, and what's more, can be presented in a way which will absorb the interest of the highest professional group.

(d) Look for an adviser. Somewhere there is a man who will work with you, who knows people in our field, knows the cross-threads of ideas, knows who can help to develop a program or present topics. In my work I always had the guidance of the Indianapolis chapter of the American Society of Safety Engineers, and beyond that I had phone contact with our longtime friend J. C. Stennett, who is an encyclopedia of guidance and help, and who I called on frequently.

Education for safety personnel—preparation of the engineer—upgrading performance—I wish I could tell you exactly where you can acquire the educational background that fits your particular needs, your particular personality, your particular intellect. Our particular company I cannot do that for we will never be able to. We do need constantly to upgrade ourselves and to seek new directions, especially new directions in self-preparation.

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THE KINTZ AND BROWNE FIRE AND STATIC ELECTRICITY DEMONSTRATION

By

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- H. F. BROWNE, Supervisory Safety Eng., District G, Bureau of Mines, U. S. Dept. of the Interior, Dallas, Tex.

The presentations which are designated "Interactive" deal primarily with the subjects of:

- fire and explosion, cause and prevention,
- the control of flammable and toxic gases,
- the hazards of static electricity,
- safety hazards in electrical equipment.

One of the highlights of the presentations is a demonstration entitled the "Magic of Fire," which has been enthusiastically received by large audiences in Canada, U.S.A. and Mexico.

All of the undemoted lecture demonstrations are authoritative, lively, informative and enjoyable scientific shows utilizing a unique combination of specially designed equipment and lecture demonstrations. The general technique of presentation is to describe an occurrence, a theory, or operating procedure and then by use of specially designed equipment, to reproduce the occurrence or apply the theory and show the results.

The first demonstration deals with the chemistry of fire and dust explosions, the fire triangle (fuel, heat and oxygen), explosions due to pressures, the extinguishment of fire by removing individually, fuel,

oxygen and the heat legs of the fire triangle. The strengths, limitations of various types of fire fighting equipment are shown and techniques of use are demonstrated.

The lecture further deals with the special and hazardous characteristics of light hydrocarbons including natural gas and gasoline. Factors which act to convert an explosion into a detonation are demonstrated. The special effects of different concentrations of gases and oxygen on flammable limits and explosive pressures are seen as is the migration of gases according to specific gravity. Ignition temperatures and various methods of developing these ignition temperatures are demonstrated, as are dust explosions and the factors affecting them.

Special methods of control of fire and explosion in industry, and in the home are demonstrated at length. Particular attention is given to discussion of individual and local problems.

The next lecture demonstration deals with the flammability, toxicity and explosive limits of gases encountered in industry. Examination is made of the composition and qualities of normal air and the special effects of the differing specific gravity of gases as well as detailed consideration of the special qualities of oxygen, nitrogen, carbon dioxide, methane, propane, butane, gasoline, carbon monoxide, hydrogen sulphide, sulphur dioxide and mercury. Diffusion of gases is demonstrated and respiratory equipment and its choice is discussed and the affect of gas concentrations on living organisms is shown. Permissible limits and the meaning of permissible limits are described and demonstrated.

The next lecture demonstration explains and shows the nature of static electricity. Its various manifestations are dramatically presented and specific hazardous occurrences are discussed in detail and repro-

duced in miniature. Means of control of static electricity and means of preventing serious effects are demonstrated and discussed. It is shown that static electricity cannot ignite flammable materials unless three conditions exist simultaneously. Means of preventing fire and explosion from static causes are derived in demonstration from this observation.

The effects of discharges of static electricity in operations involving such common place substances as gasoline, anaesthetics, natural gas, paint, varnish and commercial alcohol are demonstrated in memorable fashion.

The final lecture demonstration is of special interest to persons who are concerned primarily with electrical problems in areas in which explosive vapours and gases may be contaminants and particularly in conduits, ducts, and underground structures. It is also of wide interest to many laymen, industrial managers, architects, contractors, supervisors, and workmen. The need for maintenance of explosion proof and permissible electrical equipment is explained and demonstrated.

Special devices are used to demonstrate the behavior of flammable gases in conduits, and enclosures. The provisions of the Electrical Code dealing with these matters are discussed, explained and demonstrated. Flame and explosions are generated and propagated by equipment which permits observation, and study of the phenomena. Comprehensive demonstration is made of the differing performances of various types of equipment in explosive and flammable atmospheres.

This series of lectures provides an unusual training opportunity for accident prevention personnel, supervisory staffs, safety committees in industry, teachers, training personnel, fire department workers, hospital workers, civil defense participants and others.

BETTER DRIVING FOR THE WHOLE FAMILY

By WILLIAM F. SABOTA
Safety Advisor, Humble Oil & Refining Co., Linden, N. J.

Traffic accidents are the number one cause of accidental death and injury in the nation today. Bayway Refinery also learned that their principal problem in the area of off-the-job safety last year was traffic accidents. This is the story of the action taken and the results achieved by Bayway Refinery in reducing off-the-job lost-time traffic accidents. My talk is taken from our publication prepared as a guide to other organizations wishing to implement a similar program.

For many years Bayway Refinery has sustained a comprehensive and progressive safety program. They attacked the problem of off-the-job lost-time accidents because of their conviction that employees should "Be Safe Around the Clock" and that an off-the-job program contributes toward reducing in-plant injuries.

The success of the program was primarily attributed to the enthusiastic employee participation in the off-the-job safety activities. Some measure of its success was indicated by the fact that of the 1200 employees and members of their families who enrolled for the course, only 2 1/2 per cent failed to attend all four sessions. The reductions in off-the-job traffic accidents, as a result of this program, indicate that it was very worth-while.

During the past five years, Bayway made considerable progress in reducing off-the-job lost-time accidents. The year 1956 represented the first year that action was taken to bring off-the-job disabling injuries under control. It was found that 20 off-the-job disabling injuries were taking place for every plant disabling injury. Our accidents were reduced from 263 in 1956 to 63 in 1958. In 1959 we reduced the total number of accidents by four from the preceding year.

The problem was found to be that while the total off-the-job disabling injuries were reduced, no progress was made in the area of traffic accidents. Accounting for 18 per cent of our off-the-job accidents in 1956, traffic accidents steadily increased to 34 per cent in 1959. As significant was the increase

in days lost to 54 per cent of the total due to off-the-job traffic accidents in 1959. These increases offset reductions in other areas, such as home and recreation accidents.

Program Development

STEP 1: Bayway Safety Division developed a defensive driving program based on needs, with the cooperation of the Esso Safety Foundation.

STEP 2: Defensive driving program was presented to Bayway Central Safety Committee for approval.

STEP 3: The cooperation of outside agencies was obtained to participate in the course, such as the New Jersey Division of Motor Vehicles and Division of State Police and the New Jersey Safety Council.

STEP 4: A pilot course was presented to a sample group to develop the final program format before it was offered to all Bayway employees and their families.

A letter from the Manager of Bayway Refinery accompanied by this flyer was sent to employees' homes announcing the program.

A second letter from the manager of Bayway Refinery was sent to employees' homes accompanied by an information sheet and a kit of promotional materials, as follows:

Information and Instruction Sheet

"Who is eligible?"—All Bayway employees and members of their immediate families who drive. The initial program will be presented to the first 600 who register. Attendance tickets will be sent out for this program.

Place—Auditorium, Bayway Office Building.

Time—7:30 p.m. to 9:30 p.m.—4 sessions, 2 hours each.

Dinner—Starting at 6 p.m., a free dinner will be served in the Bayway Cafeteria to everyone attending the program.

Dates—Tuesdays or Thursdays through May.

This program will continue in future

months until everyone who registered has a chance to make part.

Registration and award card—Enclosed is a return address registration and award selection card. Please print your name, address and employee number. Check the box indicating that you will or will not attend. If you (the employee) plan to attend, look over the enclosed list of Employee Awards and mark the number of your selection in the box after your name on the card. To register members of your family who drive, print their names on the bottom of the card in the spaces provided. If you register family members, have them look over the enclosed list of Family Awards and mark the number of their selection in the box after their name on the card. If you (the employee) cannot attend, you may still register members of your family who drive.

If you prefer either Tuesday or Thursday sessions, please indicate your choice at the bottom of the card.

Driving skill rodeo prizes—A total of \$350 will be awarded to the three best men and women drivers of the Rodeo. Both employees and non-employees who attend all four sessions will be eligible for selection to compete in the Rodeo. The top 15 men and 15 women selected for the Rodeo will compete for the cash prizes.

Women Drivers	Men Drivers
\$100 First Prize	\$100
\$50 Second Prize	\$50
\$25 Third Prize	\$25

Employee and family awards—Employees and family members who attend all four sessions will be eligible to receive the award they selected from the two enclosed lists.

Certificates—Defensive Driving Certificates will be awarded to everyone who attends all four sessions.

Defensive Driving Pens will be given to all who attend.

DON'T DELAY—REGISTER TODAY

Program Coordination

Behind every smoothly run program is a hard-working staff with specific assignments. The coordinator for the course was William F. Sabota, Bayway Refinery Safety Division, who was responsible for all arrangements. This included publicity, enrollment,

scheduling guest instructors, resource people, visual aids and physical facilities. In addition, each session required the following staff assignments:

1. *One attendant at cafeteria door*—punch ticket stub of persons enrolled in course as dinner guests of management.

2. *One attendant at auditorium door*—collect tickets for attendance records.

3. *One guide at ground floor elevators*—direct people to the auditorium. Assist Motor Vehicle Inspectors during psycho-physical testing in cafeteria.

4. *One guide at first floor elevators*—same duties as item 3 above.

5. *Two microphone handlers*—assist in stopping distance demonstration. Assist Motor Vehicle Inspectors during psycho-physical testing in cafeteria. Usher. Handle traveling microphones during regular sessions.

Instructors included Dr. Herbert J. Stack, Department of Safety Education, New York University; Consultant, Esso Safety Foundation; Dr. Arthur Mahony, Education Supervisor, Fair Lawn Public Schools System; Dr. Nathaniel O. Schneider, Director, School and College Division, New Jersey State Safety Council; Richard Tossell, Assistant Director, Esso Safety Foundation.

Cooperating agency representatives included George Traver, Executive Vice President, New Jersey State Safety Council; Capt. Daniel Dunn, New Jersey State Safety Council; Gerald J. Driscoll, Chief, Bureau Traffic Safety, New Jersey Division of Motor Vehicles; William J. Ford, Budd Krayner, and Richard Stearn of the New Jersey Division of Motor Vehicles; Enaley Bennett, Traffic Engineer, New Jersey Division of Motor Vehicles; Col. Joseph D. Rutter, Superintendent, New Jersey Division of State Police; Lt. Peter Hausch, New Jersey Division of State Police, and Lt. Raymond Mockridge, New Jersey Division of Motor Vehicles.

Instructional Planning

Planning for the instructional program in off-the-job traffic safety was based on the purposes of driver education and on other practical objectives of the learning group. In determining details, instructors considered the needs and interests of the employees and their families and utilized every good resource available.

Industrial Subjects Sessions

The limitation of eight hours for the course required careful planning and judicious use of time. The participants attending the Bayway course represented a wide range of driving experience, age and income. Many family groups of two to five members enrolled in each class of nearly 300 people.

Inasmuch as the individuals in these groups were at various levels of learning readiness and driving experience, the course had to be structured to meet the more common needs represented. The following instructional objectives were established; however, the development of specific learning experiences was the responsibility of the qualified instructor working with the participants:

1. Develop the concept of "anticipation" and "early recognition" of hazardous traffic conditions.

2. Develop the concept of "personal responsibility" for preventing accidents.

3. Develop criteria by which participants can measure their own driving practices and habits.

4. Develop the relationship between traffic violations and the consequences of accidents.

5. Review effective evasive steps to avoid collisions and near misses.

6. Personally involve the individual through "participation" in learning experiences related to course objectives.

Methods of Instruction

Little attempt was made to standardize methods closely, since they may vary according to student needs, size of group, type of learning experience, teacher abilities, available facilities, and other local conditions. The methods selected for the Bayway course placed learning experience in meaningful and realistic settings which were familiar to the participants. The instructors used the following teaching methods and techniques:

1. *Class discussion* was an important means for determining the more common problems and involving a large number of people through participation.

2. *Instructors' presentations* provided essential background information and prepared students for planned learning experiences. Lectures were discouraged. Instructors skillfully organized their presentations using a variety of audio-visual materials and demonstrations suitable for large audiences to create and maintain a high level of interest.

3. *Visiting specialists and resource persons* (representatives from the State of New Jersey Division of Motor Vehicles, Division of State Police, and State Safety Council) backed up the instructor at each session by answering questions raised by individuals in the audience. The students also wrote their questions on the cards which were provided and collected at the end of the session. Questions not answered became the basis for the panel discussion during the final session. The panel members were representative from each of the cooperating state agencies. State Motor Vehicle Division Inspectors also participated by administering the psycho-physical tests and scoring participants in the Driving Skill Rodeo. Their participation gave the program an "official" atmosphere and improved the participants' understanding of the objectives of each of these agencies.

4. *Stopping distance demonstration*—a series of dramatic stopping trials were run over a roped-off area of asphalt pavement at the refinery parking lot. Two cars of the exact model and weight were matched against each other—one equipped with Atlas Bucron tires, the others were factory-equipped tires. The measured braking distances of the two vehicles at 40 mph on both dry and wet pavement impressed the audience with the fact that even with Bucron's added margin of safety—"You Can't Stop on a Dime!" Volunteers from the audience were invited to drive the vehicles at 20 mph and make emergency stops.

No attempt has been made to present a detailed course of study in this manual. The following outline and sequence was developed as a guide in organizing instructor presentations to achieve the course objectives.

Outline of Course

A.—First Session:

1. Informal greeting to group by top management.

2. Group orientation—purpose of the course and seriousness of the traffic accidents with particular emphasis on local problems; introduction of guests and instructor by coordinator.

3. Audience interviews to familiarize audience with discussion technique and use of microphones, by instructor, "mike" handlers, and audience volunteers.

4. Discussion on basic causes of traffic accidents and meaning of "defensive driving," namely, avoiding mistakes of others by anticipation and early recognition, using transparencies.

5. "Seven-tenths of a Second"—strip film with tape recording.

6. Development of proper seeing habits using transparencies and trapezoidal window demonstration.

7. "Smith System" a motion picture for developing driver alertness.

8. Discussion of film and question and answer period, conducted by instructor, audience, State Motor Vehicle and Police representatives.

9. "And Then There Were Four," a motion picture. (Note: Interest can be stimulated by not revealing the ending of the film until the next session.)

10. Summary and assignment (*You and Your Driving booklet*) by coordinator.

B. Second Session:

Prior to this session, the group met for a demonstration of stopping distances by the New Jersey Safety Council.

1. Summary of previous session and introduction of guests & instructor by coordinator.

2. Demonstration of psycho-physical testing and significance of tests by audience volunteers, using transparencies.

3. Tell Them the Truth—the alcohol story showing physiological function—no warning signs at time drinking becomes dangerous, using transparencies.

4. "And Then There Were Four" (if not completed prior session)—motion picture.

5. Discussion of film.

6. "To See Ourselves," a motion picture

7. Discussion of film.

8. What Makes Us Tick, by Dr. Arthur Mahoney—discuss how emotions are related to attitude development and show how attitudes influence our actions in practical situations—using transparencies.

9. Questions and answer period—instructor, audience, State Motor Vehicle and Police representatives.

10. Summary and assignment (vehicle safety checks)—coordinator.

C. Third Session:

For 30 minutes previous to this and the fourth sessions, four sets of psycho-physical testing apparatus were operated by Motor Vehicle Division License Examiners and assistants.

1. Summary of previous session and introduction of guests and instructor—coordinator.

2. "Freeway Driving Is Different," a motion picture.

3. Discussion of film to emphasize important differences.

4. Discuss safe driving practices and specific steps in meeting the more common driving emergencies; show transparencies.

5. Improving perception in driving—discussion illustrated with color slides to provide practice in "early recognition" and "anticipation" principles, using color slides.

6. Question and answer period, conducted by instructor, audience, State Motor Vehicle and Police representatives.

7. Summarization and assignment (prepare and mail in questions on "what I want to know" for panel discussion).

D. Fourth Session:

1. Things I Would Like to Know—question and answer discussion around questions submitted on cards prior to or during the session, conducted by a panel: State Motor Vehicle Division, Police, Safety Council and Course Instructor. (Transparencies were utilized for illustration.)

2. Summarization of course by the instructor.

3. Objective Driver Knowledge Test (20 minutes).

4. "You and Your Driving," a motion picture.

5. Discussion of film.

6. Closing remarks by coordinator and management.

Instructional Materials

There are many audio-visual resources in driver education to aid the instructors to more fully motivate learning among his students. The following aids were used at Bayway for the purpose of illustration, stimulating discussion, and for holding the students' attention and interest:

a. Motion pictures especially related to the course content.

1. "Smith System"—9 min. B&W, 16 mm sound—Training film on proper habits of seeing—Ford Motor Company.

2. "And Then There Were Four"—25 min. B&W, 16 mm sound—Inspirational film showing faulty attitudes—Socony Mobil Oil Company.

3. "To See Ourselves"—15 min. color 16 mm sound—Provocative film on personality factors—Aetna Casualty and Surety Company.

4. "Freeway Driving Is Different"—15 min. color 16 mm sound—Training film showing how to drive on freeways—American Automobile Association.

5. "You and Your Driving"—14 min. color 16 mm sound—Defensive driving film with a refreshing "positive" approach—Esso Safety Foundation.

b. Transparencies used with overhead projector. Large enough to be easily seen at the rear of the auditorium. Utilized like a blackboard. Allows instructor to face his audience. Stimulates greater degree of student participation.

1. "Driver Safety Education," 7" visual training transparencies suitable for 7" or 9" overhead projector. Shows specific traffic conditions.—Porto-Clinic Instruments, Inc.

2. Transparencies may be made up to suit the needs of the instructor.

c. Slides and strip film were specifically related to course content. A synchronized sound recording also was used with a strip film.

1. "Seven-tenths of a Second"—4 min. 35 mm color strip film with tape-recorded narration and music. Shows the effects of a collision in tenth-second detail.—Bell Telephone System.

2. Perception slides—taken with a 35 mm camera in color, showing local traffic situations. Individual scenes were flashed on the screen for 3 seconds to improve "early recognition" of traffic hazards and to stimulate discussion.—Center for Safety Education, New York University.

3. Seeing habits—35 mm B&W slides taken from "Observation Perception"—E. I. duPont de Nemours & Co.

d. Psycho-physical testing device—each student was afforded the opportunity of being tested on a Porto-Clinic by a uniformed motor vehicle inspector on the following: visual acuity, depth perception, color vision, peripheral vision and stopping reflex. Each of the items were demonstrated and related to safe driving practices during a regular session.—Porto-Clinic Instruments, Inc.

e. Reading material—the Esso Safety Foundation *You and Your Driving booklet* and tests and the New Jersey Department of Law and Public Safety Driver's Manual were the basic reading materials. Other appropriate reading materials from various sources were distributed at each session.

f. Trapezoidal window demonstration—particularly effective demonstration to show how we do develop seeing habits that can produce errors in the interpretation of what we see on the road.

(Note: The materials used in the Bayway course are only representative of the many fine educational aids available in the field. Consult your state safety council or other traffic safety agency in your state for assistance in obtaining these aids.)

Driving Skill Roadtest

Eligibility of contestants in the men's and women's divisions was based on attendance at all four sessions of the Defensive Driving course and placement among the top 15 scores of the Driving Knowledge Test administered at the end of the course. Dr. Nathaniel Schneider, New Jersey State Safety Council, assisted by eight New Jersey State Motor Vehicle Inspectors, conducted the contest.

The score sheet for the Driving Skill Contest was based on New Jersey State Teen-age Road-test.

Program Evaluation

Approximately 1200 employees and members of their families who drive attended the Defensive Driving Program. Nearly 25 per cent of our employees were in this group. Those employees who did not attend were made aware of the course objectives by favorable newspaper coverage published by the refinery and local communities.

The reactions of employees and relatives participating have been gratifying. On a course evaluation questionnaire completed at the end of the last session, 99 per cent of

the participants rated the program "excellent" or "good" on its educational value and helpfulness. More than 85 per cent of those who attended voluntarily took the Driver Knowledge Test at the end of the course. Scores on the 50 questions based on course material averaged 82.5. This indicated the participants learned their lessons well.

The benefits derived from this program were not limited to the area of improved traffic accident performance. Bayway is now experiencing its lowest off-the-job and on-the-job disabling injury frequency rates ever recorded. These results support the belief of Bayway management that the course not only contributed toward making our employees safer drivers but also made safer workers.

Many other benefits were derived from the program which cannot be converted into frequency rates. The program added to the prestige of Esso in the community and impressed upon all employees and their families that management was sincere about reducing accidents. The program contributed toward improving employee relations by providing representatives of management and their families an opportunity to meet on an equal and continuing basis with wage and salary employees and members of their families. It also strengthened management and union relations by their working together to promote the program.

In addition, it reinforced the relationship between Esso and the state agencies that participated, such as the New Jersey Division of State Police, New Jersey Division of Motor Vehicles and the New Jersey State Safety Council.

One of the primary justifications for this program is the reduction in off-the-job accident costs as a result of a decrease in traffic accidents. It is anticipated that the savings represented by the reduction of traffic injuries will pay for the Defensive Driving Program in one year. Like any good investment, additional dividends are expected in the future.

Recommendations for Future Sessions

1. Continue the four, two-hour sessions, inasmuch as a large per cent of the partici-

pants reported that the length of the course was just right.

2. The course should be conducted during the spring, summer or early fall months due to the longer daylight hours and warmer weather for outdoor demonstrations, namely the stopping distance demonstration.

3. Early planning is essential with regard to obtaining speakers, resource persons, state agency cooperation, facilities and audio-visual aids.

4. Instructors should utilize practical examples familiar to the audience along with as many visual aids as feasible. Straight lectures should be discouraged.

5. Discussions around specific points with decisions (voting) or conclusions drawn is highly desirable. However, questions or comments from the audience of a "gripe" nature and personal experiences not of general interest or directly related to the discussion tend to waste time and add little to the "learning" process.

6. Written questions from the audience should be encouraged because they contribute to the sense of "individual participation." Cards for questions can be given to the participants as they arrive. A specific time should be allowed for answering these questions during each session.

7. Perhaps the most important recommendation is that only highly qualified and interesting speakers participate as instructors and panelists. It is essential that each session be made as interesting as possible in order to continue a high level of attendance.

8. In the Driving Skill Contest a car should be located at each of the test areas. This expedites the completion of the testing, thereby improving the efficiency of conducting the contest.

9. It is suggested that incentive awards be continued, as they were effective in motivating attendance.

(NOTE: Copies of the course manual may be obtained by writing to Safety Department, Esso Standard Division of Humble Oil and Refining Co., Bayway Refinery, P.O. Box 222, Linden, N. J.)

GETTING PEOPLE TO UNDERSTAND LAW ENFORCEMENT

By FRANKLIN M. KREML

Dir., Transportation Center at Northwestern University, Evanston, Ill.

I am glad that the title of this talk asks for "understanding" instead of "liking." None of us really likes enforcement, especially if it is applied to us; but we all hope for acceptance of and support for enforcement.

Enforcement is, of course, an essential element of traffic safety—even as it is an essential element in industrial safety or in that matter, in virtually every aspect of life, from the maintenance of an organized, effective military arm to the rearing of children. In bringing up children or maintaining an army we speak of enforcement as supervision or discipline, but it is still enforcement.

Naturally, the more self-discipline we have, the less need there is to impose enforcement. If people generally can be made to see this—in this light—then we will have come a long way in "getting people to understand enforcement."

In a word, enforcement is the discipline that is imposed when lack of self-discipline causes anyone to intrude upon or violate the rights of others. To fail of enforcement under such circumstances, is to invite anarchy.

This would be the end of my speech if we were interested only in the philosophy of enforcement; but it isn't quite this simple in life and practice because public attitudes and misunderstandings create many difficulties. We are still quite immature, as a people, in our attitudes toward the enforcement of our own laws. Some people are truculent in their resentment of enforcement action, and with such people officers sometimes have difficulty in making even routine arrests.

There are many attempts to evade or beat the law, varying from the childish erasure of chalk marks on the tire of an overparked vehicle to the destructive device of having a child riding in the rear seat of a vehicle "look out for the cops." These unfortunate attitudes—this immaturity—

spring, in part, from our heritage of freedom; some come from widely held beliefs that are erroneous or from a lack of respect for the law and its officers. Let us look at these latter two for a moment.

One of the most common public misconceptions lies in the statement, "I have a right to drive!" People think that what they have is a licensed privilege and this concept may be too late to correct.

Another misconception is that "the use of radar, unmarked cars, concealed officers, etc. is 'unfair,' 'un-American,' and amounts to a speedtrap." Now the difference between the clearly illegal practice of entrapment and devices such as those just mentioned, which are commonly called "traps," is the difference between the securing of evidence of the violation by reliable though perhaps surreptitious means on the one hand and, on the other, actions on the part of an officer which induce the commission of an offense which might not otherwise have been committed, for the purpose of getting evidence thereof.

The means of securing evidence are unimportant so long as the devices are accurate and the officers honest. A change of method will not insure honesty. It would, of course, be extremely desirable to have a far-ranging, all-seeing patrol to insure the proper enforcement of laws, but this is completely unfeasible from the standpoint of municipal and state finance.

We hear, too, that "policemen enjoy catching erring motorists." This may be true in a few isolated cases, but one of the problems in most traffic departments today is the difficulty of getting officers to enforce traffic laws with sufficient vigor.

These three misconceptions—along with others—lead to a fourth—an attitude which sets the law enforcement officer apart from the rest of society. This is dangerous, for the policeman must become a respected member of the community. We cannot overcome misconceptions about enforcement if

we do not have respect for the law and its officers.

There is some real basis, in my view, for the lack of respect for the law and its officers. Traffic law enforcement has not always been carried through with that integrity, reasonableness, and intelligence which the public has a right to expect. Let us look at each of these.

Integrity. The "fixing" of cases by police officers, prosecutors, clerks and judges, while greatly reduced over what it was a decade ago, is still widespread. The effect of this upon the confidence of the public is incalculable and positively dangerous—particularly among our younger citizens. This is a serious weakness in the moral fabric of our society, reflecting a lack of both devotion and courage on the part of the officers and a cynicism on the part of the public which has lost its capacity for righteous indignation wherever these conditions are tolerated.

Reasonableness. The use of radar to enforce speed laws to within two or three miles of the limit; traffic violation bureau fine schedules and the crowded courts which deny a hearing; the fixed limits in chemical testing for intoxication; and the "point system" for drivers license revocation, while apparently "business-like and efficient" are substituting artificial standardization for judgment and reason and courage in law enforcement. This mechanization and efficiency are very handy for the politician, but the public has a deep sense of the unreasonableness of it all.

Intelligence. The aim of selective enforcement is to produce the safest possible con-

dition with the available resources. It is based upon accident investigation and good records—by time, place and type of violation. The public will understand and support such enforcement; but it is still not being done in even a majority of our cities and states; it requires the training of top people, both staff and line.

When the public knows that enforcement action truly reflects accident experience, then understanding and acceptance will follow.

What does all this add up to? We have seen that we must have enforcement; we cannot have enforcement without public understanding and support; the public will not support unless the enforcement is honest, reasonable and intelligent; and for such enforcement we need highly trained, well motivated, adequately supervised police, from top to bottom, to carry on a well-organized program which, in turn, is supported by an effective court program.

The initiative to achieve all this can come either from the official (court and/or police) or civic side (safety council, chamber of commerce), but initiative must be taken in the development of enforcement that meets these criteria.

Once the enforcement program has begun, then all of the citizenry must be informed by every means available, from the police officer writing a selective enforcement ticket, to the statements of the judge to the defendants, to the use of TV programs. This will be easier to do as the inevitable results of an effective traffic law enforcement program evidence themselves in a reduced accident experience; for in this, as in almost all human endeavors, nothing succeeds like success.

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OCCUPATIONAL HEALTH HAZARDS — ENVIRONMENTAL

By PAUL E. TOTH
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It has often been said that anything taken into the body in too large a quantity may be considered a poison.

The problem then becomes one of defining the limits or quantity of substance a person can take into his body without producing deleterious effects on his health and well-being. For many of the dusts, gases, vapors, and fumes encountered in the environment of our workrooms in industry, there are limits that are referred to as maximum allowable concentrations (MAC). These limits are based on an eight-hour day exposure and are nothing more than bench marks or guides which enable an industrial hygienist to properly evaluate the extent of an exposure and to determine whether or not a potential health hazard is present.

The list of maximum allowable concentrations can be obtained from the American Conference of Governmental Industrial Hygienists, 1014 Broadway, Cincinnati 2, Ohio, or if you have access to the American Industrial Hygiene Association Journal of August, 1961, you will find it there.

When we say these values are bench marks, we mean that more factors are considered in evaluating an exposure than just the finding of a certain amount of contaminant in the air. Factors such as skin absorption, accumulative effect or sensitizing properties of the suspected material must also be considered for proper evaluation of the exposure. Now let us consider but a few of the many toxic materials one may be exposed to in different industrial environments.

Lead

Lead, I'm sure, we are all familiar with, yet it is this familiarity that gets us into trouble with this metal, because we choose to forget the fact that it is an accumulative poison. The maximum allowable concentration for lead is 0.20 milligrams per cubic meter, and the little we take into our sys-

tem today that is in excess of this value is added on to the little we take in tomorrow until the body can no longer safely hold the burden. Chronic lead poisoning will develop among employees exposed during the course of their work to excessive levels of lead dust or fume. Clinical manifestations may appear as loss of appetite, nausea, vomiting, general sickness, irritability, dizziness, and headache, and unless the afflicted person has biological tests taken for lead absorption, the diagnosis may be missed completely until more severe symptoms develop.

Taking appropriate action when blood lead levels indicate an absorption of 0.08 milligrams of lead per 100 grams of whole blood is essential for the prevention of lead poisoning. Recommended action is to remove the employee from further exposure and to review the area of operation to make sure that all engineering controls and safety precautions are satisfactorily in use. Obviously good engineering control is required to prevent the lead from being dispersed into the workroom. In addition, good personal hygiene is required to further reduce exposure. Finally, biological tests, preferably blood leads, are required to ascertain any shortcomings in either of the first two control measures.

Cadmium

Cadmium metal, either as a plating on parts or the solid metal itself, will volatilize when heated above 600°F to produce a toxic brownish-yellow cadmium oxide fume which has no pronounced odor or immediate effect but its inhalation may induce after a few hours or much less depending upon the concentration of exposure a painful and sometimes fatal pneumonitis. The maximum allowable concentration of this material is listed as 0.1 milligrams of fume per cubic meter of air and only by means of a well-engineered exhaust system are we able to control any operation generating the fume to a value below this level.

Beryllium

Beryllium metal is being used quite extensively in the aviation and missile industries. Exposure to minute quantities of fume or dust from this metal may also cause an acute chemical pneumonitis. The maximum allowable concentration is 0.002 milligrams per cubic meter of air and concentrations as low as 0.025 milligrams per cubic meter for thirty (30) minutes are hazardous. The toxicity of this metal can be attested to by the reports of non-occupational illness caused as a result of air pollution or home contamination resulting from dust carried home on the employee's work clothes.

Recommended control procedures are to enclose beryllium machining and finishing processes as much as possible and to ventilate by means of a local exhaust system.

Carbon Monoxide

From the time man first encountered fire to the present, when the automobile contributes gas to his environment, carbon monoxide has been with us as an insidious killer. You can suspect its presence wherever there is fire, but don't be fooled into believing that just because there is a lot of air present that carbon monoxide will not be formed. To illustrate this point, take the burning of newspaper in excess air as an example. According to the experimental work performed by Easton, the following analysis of the products of combustion was found:

Carbon Dioxide	7.6%
Carbon Monoxide	0.2%
Oxygen	7.7%
Nitrogen	77.6%
Unsaturated Hydrocarbons	1.2%

The maximum allowable concentration for carbon monoxide is 100 parts per million; the concentration obtained by the burning of newspaper in excess air was 62,000 parts per million, enough to kill a man in less than five (5) minutes of exposure. Sources of this gas are smoke from a coal fire, flue gas from boilers and house heaters, gas from charcoal briquets and from coke-burning salamanders, and whenever a flame impinges upon a cold surface—just to mention a few.

Carbon monoxide is not a protoplasmic tissue poison. Were it not for its affinity

for the hemoglobin of the blood, it would be classified with the simple asphyxiants such as nitrogen and hydrogen.

For some unknown and unfortunate reason, the hemoglobin's affinity for carbon monoxide is approximately 300 times greater than its affinity for oxygen. Its chief mode of action is to combine chemically with the hemoglobin and thereby deprive the body of its respiratory function. There is no further change in the system. The carbon monoxide remains thus combined until the victim is removed from the contaminated atmosphere to fresh air where the chemical process is completely reversed; that is, the hemoglobin gives off the carbon monoxide and takes on oxygen.

There are no cumulative effects from carbon monoxide for it is not a cumulative poison. The misconception expressed as "chronic carbon monoxide poisoning" is probably based on cases where there has been prolonged asphyxia which has damaged the brain too severely for complete recovery but not sufficiently enough to kill the victim. This same brain damage will result regardless of what the circumstances are that caused a deficiency in the supply of oxygen to the brain cells.

Plastics

Polyurethane foams and epoxy resins are finding wider use in numerous applications. The diisocyanates used in the production of the urethane foams are upper respiratory irritants and extreme sensitizers. Persons who have once become sensitized to these materials develop severe asthmatic attacks if they should again be exposed to extremely minute quantities of the material. Exposure to large initial concentrations will also result in an asthma-like syndrome. As a rule once a person has become sensitized, he can no longer work with or in the vicinity of this material. The best control measures for protection against exposure to the diisocyanates is to put in a well-engineered ventilation system before operations begin.

The amine hardeners used in the epoxy resin system are the principle cause of dermatological manifestations resulting from contact with these materials. We have a great deal of difficulty in trying to convince people of the importance of wearing adequate protective equipment in order to prevent skin contact with subsequent

sensitization. They are inclined to ignore the warnings because in many cases the skin reactions do not appear until several months after a person has started working with the resin. Once a reaction has developed, they must exercise even greater care then required initially in order to prevent a recurrence.

High Energy Fuels

The race for missile supremacy and the conquering of space has confronted us with increased problems of exposure to high energy fuels and their decomposition products. Among these are hydrazine and the boranes—diborane, pentaborane and decaborane.

Hydrazine finds its use as a propellant fuel, either alone or with other compounds such as nitric acid, hydrogen peroxide or oxygen. It has a maximum allowable concentration of one (1) part per million, and in addition to the inhalation hazard, the material is absorbed through the skin. It is primarily a central nervous system stimulant causing excitement, convulsions and cyanosis.

Diborane is a gas at room temperature and has a maximum allowable concentration of 0.1 part per million. Inhalation produces congestion, edema and hemorrhage in the lungs. Its toxicity is comparable to that of phosgene.

Pentaborane is a volatile liquid with a tentative maximum allowable concentration

of 0.005 part per million; however, it is recommended that the exposure be kept as near to zero as is possible since no medical preventive or therapeutic agent has yet been developed for this compound.

Decaborane is a solid having a tentative maximum allowable concentration of 0.05 part per million. Both decaborane and pentaborane attack the central nervous system. Protection is best afforded by the use of air-supplied respirators or cartridge-type respirators that are specifically designed and designated for protection against these compounds.

In concluding this brief discussion, may I point out to you that the services of your local, state, and federal health agencies are always available to you. Should you desire information on the potential health hazard associated with any material or process to which you or your associates are exposed in your particular place of work, feel free to contact any one of them for assistance in evaluating the problem.

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OCCUPATIONAL HEALTH HAZARDS — MEDICAL ASPECTS

By HERBERT K. ABRAMS, M.D.
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I would like to quote from a famous writer his description of a "modern" community:

It was a town of red brick, or of brick that would have been red if the smoke and ashes had allowed it; but as matters stood it was a town of unnatural red and black like the painted face of a savage. It was a town of machinery and tall chimneys, out of which interminable serpents of smoke trailed themselves for ever and ever, and never got uncoiled. It had a black canal in it, and a river that ran purple with ill-smelling dye, and

vast piles of buildings full of windows where there was a rattling and a trembling all day long, and where the piston of the steam engine worked monotonously up and down, like the head of an elephant in a state of melancholy madness. It contained several large streets all very like one another, and many small streets still more like one another, inhabited by people equally like one another, who all went in and out at the same hours, with the same sound upon the same pavements, to do the same work, and to whom every day was the same as yesterday and tomorrow, and every year the counterpart of the last and the next...

On every side, and as far as the eye could see into the heavy distance, tall chimneys, crowding on each other, and presenting that endless repetition of the same dull, ugly form, which is the horror of oppressive dreams, poured out their plague of smoke, obscured the light, and made foul the melancholy air. Strange engines spun and writhed like tortured creatures, clanking their iron chains shrieking in their rapid whirl from time to time as though in torment unendurable, and making the ground tremble with their agonies . . .

Before you try to guess which city this is, let me tell you. Charles Dickens wrote this in his book *Hard Times*, published in 1854, describing a typical city in England during the years of the industrial revolution (1760-1830). The description sounds too familiar for comfort to us in America in 1961, at a time when we are going through another industrial revolution: automation, atomic energy, space travel, and many powerful new chemicals. They are exciting developments. They offer a promise of a wonderful world of tomorrow. However, they also pose serious threats to our health and well-being, unless they are properly controlled.

We must ask ourselves whether we are better prepared to meet these threats than the English were 150 years ago. Certainly, we are better prepared technically. In 1800, except in a few instances, little was known about the health aspects of exposure to chemicals, to ionizing radiation, or the effects of long hours of work, poor lighting and ventilation. Today, however, our technical knowledge is sufficient, so that we can say with assurance that we know how to use any chemical with safety. We know how to set up proper protective measures to make every job safe.

The big question is, "Are we utilizing this knowledge?"

Perhaps you who represent workers in industry know the answer better than I do. Let me give you only two examples that will help provide the answer. In Illinois, in 1958, there was found "a drug packaging plant where 103 employees were subjected to a full body fluoroscopic examination each day as they left the plant as a check against pilferage. During the examination, the entire body from the top of the head to the bottom of the shoes was exposed to ionizing radiation. The firm had practiced this procedure on all employees for some 12 years, but discontinued it when advised of the hazards in-

volved." I am quoting from the Report of the Atomic Power Investigating Commission to the 71st General Assembly, State of Illinois, March, 1959.

In the same report, the study found that:

Gross contamination and excessive levels of radiation typify nearly all radium processing installations in Illinois included in the survey. These conditions result from a lack of adequate shielding of proper routing of materials, as well as poor housekeeping within the plant, as noted by the contaminated paper and rags littering the floors, the lack of local exhaust ventilation and presence of contamination in eating areas. In addition, it was noted that labels on containers of radium-luminescent compounds do not contain information as to the quantity of radioactivity included. In all radium plants surveyed, little or no use was made of personnel monitoring devices such as film badges and, therefore, there is no adequate record of radiation exposures received by working personnel.

This was Illinois, 1958—thirty years after the tragedy of the girls who painted watch dials: they pointed the brushes containing radium paint with their lips, and later died of bone cancer.

The role of environment on health grows in importance as we gradually control the infectious disease agents that caused the plagues of old, and as the chemical and physical hazards of our industrial environment become ever more important determinants of our health and our diseases. A recent report of the Public Health Service made for the House committee on appropriations states: "After hearing the evidence, the members of the subcommittee concluded that the health hazards resulting from changes in the environment are far greater than is generally realized and that all levels of government, industries, and research and educational institutions need to step up their efforts to deal with the problem."

The number of chemical materials man is being exposed to is increasing constantly. Over 600 chemicals are currently being added to food; over 600 million pounds of pesticides are used annually, in the United States. Approximately 500 new chemicals are introduced on the United States market each year.

The occupational environment is the basic element in our total environment. Our occupations largely determine how and where we as individuals will live, and, indirectly or directly, may actually influence our life expectancy and our mode of death. Our

industries, in addition to affecting the immediate eight-hour working environment, also largely account for the chemical and physical contaminants in the air we breathe, the water we drink, and in the food we eat.

One example will illustrate: recent studies show that people living in manufacturing areas experienced higher death rates than residents of non-manufacturing areas. The difference was greatest for cancer, and tuberculosis of the respiratory tract (mainly of the lungs), and for various forms of heart disease.

Air pollution was a major factor in causing this greater mortality, but socio-economic conditions also played an important role.

Occupational Diseases

Occupational disease hazards may be classified in various ways. For example, by the type of agent which causes the disease: chemicals, in the form of liquids, dusts, gases, fumes and vapors; physical agents, such as noise, ionizing radiation, abnormal temperatures and pressures, vibration, and physical strain; infectious disease agents, such as the germ that causes brucellosis in meat-packing house workers and farmers.

Or occupational diseases can be studied according to the part of the body affected or the kind of disease. For example, many toxic chemicals may attack the skin, causing an inflammation which we call dermatitis. These or other chemicals may affect the lungs, the liver, the kidneys, the bones, or various combinations of organs of the body, and, in many cases, the entire system.

Occupational diseases may be acute and temporary, or may be chronic and long-lasting. Brief exposures to certain chemicals may produce symptoms that are of short duration, and the individual recovers quickly. A good example of this is metal fume fever, arising from inhalation of the fumes produced when certain metals are heated to temperatures above the melting point. Among the metals which can cause this are zinc, copper, magnesium, cadmium, iron, manganese, and others.

More important, however, are the chronic diseases of industry. These are the diseases of relatively long duration arising usually from long-continued exposure to relatively small amounts of toxic chemicals.

Sometimes these diseases do not show symptoms until long after, in many cases years after, the exposure has stopped. A good example of this is beryllium, a metal which may result in serious and fatal lung disease up to 15 or more years after breathing the contaminated dust or fumes.

We must remember that diseases, like everything else affecting living things, cannot be put into rigid categories. Not all chronic occupational diseases need to result from long-continued exposure. Only a brief exposure to a large dose of ionizing radiation (X-ray or radioactive chemicals) may result in cancer. Similarly, a brief exposure to a sufficient dose of carbon tetrachloride may result in chronic kidney disease or liver disease. In other words, there are many variations and combinations of these conditions.

To attempt a detailed listing of all of the chemicals and metals which can cause disease would only be disturbing and confusing, and we would be in danger of not seeing the forest for the trees. Every industrial chemical is dangerous. It is merely a matter of determining how dangerous it is and establishing procedures for protecting against it. The time is past when "experts" can stand before a group of workers, or, for that matter, a group of physicians and scientists, and say without evidence that this or that chemical when absorbed into the body is harmless. I recall only a few years ago attending meetings of industrial physicians and being shown X-ray pictures of lungs of coal miners, black with inhaled coal dust, and being told that this dust was harmless. Yet, long before that time, British scientists had demonstrated that coal dust can cause disabling lung disease in miners. We in the United States were merely slow to accept the evidence.

Diseases of the Lung

The respiratory system (lungs, bronchi, and larynx) is the most frequent site of chronic diseases caused by industrial poisons. For a long time, we have recognized that silica dust, as it is inhaled by the metal miner, the foundry worker, the pottery worker, the tunnel digger and others, causes a disabling and often fatal disease called "silicosis." Similarly, we know that asbestos dust causes a serious lung disease called

'asbestosis.' And, there is a lung disease found in workers in the manufacture of alumina abrasives, called 'Shaver's disease' (after Dr. Shaver who described it). The dust has high concentrations of alumina and silica. Diatomaceous earth, a form of free silica, similarly causes serious lung disease. And there is byssinosis, resulting from the inhalation of cotton dust. Until a handful of years ago, some of the experts insisted that many dusts when inhaled into the lungs were inert; that is, they produced no effect on the body. However, as we learn more, we find that these so-called "nuisance" dusts are also capable of causing disease. For example, talc, corundum, feldspar, graphite, porcelain, barite, cement, mica, slate, kaolin, and many others.

Even farmers, as well as grain handlers in the holds of ships, suffer from a respiratory disability when inhaling large amounts of grain dust. They develop chronic bronchitis with shortness of breath, cough, etc. Chronic bronchitis can result from inhalation of irritating dusts, fumes and gases; for example: phosphorus chloride and other volatile chloride compounds, acid fumes, phosgene, nitrous gases, aldehydes, solvents and other chemicals.

One of the leading toxicologists in the country, Dr. Herbert Stokinger, of the Public Health Service, points out that:

...our experience with occupational lung diseases makes it difficult to escape the conclusion that all dusts, irrespective of their nature, if breathed in sufficient quantity and for sufficient time, may cause profound damage to the lung, and emphasizes the desirability of the physician's obtaining an accurate and thorough history on individuals suspected of pulmonary disease.¹

Other Chronic Diseases

Let me discuss a few more of the chronic disease hazards, since these are the chief occupational health problems of the present day. The chlorinated hydrocarbons, such as carbon tetrachloride, represent a large group of chemicals used in industry. These can damage the liver and the kidneys. The chemicals known as aromatic amines, represented by beta naphthylamine, used in the manufacture of dye and other commodities, have been proven to cause cancer of the urinary bladder. The central nervous system—that is, the brain and spinal cord—can be affected by many chemicals. Tetraethyl lead causes severe brain disease called encephalopathy. Manganese, one of the im-

portant industrial metals, causes a disease that is remarkably similar to multiple sclerosis. Carbon disulphide may cause severe nervous system effects, affecting the nerves, muscles, and brain.

Serious and sometimes fatal blood diseases may be caused by exposure to benzol. Of course, we know that ionizing radiation in any form—whether through exposure to X-rays or radioactive chemicals—may cause fatal blood diseases as well as various types of cancer. The bones can be affected by exposure to radioactive chemicals, fluorides, phosphorus, and other chemicals. Cadmium affects the lungs and kidneys.

The heart may be affected by the metal known as antimony, and possibly by nitroglycerin, and there have been a number of reports that the heart may also be affected by brucellosis infection, which occurs among slaughter house workers and farmers.

Nitroglycerin and related chemicals used in the manufacture of dynamite and other explosives make an interesting story and illustrate some of the problems in occupational medicine. Workers have been exposed to this group of chemicals for many years. They have known for many years the severe headaches this chemical causes. For years, also, we have heard reports of sudden deaths among workers exposed to nitroglycerin. We do know that this chemical has a powerful effect on the body. It causes profound reduction in blood pressure, severe headaches, palpitation of the heart, nausea and vomiting, fainting, dizziness, and other symptoms. It can also cause skin inflammation. Whether it can cause heart disease is disputed. Even though we have known this chemical for many years, there has been insufficient investigation of the health hazards, and inadequate preventive measures.

Cancer

Occupational cancer is one of our most serious problems. It also provides us with a remarkable opportunity to study cancer in general. The first breakthrough in the mystery of cancer came with the discovery of an occupational cancer. In 1775, in England, Dr. Percival Pott called attention to soot as a cause of cancer of the scrotum in chimney sweeps. These were little boys who climbed into the chimneys to clean them out. Years after working in this

occupation, they died of cancer of the scrotum, which was traced to the soot which penetrated their clothing. Similarly, for years we have known that an excessive number of uranium miners in Europe have died of lung cancer. (Recent studies in our own uranium mines reveal dangerously high exposures.¹)

Since then numerous other chemicals, in addition to ionizing radiation, have been demonstrated to be capable of causing, or contributing to the development of, cancer in various parts of the body. Some examples are beta naphthylamine, which I mentioned earlier, causing cancer of the urinary bladder, coal tars which can cause cancer of the skin, chromates which cause cancer of the lung, and many others. Recent studies have focused suspicion of lung cancer hazards in the work of welders, sheet metal workers and other metal workers.

Skin Diseases

Skin diseases are, as you know, the most frequent type of occupational disease which we see. Most of them result from direct irritation by chemical or physical agents. A smaller number result from an allergic reaction to a chemical. Almost any chemical contact can result in dermatitis. Many of the new chemicals are causing skin troubles. For example, the epoxy resins: These materials are being widely used in electronics, automobiles, pattern-making, die-casting, aircraft, and other trades—for surface coatings and paints, molding compounds, various plastics, and electrical insulation. Another group of chemicals which causes skin disease are the chromates. Chrome ulcerations of the skin are well known. The chlorinated hydrocarbons also may cause skin diseases. One of them is called 'chlor-acne' because it resembles acne. Machinists and metal workers often get a dermatitis from cutting oils. Coal tars produce skin changes, some of which may turn into cancer. There are a host of others too numerous to mention.

Protection

These are only a few examples of the occupational disease hazards arising from contact with chemicals. The alert worker will become acquainted with the materials he is handling and the process he is using, so that he can help to protect himself and his fellows. If he should suffer excessive

exposure to some harmful material, he will know what to tell the doctor who examines him. The alert doctor will be able to correlate the occupational history with the physical findings and symptoms and decide whether the patient is suffering from an occupational disease.

Very few occupational diseases produce such characteristic symptoms that they can be readily identified as an occupational disease. After all, the body can react to harmful stimuli only in a limited number of ways. For example, a worker may have severe pains in his abdomen. These might be caused by appendicitis or by lead poisoning. Leukemia may result from unknown causes or from exposure to X-rays. A person suffering a certain type of paralysis may have multiple sclerosis, a disease of as yet unknown cause, or it could be manganese poisoning. The person who has a cough, shortness of breath, and is losing weight, may have tuberculosis, silicosis, berilliosis or cancer of the lungs. A history including occupational history and a thorough examination is the only way of telling those conditions apart.

Prevention

All occupational diseases are preventable. If we were doing our job right, we would have nothing to talk about today. The fact is that unknown numbers of people are suffering from a great variety of occupational diseases because we are not adequately protecting against them. What are the protective measures which we should follow?

(1) *Education:* Employees should be given adequate training for their jobs, so that they understand the process, know the materials they are handling, and, therefore, can protect themselves and other workers from injury.

Key employees should be instructed in first aid. Management and labor both have responsibilities here. Shop health and safety committees can help in the health education of workers. There is no substitute for knowledge.

(2) *Protection of the environment:* This means from the air of harmful dusts, fumes, gases, vapors. This is accomplished by means of engineering measures, such as exhaust ventilation, enclosure of hazardous processes, wetting down methods for suppression of

dust, and substitution of less harmful for dangerous materials. Good lighting and reduction of noise, etc. are other environmental problems that the engineer can help to solve.

Only when engineering measures are not possible should respirators or other personal protective devices be depended on for protection against inhaling of harmful materials.

(3) *Good housekeeping and sanitary place of work.* This means a clean place of work, free of dirt and dust, and accident hazards. There should be adequate toilet, washing, shower, locker and eating facilities. Hand washing alone can often prevent dermatitis and other diseases. All containers of chemicals should be properly labeled.

(4) *Personal protective devices:* Whenever necessary, management should supply workers with respirators for protection against noxious dusts, fumes and gases in the air; suitable gloves and work clothing for protection from harmful chemicals; hard-topped shoes and hats for protection from falling objects; safety goggles, etc.

(5) *Medical protection:* This includes first aid facilities and a medical department. Every worker should have a periodic physical examination, not for the purpose of disqualifying him for work, but for the purpose of detecting disease early so that prompt measures can be taken to protect his health. The physician has an ethical obligation to inform the worker or his family of any finding important to his health.

In addition to first aid and medical care for work injuries, all workers and their families should have access to modern medical care. Unions throughout the nation are obtaining such care through collective bargaining. Union health centers and other plans, such as Health Insurance Plan of Greater New York and the cooperative health plans, are attempting to bring good care, including preventive medicine, to working people.

(6) *Plant health and safety committees.* Every place of work should have a committee of representatives of the workers concerned with the health protection of the men and women in the plant. This committee should have authority to make periodic inspections of the plant and make recommendations to management. The com-

mittee should meet regularly with the plant physician, the nursing staff, the plant safety and industrial hygiene engineers, and with other representatives of management to discuss health and safety problems and to plan programs of education of the workers in these problems.

(7) *Government safety and industrial hygiene agencies:* These agencies should be called upon for help, whenever the union believes that management is not adequately providing health and safety measures in any particular problem.

How We Are Doing Our Job

How well are we doing in protecting our workers? Let me cite a few facts. The prevalence and incidence of occupational diseases in the United States is unknown, because in many states there is no reporting of occupational diseases. And, in those states where there is reporting, it is incomplete and not uniform. Moreover, we know that numerous occupational diseases are not recognized because of medical ignorance, deficiency in medical education, deficiencies in workmen's compensation laws and health and safety laws.

Health services in many private industrial plants are inadequate, and most workers are employed in small plants where such services are not provided. According to the Public Health Service, 90 per cent of the labor force is not receiving proper industrial hygiene and health services.

The governmental agencies, federal, state and local, which are charged with responsibility for protecting the health of workers, are for the most part grossly inadequate in their resources and services. They suffer from lack of funds, personnel and even from lack of authority. At least seven of our states have no occupational health unit in their health or labor departments, and in all of the state occupational health agencies in the entire country, there are less than 40 physicians employed. There is no uniformity of industrial health codes and standards, and the states differ in the hazards regulated and in their regulations for the same hazards.

There is a serious and growing shortage of physicians and other health personnel both in and out of industry. Dr. Harold J. Magnusson, Chief of the Division of Occupational Health of the U. S. Public Health

Service, estimates that by 1970, industry will need 4800 physicians, but is expected to have only 2900; while 35,000 industrial nurses will be needed, but only 26,000 are expected; and 3400 industrial hygienists will be needed, but only 1600 are expected.

Workmen's Compensation

Good workmen's compensation laws are basic to the health of industrial workers. Without strong workmen's compensation laws, it is difficult to see how we can ever have really effective implementation of our industrial health measures. The fact is that although the workmen's compensation laws are the earliest form of social legislation in the United States, they are in almost all cases hopelessly behind the times. They are inadequate in their provisions for compensation, for medical care and rehabilitation, and most of them have not been brought up to date to permit equitable recognition and compensation for the injuries inflicted by radiation and chemical hazards which cause chronic diseases, usually after long latent periods between exposure and the first symptoms of disease.

Two states still have no occupational disease coverage. Nineteen state laws cover only specified diseases. Most of the laws exclude farm work, domestic work and casual employment. In over half the states, employees in small establishments which have less than a specified number of employees are excluded, and in 12 states the laws apply mainly to a list of "hazardous" employments. Many white collar workers are today excluded from the workmen's compensation laws.

Research

The level of our research in occupational health is correspondingly low. Research is largely in the hands of private industry, and it is guided substantially by the economic needs of the particular industry. Even where research is done in universities, much of this is subsidized for special needs by private industry. Governmental agencies sporadically have made excellent contributions, but their resources are chronically inadequate. There is an urgent need for a system of research and consultation facilities in various parts of the country where workers and employers alike can go for scientific solutions to their problems.

Hope for the Future

Last year, a subcommittee of the House committee on appropriations under Congressman Fogarty conducted hearings on these problems. These are published in a "Report on Environmental Health Problems," available through the Government Printing Office. It is interesting reading. These hearings raised hope that better appropriations would be made to the Public Health Service and other agencies for an expansion of services in the environmental health field.

In the meantime, there is a dangerous vacuum in the supervision of hazards from ionizing radiation as differences prevail among the interested agencies, AEC, U. S. Public Health Service and the states, over jurisdiction in this field. At the moment, controls in this field are a patchwork with good programs in a few states like New York and California, but poor or almost non-existent programs in most others.

The implications of all this should be obvious. Occupational health and workmen's compensation vitally and directly affect the health and life of working people. Yet the unions so far, for the most part, seem to be apathetic about this. Now that unions are deeply involved in health insurance, for the care of non-occupational diseases, perhaps there will be a resurgence of interest in the environmental factors which affect our health.

A few unions have begun to help themselves. Some have negotiated clauses in their collective bargaining agreements embodying a number of the preventive measures I outlined earlier, and have also asserted the union's right to bring expert consultants into the plant.

The United Auto Workers has a department of occupational health, staffed by two experts in safety and industrial hygiene. The International Association of Machinists has a medical consultant. The International Chemical Workers' Union also has a medical consultant and recently appointed a staff safety man. These people can be of great help to workers in providing them with expert knowledge and honest information. Obviously, however, every union cannot and should not hire its own corps of experts and set up its own research laboratories. We are dealing with big social problems, and they must be met socially.

Professor of Sociology of Columbia University, C. Wright Mills, defines the issue in this way:

No moral endeavor, no political orientation, no human study that does not pay close attention to man at work, can possibly be adequate for our time. For work is affected by and in turn affects all that man is and all that he might become. The question we must ask of any society or of any social program is what kinds of men and women does it select, encourage, create? And, in terms of this human evaluation, the most important question we can ask is whether work is a void in which men sacrifice themselves or whether work is a central feature of a style of life in which man may realize himself. . . .

- REFERENCES
- (1) Hunter, Donald, *The Diseases of Occupations*, Little, Brown & Co., 1960, pp 45-4
 - (2) *Report of the Atomic Power Investigating Commission to the 71st General Assembly*, State of Illinois, March, 1959, p. 25

SOME OBSERVATIONS ON OCCUPATIONAL DERMATOSES

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Incidence of Industrial Skin Diseases

While there are at present no reliable statistics on the incidence of occupational dermatoses, their frequency is undisputed. Indeed, in World War II evidence indicates that there were more skin casualties than all other battle casualties in this very specialized occupation of soldiering.

In England, a three year study done between 1930 and 1932 inclusively, more than 72 per cent of all occupational diseases were found to be industrial or occupational dermatoses.

Reports from the compensation boards in seven states in this country indicated that 65 per cent of all compensable cases were occupational dermatoses. In a fashion more understandable to those of us accustomed to cost and taxes, this means an estimated loss of more than ten weeks per year with an annual cost of approximately one million dollars. This, in itself, a staggering figure.

Anatomy and Function of the Skin

With these brief statistics, it is well to ask something of their body area, so easily

- (3) U. S. Department of Health, Education and Welfare, Public Health Service, Summary of Report on Hearings on Environmental Health, 1959
- (4) Rumsford, John, *Mortality Studies in Relation to Air Pollution*, presented at meeting of American Public Health Association, 1959
- (5) Stokinger, as quoted by Mancuso, Thomas, in *Ohio State Law Journal*, "Medical Aspects of Occupational Diseases," Vol. 18, No. 4, p. 631
- (6) Mills, C. Wright, in Symposium, "Man and Work," Northern California Mental Health Association, San Francisco, 1951
- (7) *Governors Conference on Health Hazards in Uranium Mines*, U. S. Department of Health, Education and Welfare, Public Health Service, Washington, D. C., 1961
- (8) *Report on Environmental Health Problems*, Hearings before Subcommittee of Committee on Appropriations, House of Representatives, 86th Congress, Government Printing Office, Washington, D. C., 1960

disposed to such great measure of damage. And again it is felt that a most superficial look at the anatomy and function of the skin, as it is related to this question, is indicated especially for those not related to the medical sciences.

It is not always realized that the skin is one of the most important organs of the body. In its embryonic development, it represents the first of the three primary or basic tissues formed, the ectoderm. And from this ectoderm the largest sensory organ is developed, the brain. So the skin is not only a prologue to the brain, but remains the next largest sensory organ.

The skin is an organ, a very complex organ, constituting about one sixteenth of the total body weight. It contains, within its comparatively thin structure, muscles, blood vessels, nerves, glands, specialized cells such as those that produce pigment and appendages such as nails and hair.

With over-simplification, we can divide the skin in two major layers—an inner layer, called the corium and an outer layer called epidermis. The inner layer is tough, elastic and resilient, and its chief function

is to protect against normal and everyday injuries the more susceptible inner organs; and this is the skin layer which, on tanning, produces leather.

The epidermis, or outer layer, likewise protects by means of its outermost, insensitive, cornified layer, its oil gland and sweat gland secretion, and by means of pigment content. These elements are present in all normal skin and vary only by degree or quantity.

Of the many functions of the skin, the following are of particular pertinence to this discussion:

(1) It protects the underlying tissues of the body by the physical means of resilience and elasticity.

(2) It protects by means of the relatively insensitive outer "horny" layer of the epidermis by its resistance to noxious substances.

(3) It protects the integument from actinic and other physical radiations by means of its pigments.

(4) It receives and transmits sensations of many types to the central nervous systems such as pain, heat and cold.

(5) It regulates body heat so that extremes of external temperature changes can be neutralized.

(6) It secretes water and some waste products.

(7) Finally, it has a small role in respiration and gaseous interchange.

All of these functions are constantly being modified by internal and external influences designed to allow man to maintain some constancy in an ever changing environment.

Historical Background of Industrial Diseases

From a historical point of view, injuries suffered by the skin were known but not favored in medical writings for many years. Not until 1700 when Ramazzini published his *Treatise* was formal recognition achieved and many of his observations still hold true today.

In 1775, Percival Potts noted and described the chimney sweep cancer of the scrotum, as previously mentioned by Dr. Abrams.

Not until the early part of the nineteenth century were added interests and contribu-

tions made to this subject. Then English, French and Germans began to describe the occupational dermatoses of their era.

Not until World War I did American dermatologists begin their prolific and significant studies. At this time there was an intense revival and expansion of the chemical industries and many new areas in the field of industrial dermatoses had to be explained. These new areas are still being met with even today.

In 1928, the United States Public Health Service organized the Office of Dermatitis Investigation, which is exclusively concerned with occupational and other forms of contact dermatitis. This, in part, has led to formulation of laws in the majority of states designed to compensate workers for occupational diseases.

Predisposing Causes of Occupational Diseases

It is almost impossible to classify clearly all the professional and occupational damages to which skin is subjected. The new chemicals, the complexities of manufacture and the wide usages and the resultant chemical products increase this difficulty.

However, certain factors remain constant. I should like to summarize some of these among the predisposing factors that play an important role:

First—Illustrating the protective role of epidermal pigment, it is an accepted fact that negroes are less susceptible to certain skin irritants than other races. Thus they are the choice employees as grinders and dyers in dye factories, where irritating dusts as well as dyes are the major hazards. This is likewise true where solvents are the irritating factor as in dry-cleaning establishments. However, oils and their by-products are the chief irritants of negroes and an increase in dermatitis occurs in negroes chiefly in the form of oil acne.

Secondly—Types of skin vary markedly in individuals as well as in races. The thin, blood-skin individual has trouble obtaining employment in those industries that bring them in contact with potential irritants and, I may add, if those industries' pre-employment examinations are adequate.

Workers with thick oily skin can tolerate the action of fat solvents, such as soap,

turpentine, naphtha, benzol, etc., better than the workers with dry skin. It is universally true that in occupations where clothing may become soaked in oils, greases and waxes these individuals with hairy, scrobbled or oily thick skins are more likely to develop folliculitis and acne-like lesions.

And, as a final note, in the same individual, the skin of the inner arms are more involved than the palms.

Thirdly—Perspiration and sebum usually act as a protective by diluting irritating agents that are already in solution. But a third predisposing factor is in that individual who perspires excessively and works in solid substances such as calcium oxide. Here the moisture can produce a chemical change where the conversion to calcium hydroxide proves to be an irritant.

To affect the skin, materials must wet the skin, thus acting by chemical combinations or by extracting moisture and fat. Obviously, these are materials soluble or miscible in sweat.

Fourthly—Age of the worker can also influence the incidence of occupational dermatoses, another factor to be considered. Whether or not this is due to relative inexperience and lesser previous exposure in younger people, statistically they are more susceptible.

Fifthly—As in all fields, the matter of sex must be considered when discussing predisposing causes. The skin of women is usually drier than that of men.

However, during menses and pregnancy there is an increase in perspiration and therefore an increase in the sensitivity as before mentioned.

Likewise, women are more concerned and more prone to individual cleanliness in their habits and so fewer incidences are reported.

On the other hand, fewer women are engaged in hazardous occupations and there is an absolute statistical decrease in reported cases.

Women seek first aid more readily and sooner than men and so develop fewer chronic dermatoses reported as compensable.

Sixthly—The existence of previous non-occupational diseases is also a predisposing factor. There are workers more prone to develop industrial dermatoses than others. These are the individuals who have had

previous skin diseases. This may or may not hold true for those with mycotic, or fungus, infections. There is no real evidence that this is true. Illustrative are the diseases of psoriasis and lichen planus. In these individuals, though currently clear of the acute lesions, the development of trauma may cause recurrence or new lesions of these diseases completely unrelated to occupational dermatoses.

Seventhly—Cleanliness, or rather the lack of cleanliness, or its careless application is a most important factor. And cleanliness means not only personal but also environmental. This is particularly true where workers handle or are exposed to fumes, dust and noxious vapors. Moreover, the clinical substances used in cleansing must be chosen judiciously, since they too can cause a reaction. The subject of cleanliness will be mentioned later.

Eighthly—The question of allergy is being deliberately passed over, since there is little agreement as to specific definition of this term. Suffice it to say that most, if not all, persons can be or are allergic if exposed to the right allergens. Guarding against this possibility is a herculean task.

Actual Causes of Occupational Dermatoses
The actual causes of occupational dermatoses may be simply divided or outlined in five major groups:

- (1) Mechanical.
- (2) Physical.
- (3) Chemical.
- (4) Plant poison or irritants.
- (5) Biological.

Any or all of these factors may be encountered or predominant in any occupation. For example, the farm worker is exposed to most of these factors. There may be mechanical injury from farm machinery; there may be physical injury from heat, cold or the arctic rays of excessive sunlight; chemical irritants of fertilizers and insecticides may play a role; or the biological infections from fungus and parasite organisms from the effluvium of animal and plant materials are important and, of course, plant poison.

Mechanical agents which may cause callusities, tendon injuries, cuts and abrasions fall within this category. These in turn may lead to infection, or, as many investi-

gators think, may become the sites of malignancies. In those patients, previous sites of skin diseases such as psoriasis or lichen planus, new lesions or an aggravation of old lesions is common.

Among the physical agents that are likely to excite occupational dermatoses are the following most common:

High temperatures may cause excess perspiration leading to the common heat rash, intertrigo, or less commonly, erythema ab igne. More permanent skin changes may result. These are the afflictions of the workers, produced by prolonged exposures to heat occurring in such workers as stokers and steel workers.

Cold and electricity may also take their toll amongst outdoor and electrical workers.

The deleterious effects of X-ray, radium and ultra violet radiation is well known to all of you; as Dr. Abrahams has previously indicated, this is particularly true with medical workers or technicians, miners of radium and uranium, and laboratory workers in the new field of nuclear energy and atom-splitting.

Chemicals are of necessity the predominant villains in the production of industrial dermatoses. These can be divided into what are primarily skin irritants or skin sensitizers.

The primary irritant is defined as an agent which will cause damage by direct action on the normal skin at the sight of contact. Only substances which can wet the skin or be dissolved in its solutions of sweat or sebum are in this category. Unfortunately these primary irritants, under specific circumstances, may also become sensitizers. The sensitizer, on the other hand, may not produce demonstrable skin changes on first contact, but only after prolonged exposure of one or more weeks may cause changes that produce a definitive dermatitis.

Here, the field of allergy enters the picture and its varied theories are an attempt to explain the mechanics of this most common condition.

For a detailed list of those major groups, the readers are referred to the encyclopedic work of Rostenberg and Sulzberger in the Journal of Investigative Dermatology, Vol. 11, No. 3, June 1939.

What, in general, are the methods of preventing the wholesale occurrence of occupational dermatoses?

The ideal method, of course, is to safeguard the worker so that these noxious agents mentioned, do not come in contact with the worker's skin. This is obviously an impossibility.

The modern factory or laboratory, new in specific construction and automation, is coming closer and closer to this ideal.

The following basic precautions should be observed whenever at all feasible:

- (1) Cleanliness of working environment.
- (2) Personal cleanliness encouraged by shower baths, lockers for street clothing and work clothing.
- (3) Initial physical examination to be assured that the applicant does not have any predisposing skin ailment.
- (4) Insistence that workers report all irritations of the skin, no matter how trivial, to the medical department.
- (5) The use of protective clothing where indicated, as well as the use of protective medications.

But, whereas it is impossible to outline any few basic principles of prevention, there is an encouraging number of positive factors.

Train inspectors, sanitary and safety engineers who are usually employed by insurance carriers and municipalities are the front line task forces. These people train superintendents, foremen, and plant physicians, who in turn instruct the workers of any avoidable hazards of the occupational dermatoses.

While the problem of occupational dermatoses is complex and large, I, for one, am confident that American ingenuity will eventually solve it.

I believe in facing problems directly, and I believe in knowing just where you stand before you start any kind of discussion or action. So before we go any further, I think it will be good for us to take a quick look around to determine our condition and position.

We have done some good work in safety in the United States. We have accomplished much, but, we are not finished. There is still plenty of work to be done.

When we begin to look around, we find some rather appalling figures and these figures tend to disturb us very much. They also become the basis for marching orders for the day. Very quickly they tell us what must be done.

I am sure you know these figures, but let's get them before us again. In 1960, 93,000 people lost their lives in accidents. No matter how much this figure is improved over the years, it is still 93,000 too many. In dealing with the loss of human lives, even one is too many.

To express this loss in another way, every six minutes, twenty-four hours a day, year in and year out, somebody loses his life in an accident. This adds up to the 93,000 lives I mentioned. This is almost as many deaths as the United States suffered in World War I, and we thought the losses in that conflict were disastrous. This loss in life from accidents represents the entire population of Springfield, the state capital of Illinois.

But, there are still worse figures. We have been talking only about fatal accidents. In addition to the deaths, 45 million persons were injured in 1960. If you care to think in terms of dollars, these accidents cost over 13.5 billion dollars. Going beyond these figures, no one can measure the grief, the worry, the discomfort and the unhappiness caused by the accidents to the millions of people connected in some way with the victims.

We could go on and recite a lot of figures but these are enough to set the stage. There is still a big job to be done. These figures are a little bit cold because they are impersonal. They become more realistic when they represent real persons in your family, your neighborhood, or your plant.

I picked up a paper recently to make an experiment. I scanned the paper and I listed

the headlines and feature stories, from the one issue, that were concerned with accidents and safety. This is what I found:

jet plane crashes into store roof—pilot killed and 35 injured.

Six from area killed in auto crash.

Youth, 16, drowns in farm pond.

Indiana man killed in Ohio road crash.

Driver hurt, phones knocked out, in truck crash.

Grid star injured in freak accident.

Family of seven wiped out in tenement fire.

Here we had in one issue of a newspaper, 16 dead and 38 injured, and all within my community or population center. These examples bring the figures closer to home. They do not tell us that our job is done in safety.

I read these accident and fatality figures regularly, and I am sure you do, too. They have a great effect on me. They stimulate me to continue everything I've ever done in the interest of safety, and to step up the pace if possible.

Since our special emphasis today in this section is industrial safety, let's take a closer look at that level. I think we will soon see that there is no level that is not dependent on all other levels.

In industrial safety there has been some fine work done. The fatality rate in all industry has been reduced and injuries have been greatly diminished. I am going to use some facts and figures concerned with Firestone, because, first, this is the situation I know the most about, and secondly, it will serve as a typical example of industrial safety in action.

At Firestone, we have reduced our frequency rate from 6.3 in 1946 to 1.7 in 1960 and to 1.3 for the first six months of 1961. Our severity rate has been reduced from 970 in 1946 to 305 in 1960 and to 275 for the first six months of 1961.

Our company has received the Award of Honor of the Safety Council on a company-wide basis, several times and individual plants have been cited frequently for meritorious performance. Firestone holds the world's record for tire plant safety—a record when one tire plant went through almost 10 million man-hours without a lost

time injury. In the industrial rubber goods classification, a Firestone plant holds the record of 7 million man-hours without a lost time injury.

I give you these figures not only because I am proud of them, but because they indicate what is being done with definite safety programs and by instructional procedures that keep pounding home the value of safety.

Our point of emphasis here is that in spite of what has been done in industrial safety the figures for over-all accidents continue at very high levels.

Safety programs in industry have undergone great changes in the time I have been associated with them. The scope has greatly expanded. In the early years the emphasis was in the prevention of fatal accidents. Today, although the fight still goes on against fatal accidents, the program now includes prevention against even the most minor injury.

As safety programs in industry have developed into their present state, they have passed through several stages.

The first stage could be described as mechanical. This is the stage when we put guards on gears, stop rails on rollers, wire grilles to protect accidental contacts. It is the stage of guards, guides, grilles, and gimmicks to prevent injuries. It is the time of automatic stops and safety releases. We installed lights, we protected against flying objects, we painted, we smoothed, we roughed up—anything and everything—to make the environment reasonably safe. All these things helped but they were not enough.

The key word in the second stage is "attitudes." Industrial safety people found that in spite of guards, automatic warnings and all other devices, that men were still getting hurt, because safety was not in their thinking; it was something the safety man did. Safety programs were started to train men on safety. This program was not only to train supervisors but to develop safety attitudes in all employees.

Safety operating instructions were prepared; safety shoe programs and eye protection programs have been emphasized to influence the man to think safety. Safety scoreboards screamed at him to be safe, they were even made to move, rotate and

spin, so he would notice. There are safety contests, slogan contests, and awards of every type to impress safety indelibly on the mind of the individual.

The third stage is going on continuously. It includes the first and second but it goes further. It moves into every level of our split-level house of safety and it tries two advanced steps.

(1) Make every man his own safety expert with responsibility for safety on every level.

(2) Make every person think and act safely twenty-four hours a day.

Why is this necessary? Because in spite of all our gains in industrial safety, men still get injured and killed. Some of these happen in industry but many more occur when the individual worker is functioning on another level.

There is a story of a prize fighter who was slightly overmatched. During the first round, his opponent had his fists in our fighter's face most of the time. He was roughed up pretty badly. His second, or man in his corner, however, thought he should encourage him and when the fighter came into the corner between rounds, the second said, "Nice round, boy; he never laid a glove on you."

In the second round, it was even worse, as the opponent began to put more snap into his punches. By the end of the round, our fighter returned again to his corner, a little groggy and much the worse for wear. The second told him, "That was a good round, he never landed a solid blow." The fighter was a little bewildered because he felt the effects of several solid blows and he was not very optimistic. However, he kept going out for each successive round and coming back in worse shape each time. Finally, when he had been told again that the opponent had not landed any telling blows, he said to his second, "When I go out this round, I want you to keep an eye on that referee, because someone is beating the hell outta me out there."

So it is with safety. All the things that have been done are not enough. Someone is still beating the hell outta safety. In most cases it isn't you, it isn't you, and it isn't you. It isn't this group and it isn't that group, but the damage is still being done. There were still those 93,000 lives

lost and those 45 million injuries. Let's see if we can find who is doing it.

National statistics show that nearly 70 per cent of all fatal accidents among workers occur off the job and more than half the accidents resulting in workman disability take place away from the job. This leads us to a conclusion that the safety practices followed by the worker, while on the job, in many cases do not carry over after he passes through the factory gate.

Do you realize that in the decade 1950-1960, nearly three quarters of a million Americans were killed in motor vehicle, public and home accidents—the other levels?

We have been very interested in this off-the-job safety problem at Firestone. Twice each year we run checks of on-the-job and off-the-job accidents. The checks are made in May and December and cover the accidents in that given month. In the past three years, in these checks, we have found 31 lost time injuries on-the-job as opposed to 322 off-the-job. There have been, in these six monthly periods checked, no fatalities in the factory and three off-the-job fatalities.

We have a new challenge and we must face it. We must reach for that split-level type of safety that operates on every level.

A man may have a home workshop which has guards on the power tools; he may wear goggles and observe all the safe procedures when in his shop. But, if he has a fire hazard in his attic, or he smokes in bed, or he has a car in the garage with bad brakes, or he has objects piled on his basement stairs, or he paints his house using an unsafe ladder, he is the fellow who is beating the hell outta safety.

I read an article recently which made this statement, "Population is increasing rapidly. Since most fires are the result of human failure, the expected population growth will increase the number of fires."

This very plainly says, *the more of us there are, the more there are to be careless.* This is a pessimistic statement and tends to assume that you and I are not going to do anything about it. This statement concerned fires but it could easily apply to all accidents caused by human failure. Take another look at that statement.

The more people there are, the more there are to be careless.

My argument here today is that it does not need to be this way. We just have more work to do and more people to reach. Let's turn that statement into a positive one, full of challenge:

The more people there are, the more there are to learn and practice safety.

Of course this is a big job. Who is going to do it? I gave a title to my remarks—"Safety Is A Man-Size Job." I have built up to this climax. There are two meanings to this title.

First, it means that safety fits your person—it is your size as an individual. It is man size. It is not too big for you. It is not too small for you. It is true that safety is an over-all task, on which all groups and individuals must cooperate, but it is no good at all unless each individual assumes safety as his job. Advertisers talk about certain foods being bite size—the size of a bite. Safety is man size—the size of a man.

My second meaning when I say safety is a man-size job, is that safety is a really big problem. When we want to express the large proportions of anything, we say it is man-size. A man-sized cup of coffee is a big one; a man-sized appetite is a big one; and a man-sized safety program is a big one.

Safety begins at this man-size level. Every individual must practice and live safety. Someone has given us this very challenging statement—*Take chances and the chances are that you won't have many chances left to take.*

First, we all operate as individuals. We begin a full-size safety program by being safe ourselves—and not just on one level—on all levels. This, in itself, is a man-size job. You cannot stop a person from having an accident by telling him not to have one. "Don't have an accident," is as futile a statement as "Don't have an ulcer." Someone has said, "You can lead a man to safety, but you can't make him practice it."

In another comparison, you can put collection cans along the streets and highways, for the deposit of rubbish, but, whether or not people use them is largely a matter

of personal attitude. You can force persons, by law, to install safety belts in their cars but, whether or not they are used is up to the individual. Safety is man size.

I recently heard a very clever story on individual safety.

Let us suppose I put 331 pills in a bottle. Three hundred of them are simple bicarbonate of soda; thirty of them are harmless sugar pills and one is deadly potassium cyanide. The pills all look alike. Now, we shake them all up and offer you the bottle. Are you willing to take a chance, select a pill and swallow it? Not very many of us who love life would take the chance. Yet, traffic safety engineers tell us that these are the odds on running a red light. *Once in every 331 times there is a fatality.* I wonder why the individual looks at the odds so differently when he is behind the wheel?

I believe there are two key reasons why industrial safety has been successful. The first is concern. Management has been concerned and has taken every measure to make each person concerned, not only for his own safety but that of his fellow workmen. Labor has been concerned and has cooperated in industrial safety programs. Where there is no concern there is no safety program of any value.

The second key word is responsibility. Our safety programs at Firestone have been successful because we have placed responsibility. A plant manager is responsible for safety in his plant. He, in turn, makes department managers and supervisors responsible. Safety is a responsibility just like production, cost, and economical operation.

So, we are back to the individual. The only way we can ever accomplish split level safety is through the individual being concerned and accepting responsibility.

Safety is a matter of personal attitude. People work, drive and play with the same attitudes as they live. If we can teach people to embrace safety attitudes then they will drive safely, work safely and play safely.

If every individual tries to improve his safety attitudes then he will be safer and he will frown on all persons who do not behave safely. The unsafe individual can-

not be tolerated and those who work with him should be critical of his action.

I believe that with men thinking and living safety that there will be benefits all along the line. Workers will be interested in the quality of their product because such quality will contribute to safety. He will be interested in good housekeeping because it has a close relationship to safety. Most important to all, he will think safety and practice safety on every level of his split-level life.

If safety is to be a way of life, appearing in every level on which we operate, who is going to bring it about? I say the job is a man-size one. Management, labor and the individual must all work together in promoting the safety theme. And you must operate on every level of your life. More than this, you must operate consistently on all levels. We must be consistently safe. A safety attitude must be practiced at home, at work, on the highway and in the community.

Safety is non-controversial. There is only one side. So we do not need to cast ballots or hold elections. Management and labor have no argument on safety. So we can spend all our energies in promoting the safety attitude.

Certainly we need to continue all the mechanical means we have ever used in industrial safety. We need to continue our drive against industrial accidents but we must expand our vision and find a way to extend safety practices to all levels. Howard Pyle, the Council president, has said it very well, *"I've want every American home safe and safe at home."*

There is still a man size job to be done in making safety a full-time, around the clock attitude.

There is still a man-size job to be done in industrial safety, to hold our gains and to cut deeper and deeper into accidents and poor safety practice.

There is still a man-size job to be done on the public safety level.

There is still a man-size job to be done on the traffic safety level.

Attitudes are exposed by behavior. You don't have to be a psychologist to develop sound safety attitudes. You do this by the

way you act, by the things you do, by the way you talk. By your attitude you not only control yourself but you teach others. Each individual must have *concern* and he must accept *responsibility*.

I will close with a little verse that tells a story:

If everyone who does a job, would say
a little prayer,

And keep in mind those other folks depending on his care,

And make a vow, and pledge himself to never take a chance,

The great crusade for safety would suddenly advance.

The job is man-size. Now, let's do what we can to become men capable of a man-size job.

SAFETY IS OUR CHALLENGE

By GEORGE M. HARRISON

President, Brotherhood of Railway Clerks, Freight Handlers, Express & Station Employees, AFL-CIO, Cincinnati, Ohio

It is pleasant to be able to begin my remarks by noting that today's news on the safety front in American industry is the best we have had for some time. The last two quarterly releases of the U. S. Bureau of Labor Statistics, covering the first six months of 1961, have each reported that work injuries in manufacturing plants reached record low rates during that period. The rate of 10.4 disabling injuries per million man hours worked, which was set in the first three months of this year, equalled the all-time record low for any quarter, established in the last quarter of 1960.

In fact, according to a September release, the first six months of 1961 produced the best six-month average recorded, six per cent lower than in 1960 and 1961 may be the best year on record.

This optimism then is qualified by the injection of a note of caution.

"However," the Labor Department continues, "the greater-than-seasonal increase in May and June could indicate a rising trend resulting from increased industrial activity. Previous experience suggests that increased industrial activity is followed by an increase in injury rates."

Those words are worth repeating, for they certainly make clear that safety is, indeed, our challenge. "Increased industrial activity" says the Labor Department, on the basis of past experience, "is followed by an increase in injury rates."

Aren't the implications contained in this statement truly shocking? Aren't they a tragic indictment of the ethical standards—or the lack of them—which our industrial society exhibits in this area of industrial safety? Is it really necessary in order to reduce the killing and maiming of workers to have that happen only because of a decline in business which brings reduced industrial activity? In other words, are safety and prosperity incompatible?

The facts, based on past experience, would seem to indicate that this is the case. I would like, however, to challenge such a conclusion. I do not believe that prosperity and mounting accidents are necessarily related. In fact, I would contend that greater prosperity can make possible the necessary basic expenditures and greater care which will insure greater safety on the job, reduce the staggering economic losses resulting from accidents, and thereby make prosperity even greater.

In recent years, industrial accidents have accounted for only about one-seventh of the deaths and for about only one-fifth of the injuries of the more than nine million different kinds of fatal and disabling accidents suffered within our nation annually.

The shocking thing about these statistics is that they tend to reflect a gross indifference to accidents on the part of us as individuals. This is borne out by the fact that by far the greatest number of disabling accidents—four million of them

annually—occur right in our own homes. More than two million more accidents annually are of a nature which the National Safety Council classifies as public, and include such categories as those accidents occurring in hunting and swimming and other recreational activities, in transportation other than by motor vehicles, in public buildings, etc. Finally, each year motor vehicle accidents take a tragic toll of more than one and one third million victims and account for the highest number of fatalities, in the neighborhood of over 37,000 deaths annually.

Thus nearly seven out of every nine accidents occur either in our homes, on the highways or in recreational pursuits and other public activities. These are the kind of accidents where individual responsibility clearly is very high. Carelessness and selfishness as individual weaknesses account for most of this tragedy.

We find that the huge annual toll of occupational injuries and deaths has been running at the rate of about two million a year ever since the end of World War II. The yearly average for a ten-year period (1946-1955) was 17,040 killed or totally disabled for life, 83,600 partially disabled for life, and 1,893,000 more temporarily disabled—a yearly average of 1,994,000 injuries and deaths. The annual cost to employers of these accidents, according to a Labor Department estimate which it terms "highly conservative," is more than \$3.5 billion. When estimated annual wage losses to employees of \$1.4 billion are added, the total yearly economic loss to the nation of occupational accidents amounts to nearly \$5 billion dollars.

This needless toll of economic waste and death, pain and mutilation of workers has been going on for too many years. Over the 15 years which have elapsed since World War II ended, some 30 million workers have suffered from industrial accidents and the nation has paid some \$75 billion in economic losses to support this accident toll. When we recall that these industrial accidents amount to less than one-quarter of all accidents, the picture takes on an aspect of hopelessness which it may very well deserve.

However, the long-range picture can give us cause for courage and a hope for an

end to this tragic suffering and economic waste. The truth is that, over the years, real and significant progress in reducing work accidents is being made. Industrial accidents have been reduced steadily since the turn of the century through the elimination of some of the unnecessarily hazardous working conditions, through better laws for the protection of employees, and through joint cooperation of labor and management in many industries. This progress has even picked up speed in recent years. The casualty rate in American factories in 1951-1955 was 17.3 per cent lower than in 1936-1940. In 1956 the number of casualties in manufacturing per million hours worked was 20 per cent lower than in 1949, and in the first six months of this year it was down 30.6 per cent.

These figures indicate that real progress has been made, and is being made, in reducing the toll of accidents in industry. They show that the battle for safety is not hopeless. They prove that with proper concern by management, with joint labor-management cooperation to prevent accidents, and with adequate interest and action by the legislative and administrative arms of the government, accidents can be prevented to a remarkable degree. They show that where there is a will, there is still a way.

Before progress of this kind can take place, however, there clearly must be a will to do something about it on the part of both management and labor and government. Nothing proves this more clearly, in my opinion, than the tragic record of what has been happening in the railroad industry in recent years. I happen to know a little something about that industry, since I have spent most of my working life as either a railroad employee or a railroad labor union official intimately concerned about the condition of the industry and the working conditions of its workers.

I have already said that I do not believe that the rate of accidents in industry must be related to its rate of output, as the Labor Department press release quoted at the outset says "previous experience suggests." Certainly, experience in the railroad industry does not bear this out. Most of you are well aware that the current level of operations in railroading has not matched levels in recent years and therefore if the

Other splendid achievements are the distribution of over 400,000 Mouth-to-Mouth Resuscitation Instruction cards as a public service and the establishment of a radiation safety department at the international union level. The union's monthly periodical always carries a full-size safety poster on the back cover and consistently contains printed articles dealing with safety.

Many other factors were taken into consideration by the Awards committee when judging IBEW's activities, but the above should suffice as an indication of the excellent job this union is doing.

Here today to accept the Harry Read Memorial Award of Honor on behalf of the Brotherhood of Electrical Workers is Mel Boyle, administrative assistant to international secretary-treasurer, Joseph Keenan.

3. International Brotherhood of Operative Pottery, AFL-CIO, Local 89, San Pablo, California.

The Labor Conference is pleased to name another winner of the highest award for a labor organization—the International Brotherhood of Operative Pottery, AFL-CIO, Local 89. This local represents workers at the American Radiator and Standard Sanitary Corporation in San Pablo, California.

This local has received so many awards from the National Safety Council over the past ten years that it would leave you breathless to hear them all. Its safety activities are manifold, including such out-of-plant programs as instruction in the safe use of firearms for youngsters and participation in the "Swim to Live" program.

On May 8, 1961, the employees of this plant established a new "world's record" for safety in the clay and mineral products industry by completing a full ten years without incurring a chargeable lost time injury. For that they received an Award of Honor from the Council.

The Labor Conference is proud to present its top award, "The Harry Read Memorial Award of Honor" to Local 89 of the International Brotherhood of Operative Pottery, AFL-CIO.

Here to receive the award for the local union is Brother E. N. Steward, local union president.

4. General Industrial Workers Union Local 146 of the Distillery, Rectifying, Wine

and Allied Workers, AFL-CIO, Linden, New Jersey and a "Citation for Distinguished Service" to:

Joseph P. Shepherd, Local 146 safety chairman.

The fourth labor organization to win the Labor Conference's highest award is local 146 of the Distillery Workers union, AFL-CIO, which represents employees of the General Aniline and Film Corporation in Linden, New Jersey.

Here again is an outstanding example of a union that is concerned not only about in-plant safety but community safety, as well.

To give you a brief idea of the scope of its activities, this local union deeply involved itself in a Bike Safety campaign in the community, gave every employee copies of New Jersey Traffic Accident Facts prior to Labor Day, and copies of the Driver's Manual of the State of New Jersey. On August 26, 1960, a major goal was accomplished at this plant when 1,500,000 man-hours were worked without a lost-time accident.

These activities are an indication of the imaginative programs which this local union carries out.

To the local union we are happy to present "The Harry Read Memorial Award of Honor."

To the local's safety committee chairman, Joseph P. Shepherd, who sparkplugged those programs, we are proud to present the "Citation for Distinguished Service."

Here to receive the awards are Joseph P. Shepherd and the local's current safety committee chairman, Hayward Webber.

"The Harry Read Memorial Award of Merit" to:

United Steelworkers of America, AFL-CIO, Local 1010, E. Chicago, Ind.

"Citation for Outstanding Service to Safety" to:

Kenneth S. Kovack, United Steelworkers Local 1010 Safety Chairman.

An "Award of Merit" is presented to the United Steelworkers of America, AFL-CIO, Local 1010, East Chicago, Indiana, which represents workers at Inland Steel Company in East Chicago, and a "Citation for Outstanding Service" to Kenneth S. Kovack,

chairman of the local's safety and health committee.

Here to receive the "Citation" is Kenneth S. Kovack, who is also the local's recording secretary. Here to receive the "Award of Merit" on behalf of Local 1010 is Louis Chickie, treasurer of Local 1010.

"The Harry Read Memorial Award of Merit" to:

United Auto Workers, AFL-CIO, Local 837, Elkhart, Ind.

An "Award of Merit" is presented to Local 837 of the United Auto Workers of America, AFL-CIO, bargaining agent at the Taylor Products Division of the Tecumseh Products Company, Elkhart, Ind.

Here to receive the award on behalf of the local union is Alice Reed, the local's safety chairman.

"The Harry Read Memorial Award of Merit" to:

Local 5, Industrial Union of Marine and Shipbuilding Workers of America, AFL-CIO.

Local 90, Industrial Union of Marine and Shipbuilding Workers of America, AFL-CIO.

An "Award of Merit" is presented to local 90 of the Industrial Union of Marine and Shipbuilding Workers of America, AFL-CIO, and office workers local 5 of the same Union at the Quincy Shipyard of the Bethlehem Steel Company in Quincy, Mass.

Here to receive the awards on behalf of their respective locals are Mr. Fitzgerald, president, and Mr. Houruda, safety committee chairman for Local 90; and Mr. Olivero, president, and Mr. Switzer, safety committee chairman for Local 5.

"The Harry Read Memorial Award of Commendation" to:

Brotherhood of Locomotive Firemen and Enginemen, AFL-CIO-CLC.

In recognition of its nationally known Safety Awards Program for railroad locomotive crewmen, we are pleased to present an "Award of Commendation" to the Brotherhood of Locomotive Firemen and Enginemen, AFL-CIO-CLC.

Here to receive the "Award of Commendation" is Brother H. E. Gilbert, President of the Brotherhood of Locomotive Firemen and Enginemen.

"The Harry Read Memorial Award of Commendation" to:

International Brotherhood of Pulp, Sulphite and Paper Mill Workers, AFL-CIO.

To the International Brotherhood of Pulp, Sulphite and Paper Mill Workers, AFL-CIO, we present the "Award of Commendation" for their nationwide efforts during 1960.

The committee to accept this award is composed of Vice President Elmer Meins; International Treasurer Henry Segal, and International Representatives, Wellington Meyer and Edward Zeininger.

"The Harry Read Memorial Award of Commendation" to:

Independent Radionic Workers of America, CUA.

An "Award of Commendation" is presented to the Independent Radionic Workers of America, bargaining agent at the Zenith Radio Corporation in Chicago, Illinois.

Accepting the award on behalf of the organization is Eugene Raetz, president.

"The Harry Read Memorial Award of Commendation" to:

Local 1255, International Brotherhood of Electrical Workers, AFL-CIO.

An "Award of Commendation" is presented to Local 1255, International Brotherhood of Electrical Workers, AFL-CIO, representing workers at the Orangeburg Manufacturing Co., a division of Flintkote, Orangeburg, N. Y.

Here to receive the award on behalf of the local union is Arnold Smith, President, and Allan Kunz, Director of Safety.

"Citation for Outstanding Service" to:

Lois F. Malecki, Local 272, International Brotherhood of Pulp, Sulphite and Paper Mill Workers, AFL-CIO, Everett, Washington.

A "Citation for Outstanding Service" is awarded to Lois F. Malecki, safety director of Local 272, International Brotherhood of Pulp, Sulphite and Paper Mill Workers, AFL-CIO, representing workers at the Simpson Lee Paper Company, Everett, Wash.

We are pleased that Lois has come all the way from the state of Washington to receive this highly-deserved award.

"Citation for Distinguished Service" to:

P. L. "Roy" Siemiller, General Vice President, International Association of Machinists, AFL-CIO,

G. G. Grieve, Secretary, Labor Conference, National Safety Council.

And now we have two "surprise" awards to make to two of our associates in the Labor Conference, both of whom have made

outstanding contributions beyond the call of duty to the development and growth of the Labor Conference. It gives all of us in the Labor Conference the highest pleasure to present the "Citation for Distinguished Service" to Brother Roy Siemiller, General Vice President, International Association of Machinists, AFL-CIO, and to the Secretary of the Labor Conference, Gil Grieve.

HOW WE WORK ON A JOINT BASIS

By JACK MOYE

President, B. F. Goodrich Local 5, United Rubber Workers, Akron, Ohio

It is a thrill to be here speaking for thousands of our members throughout the United Rubber Workers and for many other unions that have benefited from the efforts of joint safety committees. A little over two years ago this would not have been possible, for the history of The B. F. Goodrich Company shows a continual fight by management against the endeavors of our local union and others to obtain joint safety committees. This was true of a good many of the Rubber Workers' systems throughout the United States and Canada.

However, our members in 1959 had made up their minds that they were going to fight for this committee, along with many other things, and the establishment of such a committee was brought about by the efforts put out through a 55-day strike. Our people fought to get it. They thought it was worthwhile, and realize it even more so today; for remember, it is their fingers, hands, feet, eyes and lives that have been saved through cooperation of this kind.

I am pleased to say that, to my knowledge, this fight against a joint committee was not led by management people who are directly responsible for safety in the Goodrich plants.

To make a committee of this type successful, we have found that it takes action by both parties (labor and management), not just words. We have that sort of action in the Akron B. F. Goodrich joint committee, for any time of the day or night, including Sundays or holidays, we individually and collectively are in the plant

looking at problems. We have found that our members get a "lift" when they see the joint committee in the department looking at their problems and attempting in some manner to solve them.

To make a joint committee really successful, I feel that the department committeeman should always have a part in the discussion when a safety problem is being investigated in the department, and that he should be kept informed of the handling that has resulted through the joint effort. Having the committeeman in on a problem, as well as the foreman, brings about better results. It does not leave it in one person's hands and one person's thinking.

Also, I strongly feel that you should make sure that a problem is one of safety or health. Believe me, you will lose the value of the committee if you allow other types of problems to be tied in with safety. There are other people connected with our union that handle personal problems or standards problems. Use your people that are assigned to those types of cases to take care of them. The safety committee's value greatly increases if this rigid rule is followed. Management of this plant realizes that if the joint committee makes a recommendation to resolve or correct some condition, that it is actually tied in with safety, that it bears looking into, and that they had better be about correcting it.

Our committee meets every week, at which time we not only discuss the problems going on in the plant, but exchange

ideas, speak freely to one another, and above all try to see ahead to prevent future accidents. This is one of the great goals of a joint committee. When you learn to drive for future results, you are on the right road.

A desire to help bring about true safety is another requisite. If your committee in its actions gets "humdrum" it will lose the spark that is necessary. Keep people working on the committee that have a mutual trust and that have the drive to make progress in safety.

One of the very profitable benefits brought about through our joint committee is that now dozens of problems are solved without their ever being put in the hands of the joint safety committee, for we have found that department management does not want to appear on the bi-weekly write-up that is distributed throughout the plant and

which is brought to the attention of the higher groups of management. This, in my opinion, is one of the greatest gains of a joint committee. Now the foreman in the department is making it his business so very often to be about resolving the problem and not just sloughing it off.

If you can make the people that work in the department realize that they can obtain great results by cooperating with and putting pressure on their immediate supervision, part of your battle is won.

We of the Goodrich URW unions fought long in 1959 to obtain, among other things, a joint, forceful safety committee. We have pledged, and are using the same effort, to make it the best one possible. Jointly we have corrected many hundreds of health and safety problems in the past two years. We are proud of our joint safety committee; we hope you are of yours.

HOW WE WORK ON A JOINT BASIS IN ACCIDENT PREVENTION PROGRAMS

By THOMAS J. CAIN, JR.

Director of Safety, The B. F. Goodrich Co., Akron 18, O.

Talking with you this morning as an industrial safety specialist for the B. F. Goodrich Co., which has eight United Rubber Workers locals using joint, or co-operative I like better, safety program activities, I want to emphasize that such participation has a very decided and definite plus.

Why do I believe that co-operative, management-labor or labor-management, accident prevention efforts are desirable? Let me tell you that such thinking was not always the case, even with my own company. I remember that for some ten years the URW and especially Local 5, pleaded, urged, and struggled for such a committee as part of the agreement. Finally, and thanks to the untiring efforts of Jack Moye, we have had co-operative committees in the eight plants with URW locals, for a little over two years.

The results have been splendid. I can report this to you with no reservations.

Our agreement states that problems which are not resolved to the satisfaction of the union members of the committee (three in number, with three company members) may be taken to the step immediately preceding arbitration for handling. We have had no such problems to date. Our goal is to see that we don't have any.

If you are one of the "doubting Thomases" as to the effectiveness of co-operative handling of safety problems, I can tell you that you may have overlooked one of the big advantages of such arrangements. Hundreds, yes thousands, of situations which might ordinarily be submitted as formal grievances requiring hours and hours of discussion and reams of paper work, are handled on an informal basis—solutions are arrived at with promptness and the time required for "labor problems" is greatly reduced. Remember, these problems normally require a great deal of time and expense for the members of your Local, too; so the ad-

That is the heritage bequeathed to us today by those sturdy pioneers of yesterday. Could we do otherwise but carry on the work that they started?

The conditions of a half-century ago that caused those men to rise up to action were by today's standards absolutely terrifying. Structural iron workers and electrical workers lost 10 per cent of their members each year in fatalities. Joyce Kilmer in his immortal lines wrote, "Only God can make a tree." God must have been fond of Oregon, for He covered millions of acres of the state with beautiful trees—pines, firs and hemlocks—the finest examples of His handiwork.

Those beautiful trees fell prey to the demand for lumber. Logging methods of fifty years ago were crude. Much of the tree was wasted; and worse yet, human beings were sacrificed in the process of converting the standing trees into marketable lumber. The wrath of God seemed to descend on the people for their wasteful methods of harvesting the trees that God had made. The terrible toll in human lives and broken bodies called to the higher instincts of men for a safer and better way to do it. Even so, change came slowly.

As the Industrial Accident Commission became better established, the safety program developed with it. The Legislature in 1939 entrusted the Commission with the administration of the Oregon Safety Law, giving the Commission complete charge of industrial safety. With that came the authority to promulgate safety codes which, when filed with the Secretary of State, have the force and effect of law. The annual budget for safety work is nearly \$800,000. Counting the fifteen girls in the office, this finances a force of 102 persons at this time. Everyone from the Director to the newest person is dedicated to making our state a safer place in which to work.

Labor unions started the movement for safety in Oregon, and it is only to be expected that their interest should continue. Union members serve unselfishly on code committees, supplying knowledge that only those actually performing the work can have. These committees, composed of the best informed persons from Labor, employers and technical men, aid the Commission in establishing safety codes for the industry of our state. Without the help of

these splendid union members, the Commission would find it very difficult to develop and revise the safety codes.

Our Commission believes in bringing the message of safety to the people we serve. Each year regional safety conferences are held in various parts of the state. Local rallies are held, sometimes in remote areas. Union members help greatly in promoting these affairs. For many years it has been the custom to have as co-chairmen for all conferences a labor man and an employer. We try to balance the program with employers and labor men. One of the best safety skits I have ever witnessed was acted out entirely by loggers dressed in genuine working and work-in clothes.

One of the really spectacular demonstrations, and one that is used quite frequently at our safety conferences, is a demonstration of safe handling of high voltage electric lines. These lines are not energized, but are handled as though they were. After that demonstration an accident is simulated: a flashlight bulb very graphically imitates an arc; a lineman drops over, only his safety belt holding him. His partner on the pole immediately goes to work applying artificial respiration. The ground men spring into action: the radio in the truck is used to call for an ambulance; tackle is rigged to bring the injured man down from the pole. Meanwhile the second man on the pole top continues giving the "victims" artificial respiration. If it can be staged outside, the wail of the siren on the approaching ambulance may be heard. The audience is tense; if they are seated you may be sure they are on the edge of their chairs.

This demonstration requires employer participation, of course, and I wish to pay a compliment to our Oregon employers in all industries: they are wonderfully cooperative. But this demonstration is almost always performed in off-working hours by union linemen, cheerfully and for free. Another example of union members promoting safety.

Time does not permit me to tell of all the examples of cooperation between the Commission and labor unions and their members. Several former union business agents and officers are now continuing to serve their brother members as safety representatives in our accident prevention di-

vision. Our people are welcomed at union offices and union meetings and conventions.

My presentation to you would not be complete without telling you of the program for safety in the pulp and paper industry. This was presented to the employers by labor people at a wage negotiating meeting more than fifteen years ago. The employers accepted and it was agreed that the safety program would be a joint affair. It works far better than when the employers tried to do it alone. I have attended their state meetings, and I have attended their joint meeting of the three west coast states—Washington, Oregon and California. All the delegates speak the same language; it is impossible to tell who represents the employers and who are the delegates sent by the unions. This joint safety program of the Pacific Coast Association of Pulp & Paper Manufacturers and their workmen, union members, has gained national fame and recognition.

In early 1944 I was a delegate from my local union to the Portland Building Trades Council. I evidently talked too convincingly of the need for a health and safety committee. It was formed, and I found myself to be the chairman. This committee still functions after more than seventeen years.

We asked the Commission to teach a basic safety course to all the business representatives of the Council, and for the next twelve weeks, every Tuesday from 11 A.M. to noon, the Commission's safety instructors taught the business representatives of the Portland Building Trades Council how to analyze the causes of accidents, how to look for unsafe conditions, the most successful methods of correcting unsafe attitudes, and all the other items that were taught to the Commission's safety representatives.

I am quite sure that it would be safe to say that upon the completion of the training course, the Portland Building Trades Council had the best safety-trained business representatives in the country.

I would not have you believe that in Oregon we have no problems. We have plenty. We have very few large employers, none of the huge plants that people of the eastern part of the nation are accustomed to. Most of our employers have less

than fifty workmen and many, many of them less than ten. To make this situation even more difficult, there is a tremendous turnover in these small employers. This is particularly true in logging and construction work.

The growing custom of subletting parts of the work has been a big factor in the increase of these small employers. We have found that working with unions is of tremendous help in coping with the problems present when workmen shift rapidly from one employer to another. We have our problems with employers who want to cut corners, but what troubles me most are the problems we have with workmen, our own union members. It is most distressing to have workers who for some reason seem to feel that they have put something over on someone when they get by with a violation of a safety rule. Fortunately, there is much less of this than formerly.

As late as fifteen years ago the Commission's safety men sometimes met with less than a cordial reception when visiting places of employment. I am pleased to say this has greatly improved. In fact, there is complaint now that our men do not get around often enough.

I try to attend all of the labor conventions in the state and bring some of the Commission's safety people with me. If for some reason I cannot be there, I have someone there to represent me. Our people are well accepted, and the acquaintances made are a great help in the future. It is much easier to transact business with a person who is not a stranger.

We still have far too many workers killed and maimed; last year the Commission paid \$25,844,000 to injured workers or for their medical care. I would hate to think what this figure would be if we did not have the excellent safety program that we have. The accident frequency for all industry of the state has shown a steady decline over the years. Last year the frequency was lowered by the phenomenal figure of 9.47 points. That is too great a reduction to hope to duplicate every year, but we will make every effort to reduce further accidental injuries.

Oregon's safety program has gained national recognition, and it could not have been accomplished without the cooperation

of union men and women. It is very difficult to measure just how many lives have been saved. A study made a few years ago showed that if the frequency of five years previous had been applied to the employment of 1958, the claim costs would have been about \$5 million more than they were. That savings of \$5 million of claim costs means that fewer persons were injured, fewer wives became widows, and more fathers came home to their children after the day's work.

No monetary value can be placed on the blood that was not spilled, the bones that were not broken, and the suffering that didn't occur. This is the real achievement of a safety program. This is the end for which dedicated people serve. Conservation of manpower and the alleviation of human suffering are being accomplished.

Oregon has witnessed a phenomenal improvement in the conditions that existed when Oregon citizens, aroused by the appeal made to them in the *Voters' Pamphlet* by those union leaders of more than a half-century ago, established the Employers' Liability Law by their campaign for votes for safety.

Although much progress has been made and we are encouraged by that progress, the job is not yet done. The number of widows, while smaller, is still too large. Fewer workmen are disabled, but there are still too many. The standards of the future must be higher than the standards of today. We of today must carry on the work begun many years ago by our predecessors and pass on to our successors an inspiration to accept as their motto, "One injury is too many."

OTHER PRACTICAL APPROACHES FOR WORKING TOGETHER IN SAFETY

By MRS. PAULEEN J. FIELD

Chairman, Safety Committee
United Auto Workers Local Union No. 652, Lansing, Mich.

I wonder just how many of you have joint industrial health and safety committees, partial cooperation—or none at all. We all recognize the fact that some large and small industries, with wise managements, do have joint labor-management safety committees. But very few companies with multi-plant operation enjoy 100 per cent cooperation between labor and management . . . in each and every section of the country."

Ford Local 600, for example, has a full-time safety director, at the union level, as well as a workable strike clause to take care of unadjusted industrial health and safety problems.

The West Coast Papermakers and Paperworkers enjoy cooperation with management in regard to safety.

These examples are but two, however, of a wide area which is as yet untouched by complete harmony or even agreement between management and labor in respect to the industrial health and safety movement.

Well-coined phrases such as "Safety is everybody's business," come to mind, let us say, instead, that "The safety movement cannot survive without active participation of all citizens, including labor and management, in whom dedication and selflessness are the prime requisites."

Our safety committee has approached management for a top level meeting to discuss areas of safety we could agree on, such as traffic and home safety, as well as protective equipment. We were promptly informed that management, and General Motors, maintain that planning and administering the safety program and providing adequate safety facilities is a management responsibility which they always have and always will continue to fulfill. This being the case, they could see no need for a labor-management safety committee.

There is none so blind as they that will not see.

In my opinion, opposition to joint effort

is a narrow-minded and shortsighted attitude. Insofar as our safety committee was concerned, this viewpoint added incentive and the necessary stimulus to continue to work in safety, with or without management's cooperation—not only to prove to management our sincerity in improving existing conditions, but also to do what we could to educate the membership and their families against fatalities occurring on or off-the-job.

How then do we operate without management's cooperation in safety?

1. Form your committee, as large or as small as your needs, depending primarily on plant size.

2. Conduct training classes for the committee so they may more readily recognize hazards. This should also include a Red Cross class. Resource people may be obtained through your international union health and safety division, the Bureau of Labor Standards, Washington, D. C., state labor and health departments, and the National Safety Council, all free of charge.

3. District committeemen, stewards, top committeemen, and the membership should also have education. If you are working without management's cooperation, safety committeemen just will not have access to every area of the plant, therefore liaison should be established between the shop committee and safety committee at all times.

4. Safety grievances in most instances are useless. No human being has the right to bargain another's life away. It usually takes fifteen days before the grievance is on the table to be discussed by labor and management. Untold injury or even death can be caused in the meantime. There is either a hazard or there isn't. The employee should have the right to refuse to work in unsafe conditions without fear of being penalized. Should this be in dispute, the international should be called in at once.

5. Provided you have all the facts, a very successful and effective method of keeping your membership informed is to publicize the case in the union paper.

For example, we were having trouble with an over-zealous foreman grabbing bumpers off the line that he thought had not been buffed enough. Result was, not only did a couple of bumpers get away from him,

thereby endangering the lives of the employees in the department, but he ended up being injured himself. This was contrary to all the training he had supposedly received. Employees in the department were greatly relieved and their morale boosted when the condition through publication was corrected.

Weekly or monthly articles on all phases of safety, bulletins from your state health department, National Safety Council, as well as safety cartoons, will attract attention and bring about an increased awareness to the membership and their families.

6. Where the local union consists of several units, each dealing with a small plant, every unit should have an industrial health and safety committee. The local union hall should be the focal point for all meetings. Safety material, training manuals, etc., would be on hand for all the committees to utilize. Safety posters from the National Safety Council can be placed on the local union bulletin board.

The chairman for each of these unit safety committees could meet every two months to discuss the different plant problems and have an exchange of ideas.

7. Wherever possible, make the entire membership part of your program. Set up a booth during local union elections or at membership picnics. Literature can be handed out concerning industrial safety, home safety, traffic safety. In fact, cover the whole field. You will be surprised at the interest shown. During the 1958 strike, for instance, our committee, with the help of the picket captains, gave out 5,000 copies of the Michigan traffic violation point system.

Ten or twelve-minute films on different phases of safety, are usually available which can be made part of the safety committee's report during membership meetings. The steward and committeemen's monthly meetings serve as an effective method for not only education but also as a source of information in regard to existing conditions in the various districts in the plant.

Above all—keep records. I'll go into this important area a little further on.

If, however, you do not receive satisfaction in correcting an existing hazard, after going through the foreman, general foreman, etc., we in the U.A.W. have found the most effective method to be the following.

Send direct to the international health and safety division: (1) the problem and what it involves; (2) the area; (3) the foreman's name; (4) the particular plant involved. The international industrial health and safety personnel will, in turn, send the information to the state labor department or health department; whichever is the most appropriate place. In this way, not only the international will receive an answer, but also the local safety committee. Depending on the reply, the committee can follow up to see if the condition is corrected.

Both the U.A.W. safety director and industrial hygienist also may enter the plant by request, through your international representative and/or regional director.

When management sublets a job to outside contractors, try to convince them to include the plant's safety standards in the contract. Nothing is more demoralizing to the regular employees than to work side by side with these workers when they are not required to wear the same type of safety equipment, such as safety glasses, etc.

It is not unusual to find that each management in G.M. has different ideas about safety standards and the wearing of protective equipment. While one plant has 100 per cent eye protection, another has eye protection in only what is considered hazardous areas. For their own protection female employees wear caps, glasses, short-sleeved blouses and slacks in one plant, while in another, dresses, skirts, no head protection are the mode. This can only lead to misunderstanding and an indifferent attitude on the part of the employee in regard to the safety program.

Joint labor-management safety committees can be of great use to management in both small and large plants. The foreman, a very busy man, is responsible for production, quality, and, supposedly, safety in his department. On top of this, he has to worry about efficiency. It is not unusual to have the foreman call the employee to the desk every so often and say—"Sign here." If the employee asks what I am signing for, the reply is, "I've just given you your safety talk," or, "You've had your good housekeeping talk for the month."

To further aggravate good working conditions and employee morale, it is not un-

usual for the employee who receives an injury to be given a reprimand for working in an unsafe manner, even though in the majority of cases, by having the proper engineering or education, the accident would not have occurred in the first place.

Safety committeemen trained to detect hazards could eliminate many of these accidents before an injury or death does occur. He also could talk to his fellow employee, should he, through ignorance or lack of knowledge of the job, be working in an unsafe manner.

Safety signs throughout the plant should be changed with ever increasing regularity. By signs, I do not refer to the monthly posters sent out by the National Safety Council, but to the large signs placed throughout the plant by management.

However, even the posters should be in a prominent place for all to see. Employees become so accustomed to the same old sign, it doesn't even register; thus the need for eye catching slogans.

Department-wide safety contests, with prizes, for the lowest injury rate should be conducted. A catalogue of prizes, sent to the home so the family can be made a part of the contest, would add incentive. Not feasible, you say? Why not, when thousands of dollars are spent on recreation prizes.

Management and labor could conduct a joint safety check on cars in both a spring and fall campaign, and certainly all steps should be taken to include labor in the local safety councils which are a part of each community and represent all segments of society except labor.

None of the previously mentioned points are going to be easy. It will take courage but, as Winston Churchill said, "Courage is rightly esteemed the first of human qualities, because it is the quality that guarantees all others."

Perhaps you have heard about the man who went out to play a game of golf.

After teeing off, he found that his golf ball had landed in a sand trap, right smack dab on the top of an ant-hill. Well, each time he took a swipe at the ball to get it out of the trap, he killed a couple of thousand ants. This kept up until there were only two lonely ants left. One ant looked at the other and said,

"I don't know about you, buddy, but if you want to survive, we'd better get on the ball."

This is what we must do, in labor. We have approximately 74,000 local unions throughout the United States. With 63,000 of them in the AFL-CIO, the potential for a working force for safety is great indeed. One of the reasons for organizing in the 30's was working conditions. Where do we find ourselves today? In most cases, at the bottom of the totem pole.

There is not enough concentration on prevention and the cure of industrial injuries or industrial caused illnesses. It does no good to put the cart before the horse, so to speak. Having industrial health and safety subordinate to Workmen's Compensation is equivalent to the American Medical Association deciding to eliminate medical research and investing in cemetery lots.

The four "E's" of safety should be: Education, engineering, enforcement and effort.

After an injury or illness occurs, \$100 or even \$200 will never compensate the worker or family for the lifetime of misery ahead. You are lucky if you receive \$36 a week, which cannot even begin to keep a family of three. The end result is welfare, with all taxpayers sharing the burden.

We in the union movement do not fully utilize the tremendous resource of our membership which is available. Even though our vice presidents, regional directors, international representatives, etc. recognize the importance of industrial health and safety, it is brushed aside in too many instances for what are considered more important things.

Must we continue to make progress in safety through tragedy? Has manpower become such a glut on the market that we can turn aside without a thought to preventing another occurrence?

Our own George Brown put it very aptly when he said, "Would you mind getting to the job, staying on the job, and still live long enough to collect all the benefits the union has won across the bargaining table? More of our people are being killed than we are organizing."

It is up to the rank and file, therefore, to go to work and put pressure on from the grass roots:

1. To make the industrial health and

safety committee a mandatory standing committee in every local union, in our constitutions, through convention action;

2. Through membership action, to request regional health and safety conferences at least bi-annually;

3. By requesting our regional directors to include a full week of industrial health and safety classes at our regional summer schools;

4. By taking out membership in the National Safety Council Labor Department.

Only by doing these things will we build the solid foundation which is necessary to grow on. In this way also we will eventually receive the language we so desperately need in our contracts and the legislation to back us up.

We must keep our international health and safety department aware at all times of industrial hazards. In the event of injuries, keep case histories. As U.A.W. Region 1C Director, E. S. "Pat" Patterson, said at a recent safety conference held in Lansing, "Each year we negotiate we are faced with the same problem. Management at G. M., for example, polishes all their safety awards and hangs them on the wall. Each time we bring up health and safety, they point to their wall. We realize that problems exist; the law today makes it necessary only to report lost-time injuries."

However, it cannot be emphasized strongly enough that if we continue to spread our adequately trained union safety personnel so thin, the rank and file have a stupendous job ahead. Most of our international unions have only one or two safety personnel to take care of the U. S. Other internationals have only part-time personnel, no established industrial health and safety departments, or even safety film libraries for the rank and file to go to.

In the state of Michigan we have to work with an antiquated 1909 industrial law, no building code, and we had 40 construction workers killed last year. Even our school hot water boilers are not covered under the law, to protect our children. For lack of adequate staff, the state labor department could make less than half of the annual inspections required under the horse and buggy law. There are approximately 16,000 industrial establishments in the state, with 22 inspectors. We need at least 144 more to

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do the job even under the present inadequate law. It is little wonder that workmen's compensation insurance rates jumped 11 per cent last year.

It was interesting to note that school custodians met in East Lansing recently. While there, one minute of silence was observed for a fellow custodian who unfortunately was blown up while performing his duties at the school. By the grace of God, it was one unfortunate victim and not a whole school of children. But even one is too many. Not one recommendation was made from this meeting to the House-Senate Labor Committee to amend the law to cover all boilers, increase the Labor Department staff or provide adequate funds for the department.

Each of these points discussed with you today are but part of the overall picture. Management and labor should join hands with pride and humility to work side by side towards a common goal, which is greater than all of us.

Nothing great was ever achieved without enthusiasm. This is 1961 with all its automated machinery, new hazards from chemicals and radiation. The old problems still have to be whipped before we can lick the new ones. We have a long way to go and a short time in which to do it.

Return home determined to work enthusiastically towards wiping out the misery and heartbreak caused by these needless deaths and injuries.

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SAFETY, BUILT-IN

By JAMES P. McALLISTER III
General Mgr., McAllister Towing Ltd., Montreal, Que.

The docking of large ships with relatively small tugs is, at best, a very hazardous business. A few years ago the *John Pratt* of Montreal was heeled over so far by the hawser from a ship she was undocking, that she capsized and sank with the loss of four members of her crew.

During another undocking operation a tug, because it was unable to manoeuvre into a better position, released the towing hawser prematurely. The line became entangled in the propeller of the ship, leaving it helpless and at the mercy of the five-knot current in the harbor. The ship was carried down the river and under the Jacques-Cartier Bridge. But, in this case a catastrophe was averted when the bow anchor was released which held the ship in midstream.

Each of these situations could have been avoided if the tugs were more manoeuvrable and had greater stability.

So, to those connected with tugboats engaged in ship handling, safety is almost synonymous with performance. A tug which can perform exceptionally well is one which, per se, has a high degree of "safety built-in."

With this in mind, then, I would like to review the characteristics of the new twin-screw hydroconic tugs recently added to our Montreal and West Coast tug fleets. These characteristics, such as reserve power and manoeuvrability make possible the hydroconic tugs' excellent performance capabilities. At the same time, therefore, they are the most important safety features built into these tugs.

I will cover them more or less in their relative order of importance.

1. Manoeuvrability.

Manoeuvrability in the hydroconic tug *Helen M. McAllister* is very high. It is obtained by the use of twin screws and large rudders and by so arranging the stern and the deadwood area that flow across the vessel to rudders and wheels is virtually unimpeded when the former are hard over. This allows the vessel to be turned with

great facility and rather rapidly within her own length, so that she may be placed exactly where she is needed at any given moment.

The location of the towing hook is of great importance. If it is too far aft, the pull on the hook by the ship's hawser will tend to offset the turning effect of the rudder. With little power to steer itself, the tug would then be unable to "stay in shape" (that is, exert its pull in the desired direction from the ship) and the Captain might have to release the towline prematurely. The towing hook on the twin-screw hydroconic tug *Helen M. McAllister*, however, is located approximately at the center of lateral resistance, just aft of amidships, much closer to the axis about which the tug turns. The hawser in this case therefore, does not affect the ability of the tug to turn and move in the desired direction. The above point is very well illustrated when operating in a current.

The tug with the hook at the stern will be unable to turn itself into the current to get to the desired position upstream. Instead it will be swept broadside by the current toward a point downstream from the ship. When this happens, the tug, unable to pull in the desired direction, would have to release the tow line. This would leave the pilot on the ship without the assistance he might have needed to manoeuvre the ship without damage or injury to the crew and passengers.

The tug with its hook just aft of amidships, on the other hand, would not be hindered by the towline from turning directly into the current and running to the desired position to exert its pull.

Another factor which affects manoeuvrability is the speed with which the propeller(s) and rudder(s) respond to engine controls and helm in the pilot house. On the *Helen M. McAllister* the engine control lever in the pilot house is connected mechanically by a torsion bar system to the engine throttle and the control cock on the reverse reduction gear. The clutch it-

self is hydraulically operated and is capable of reversing very quickly.

This system is so effective that the direction of rotation of the propellers can be reversed within two seconds of the movement of the engine control lever in the pilot house. To complete the picture the propellers when started in the ahead or astern direction "bite" the water almost immediately, and because they are relatively large (98 inches in diameter) they create ample thrust to start the tug moving quickly either ahead or astern.

To summarize, then, the *Helen M. McAllister* attains maximum maneuverability on the end of a towline, primarily because:

1. The position of the hook is almost midship, and

2. The twin propellers and rudders can create a very high torque to turn the vessel in any direction.

So, when the *Helen M. McAllister* is in a dangerous position, due to the current or an unexpected movement of the ship, she is able to maneuver quickly to safety.

II. Visibility.

Lack of visibility in a tug can be one of the greatest dangers to its safe operation. A heavily obstructed view in any direction almost inevitably produces dangerous situations, at times, as the Master is unable to take the necessary action until the situation has developed. In order for the Captain to take advantage of the quick maneuverability of a vessel like the *Helen M. McAllister*, he must be able to see all that is going on around him.

Excellent visibility is attained on this vessel by large windows all around, not only forward, aft and on the sides, but also in the four corners of the pilot house. Since there is no captain's cabin behind the pilot house, the deep windows looking aft provide a view of part of the main deck at the stern. In addition, the slight obstruction caused by the stack is offset by controls being installed on both the port and starboard side so that the Captain can work, during a job, from the side giving him the most advantageous view.

Standing at the controls and with his head out of the window, he can see up and down the full length of the tug. This feature is particularly important in mak-

ing a soft landing against a moving ship, thus reducing the possibility of knocking an engineer or cook off his feet with an unexpected jolt. In addition, by being able to see the water immediately adjacent to the tug, from bow to stern, the possibility of running over debris or logs, which may cause damage to the propellers, is lessened.

For the safety of the deckhands the Captain should be able to see the entire working area on dock, from the fantail up to the towing hook. Such a view enables him to maneuver the stern of the tug in the direction which would best assist the deckhands to manhandle the heavy towline up to the hook. Also it would be unlikely for the Captain to release the towline if he could see that one of the deckhands was in the way.

Probably most important of all, though, the Captain must be able to see the ship and his towline leading from the hook up to the deck of the ship. Then, if the ship speeds up, slows down or begins to turn, the Captain will be aware of it immediately and can maneuver the tug accordingly. Although the deck over the *Helen M. McAllister's* pilot house is not transparent, the windows are high enough for the Captain to see the towline and the ship in all situations.

III. Stability.

It is essential that a harbor tug be very stable so that it is capable of being pulled sideways by a tow rope without rolling over. The unfortunate experience of the Montreal Harbour tug *John Pratt* illustrates only too clearly how quickly and suddenly a tug can be pulled broadside by the towline and then capsized. A high degree of stability, more than any other feature of a harbor tug, is necessary to the safety and, therefore, the peace of mind of the crew.

Stability may be defined either by curves of statistical stability, by dynamical stability or by the metacentric height, better known as GM. As most modern harbor tugs are essentially of similar type and the main dimensions for a given tug can only be varied without certain limits, it is natural to choose the metacentric height as the most convenient criterion when discussing stability.

The GM of the *Helen M. McAllister* at 15 inches, is considerably more than her

conventional counterpart. In addition, her large tow hook is so designed that when at right angles to the center line of the vessel, a moment is produced opposing the heeling moment caused by the tug being dragged sideways through the water. These two factors, the high amount of stability, and the specially designed towhook, make it virtually impossible for the *Helen M. McAllister* to be capsized.

At the same time the increase in breadth required to produce these metacentric heights is not a worry to the hydroconic form as the water flow is such that the resistance of the hull is relatively insensitive to breadth and it is therefore possible to build-in this safety without detriment to the propulsive qualities of the vessel.

IV. Protection for Propellers.

A traditional problem with twin-screw tugs has been propeller damage due to the propeller extending out beyond the sides of the tug. The twin-screw hydroconic tug, however, is so arranged at the stern, that the wide, flat sections completely cover the propeller. This cover extends sufficiently far to protect the propeller from contact with, say, a ship alongside, under any reasonable conditions of heel.

Coverage by the flat section is under water and this underwater coverage extends beyond the projection of the propellers, thus preventing air drawing, and hence giving a good solid flow of water to and from the propellers. This feature minimizes the possibility of ropes being drawn into the propeller.

In addition, flow to the propellers is along the buttock lines at the stern, and has little or no water line component. This has definite safety aspects because it not only prevents debris from being sucked into the propellers and causing damage, but also minimizes the possibility of a man, who might have fallen overboard, from being sucked into the propellers.

V. Single Engine Capability and Reserve Power.

Should there be mechanical trouble in a tug or should one propeller become entangled in a line when working, a very unfortunate situation may arise which would endanger the tug and the vessel she is

hauling. In the twin-screw hydroconic tug the vessel can continue to work with one propeller only, since the steering and general propeller capabilities are such that she can still maintain a straight course with quite a small angle of helm. In addition, the *Helen M. McAllister* can exert a tow rope pull in excess of nine tons with a single engine and propeller, which would be sufficient to continue the operation to safety.

VI. Seaworthiness.

Seaworthiness is a necessary feature for tugs that are operating in coastal waters. Last year, a twin-screw hydroconic tug, the *Island Mariner*, was sailed from England to Victoria, British Columbia, for duty on the West Coast. En route, it was caught in a hurricane off Bermuda, but the Captain reported that the vessel was never in danger at any time. During the height of the storm, he was forced to run with it and he mentioned that she maintained her heading with little tendency to brash.

Basically, the hydroconic tug is arranged so that with the wide, flat stern, the center of pitch is far aft, and the bow is of such a full form that it heavily dampens the motion. As a result, the bow does not acquire high pitching amplitudes, while the stern tends to follow the wave slope, i.e., slides up and down. This produces very satisfactory propulsive conditions as the propeller is never kicked out of the water, and hence there is no undue power loss or danger of mechanical or personnel trouble in the engine room.

Sizeable rolling chocks were fitted to the *Island Mariner* with the result that the rolling is dampened considerably. Although the *Island Mariner* has logged many days towing in the open ocean off the British Columbia coast, she rarely rolls the crockery off the galley table.

A more important result of this dampened motion than the saving of dishes, however, is the good physical condition of the crew. Fatigue and/or seasickness are at a minimum on the *Island Mariner*, and the men are therefore less prone to accidents.

VII. Structural Integrity and Continuity.

Great attention is paid to structural integrity and continuity because it is the opin-

tion of the designers of the hydroconic tug that vibration and loss of alignment of the main propulsion machinery is highly undesirable both from the efficiency and safety points of view in a small ship. Generally large powers are installed in towboats relative to the size of the ship and it is very easy to get bad vibration and machinery suffering from lack of alignment. All engine girders are taken right through to the stern and form the rudder trunks and seatings for the steering gear. The comparative lack of vibration undoubtedly produces a more satisfactory working condition and enables the crew to concentrate better upon the safe and efficient working of the ship.

The scantlings of the *Helen M. McAlister* are especially heavy with frame spacing cut in half forward of amidships to provide the strength to operate in ice. This additional strength is an added safety factor in case of collision or other damage.

The subject of marine safety in Montreal Harbor as well as throughout Canada, is a major concern of the Canadian Steamship Inspection Service. The numerous inspectors of this Service do a first class job in ensuring that ships are built, repaired and maintained in a safe operating condition and in accordance with a myriad set of regulations. These regulations cover sub-

jects all the way from safety valves and shafting to life boats.

But, as detailed as these time tested safety regulations are, I do not believe that they can possibly cover all the important safety features of an inherently hazardous business like the operation of harbor tugs. The harbor tug is a highly specialized vessel. It is for this reason that I chose to dwell on those items which make a tug an efficient vessel and, therefore, a safe vessel.

In the twin-screw hydroconic design we have a tug which scores high in maneuverability, visibility, stability, protection of propellers, power reserve, seaworthiness, strength of hull, thus providing a safe and efficient working implement for captain and crew. These qualities greatly enhance established safety regulations and the effectiveness of a properly trained "safety-conscious" crew.

It must be emphasized that a Master with boat handling ability and an awareness of safety must ultimately be relied upon to properly and safely operate a tug with these high performance capabilities; however, it is those safety factors which can be built in we believe the performance of the twin-screw hydroconic tug illustrates their effectiveness to such a degree that they become the worthy subject of this address.

SAFETY, BUILT-IN

By WILLIAM C. McNEAL

Vice Pres., Oil Transport Co., Inc., New Orleans, La.

I hope to pass along some safety ideas and also to inform you of the progress made in marine safety on our rivers. Most important, though, I am anxious to learn from you about safety—I am no expert. This is the principal reason I have been at these meetings for the past several years.

Built-in safety has been slow to arrive in the river business. But I am proud to say it is as much a fact today on the rivers as it is at sea. This has been rapid progress. I can recall six years ago we installed fixed carbon dioxide engine room fire fighting systems in two modern tow-

boats. Both boats had been built about 1949 with no such system. And there's a lot more to this story of adding safety features to existing towboats. However we got the job done with help from the Coast Guard, underwriters, deep sea operators, shipyard and some plaintiffs' attorneys.

Let's take a look at a conventional river towboat—our motor vessel *Bayou Larose*. This boat regularly works the river system with a tow of about 11,000 tons capacity, some one thousand feet long, in the petroleum trade. Certain conventional operational and safety features are apparent

at a glance—radar and radio antennae, two large searchlights, railings, ring buoys, a large whistle and navigation lights.

If we could get aboard more would be visible. These would include a rate of swing indicator, public address system and depth recorder in the wheelhouse, as well as excellent firefighting equipment with both carbon dioxide and water fog systems. You also get an indication here of good housekeeping, that oldest, good safety practice. I am proud to say this is true. Of course housekeeping for good housekeeping is a basic custom item. Also this boat is twin screw with wheelhouse engine control as are most river towboats. These two facts are taken for granted but they are big plus factors in a safety built-in program.

Towboats provide the glamour in our business. Like most glamorous items they are expensive, attract attention and require financial support. So we need the rather pedestrian barges as a tow for the boats. It's the barge that carries the cargo to earn the money—there would seem to be a word here somewhere. But I won't pursue it.

There is, though, this very real fact. We have concentrated our safety engineering on the towboats to a far greater degree than we have on our barges. And the ever widening scope of unusual cargoes demands we pay more attention to barge safety.

Here are some of our petroleum barges at a loading dock in Louisiana. They are all equipped with the Coast Guard required safety devices including a remote pump engine shutdown so ably advocated here a few years ago by Mr. Spellacy of Humble Oil & Refining Co. But let's take a look at some other features. Cargo hose hoists on barges are excellent devices. Note the dark green deck paint to prevent searchlight reflection at night. And perhaps you can detect the wide strip of non-skid paint around the edges of the barges. Also the edge has a white strip all around, to aid the pilot as well as the deckhand. Other deck obstructions are painted to contrast with dark green. Here again good housekeeping is vital. These barges are in the asphalt trade but you don't see any asphalt on deck. Also rope and cable are properly stowed.

Take a closer look with me at this new type cylindrical tank barge designed for

the asphalt trade. This barge has just completed its maiden loading of 250 degree asphalt. You can see the catwalk with hand-rail on top of each tank. And the side hand-rail is visible at the lower left corner of the picture. The steam line and cargo pipeline is in between the two tanks where crewmembers don't walk, thus helping to eliminate burns. We are looking at the bow of the barge. Usually the pumping unit is on the stern. But we felt the much larger bow area was the best location. This allows plenty of space on the stern deck for the crew to make barge couplings with less danger of falling overboard. Special purpose barges require special thought if we are to build in safety.

We've spent some time here looking at the built-in features on river equipment. These are all important along with many other items that are or can be built into the many vessels on our rivers. There is a staggering variety of vessels in use today. There will be more tomorrow as we find new and better ways of handling cargoes and barges. Planning for safety in equipment must start at the beginning of the construction program. And I believe today it generally does.

We have not yet touched on the most vital area where safety must be built in. Take a look at this picture. The man in the middle is master of the *Bayou Larose* and with him is the cook and one of his deck crew. All are human beings, all have brains. And it is in this brain that we have our vital area for building in safety. In New York last April, Mr. Mansell of Bethlehem Steel's Shipbuilding Div. made a summary of the President's safety conference that bears repeating.

He said, "In March of 1960, at the President's conference on occupational safety at Washington, D. C., the need was stressed for more employee and supervisory training, plus an awareness of the mental lapses of people. It was pointed out that, biologically, human beings have not changed in reaction time since the beginning of man, and that this has always been a problem in the increasingly complex industrial environment. The claim was made also that we have reached the point of diminishing return from purely physical safeguards, and that we must work on the physical characteristics of the individual, with the first line

supervisor understanding himself and the men working for him as to attitudes and emotions, which may seriously affect his conduct on the job."

Our company safety program has undergone a basic change since its inception in 1954. Simply put, it is this: we primarily worked at that time in safety engineering. Today we primarily work at safety psychology. I think Mr. Mansell has summed up the reasons for this change.

Practicing psychology is done by all of us each day in simply living. We need to pinpoint this in our safety programs. By way of suggestion I recommend a review of your safety program, quietly, in your head. You are out to sell an idea and this is one sales campaign where no holds should be barred. I remember the safety engineer who used to present an artificial eye to any man he spotted not wearing goggles where necessary in his plant. No words were necessary.

Specifically, on towboats, I would devote the most time to the captain, chief engineer, deckmate and cook. Why the first two should be sold is obvious since they lead the boat. But the deckmate is most important to me. He is on the spot with the men. Not only can he give a fast warning or an on-the-spot safety lesson, but he can see the hazards at close range. Many a valuable safety idea in our fleet has come from a deckmate. My reason for including the cook is a bit more subtle. Generally the cook is an older, more mature person. Also the cook sees everybody frequently in galley hull sections. So tell the cook on

talking about safety instead of pinup pictures. The mere mention of the word "safety" helps remind crew members.

Because towboat crews generally are not scholars of English, I prefer limited amount of written safety material. But it can be used. Keep it short, to the point and in words of less than four syllables. Posters are always excellent. A source of inland posters of first rate quality is available either through the American Waterways Operators or the Safety and Health Committee, or both.

The basic way to sell anything is to talk with the customer. So you must see your crews, talk with them, know them and just plain work hard for built-in safety in the head.

One final observation—few of us working at safety with inland companies are professional safety men. In fact, few of us work at safety full time in our companies. Most of us were assigned the job of safety. So now comes the question, are you sold on safety?

Three months ago I was attending a safety meeting with another interested person working part time in safety. As we left his plant in his car he failed to observe a stop sign and failed to observe the speed limit. I doubt that he is a successful safety salesman because he had not yet sold himself. I find it a bit uncomfortable to reflect on my own shortcomings in this field. We have a big job ahead of us. Let's start by making certain safety is built into our own heads.

SAFETY, BUILT-IN, ON RIVER TOWBOATS

By V. KEHRES

Asst. Chief Eng., St. Louis Shipbuilding & Steel Co., St. Louis, Mo.

The shipbuilder is the proverbial jack of all trades, and, if he is going to stay in business, he had better be the master of them all.

He is the contractor building a propulsion power plant, an electrical power plant, hotel accommodations and restaurant facilities. He is the insulation contractor, the sheetmetal worker, the plumber, electrician,

carpenter and painter. Besides all this, he must build a hull that will float and is stable and seaworthy to incorporate the results of the above labor.

Therefore, to the designer and shipbuilder, whether of ocean craft or of river craft, safety has many facets. Many safety features are common with other industries; many are unique with the marine field.

The naval architect's first responsibility is to design a hull that is stable and seaworthy to protect men and cargo. To insure that this safety is built in, naval architects have an intensive training period, and several agencies have established standards of safe design and construction. The American Bureau of Shipping and the United States Coast Guard, to name only two agencies, will approve design drawings and follow through with inspection during construction.

However, while stability and seaworthiness are the most important safety features that are built into a hull, we wish to discuss today some of the less obvious safety features which are included in river towboats and barges.

Many items, although they are vitally important, are common with all industries and are included by all reputable towboat builders.

We will list them here:

1. Non-skid deck surfaces and stairreads.
2. Handrails, grab rails and safety lines.
3. Adequate lighting on stairs and ladders.
4. Adequate floodlighting of deck work areas.
5. Guards over moving machinery parts.
6. Elimination of sharp plate edges.
7. Contrasting colors on deck fittings and other deck obstructions.
8. Insulation of engine exhaust lines.
9. Rubber floor mats and wood handrail switchboards.

The modern safe towboat has many unique features, however.

Standby equipment is very important. To prevent loss of the entire power plant, standby electrical generators are provided that can be thrown on the line on short notice. Loss of electrical power would kill all the motor driven equipment and could leave the boat and tow at the mercy of the river current, and hazards such as bridge piers, locks, dams and bars. Likewise standby air compressors and steering gear pumps are provided for the safety not only of the towboat and tow but for that of the crew. We have to admit, however, that in the opinion of the crew, the most important standby unit is the standby refrigeration compressor we install on most of our towboats. Most everything else is secondary to keeping the food on the mess table.

Continuing the theme that properly operating mechanical equipment contributes to the safety of personnel and tow, the use of audible and visual alarms is an important safety feature. In addition to the standard general alarm system to warn of fire and pending danger, there are alarms to indicate low lubricating oil pressure, high cooling water temperature, failure of a steering gear pump, fuel oil day tank low level, etc.

While escape hatches are common on ocean craft, it is only in recent years that they have been standard equipment on river towboats. This now common usage, like so many other safety improvements, was the result of a near catastrophe. A few years ago on a large towboat, a high pressure fuel line on a main propulsion engine developed a leak and filled the engine room with atomized oil. The engineer, working in the forward auxiliary machinery room, was unaware of the leak until the fuel was ignited, probably by the oil burner on the heating boiler. The engine room was immediately a holocaust, trapping the engineer in the below decks compartment. Thanks to some far thinking designer, this was one of the boats having an escape hatch from this compartment to the quarters above and the man's life was saved.

The firefighting equipment on towboats is improving all the time. Fire pumps of 300 GPM at 100 psi are not now uncommon. The fire pumps, usually located in the lower engine room, now have remote start-stop switches mounted on the outside of the deckhouse.

The problem of engine high-pressure fuel line failures is not uncommon. Several boats are fitted with fog nozzles mounted directly over the main engines. Upon detection of a fuel oil leak a fog spray is released, filling the engine room and thus avoiding ignition of the atomized oil. The source of water for these fog nozzles is a separate diesel-driven fire pump mounted on deck. Thus, the engineer, from a remote location, can eliminate the danger of fire and safely enter the space to cut off fuel pressure.

As an added precaution, to combat the same hazard, these boats have a cut off in the fuel oil line at the fuel pump which operates automatically when the fuel oil is cut off at the rack by the pilot house

control or manual engine controls. This in effect removes the pressure from the entire fuel line by remote control.

To get at the root of these fuel oil line leaks, however, we have instigated recent metallurgical research to improve the wearing qualities of the fuel line material. We believe that this problem will be resolved very soon.

Many towboats have banks of CO₂ cylinders that are piped to the engine room bilges for combating fires. From a remote control station outside of the deckhouse the CO₂ is released to any part of the bilges. The cylinders are sized so that the engine room can be completely flooded to smother out any fire. Since there is the inherent danger that a man could be trapped below and be suffocated by the CO₂, an alarm sounds when the CO₂ is released. Also, to cut off the air supply to a fire, a pressure switch, when the CO₂ is released, automatically cuts off all engine room supply and exhaust fans.

This principal of automatic shutdown is used in other applications.

A few years ago the engine crew of a 2400 H.P. towboat had a harrowing experience. The Chief was unaware that a lube oil leak had developed in the manifold of the turbocharger of the port engine. The Captain, seeing the smoke from the exhaust caused by the burning oil threw the clutch out—an unfortunate natural instinct. Away went the engine—running on lube oil since the overspeed trip had long since shut off the fuel oil. No one knows what fantastic RPM's were attained by the runaway engine when the flywheel started disintegrating. Pieces of cast iron, torn off the flywheel by centrifugal force, started flying through the engine room and through the roof. One piece sheared off the governor of the starboard engine and away went the second engine. Fortunately, the Chief was able to stop the engines without even an injury to any personnel.

To prevent such a recurrence of main engine "runaway," many boats now have an air and oil operated automatic shutdown on the air intake manifold energized by the overspeed governor. Several have manual air shutoffs, operable from outside the engine room.

In addition to lubricating oil low pres-

sure alarm, several boats have an automatic shutoff in the fuel line actuated by low lubricating oil pressure, thus preventing engine damage.

While on the subject of engines, it is good to note that several diesel engine manufacturers are designing their crankcase covers to withstand a crankcase explosion. Thus, not only are flames contained within the engine but the hazard of flying covers is eliminated.

When built by reputable shipyards there is a vast amount of hidden built-in safety in the electrical systems of river towboats. Proper grounding, insulation and installation of electrical equipment and wiring by trained competent electricians can be the most important asset to the boat owner and the most important safety feature to the crew.

Today's excellent electronic navigational equipment has added greatly to the safety of marine personnel. The almost universal use of radar on the larger boats has lessened the chance of collision with other boats, bridge piers, etc. The radio telephone is a great assist in anticipating an oncoming tow when navigating around a blind bend.

So from stem to stern and from the pilot house to the bilges, the shipbuilder is constantly safety conscious. Whether he is wearing the hat of the designer, the steel erector, the machinist, the pipefitter or the electrician, he is concerned with the safety of personnel.

The great improvements in recent years in the built-in safety features of the better river towboats is a credit not only to the enterprising shipyards but also to the many safety minded towboat operators. After all, many of the above features can be costly. It is the owner who pays the bill without the anticipation of a quick return on his money.

While all of these built-in safety features—the automatic shutdowns, the remote controls, etc.—are all commendable, they can breed a new danger. I am convinced that this trend to automation in the safety field can promote over-dependence on mechanical equipment and create safety laziness in personnel. It is incumbent upon the towboat owner constantly to instruct the crew that these built-in safety features are to aid and assist him, and are not a substitute for his constant concern for safety.

SAFETY, BUILT-IN

By WM. A. McCORMICK, JR.
Safety Supr., Union Barge Line Corp., Pittsburgh, Pa.

I certainly feel honored to have been asked to help out in this session, and yet I feel like a youngster to marine work. Although I have been partially associated with marine work for six years in lock, dam and bridge construction on the rivers, I have only been in full time marine operations since January 1 of this year. Throughout my presentation, I want you to keep in mind that "I just came on watch" for this job the first of the year.

My duties as safety supervisor with Union Barge Line Corp. are to help administer the corporation hazard control program in towboat operations. In addition to Union Barge, I have the same responsibilities in the Keystone Div. of Dravo Corp., a sand and gravel producer with a fleet of towboats, barges and dredges, with some towing in the coal trade operating on the Monongahela and Ohio Rivers in the Pittsburgh, Pa., area. Also, Keystone Div. operates nine land plants and three large mixer truck fleets.

My third area of responsibility is the Potomac Sand and Gravel Co. located in Washington, D. C., recently acquired by our corporation. This is a sand and gravel producing company operating in the Potomac River with five dredges, five tugboats, one towboat, two stiff leg derrick boats and a large fleet of sand barges feeding two large processing distribution land plants.

In more detail, my work consists of making inspections of all plant and marine equipment, making recommendations at all levels of management, developing and conducting safety education meetings for supervisors and working out problems in design with maintenance and engineering department people. In short, much time is spent on planning ahead, keeping up to date on new technological developments and selling the service—safety.

To do this job properly, you must like the work. You must be analytical minded, and like to work with all kinds and types of people from top management down

through the craftsman. The first essential of this work is to be able to work with and get along with all these people. The job can only be done by mixing with the people who do these jobs, observing their operations, asking them questions to learn all the details possible about the operation. You must convince these workmen that you need their help.

The quickest way to learn the routine and hazards of a job is to ask the man who is performing the operation. The many years of experience of all these workmen must not be ignored. To this end, much of my time is spent aboard our marine equipment under actual operation.

Employment with Union Barge Line enables one to enjoy a situation not common to many people in marine safety in that our parent company Dravo Corp., is a builder of marine equipment, as well as an operator of marine facilities. I learned early that the best time to get safety devices on a piece of marine equipment is when it is being built. This covers part of the area of the subject of our discussion here today, which, as you know, is "safety built in." It is much easier and less expensive to get such items as proper sloped stairways, shaft coupling guards, proper fire protection systems, hand rails, deck toe rails, etc. on the boat when it is being built, rather than after it is in service with full fuel bunkers. This is something our entire marine industry should strive for in the future, by taking advantage of the experience over the past years.

The Inland Waterways Safety and Health Association has formed a subcommittee for this purpose. Our aim is to develop minimum standards on various safety items that can be built into marine equipment. Eventually we hope to have a manual that can be placed in the hands of boat building companies and operating companies to help them build and maintain their boats and plant equipment as hazard free as possible. Of course this same information can be used to make existing equipment much safer.

Now, through the medium of some colored slides, I want to take you with me on a trip over several pieces of marine equipment and show you some of the situations I have noted and photographed in my travels. Whose equipment, or where it is, is not important. We will cover dredges, towboats and barges. We will see old equipment as well as new. We will see hazardous situations as well as good situations. Many of the ideas you will see for safer operation are old. Many may be new to you. If we do nothing more than to get you to thinking, we will have well spent our time here.

When looking for a good picture to take for an introductory slide, I could not pass up this scene.

Slide No. 1—Boys' Future. Two young boys, cub scout age, looking at the marine activities along the Ohio River. I am sure this takes us all back a few years. To me, this picture means a lot of things. It projects into the future—here are two young minds being developed. The things they see and hear in the next ten years, that is in the 1980's, will surely be instrumental in helping them make their choice of an occupation or profession for their life's work.

And, as I saw these two lads, the thought occurred to me—What if they choose the marine transportation industry? What would they be getting into safety-wise? Well, if our industry does not better itself, they will come into an industry that ranks 38th out of 41 major industries in this country. Just about on the bottom. And for every million manhours they and their buddies would work, 21 of their fellow workers will have disabling injuries, losing a total of 2296 mandays. Now I, for one, do not want to wish that on any of our future workers. I particularly do not wish it upon these three.

Landing Work

Slide No. 2—Stairs to Landing. When workmen and crew members get aboard towboats, they usually cross over a landing, a dock or a wharf. Due to the physical terrain and the nature of a river to cut a channel, most river landings require long stairways and gangways for access from top of bank to the river level.

Thought should be given here to angle

of stairs, width, type of tread, etc. Most of the people using these stairs and gangways are carrying a suitcase, tools, store parts, etc. At least one hand is always full. Thus good railings should exist here on both sides of the stairways.

Many of the women wear high heel shoes, thus tread type should be considered, so as to not catch high heels and trip the ladies. Also, width should be such that two people can pass easily. Remember all the traffic to and from the landing, regardless of reason, uses these access ways. Make it as efficient and safe as possible. In many instances a well sloped ramp can be used in place of a stairway. Consideration should also be given to the accumulation of snow and ice during the winter months, if in a northern area.

Slide No. 3—Life Ring Stand. For the protection of the workmen around landings, "life rings" should be placed at locations near the outer edge of the fleet. They should be visible and easy to get to and always ready for immediate casting.

Slide No. 4—Life Jackets—Kapok Type. When working near or over water, men should wear life jackets. There are many types on the market. All have advantages and disadvantages. This is one of the standard kapok types. Bulkiness is its greatest drawback.

Slide No. 5—Life Vest—Vinyl-Foam Type. Another type of vest used in marine work is this "vinyl foam" model. These vests are light and not bulky. The buoyant material is a series of independent air cells, thus the material will not absorb water. Tearing the material or punching it full of holes does not affect the buoyancy. The material will not support combustion. A disadvantage is that the pad is hot on the wearer's back in summer months, and in sub-zero temperatures the material becomes stiff.

Slide No. 6—Workmen Without Vests. When men work near or over water, they should wear vests. A severe bump or mistep or stumble can put them into the drink, and when the current is swift and the water is muddy, as it is during open river conditions, it is imperative that they be seen in the water.

Slide No. 7—Rowboat Scene. A common scene on the river. This is a yawl play

at a crew change on a dredge. One of these men is the Mate. We keep hearing that men are good swimmers. It is well to point out that it's usually a good swimmer who drowns, the non-swimmer most always has on his vest. If a piece of ragging flies and hits a man in the head, knocking him unconscious and into the water, being a good swimmer won't help at all. The real purpose of a vest is to that a man so he can be seen to be hauled in, not a competitive device for good swimmers. I have been tempted many times to put up signs saying—"Good swimmers never drown, they just float away and sink." I often see yawls so fully loaded that they look more like a "tramp ship" than for what they are intended.

Walkways and Railings

Now let's go aboard some equipment and see some stairs, walkways and applications of hand rail guards. People move all over the equipment, and for just plain walking, several things have been done to prevent falls. Also several hazards exist which can cause falls.

Slide No. 8—Tugboat Underway. Here we see material on the guard. This guard is not too wide and such obstructions increase the chance for a man overboard. Note that there are no life lines or rope railing on this boat.

Slide No. 9—Life Lines. These lines serve as a good railing. When stern lines are used, the snaps are loosed, then re-snapped after the stern lines have been dragged back and tightened in place.

Slide No. 10—Rope Railings. Here the guard is much wider than the top of the deck house, so rope railings are used. Notice, however, that there is no toe rail on this guard. If one slipped on ice and slid down under this particular rope face down, he would not have anything to catch onto.

Slide No. 11—Toe Rail. Here we see a toe rail to act as a catching point, should one begin to slide overboard.

Slide No. 12—Mariner Stairs. Continuing with stairs, here is a nice application. These stairs are well sloped, they aren't too steep, or too flat; they are equipped with good hand rails; the treads are open to prevent snow and ice from accumulating, and there is plenty of head room at the stair entrance.

Slide No. 13—Control Treads. These stair treads are painted with a non-skid mix and at night they reflect light. At night these stairs stand out like piano keys in a dark room.

Slide No. 14—Tow Knees Hand Rails. Hand rails on tow knees are very helpful to deckmen, especially when the decks are wet and the men are carrying ratchets, lines, tools, etc. This is a stairway and any stair way should have a hand rail.

Slide No. 15—Cover Barge Hand Rail. Here is a rail on a covered barge. Note the non-skid walking surface on the gumed.

Slide No. 16—Dredge Hoist Railing. Hoist landings should be well guarded. Here a section can be removed while landing the material. Then this section can be replaced, giving continued protection against falls overboard.

Slide No. 17—Searchlight Without a Railing. A hazard exists here in that there is no railing around this searchlight. Searchlights require considerable maintenance and should be protected as this next light shows.

Slide No. 18—Searchlight with Guard. Railings such as these prevent falls.

Slide No. 19—Engine Room. In this engine room, note the good railings, also note the toe rail on the deck to keep tools, bolts, pipe, rounds, etc. from falling below when working on engines.

Slide No. 20—Roofing Paper Walkway. Here is a good application for a non skid walkway. This is regular roofing paper anchored to the top of this tar pitch roof, above the engine room of a towboat.

Slide No. 21—Sand Well. No guard near the walkway here. One could slip into this well—it is an out of the way place, but men do go in this area to check the equipment and work if need be.

Slide No. 22—Spilled Gravel on Walkway. Here is a nice walkway, with a good handrail, but look at the mess here on this deck. This gravel is tough stuff to walk over. One could fall easily and strike his head on some steel object, causing a serious injury. This gravel was spilling over the edge of the walkway to the next deck 20 feet below where deck hands were working loading barges.

Slide No. 23—Sagging Belt. The cause of this gravel situation which you have just

seen, is the sag in this belt. An extra set of rollers here would prevent this situation.

Slide No. 24—Conveyor Belt. Another belt here with spilled gravel. This can also fall below and strike a worker. A longer skirt would help eliminate this condition.

Slide No. 25—Dirty Gnnel. The best deckhand in the industry could not walk over this obstacle course. Gnnels must be kept clean at all times, and believe me this is a constant battle. This particular barge situation was created at a landing where this barge was unloaded. However, it did come in a tow back to a dredge in this condition.

Slide No. 26—Cluttered Walkways. Here is a real accident trap. Tools on the walkway and a hose across the walkway, a real tripping hazard. No railing on the left side. As you can see, this is high in the air, about 60 feet to the water level.

Slide No. 27—Cluttered Rake on Barge. Such items make it rough on deck crews if not cleaned up.

Slide No. 28—Hand Winch. Here is something that can be a real accident maker. This is a hand winch used for lifting yaws on yawl booms and raising conveyors around dredges. You will note that this has a friction-type band brake. Many times this handle is not removed as it should be. The clutch is released and the handle unwinds and hits the workmen right smack across the head, or breaks a wrist or arm.

Slide No. 29—Electric Hoist. Of course the more modern method is to use electrically driven hoists and winches with push button control.

Slide No. 30—Electric Driven Winch. Here is an electrically driven winch, note how the gears are not guarded. It would be very easy for one to get caught between these gears. Note the crowded condition the operator would be in while operating this winch. Better design would have eliminated this situation.

Slide No. 31—Unguarded Belt Drive. Here is another accident trap—if one would slip and fall into this with his hand or arm, serious injury could result.

Slide No. 32—Guarded Drive. Here is a drive that is 100 per cent protected. This could not cause injury if anyone would come in contact with it.

Slide No. 33—Partially Protected Drive. Here is just about a 100 per cent guarding job, however one shaft end has been left unprotected. Note that one shaft end is covered with a metal cup and one left exposed. You can't see it, but there's a real sharp key sticking out of the groove which could cause injury to someone's knee or wind up clothing if someone came against it.

Slide No. 34—Shaft Cover. Here a walkway passes under a shaft. However the shaft is well protected with proper guarding.

Slide No. 35—Shaft Coupling Guard. Note the well-formed and well-insulated shaft coupling guard. This is the coupling between an engine and a light plant on a towboat. This same drive operates the pressure pump for the hydraulic steering system.

Slide No. 36—Belt Drive Shaft Protector. This is the scene in the engine room of a small construction job towboat. A four belt sheave drive was installed to run an air compressor in a changeover from manual to air steering. This is a very good application of scrap parts built into a very nice guard.

Slide No. 37—Main Drive Shaft Coupling Guard. Another well constructed and well anchored shaft coupling guard. This is on the main drive shaft of a large towboat. On many boats this area is used for storage. This is fine if done properly. However if any combustible material got against this exposed shaft it would be ignited by friction, the oldest fire starting principle in the world.

Slide No. 38—Flanking Rudder Bumper Plate Hazard. This is a real accident hazard built into a new boat. This is the end of the connecting arm on the flanking rudder control. When thrown to the extreme port position, this bearing point strikes against this bumper plate on the bulkhead. Just to the right of this area is a doorway. Anyone who would enter this area and try to take a shortcut, would certainly be killed if caught between the wall and the end of the control rod—thus a chain has been installed to prevent anyone from entering this area.

Slide No. 39—Resistor Bank Protection Screen. This resistor bank area carries 440 volts. However, this very nice guard made

from scrap pieces of dredge screens eliminates any hazard of electrocution, should some one fall into it or poke an iron rod or tool into the bank.

Slide No. 40—Grinder Protection. This is probably one of the most abused items in our industry. However, note here that the grinder tool post is well in toward the wheel, face shield is in place and goggles are supplied for the operator's use. Also wheels of the proper speed range and type should be used.

Slide No. 41—Kitchen Stove Guard. Most towboats vibrate a great deal, especially when flanking. Note here the weld rods that have been welded onto the stove top to prevent pans with scalding water from falling to the floor and possibly scalding the feet and legs of the kitchen personnel.

Slide No. 42—Pilot House Stairs Hazard. Note here that the stairways to the pilot house comes up at an angle where you enter them directly behind the pilot. Should one stumble and fall or mis-step especially at night when it is totally dark, one could fall directly down the stairway backward. Also a small dim night light would be helpful on all such stairways at night.

Slide No. 43—Mariner Pilot House Stairways—Good. Note that these stairs run parallel to the side of the pilot house. Here it is not so easy to back down the stairs by mistake. It might be well if a small lugged rod would be placed at the top of all pilot house stairs where they could only open from the "coming up" direction. From the pilot house side of the stairs, this rod would act as a railing.

Slide No. 44—Mariner Pilot House Controls. Note how all the controls in this pilot house can be reached by the pilot while sitting in the chair at the controls. In many pilot houses, the pilot must leave his chair and walk eight to ten feet to a radio, leaving the controls unattended. This particular boat is a very late design, where all controls are handy and the pilot does not have to leave the controls except very rarely. This is very important, especially when entering or leaving locks.

Special Hazards and Corrected Conditions Aboard Marine Equipment

Now, returning to the lower level of the towboat and out on the fleet, we will look

at some of the hazardous situations and what has been done to eliminate such conditions.

Slide No. 45—Cable Reel. This is a real accident maker aboard marine equipment. Here we have a wire reel which is not blocked. On marine equipment which yaws and rolls this reel would roll. All reels should be well blocked and preferably laid on the side, if possible. This is especially true on derrick boats when the deck goes out of level when heavy loads are picked up.

Slide No. 46—Yellow Line on Cover Barge. This is something with which we are all familiar. I'm sure. It is a bright yellow line painted continuously down the top of a covered barge. Anyone walking here, day or night, and sees a break in this white line, knows that a hatch cover is open, preventing a long fall into the barge.

Slide No. 47—Covered Barge Latch Cover Handle. Here is something that has caused fatalities. When the hatch cover rolls and strikes the end of the barge, a handle would fly over and strike a man standing in line with it. To eliminate this, these lugs were welded onto the latch cover handle. It can only rise to a vertical position.

Slide No. 48—Covered Barge Latch Handle—Critical Position. Here we see the latch cover in vertical position, the lugs preventing it from coming down over the end of the barge where it could strike anyone who may be standing in line with it.

Slide No. 49—Covered Barge Latch Handle and Employee. Here we see how an employee is protected by these lugs on the latch handle. We can see that the man is at the right height to be really "dlobbered" if this would be allowed to come on over striking his head.

Slide No. 50—Ladder Shoes. Here is something that all ladders should have when used aboard deck or any hard smooth surface. Note the ladder shoes prevent the ladder from slipping on the steel deck. Another feature here is the portable ladder step tread. This tread can be placed at any rung, allowing a 6 inch surface for the man to stand on. I sure would have appreciated this when I was a kid picking cherries back on the farm when I spent all day on a ladder rung or tree limb in my bare feet.

Slide No. 31—Permanent Rigging. Here is a ratchet, attached permanently to the side end of a barge. This metal plate is welded to the end of the eye bolt. It keeps the end of the ratchet above the deck and will not allow it to fall on deckhands' fingers. The piece of metal also acts as a permanent toothpick. Also note the non-skid surface aboard this barge.

Slide No. 32—Color Coated Ratchet. You will note that one end of this ratchet is painted green and the other end white. This is something a blacksmith did to make it easy to determine the right and left side of the ratchet. This is not a safety item, it is more an efficiency item. Anyone ordering a broken ratchet bolt, will know immediately which is left or right hand side when ordering the bolt.

Slide No. 33—Door Hooks. All doors on marine equipment should be arranged so they can be hooked in the open position. Many fingers have been damaged severely during windy days or when making up tow when doors have slammed shut on the workmen's hands.

Slide No. 34—Stove Hood. On many of the older boats when they used large stoves and then replaced them with more modern smaller stoves, the hood sticks out beyond the edge of the stove. Many of these hoods are low and are in the walking area of the kitchen crew, and become severe head bumpers. Note the hook in the upper left corner that can be used to hook the door in the open position.

Slide No. 35—Steering Gear Room. Here is a shut of the tiller room. Note the lubricating lines coming down to the various bushings in this equipment. These hoses tie into a central-point lubricating system which is a fine example of safety and efficiency tied together.

Slide No. 36—Central Lube System. These lines lead over to a central lubricating location as shown in this slide. This allows a man to do all lubricating from a clear unobstructed area and prevents him from climbing in and about the steering gear equipment.

Slide No. 37—Dredge Central Lube System. Here is the same thing applied to old equipment. Note how these caps and lines keep a man out of the hazard of climbing in on the digging ladder.

Fire Protection on Marine Equipment

Slide No. 38—Flammable Liquid Containers. Here is a common sight aboard marine equipment. Gasoline and flammable liquids are handled in just about every type of conceivable container that is made. Here we have two approved cans and sitting right along side of them is an unapproved five-gallon can. All containers should be a safety type can with the gauze flame arrestor in the spout.

Slide No. 39—Fuel Vent and Light Cover. Another precaution against fire on older boats is having the light bulb covered with a glass shield and a steel cage protector to keep it from breaking in the area of a fuel vent where fumes might be ignited.

Slide No. 40—Deck Fuel Vent. On newer boats, we have this arrangement where the fuel tank vent is located down on the guard deck level.

Slide No. 41—Hazardous Fire Ax. Here we see a fire ax stored away on the front end of a towboat. In this position, should someone slip and fall against this sharp point, it could cause a very severe injury. This hazard can be eliminated very easily by putting a cap over the point of the ax as shown here.

Slide No. 42—Fire Ax Covered Point. Here the sharp point of the ax is covered with a small piece of copper tubing. It is very simple to make. Take a small piece of copper tubing and hammer it flat on one side, then place it over the point of the fire ax. It can be removed very easily in case the ax is needed in a hurry.

Slide No. 43—Water Fire Hose. Most all marine equipment has water fire fighting equipment aboard. Here we see a very well stacked hose connected to the water line with the nozzle in place. It is very important that the line be connected to the water valve and to the hose to save time in case it is needed in a hurry for a fire. Fog nozzles are also used.

Slide No. 44—Fire Extinguishers. Most all marine equipment carries portable extinguishers. Here we see a very well equipped, well maintained extinguisher, well placed on the rig. However, it is noted that it is out in the open exposed to the atmosphere. All extinguishers, when placed outdoors where they can come in contact with the weather, should be covered, either with

a plastic bag or a box cover built over the extinguisher.

Slide No. 45—Heat Actuator.

Slide No. 46—Cylinders, Delay bottle and Trigger Head.

Slide No. 47—Main Valve.

Slide No. 48—Siren.

Slide No. 49—Pressure Operated Electric Switches.

Slide No. 50—Nozzle.

Slide No. 51—Manual Controls.

Conclusion

Slide No. 52—Boys' Future—(Slide No. 1). In closing, I want to ask each of you this question: What have you done to promote safety in our industry? Regardless of

your position, whether it be vice president, operations manager, safety director, marine architect, captain, chief mate—what have you done? This is the group that has to get things done.

We are part of an industry with great tradition. Tradition is a hard thing to cope with sometimes, because from it comes resistance to change. Nevertheless, it must give way to more efficient and safer ways. Progress must not be stopped in our economy. If you don't keep up with it, you will be passed by.

If we all keep driving, keeping our minds creative with a "don't give up" attitude, I feel certain that by the end of the next decade, our little friends here will be proud of the industry that we—then "old timers" will lay in their hands.

MANAGEMENT, LABOR, AND GOVERNMENT IN AN AGGRESSIVE ACCIDENT PREVENTION PROGRAM

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In discussing my topic with you this afternoon, let me say at the outset that I consider the whole problem of accident prevention in the maritime industries—particularly longshoring and ship repairing, with which the Bureau of Labor Standards is most directly concerned—primarily a matter of three-way cooperation between management, labor, and government. It can be likened to a triple-pronged effort on the part of these groups to bring about something desired by each: improved safety performance. It is an instance where no single group acting alone can attain success, but all three, acting in concert, can achieve highly beneficial results.

As members of the Marine Section of the National Safety Council, this audience is well aware of past and current activities in the field of maritime safety, but perhaps a brief review of the background against which the U. S. Department of Labor's safety work in the maritime industries has been projected will be helpful.

Back in 1958, when Congress enacted

Public Law 85-742 it closed up a long-standing gap in safeguarding workers in longshoring, ship repair, and related maritime operations. This law, which directed the Secretary of Labor to establish and enforce regulations "reasonably necessary to protect the life, health, and safety of such employees, and to render safe such employment and places of employment," amended section 41 of the Longshoremen's and Harbor Workers' Compensation Act (Public Law 69-803).

Passed by Congress in 1927, this latter Act represents the first attempt to eliminate in the field of safety and compensation, the "no-man's land" in which waterfront employers and workers had been operating. Based on the federal maritime authority, it applied to longshoremen and harbor workers the already-established principle of statutory remedies, regardless of fault—as opposed to negligence suits brought under common admiralty law—in cases of job-incurred injuries.

This basic law provided workmen's compensation coverage for harbor workers and

for its administration by the U. S. Employees' Compensation Commission, an independent agency. However, under subsequent reorganization acts, Congress abolished the Commission and transferred its functions first to the Federal Security Agency and, in May, 1950, administration of the Act was vested in the Department of Labor, where it is carried out by the Bureau of Employees' Compensation. Related safety and health functions were delegated by the Secretary of Labor Standards.

In addition to the usual provisions concerning compensation coverage and benefits, it is Section 41 of the Act that is of particular interest from the safety standpoint. As originally passed, Section 41 provided: "The commission shall make studies and investigations with respect to safety provisions and the causes of injuries in employments covered by this act and shall from time to time make to Congress and to employers and carriers such recommendations as it may deem proper as to the best means of preventing such injuries."

The only real authority given the Commission was the authorization to enter places of employment covered by the act, and to examine equipment and conditions found. The original act did not confer authority to compel action looking toward accident prevention. Thus, in a sense, workers in these maritime industries were still in a "no-man's land" as compared with workers on dry land who were covered by State compensation laws as well as State safety laws conferring rule-making and enforcement authority upon an appropriate State agency.

Nevertheless, by providing a system of workmen's compensation for maritime workers, Congress provided a definite incentive, and the Commission offered encouragement, for employers in the covered industries—including stevedoring and ship repairing—to develop and extend accident prevention programs in their operations. Although under no compulsion to do so insofar as the Act's provisions were concerned, many employers initiated safety programs, while others expanded or breathed new life into their pre-existing safety efforts.

Various maritime interests in a number of our major ports, including those on the Pacific coast, recognized during the 1930's

a need for correcting unsafe working conditions in their operations and for instituting safe working practices among their employees. They recognized, too, that safe methods are, generally speaking, efficient methods as well. In some instances, the maritime industries adopted safety codes and applied them on a strictly voluntary basis—there were no mandatory safety requirements at this time.

Besides the safety standards in the several voluntary maritime codes, certain voluntary promotional activities were carried on. As early as 1946, the U. S. Employees' Compensation Commission and the Department of Labor launched a broad safety training program for waterfront employees under which monthly safety meetings were to be held by employers at which insurance company safety material was to be discussed. At the same time, the Department of Labor undertook to provide educational material in the form of visual aids and other safety suggestions. This work was carried out with the cooperation of the managements of numerous progressive companies in the maritime industries. The Department also worked closely with a number of unions, holding safety meetings and conducting other safety promotional work among union members. These activities were purely voluntary on the part of management and labor—there was no compulsion, other than a sincere desire to "do something" about accidents and their resultant injuries. Then, too, the Department's work in this area was necessarily limited to the part-time activities of a handful of federal safety consultants.

This work was extremely significant, however, as it helped to establish a climate of understanding and cooperation between the three key groups—management, labor, and the government.

Yet it soon became evident that this exclusively voluntary approach, with limited personnel and funds, was not effective in bringing about much improvement in the overall accident experience of maritime operations covered by the Compensation Act. Already known as a high-hazard activity, the maritime industries during the decade 1948-1957 compiled the unenviable record of 189,097 longshoremen and ship repairmen disabled by accidental injuries—at an average rate of 18,000 a year. In addition,

1,345 workers were killed on the job. Frequency and severity rates remained high. Clearly the voluntary efforts that had been undertaken had not produced the desired results by way of reducing the accident experience in these high-hazard operations. Meanwhile, Congress was not aware of this situation—various maritime safety bills were introduced after 1941, but none was reported out of committee.

In 1958, after extensive hearings at which individual employers, employer associations, labor unions, shipping interests and governmental agencies testified, Congress enacted Public Law 85-742, approved by the President August 23, 1958, to which I referred a few moments ago.

In brief, the law authorizes the Secretary of Labor to: (1) establish and enforce safety and health regulations applicable to employments covered by the Act; (2) study and investigate safety provisions and the causes and prevention of injuries, and from time to time to recommend to Congress the best means of preventing such injuries; (3) provide for the establishment and supervision of safety education and training programs for employers and employees; (4) consult with and advise employers on the best means of preventing injuries.

Let us briefly consider these four basic points, one-by-one.

First, "establish and enforce safety regulations." Under the authority granted the Secretary of Labor by the 1958 Law, we proceeded to draft a set of proposed minimum standards covering longshoring and ship repair operations. All available codes and standards applicable to these industries were analyzed and evaluated in preparing the draft regulations. These were then circulated widely among employers, unions, trade associations, the Coast Guard, the Navy Department, and the Maritime Administration for informal criticism and comment. After study and consideration of all criticisms and suggestions, a second draft was prepared for use at the public hearings. Four such hearings were held during the latter part of 1959—Chicago, New Orleans, San Francisco, and New York—in order to afford interested parties in all parts of the country opportunity to express their views. The hearings were well attended, and

many individuals and groups submitted written, rather than oral, comments either before or during the public sessions. Again, comments and suggestions were carefully weighed, and the regulations became effective March 21, 1960.

This audience is acquainted with these regulations. I have outlined the procedure by which they were brought into being because it illustrates a cooperative—not an authoritarian approach. Based on previously established voluntary standards, arrived at through the cooperation and collaboration of management, labor, and government, the Safety Regulations for Longshoring and Ship Repairing constitute a sound and reasonable guide to accident prevention in the affected operations.

As for enforcement, we have resorted to our authority to compel action only in those few instances where our consultative, educational approach has failed to produce compliance. However, there are a few employers, I regret to say, that have not fully responded to our consultative efforts and have given only lip service to the safety and health regulations. I have also been somewhat disappointed that while most employers are cooperating with our program, they have not given us more of the benefit of their advice, opinion,—yes, even criticism—for our use in improving our efforts to be of service. We welcome such advice and constructive criticism, and are hopeful it will be forthcoming in greater amount. I assure you it will be accepted in the same spirit as that in which it is offered—one of mutual respect and confidence, reinforced by a sincere desire for bettering the industries' safety record.

Second, "study and investigate safety provisions, the causes and prevention of injuries; recommend the best means of preventing them." Our safety staff, both in Washington and in the field are continually carrying out this directive of the law. When they visit or inspect a facility, they are constantly on the alert, not only for hazards, but also for methods of controlling them. Where applicable, this information is passed on to other employers and employees in the daily contacts our field safety men make. It is relayed to Washington, where it is used in a variety of ways; to assist in improving the performance of other field men, for consideration in connection with

any proposed amendments to the regulations, published as part of safety articles in various periodicals, and used in connection with the many technical safety publications and bulletins of the Bureau of Labor Standards. This becomes a matter of "spreading the word," and is an important phase of increasing the scope of safety knowledge. Again, it illustrates the cooperative approach we have followed.

Third, "provide for safety education of employers and employees." Heavy emphasis has been placed on this activity, not only because of the mandate handed us by Congress, but because we in the Bureau have long stressed the importance of safety training and education as one of the most potent forces in developing safe working conditions and safe work practices, not only in maritime operations, but in all other safety areas in which the Bureau has responsibility. Once more, it is a matter of a joint, cooperative approach. We have continually sought and received the wholehearted support and cooperation of employers and their associations, workers and their unions, educational institutions, other government agencies, and many others, in order to provide needed safety training and education. We shall continue to seek—and, hopefully, to obtain—such cooperation from management, labor, and government, as the occasion warrants. Unfortunately, some of our efforts to encourage safety training have not borne fruit, due to problems relating to pay for workers undergoing training. Certainly, cost is a factor here, but the cost of training, as compared with the cost of accidents, can leave little doubt as to which is the greater economy.

Fourth, "consult with and advise employers." This is the core of much of our safety work. In keeping with its long-range policy of promoting safety, rendering consulting, technical safety services, and providing educational and training opportunities, the Bureau of Labor Standards relies heavily on voluntary compliance of affected parties. While we intend to enforce the law conscientiously and impartially, we expect to continue spending the bulk of our time, as we have in the past, in technical consultation and advisory service.

I think it is significant that three of the above-mentioned four points in our mandate

from Congress call for activities that seek to bring about conformity to, and compliance with, accepted safety standards, as distinguished from compulsion and enforcement. We have stressed—and will continue to stress—the techniques of consultative, advisory, and informative services throughout our program of safety in the maritime industries. The most valuable role that the Bureau of Labor Standards can play in preventing maritime work injuries is to buttress and extend its technical advisory, consulting, and training services in this area.

You who are complying fully with the regulations and who are cooperating with us in our efforts to bring about a greater degree of safety are just as interested as we in government in seeing to it that the few firms repeatedly found in violation are brought into compliance. Therefore, we shall not hesitate to use our legal authority to effect compliance with the law and the regulations in those relatively rare instances where the "consultative approach" fails to bring it about.

While we have noted a high degree of compliance with the regulations on the part of the great majority of employers, further action has had to be taken in the case of a few firms. During the last fiscal year, court action was begun seeking to restrain two ship repair yards from continuing operations that were in violation of the regulations. In one case a restraining order was issued, in the other it was denied. No cases have been prosecuted, as yet, under the criminal procedures contained in the Act. Short of instituting legal action, we now send letters from our Area offices to the managements of those firms which have been repeatedly found in violation of the regulations and which have not responded to violation notices we have served. These letters summarize the code violations found and serve as a warning—a danger signal—prior to more drastic action. In some instances, we plan to schedule conferences with such managements, and anticipate some success in bringing about full compliance in this manner.

A few figures concerning our safety activities in ship repairing during the fiscal year ended June 30, 1961, give some insight into our work in this area. Bear in mind, these relate only to ship repairing; our longshoring activities are not included

Summary of Ship Repairing Safety Program Activities

Consultations	2,806
Evaluation Surveys	353
Accident Investigations	154
Complaint Investigations	84
Ships Inspected	4,968
Violations Cited	1,910
Violations Immediately Corrected	1,032
Recommendations Made	853
Recommendations Immediately Corrected	567
Training: Number of Sessions Held	167
Training: Number in Attendance	2,153
Safety Meetings: Number Held	201
Safety Meetings: Number in Attendance	1,527
Number of Publications Distributed	17,279

So much for past activity. What about problems and prospects in the foreseeable future?

1. In anticipation of extending coverage of the safety regulations to shipbreaking, we conducted a detailed study of these operations, drafted preliminary regulatory proposals and submitted them to the industry. Comments and suggestions received were used in preparing a second draft for consideration at a contemplated formal hearing. At this point, issuance of effective shipbreaking regulations has been delayed pending clarification of a jurisdictional question. We hope for an early solution of this problem, as the hazards of shipbreaking are great.

2. A number of proposed amendments to the ship repair regulations have been drafted and submitted to the industry for comment. These are specifically designed to deal with the problems of toxic, fire, and explosion hazards aboard vessels undergoing repair. From our studies of accident investigations it is abundantly clear that this is an area where regulations are necessary and where considerable research must be carried out. It is proposed to require medical examinations for employees exposed to metallic fumes to permit early recognition of metal fume poisoning so corrective action may be taken promptly. Further definition of the term "competent person" in connection with the certification as to maintenance of gas-free and non-toxic atmospheres aboard and around vessels has become necessary. We are now engaged in developing specific standards to assure the technical competency of persons in this work.

3. In the issuance of amendments—except those that are purely administrative in nature—the Bureau has followed its

original concept of seeking the widest possible notice and comment before promulgation. The only procedural change we have made is to hold a single public hearing in Washington instead of several hearings in different parts of the country. Since the bulk of the testimony is received in writing rather than orally, the opportunity afforded interested parties to comment and criticize is not impaired.

4. Ever since the Ship Repair Safety Regulations became effective, there has been a "feeling" in some quarters that they do not apply to the small boatyard operator. While we recognize that often the small yard cannot be held accountable for safety and health measures on exactly the same basis as the large operation, and that the degree of hazard frequently differs as between large and small yards, there is no arguing the fact that a worker in a small yard can be killed just as dead if, for example, he is hit on the head by a ten-pound block falling from a height of, say, fifteen feet, as he can in a large yard. Size of the operation is not the controlling factor. The small yard is definitely covered by our safety regulations, and we have followed the "rule of reason" in applying their requirements to such yards. There is need for further study in this area, especially with regard to operations that may be unique to small boatyards, and special study of the associated hazards is indicated.

5. The regulations require that employers keep records and report data on injuries and man-hours of exposure in employments under the Act. The Bureau of Labor Statistics receives these reports, and compiles injury frequency and severity data for individual companies, ports, districts, areas, and national totals. For the first time, comprehensive figures on accidents in the maritime industries are being received.

There has been some misunderstanding of the reporting requirements and consequent difficulty in obtaining data as to the extent of disability in individual cases. Much time has been spent by the field staffs of BLS and our own Bureau in obtaining complete and consistent reporting. Although the figures obtained for the calendar year 1960 are subject to some error, we expect to attain a satisfactory degree of uniformity in reporting during the current year.

6. Training sessions and safety meetings have increased in number and attendance as fast as we have been able to meet the demand for them. This important phase of our safety program is developing in intensity, as the initial need for concentrating on inspections and enforcement becomes less pressing.

7. We have maintained a close cooperative relationship with the U. S. Coast Guard. Thus, we have almost entirely avoided duplication of effort or conflict of jurisdiction in a situation where the lines of demarcation are narrow and in some cases ill-defined. The Bureau of Labor Standards has also maintained—and will continue to maintain—cordial working relations with the states and with other federal agencies such as the Army, the Navy, the Maritime Administration, and the State Department, all of which have interests closely touching on the field of maritime safety.

In conclusion, it can be said that throughout all our activities in the field of maritime safety over the years, we in the Bureau of Labor Standards have consistently followed the philosophy of the "team" ap-

proach. We have not tried to "go it alone." We have continually sought—and obtained—advice and counsel of affected parties, including management, labor and government agencies having an interest in this field. In the reverse direction, we have emphasized the concept of voluntary compliance with reasonable standards, and we have minimized the "police" aspects of our work. In short, we have relied—and shall continue to rely—upon educational, informative, consultative means, backed by enlightened self-interest, rather than formal authority, to make significant progress in the task that confronts all of us: safeguarding the lives, the limbs, and the health of those human beings who make their livelihood in maritime occupations.

This, I believe, typifies the joint task faced by your industries; by management, and labor, with government participating as adviser, as counselor, as stimulator and promoter in this cooperative endeavor. It should act as policeman and judge only in those few cases where cooperation fails to produce the desired result: making the industries safe for those who man them.

MANAGEMENT AND SAFETY

By HENRY Z. CARTER

President, Avondale Shipyards, Inc., New Orleans, La.

There is a general agreement that the prevention of occupational injuries is achieved, first, by control of the working conditions, and secondly, by control of the actions of people. Certainly management can accomplish such controls and that is why it is generally agreed that safety is a management function.

In discussing this, we should take a look at the history of occupational safety. We have engaged in all forms of productive activity for years. During that time, no doubt we have tried to protect workmen against the hazards of these activities, but it has only been in the last half century that there have been well organized efforts to prevent occupational injuries. These activities have taken many forms—the so-called "safety program" seemed something separate from the "production program."

Regardless of how much was said about the responsibility of management and supervision in regard to accident prevention, many times the "safety program" activities tended to take away such responsibility from line supervision. When safety inspections were made by safety personnel or inspection committees, it tended to relieve those who should really see that working conditions and practices were as safe as possible.

At times management responsibility was referred to in terms of "supporting the safety program." This often led to the impression that accident prevention was separate from the rest of the activities of the organization and only needed support from management rather than active direction by management by specific delegation of responsibility and holding them accountable.

No wonder after this half century of

organized accident prevention effort, we still talk about it as something that develops below management level and for which somebody has to go to management for approval and support. We should consider it as something that will be successful when management initiates and directs such activity through its line organization and necessary staff help. Also, accident prevention should be integrated into production as completely as possible.

If we will observe those companies whose management has recognized this, we will see that they have been successful in keeping their occupational injuries at a minimum. On the other hand where results of safety efforts are less consistent, it is often when too much of the total responsibility has rested upon the safety department and when the safety program is least integrated in the production effort.

We should consider some of the activities which are important to the prevention of occupational injuries and how they can best be integrated in the production effort.

1. *Selection and Placement of Employees.* This requires close co-ordination between a number of people. If pre-employment medical examinations are used, there must be adequate information on the physical, experience, and other requirements for each job to get the greatest value. This is achieved by job analysis carried out by personnel and physical requirements should be made available to the examining doctor so that he may interpret the results of examination of the prospective employees in terms of these job requirements.

2. *Training.* Training is carried out in various ways in different organizations depending upon their needs. Sometimes safety training is carried out separately from job training, that is, safety training being done by safety personnel and job training by the immediate supervisor. In most cases, both job and safety training on the job seems most effective.

3. *Accident Investigations and Records.* Most companies require foremen or supervisors to investigate all disabling injuries of the employees under their supervision and to submit a written report. This is not to place the blame, but to take corrective action for the future prevention of this type of accident. When supervision is

required to submit such reports to his superior with indication of corrective action or recommendations on what is necessary, he is reminded of his responsibility for accident prevention each time he makes an investigation and report.

4. *Maintenance of Safe Working Conditions.* All no doubt agree that a workman's immediate supervisor has the most direct responsibility for his safety, therefore, that supervisor should also have responsibility for seeing that the man's working area and conditions are safe. The supervisor should periodically check all tools and equipment used by his men to see that they are in a safe and workable condition.

5. *Supervision.* It is considered sound management principle that an individual should be responsible to one person rather than several persons for various parts of his job responsibilities. On this basis, an employee should be responsible to his immediate supervisor for the safe performance of his job, and the supervisor should be responsible (for safe performance of the people under his supervision) only to his immediate supervisor. Why should there be different categories of rules covering different aspects of the same man's job? Is it better to have "safety rules" as such, or is it better to have operating rules and procedures which are such that the man will perform this job's safety?

6. *Safety Education.* This phase of accident prevention is one where results are most difficult to determine. It is hard to say how much of this needs to be done. Safety education should be effective as possible and should be directed at specific recognized needs for such education. Mere use of films, posters, etc., without supporting action by supervision is relatively ineffective.

These are just a few illustrations of how safety effectiveness can be maximized by integration of safety controls with production controls. We can see this is a sound approach and will agree that much of the real control will be in the hands of those in the various levels of production management.

I have long recognized that successful accident prevention can be achieved through good management which effectively uses good technical knowledge within the organization.

DISCUSSION OF PAPER ENTITLED "MANAGEMENT AND SAFETY" BY HENRY Z. CARTER

By R. D. DAUTERICH

Industrial Relations Mgr., Maryland Shipbuilding & Drydock Co., Baltimore, Md.

A. We agree with Mr. Carter: To be most effective, the responsibility for safety must start with the chief executive and flow down through the line organization.

Three ways in which the chief executive can implement this responsibility are:

1. To personally visit the scene of a major accident and stay long enough to fully understand all that happened.
2. While making a plant tour, make safety suggestions or corrections on the spot. (This activity will be a mild irritant to full time safety people for various reasons, but the overall effect is very worthwhile.)
3. Read disabling injury reports and make written comments or queries on them.

B. We have stopped having production supervisors investigate and make written reports of accidents except where they are eyewitnesses.

Our reasoning is as follows:

1. Most line supervisors are not adept at carefully gathering and accurately reporting all pertinent facts.

2. To avoid the possibility of blame on himself or those under him, a supervisor usually is unable to consider an accident with sufficient objectivity.

Of course, if any member of supervision is at fault in connection with an accident, the fault must be pointed out and any additional steps taken that are deemed appropriate.

C. We suggest that more graphic words be sought to replace "accident" and "accident prevention" in industrial safety work. Many workmen, as well as people of all walks of life, seem to have become hardened to the word. An "accident" seems to have become something that is almost inescapable rather than a harmful, hurtful experience that could have been avoided. At this time, the best substitute we can think of is "disabling injury" but we feel that someone can do better than that.

20-20 HINDSIGHT

By DAVID R. LAVALLETTE

Health Physics Engineer, Bethlehem Steel Company (Shipbuilding Division) Quincy, Mass.

The application of nuclear power to ships as a means of propulsion has effected dramatic changes in the shipbuilding industry. Included among these changes are: advanced welding techniques, improved quality control procedures, lead shield fabrication methods, clean room applications, and health physics programs for the purpose of radiation protection. The latter of these innovations is the topic of this discussion.

A radiation protection program is by no means the only line of defense against radioactive hazards associated with reactors. Prior to operation, each reactor component and the reactor plant as a whole is subjected to an extensive test program to insure safety by ascertaining that all machinery and protection devices are in proper operating order. The design of the reactor plant together with the probability and con-

sequences of any conceivable accident are thoroughly reviewed by the AEC's Advisory Committee on Reactor Safeguards to assure adequate control of all possible sources of ionizing radiation.

The nuclear industry in this country is enjoying a fine safety record. This fine record is not accidental. Historically, even during the hectic Manhattan Project days of World War II, the realization of radiological hazards was concurrent with development of nuclear technology. Responsible agencies and industry have persisted in keeping countermeasures well ahead of the possible hazards.

As elsewhere, our Quincy Yard radiation safety program preceded initial reactor operation by a considerable margin. We embarked on an extensive radiation protection program more than three years prior to our first controlled reactor operation. The establishment and appraisal of such a program will be the subject of this paper.

The basic objective of our program is to minimize personnel radiation exposures and to insure that permissible exposure limits prescribed by law are not exceeded. The protection of the general public and company liability, and the fulfillment of moral obligations are other paramount objectives.

Permissible levels are established by the U.S. Atomic Energy Commission, and documented in the Code of Federal Regulations, Title 10, Part 20. Many states including Massachusetts also have regulations relating to ionizing radiation exposures. Compliance with the requirements of certain other agencies such as the Interstate Commerce Commission and the Coast Guard is sometimes required under special circumstances. Additionally, when Naval nuclear powered ships are involved, the regulations of the U.S. Navy must be observed.

Although some requirements are common to all codes, there are inconsistencies in certain details. It is therefore necessary, when formulating a set of regulations, to incorporate the most restrictive features of all applicable codes.

Our regulations and procedures are documented in a comprehensive volume entitled the "Health Physics Manual." The manual prescribes appropriate procedures to be followed under a wide variety of circumstances. Also included are descriptions of facilities

and equipment, responsibilities of various groups, and tables of permissible exposure criteria. This manual was submitted to the U.S. Atomic Energy Commission, the Navy, and other interested agencies prior to becoming effective.

The authority of the Health Physics Department is advisory in nature except in cases when emergency corrective actions are required to avert the creation of unsafe conditions. Health physics personnel routinely survey for potential hazards using appropriate instruments, and advise line supervision relative to necessary protection measures.

The health physics group is organized on a three shift basis, with each shift comprised of a supervisor and two technicians in the field. An instrument calibration and repair technician, and a laboratory technician are also employed on the day shift. Three film badge clerks are required for the personnel monitoring program. The size of the group has been tailored to cover routine operations. When operations require additional coverage, double shifting and overtime are utilized. The possibility of extended periods of heavy work loads does exist however, and we are currently considering the feasibility of training auxiliary forces which could be called upon in times of need. Such auxiliary forces would presumably be selected from other trades in the Yard.

EDUCATION

Unfortunately the nuclear age was ushered in under a mushroom cloud. In the minds of many the term nuclear reactor is synonymous with atomic bomb. (Actually a nuclear reactor cannot perform like a bomb.) Conversely, there are many who feel that because radiation can be neither felt, seen, or heard, it can produce no bodily harm. It is readily apparent, therefore, that an extensive educational campaign is essential to any successful radiation protection program.

Our educational program has included special presentations for: management and supervision, health physics personnel, production employees, plant protection personnel, industrial radiographers, and the public.

One of the earliest endeavors undertaken was the preparation and distribution of a booklet presenting a simplified, pictorially illustrated explanation of ionizing radiation, its hazards, and its safeguards. The booklet

was originally mailed to every employee, and is given to all new hires. This presentation has proven effective in furthering the understanding of those employees who are sincerely interested in the subject. For those who are less interested, but have a need to know, a more direct means of communication is necessary. Because the booklet was originally distributed more than a year prior to initial reactor operation, additional copies were issued to those personnel who were assigned to activities directly associated with potential radiation hazards. This second issue was made a few weeks before such assignments.

Management and supervisory personnel were given lecture presentations early in the program prior to training of other personnel. In this manner all supervisory employees had an opportunity for orientation prior to their men, and could play a more active role in subsequent educational activities.

Union officers and shop stewards were also invited to an indoctrination session prior to other personnel. This presented an opportunity for open discussion of the program and hence promoted good labor-management relations.

Since trained health physics personnel are not readily obtainable, it was necessary to train men to serve as shift supervisors and monitors. Engineers with some background in nuclear work were selected as shift supervisors. Men with some technical education or experience beyond the high school level were selected as monitors. Personality was carefully considered in the selection of candidates, because each man must double as a technician and a health physics ambassador.

All health physics personnel were given a comprehensive forty (40) hour course in radiation protection principles; were required to pass a rigid examination on the subject matter, and then spent two (2) or three (3) months gaining practical experience before being considered qualified. A yellow hard hat stenciled with the term Health Physics was issued to each man upon qualification. The yellow hats serve a two-fold purpose: (1) to render health physics personnel readily identifiable, and (2) to serve as a badge of proficiency.

Periodic open discussion periods and

quizzes have aided in maintaining a high degree of proficiency in the health physics group. The problems encountered in health physics change rapidly. A situation existing today may not arise again for several months. Reviews aid in maintaining a state of readiness to cope with any situation. In general this program has proven highly successful.

Education of production employees was conducted on two scales. Those employees who were to work in radiation areas requiring film badges, but not become involved with high radiation exposures or loose radioactive material, were given a brief talk regarding the significance and proper use of film badges. Employees who were expected to become more involved were given at least two hours of lectures and demonstrations regarding the nature of the potential hazard, proper use of protective equipment, and the respective responsibilities of all involved. On the job follow-up sessions have been necessary.

A group of sixty (60) maintenance personnel were selected for a special sixteen (16) hour course in decontamination techniques. During these sessions, emphasis was placed on the proper procedures to be followed in decontaminating various types of surfaces. Very few of the men trained were actually needed, but the availability of a sizable trained force is deemed highly desirable.

All firemen and members of the guard force have received several hours of lectures and demonstrations. Particular emphasis was placed on emergency situations involving radiation hazards. Each of these groups has been supplied with a radiation measuring instrument which may be used to assess a hazard under emergency circumstances.

A somewhat different type of training program has been developed for radiographers. These men work with radiation continuously, whereas other employees may be concerned with it for only a few weeks in the year. As with others of life's hazards, familiarity with radiation can breed contempt. For this reason reviews for radiographers are conducted on a routine basis. Formal courses are given to all new men. These courses are also required by the Code of Federal Regulations, Title 10, Part 31, and hence must be documented with the Atomic Energy Commission.

Education of the community has been effected largely through lecture-discussion periods for numerous civic organizations. This program was initiated three years prior to reactor operations and has been conducted on a continuing basis. Press releases based upon conferences with various governmental agencies have also served to inform the community of our operations. The attitude of the community toward nuclear operations in Quincy seems to indicate that the public relations program has been successful.

Our experience has demonstrated that two basic principles are essential to the success of any educational program relative to radiological safety: (1) The sometimes mystical sounding nuclear terminology must be reduced to simple everyday language, (2) Repetition is essential to the satisfactory understanding of all concerned.

FACILITIES

Health physics operations entail the utilization of a few special facilities not normally available in a conventional shipyard. For our operations, four such establishments appeared necessary: central facility, environmental sampling station, decontamination barge, and film badge issue station.

The central facility houses a small chemistry laboratory for sample preparation, a counting room for radioassay of samples, spaces for calibration and repair of field survey instruments, conference space, and an office. The grouping of these particular spaces within one area presented a slight design problem arising from the presence of instrument calibration sources in relatively close proximity to a counting room. The use of a collimated beam gamma source, and proper arrangement of rooms has permitted concurrent calibration and counting operations without interference.

An environmental survey sampling station was constructed on the waterfront. The site of this station was based upon a study of tidal currents and the location of fresh water runoffs to the river. Apparatus for the sampling of river water, airborne particulates, and precipitation are located at this station.

A decontamination facility was provided largely as an insurance measure. The construction and testing of nuclear powered ships does not necessarily require such a facility. An ever present potential need does

exist however, and it seemed prudent to be adequately prepared for any realistic eventualities.

Several alternatives were considered in planning for possible decontamination tasks. These included various combinations of trailers, trucks, stationary buildings, and barges. A barge was ultimately selected for its versatility, convenience, and economy of operation. The most obvious advantage is that a floating facility can be placed in close proximity to a ship, thus promoting the efficiency of service operations.

For our purposes a used cargo lighter was purchased, and appropriately outfitted. The main deck was divided in two general areas: one for decontamination of materials, and one for decontamination of personnel. The hold was equipped with tanks and piping necessary for liquid waste disposal operations. A control area and issue area on the main deck have also served as a convenient base of field operations for health physics personnel assigned to ship coverage.

To date the barge has been used for minor jobs which might well have been accomplished safely with less overall convenience using less adequate means. To assess the facility's value solely on this basis would be unfair. However, should a major decontamination effort become necessary the barge would prove invaluable. The prospect of engaging in nuclear shipbuilding activities without an equivalent decontamination facility would certainly appear indefensible.

A film badge issue station with a potential capacity of 4,000 badges was established in the form of a portable building. This building can be placed at any necessary location.

The handling of thousands of film badges together with the necessary paperwork involves a major clerical operation. Space for those clerical activities was provided within a partitioned subdivision of the station. This design has enabled the film badge clerks to perform routine film handling duties and render assistance to film badge users concurrently.

PERSONNEL MONITORING

As previously noted, physically qualified personnel whose work involves the possibility of exposure to radiation are permitted to receive small doses in accordance with prescribed standards. When such exposures

occur, employers must determine and record the dose which each employee receives. Although there are many commercial film badge services available for personnel monitoring purposes, we have found it more satisfactory to conduct our own film badge program at the Industrial Health Engineering Laboratory in our home office at Bethlehem, Pa.

A large scale personnel monitoring program is a potential bottleneck. Supervisors of personnel who may need film badges must anticipate their needs for Medical Department approvals and submit requests for film badge service well in advance. Their failure to do so results in a deluge of last minute requests, which jam the system, thus resulting in costly delays and inconvenience. Our experience indicates that such delays can be avoided only by the issuance of timely reminders by way of memoranda or telephone.

INDUSTRIAL RADIOGRAPHY

During the past four years the Quincy Yard Radiography Department has tripled in size, and the number of sources used has grown eight (8) to seventeen (17). Furthermore, the inspection of lead shielding and heavier piping components has required the use of larger sources than were required prior to the advent of nuclear ship construction.

Health physics responsibilities relative to this operation consist mainly of developing safe procedures, equipment, and facilities, administering the personnel monitoring program, educating radiographers, surveying radiographic exposures, and insuring compliance with AEC license procedures and regulations.

Three separate radiographic areas have been established. These are shielded facilities which permit unrestricted radiographic operations with insignificant exposures to the radiographers or other personnel. Such areas are equipped with alarm systems to warn the operators in the event of accidental intrusions by unauthorized personnel. Field operations on board ships must be conducted using appropriate barriers, ropes, warning signs, and surveillance.

The use of remotely controlled sources utilizing crank out cables has also contributed significantly to the reduction of exposures. Such devices have presented some troublesome problems. Sources have become de-

tached from cables, either through mechanical failure of a coupling device, or failure of the operators to properly attach the source.

Mechanical failure of couplings has apparently been eliminated by instituting a requirement for routine inspection, and requiring the vendor to supply couplings made of an improved metal. Personnel errors have apparently been eliminated by requiring every source coupling operation to be checked by two men. Overexposures resulting from decoupled sources are additionally guarded against by requiring that a survey meter be used after every exposure to insure that sources are properly restored to their shielded containers.

One excessive, although not biologically significant, exposure has occurred as a result of a decoupled source. Human error was the apparent cause. The aforementioned precautions were instituted after the incident.

Several other source decoupling incidents have occurred without any resulting overexposure. In all cases the source has been restored to a shielded container with minimum delay utilizing special techniques. Apart from the potential exposures involved, the cost of limiting access to a space where fifty or one hundred men are scheduled to work further accentuates the importance of eliminating the accidental decoupling of sources.

One of the most important functions of health physics is leak testing isotope sources. Sealed radiography sources should not present any contamination problems. If not properly encased, however, these sources can leak. In the past four years we have discovered two leaking sources. If not detected, such leakage could have serious consequences.

The degree of success of our radiation protection program for radiography is difficult to evaluate. One possible measure of success might be the personnel exposure records. During the three years prior to the establishment of a formal program the average annual per capita exposure for radiographers was 780 mrem. During the first three full years since its inception the corresponding average has been 293 mrem. (The average annual per capita exposure limit is 5000 mrem.) Our experience illustrates a definite advantage in maintaining a radiation control program which is administratively divorced from the group which

is primarily concerned with the production of radiographic exposures.

NUCLEAR POWER PROGRAM

The exceptionally high quality of naval nuclear propulsion units has thus far limited the necessity for any drastic health physics measures at the Quincy Yard. The operation, testing, and maintenance of reactor systems, however, require constant vigilance on the part of radiation protection personnel.

A nuclear reactor normally will not contribute significantly to radiation levels in the environment. To prove this, one of the first steps in establishing a radiation safety program for reactors is to make a survey of natural levels of radioactivity in the area surrounding the site of prospective reactor operation.

Natural levels of activity are characterized by seasonal variations, and are occasionally augmented by contributions from nuclear weapons fallout. It is, therefore, desirable to commence an environmental survey at least one year prior to reactor operation in order to develop a representative baseline.

Our survey was initiated in October of 1958, more than two and a half years prior to initial reactor operation and has continued to the present time. The survey has been a cooperative effort with the Massachusetts Department of Public Health participating in a routine exchange of samples and comparison of results. This arrangement has provided a routine check on accuracy, and introduced an impartial set of observations which are available to the public.

Included in the survey are analyses of: river water, bottom silt, clams, algae, airborne particles, and precipitation.

It is difficult to assess the value of such a program, or determine the optimum scope. To date, we have found no levels of radiation in excess of the normal background, and have had no cause to refer to the data to prove that the background has not been affected. Certainly the negative results will prove useful should any question arise at a future date.

Once reactor operations have commenced a prescribed pattern of routine coverage is required. Radiation areas are kept under surveillance by health physics personnel equipped with instrumentation and equipment for the measurement of external radia-

tion levels, and the detection of loose radioactive contamination.

Personnel not wearing film badges, are not allowed to enter radiation areas. Posting of such areas with warning drapes that must be moved aside to gain access, and maintaining a roving patrol have proved virtually 100 per cent effective in enforcing this restriction. The placing of guards at all accesses was once considered, but has proven unnecessary.

When operations require the opening of internally contaminated systems, a polyethylene tent is usually erected at the site of action to restrict the spread of contamination. Access to such areas is strictly controlled by health physics personnel. Potentially contaminated equipment passing the access point is sealed in plastic bags. Strict accountability for this equipment is maintained by the use of a system utilizing duplicate tags. Contaminated materials are taken to the decontamination barge for storage, decontamination, or waste disposal.

Instrument failures have provided the only major problem encountered in this program. Most commercially available radiation monitoring equipment has proven to be delicate, and unreliable. This is especially true of neutron measuring instruments. The problem is further compounded by the extreme environmental conditions experienced in machinery spaces. The inaccessibility of certain shipboard spaces leads to rough treatment of equipment which further complicates the problem. The only effective remedy for this situation has been a routine maintenance and repair program conducted by a well qualified electronics technician.

CONCLUSION

The program outlined above may appear elaborate and expensive. It is. The size of the control program, however, is not so much commensurate with the degree of hazard involved as it is with the nature of the hazard.

With some degree of oversimplification, it might be stated that the control of ionizing radiation requires extraordinary measures, because special equipment and capabilities are necessary to detect radiation, even at levels which could prove fatal.

The establishment of an effective radiation protection program requires extensive advance preparations including the acquisition

of facilities and equipment, the development of procedures, and the training of personnel. Overall success is largely dependent upon thoroughness of forethought.

As with any type of safety program, the human element plays an important role. In dealing with this problem, it is necessary to strike a happy medium between stern admonition regarding potential dangers, and confident reassurance that when properly handled, radiation presents no more of a threat to man's welfare than other hazards

which we all encounter daily. It is generally possible to minimize reliance upon human acts by the proper engineering and maintenance of equipment, and the use of protective devices.

In conclusion, the nuclear age has presented a new challenge to the art and science of personnel protection. That challenge can be met by the application of common sense safety engineering principles together with specialized techniques pertaining to the field of Health Physics.

DISCUSSION

By R. B. CHAPPELL, JR.

Industrial Relations Mgr., Electric Boat Div., General Dynamics Corp., Groton, Conn.

My colleagues and I have studied with considerable interest the paper authored and presented by Mr. David R. Lavalette. He has done a most commendable job in presenting the cause for radiation protection programs. His analysis and treatment of this field is timely and of interest to any shipbuilding industry.

The author presents two basic points in his paper, the establishment of a radiation protection program and its subsequent appraisal.

With regard to the establishment of the program, the author does not make it clear whether the Quincy Yard Program in part or in total is novel in concept, or whether it was patterned in part or in total after other shipyards. If it was modified from other shipyards, what were these modifications and the reasons for them.

With regard to the appraisal of the program, the following points require clarification. These points and their associated comments are not intended to be critical, but are offered for the purpose of broadening the scope of the presentation.

A. What is meant by a "fine" safety program? Are there any comparative or correlative statistics? It would be appreciated if the author would qualify this term.

B. The author points out that one of their earliest endeavors was the preparation and distribution of a booklet being mailed to every employee. He further suggests that

this method proved to be effective in furthering the understanding of its employees who were generally interested in the subject. It is not clear to us what the author means by "effectiveness" in understanding. Was there any attempt to determine whether this understanding exists? Was there any criterion used to evaluate this understanding, or does he suggest that merely sending a booklet to interested readers will be an effective method of acquiring understanding? Furthermore, it would have been most interesting to see the contents of the training program given to the radiation worker.

C. Our own experience of appraising novel programs includes the concept of "feedback criteria" as a result of experience. The author's efforts to provide this program in compliance with A.E.C. licensing regulations, etc. does not give specifics as to what their formalized retraining effort is, and how often the changing state of the art necessitates continual revision of the basic, initial program.

The author touches lightly on the relationship of the health physics department and other departments in the Quincy Yard. The essential relationship is largely advisory in nature. It would be interesting to us to know whether this organizational relationship has proven satisfactory for production purposes, whether nuclear production activities can proceed with or without an advisory health physics group, and to what

extent an advisory group such as this can hold up production.

It would also be very interesting to learn more of the specifics on which the public relations program was evaluated as successful, and the content of the attitude training that was given to the community.

Finally, the author mentions the prospect of setting up auxiliary forces for standby purposes. We concur wholeheartedly with

this concept. In fact, we have not only trained two groups for auxiliary radiation monitors for the past year, but have had our training program recognized by the A.E.C.

In conclusion, we are indebted to Mr. Lavalette for the opportunity to discuss his paper and in a general way, the stimulus his paper has given to our own investigations.

DISCUSSION

By K. R. HOLTZINGER

Chief Health Physicist, Todd Shipyards Corp.

Mr. Lavalette, in the paper just presented, has properly emphasized the salient features concerning the establishment and day-to-day operations of a program to provide protection from the radiological hazards so recently introduced into the shipyards.

As he mentioned in his introduction, such a program basically is not the only line of defense against these hazards. Yet, when nuclear operations in a yard have progressed to the stage of initial criticality for a ship's reactor, or when a nuclear powered ship arrives for the first time to have radioactive wastes removed or to have work performed on her radioactive systems, the reviews, the recommendations, and perhaps the responsibilities of most other groups are well behind. At that time, direct responsibility for the protection of personnel and property is turned over to the shipyard's Health Physics group.

Let us summarize, from the paper just presented, the requirements which must be met to assure adequate readiness for this group to discharge its responsibilities:

1. Early establishment of a program ahead of operations.

2. Proper staffing of a new organizational component, which will be short-handed one week and over-supplied the next, with technically trained, competent personnel.

3. Orientation and training of management, supervision, employees, and probably, at least a portion of the general public in a vital field.

4. Provision of properly designed facilities,

and adequate types and quantities of instruments and equipment, most of which have no other use in the yard.

5. The preparation and approval of procedures which not only indicate how a new group will perform its own operations, but which also present new controls with required compliance by the operating group and its personnel.

6. The granting of authority over operations, under certain conditions, to other than the operating group.

There are several comments regarding the above list that are worthy of mention:

A. The cost to management to initiate and maintain such a program is expensive, as Mr. Lavalette concluded. Also, it is elaborate, as it must be to provide its service under various and varying radiological and operating conditions;

B. Not only management, but also supervision and operating employees share some of the responsibilities for radiation protection with the health physics group; the former is responsible because it must delegate the necessary authority and provide funds for the necessary staff, facilities, equipment and training. Supervision and employees are responsible because they must become familiar with these new hazards, and must cooperate with the program by following the procedures established for the safe completion of their tasks;

C. The "ambassador" role of health physics personnel, as Mr. Lavalette termed it, is enormous—not only to "sell" the pro-

gram initially, but to maintain the complete cooperation of management, supervision and employees, and

D. Outside of the technical field with which we are concerned, the requirements (and the problem areas) in establishing and maintaining an effective radiological safety program are essentially the same as those encountered in establishing and maintaining an effective general safety program in a shipyard.

Before closing, I would like to qualify the author's statement that most commercially available radiation monitoring instrumentation is unreliable. Out of context, this impression could result in a compounded mass of problems. These instruments are reliable and because of the environment in which they are used and the punishment

they must take, often an instrument may go erratic or dead on the job, or it may be found in this condition when it should be ready for use on a job. In this manner such instruments can be considered to be unreliable.

On the other hand, I am certain that the author did not mean to imply that generally speaking, properly maintained and calibrated commercial instrumentation, checked for proper operation prior to use, will not give a valid indication of the existing radiological conditions when operated by qualified monitoring personnel.

In conclusion, I might add that from the success of the author's company in the field of radiation protection, his paper could just as well have been entitled "20-20 Foresight."

STEVEDORING AND SAFETY BEFORE AND AFTER THE OPENING OF THE ST. LAWRENCE SEAWAY

By W. STANLEY HUGGETT

Vice Pres., Marine Div., North Pier Terminal Co., Chicago

This is a terrible hour for a stevedore to make a speech. He might be hung over from the night before, and 9:45 or 10:00 is too early to get well again. I prefer speaking after lunch where a few "bombs" would give me courage and additional thoughts (however, the added thoughts might not be on the subject, but most likely on matters such as girls, etc.)

I'm reminded of the story of the stevedore who was making his first speech before a group—it's on page 47 of the *Speaker's Notebook*—it's a very old story but very good. You've all heard it, I'm sure, so I'll not repeat it—just think of it and have a good laugh, because it will be the last one you'll have for the next few minutes.

Stevedoring in the Great Lakes above the St. Lawrence Seaway has been referred to as high-altitude stevedoring, or what one Master referred to as high-altitude sailing, contending that vessels were made to operate at sea-level and not to fly or operate 600 feet above sea-level.

We up here in the hills began stevedoring operations on saltwater vessels prior to 1935. The ships at that time were no longer than 258 feet, the controlling factor being the length in the locks in the old seaway. They were generally built with two hatches forward and two hatches aft; three compartments, two for cargo, one for the engine room. The holds were not deep, many of the ships did not have 'tween decks, and the gear was simple to rig because it was small.

Supervision of labor was relatively simple because four gangs was the maximum that could be used on any ship. The cargo consisted of canned goods, tagged goods and other types of general cargo, but there were no heavy lifts and relatively little steel.

When the St. Lawrence Seaway opened, allowing the larger general cargo vessels, ranging from 8,000 to 12,000 tons, to enter the Great Lakes, there were few people who had ever seen one of these vessels except in movies or on television. These few people who had seen them were in

the supervisory capacity. I would say that almost none of the laborers had seen the larger vessels. When the first ones arrived, there was a tremendous amount of confusion and almost a fear of these "monsters."

When asking men to climb down ladders into the lower hold of a C-2 the first time, they thought they were climbing down a mine shaft and they weren't happy about it. The deck forces were appalled at the height of the gear and had no idea of what to do first or second.

This was not necessarily confined to labor alone. There were many persons in the supervisory positions who were of the same opinion. I recall one of our supervisors on the first C-2 we were to handle had six gangs on board. When asked why the delay in rigging, he said he wanted a vessel's officer at each hatch while the rigging was being performed. We have no trouble of this nature anymore, but it was embarrassing for the first time to have one of our own personnel make an admission of this type.

Before the Seaway opened, there were normally two foremen on each vessel watching two gangs each. With one man to watch only 22 men, it was relatively easy to look for unsafe acts. At that time, we had safety meetings only occasionally, usually after we had had a bad accident.

With the coming of the larger ships, which can employ up to nine gangs, we have hired additional foremen and we try to have one foreman handle not more than two gangs, or at the outside three gangs. When there are more than three gangs working the ship, we place a head foreman on each vessel to work between the gang foremen and the ship's officers. This man's first duty is to fill out a form we have developed, which is a check list of the condition of the gear.

Prior to the war, most cargo was handled by hand; there were no lift trucks or pallets used, and the plumb height in the shed was no factor, so overhead guards were not used even after lift trucks were finally employed. Since the opening of the Seaway and the larger ships, safety meetings with supervisory personnel and labor officials have proven beneficial, we feel. Overhead guards on fork lifts have become a requirement, as well as safety nets be-

tween the vessel's railing and the dock, and in certain places in the vessel's hold.

I might say here that the regulations set down by the U. S. Department of Labor have a definite effect on labor management, and most important on the vessels themselves. Prior to the opening of the St. Lawrence Seaway, many vessels that plied the Great Lakes from foreign ports were not safe to work on. In our standard contract with all vessels we handle, it is required that the vessels be maintained in such a fashion as to meet all requirements set forth by the U. S. Department of Labor.

It is standard procedure that the foremen in charge of the handling of the vessel contact the chief officer, requesting permission to inspect the certificate of safety for the gear. If the vessel does not have one, then we are not required to commence work. I might say we have had no occasion to stop work for the reason so far.

We people in Chicago have been fortunate in having a supervisor from the Department of Labor who has been most helpful and cooperative. The Department has set up schools on safety and has periodic meetings, which to the best of my knowledge have been well attended. We, ourselves, are having more safety meetings than we had prior to the arrival of the larger vessels. We feel that this will eventually prove to be beneficial.

With a seven-month season here in the lakes, safety is quite a problem, particularly in that the first several weeks of the season are more or less a training period for many laborers and a rehabilitation period, or I should say, a refresher course for the men who have worked in previous years.

The largest percentage of accidents by far occur with the new men. Out of 100 accident cases which occurred under my company's supervision last year, 41 of them involved inexperienced men, and 13 were uncontrollable, these two types making up over 50 per cent of the total accidents.

During the first several weeks, we are normally working long hours, seven days a week, with no let-up, in order to alleviate the normal spring jam-up. Generally, there are not enough regular laborers to fill all the positions during this period. This means that fresh crews cannot be employed for

sense that meeting after meeting and conference after conference we should talk at such length about gear and equipment and so little about human failures. I suspect it is because it seems so difficult to do anything about the human equation.

A not uncommon stevedoring accident is one where the gear is rigged to permit the landing of beams or pontoons on the offshore deck during uncovering operations. After the hatch is uncovered the gear is not re-rigged to handle the discharge of long logs or lumber from the hold. With the booms wing and wing the long loads make for a tightline situation. The midship guy carries away under the added stress as the load crosses the onshore deck. Technically, this is a gear failure; but the cause is human failure. It is a human failure on the part of the deckmen who failed to rig properly and on the part of supervision who failed to see that the gear was re-rigged before starting the operation. Both would no doubt blame the accident on the "rotten guy" and we would discuss the failure of guys at great length at our next safety meeting. Actually, the problem is with the two legged guys called men.

Why do we keep getting more and more rules and regulations regarding gear and equipment? I think there are three reasons.

First: An accident experience in an industry is bad and the union and the employer demand that something be done to make tools and equipment safer. They pressure (or correct) what they honestly (but mistakenly) believe to be the real accident causes.

Second: Government officials respond to these demands and commission their safety people to do something about them.

Third: Since it is always easy to deal with the tangible and difficult to deal with the intangible, safety people go to town on rules and regulations concerning gear and equipment. This is only natural because here they have something they can really sink their teeth into. But is all this time and effort productive of any appreciable reduction in accident experience? Not so long as we neglect 90 per cent or better of the real accident causes.

It just seems sensible to me to find out what really causes accidents and to devote

our time and efforts to elimination of these causes that would be more commensurate with the frequencies with which they occur. I agree that gear and equipment can become lethal weapons; but why? Statistics prove conclusively that between 75 and 90 per cent of all accidents involve "human failures." Our problem seems pretty clearly defined. It seems to boil down to unsafe work practices.

Let me cite you another example of what is meant by this expression. In preparing for the safety conference we reviewed last year's accident reports. We noted that we had two reports for the same man, on the same ship, on the same day. The descriptions of the accidents were almost identical. Both reports indicated that the man was working with his back to the rail and fell overboard when his picaroon suddenly pulled free. One report said he fell between the ship and the dock and the other said he fell off the offshore side into the water.

At first we were sure that these were duplicate reports of the same accident, but the discrepancy caused us to check further. We learned that this man had been working in the morning with his back to the offshore rail and went overboard when his picaroon pulled free. He was uninjured; and after changing into dry clothes, was right back on the job. Later that day he was engaged in the same operation on the onshore side of the vessel and again had his back to the rail when the picaroon pulled free and, again, he went overboard. This time he struck a fender log and received minor injuries. They could easily have been fatal!

Although this man was a regular longshoreman, he had never received a minute's training in how to use a picaroon or how to stand while using it. He had learned bad habits in the school of experience, and these bad habits had finally caught up with him—twice in the same day!

The foreman claimed that following the first accident he told the man to pull fore and aft—not athwartship—and never to stand atop a deckload with his back to the rail. It would appear that habit had prevailed over these belated instructions.

In discussing this accident at the Governor's Safety Conference someone pointed out that habits play a large part in safety

We can either develop good or bad habits in doing any task.

By now we knew that the tools and machines used daily in our industry were also being mis-used daily. This equipment is just like atomic energy in that it can be used for our benefit or for our destruction. And just like atomic energy, how it is used rests pretty much in the hands of the man using it. The big question is how do we get men to use these things safely? Someone suggested we plaster the waterfront with posters urging the men to "Work Safely!"

The consensus was that this alone would be about as effective as a sign in a cocktail lounge admonishing the customers, "Don't sin by drinking!"

It was soon apparent to one and all that men would continue to use unsafe work methods unless trained to do otherwise. With the advent of this realization in the minds of both labor and management, our training program was born.

The union said it would provide the men to be trained if management and the government agencies would provide the training. The safety people from the industry, the state, and the U. S. Department of Labor took the ball from there. They burned the midnight oil developing an 18-hour course for longshoremen in injury avoidance. They studied accident reports in detail to determine the areas in which training was most needed. They developed charts and other visual aids to assist in making the lecture portions of the course more interesting.

They secured many good films which helped provide both motivation and instruction in safe work practices, and they developed many practical demonstrations in the safe use of tools and equipment. In short, they tailor-made a course based on the local needs as indicated by analysis of local accident statistics. They then went to the union locals and said they were ready to train longshoremen. The response was most gratifying.

On January 30th, 31st, and February 1st, the first course was held in Port Gamble, Wash. This is a small local on the Puget Sound with 36 members. All of the men turned out to take the training. Not only did they attend the 3-day, 6-hour sessions on their own time and without pay, but they also arranged for their ladies auxiliary to

provide lunch each day for the hungry staff and students. At the conclusion of the course these men were most generous in their praise and encouraged the other locals to avail themselves of the training.

Next, the instructors went to Anacortes, Washington and again experienced the enthusiastic support of that local's entire membership. From there the training team went to the port of Everett with the same result.

By now word of the course had spread throughout the state and into neighboring states on the Pacific Coast. The men began asking for training and, in some instances, even demanding it.

In May and June, classes were set up to accommodate the men in the Grays Harbor area. The Aberdeen local of Grays Harbor has a large membership. It was decided to handle no more than 30 at a time as to do so would be to reduce the effectiveness of the session. Therefore, the classes were limited to that number and a series of classes set up so everyone would have the opportunity to attend. Each series of courses was 18 hours. The men asked for 3-hour sessions at night, two nights a week, for three weeks. The set quota of 30 for each class was filled.

Training was discontinued during the summer months because of vacations. Classes are to start again this month and the remainder of the Washington ports will be trained.

As yet it is too early to measure the effectiveness of this training. We do know that it has received a tremendously favorable response from the men. We are still a little amazed to find that longshoremen, after working all day, will sit three hours at night and listen to instruction on injury avoidance. We feel that the key to this success lies in the fact that the men were convinced at the outset that this was something for their benefit. Several have stated that they would have been less likely to attend if they were offered pay because then they would have expected a management "brain-washing session." We believe that the reason we continue to get such a wonderful response is due to the word-of-mouth advertising of those who have taken the course.

We believe that by making this a joint

craft antenna-reeling motors as cargo winches. These were DC motors, and we had a rectifier converter built so as to be able to operate on 110 volts AC.

This gear model has found considerable use by stevedores wishing to work out certain hoisting problems in connection with prospective ship jobs.

Paper drinking cups were a source of needless, wasteful loss. Investigation showed that another, and better, cup, packed in a manner more advantageous to our needs, could be purchased at far less cost. In addition, each individual cup bears one of an assortment of safety slogans. Paper cup costs were drastically reduced, and a means of bringing a safety message to the men was achieved.

We had a similar experience with work gloves, which employers had traditionally provided for certain types of work. A plastic-coated glove did not stand up well under normal work use, nor did it afford a secure gripping surface. Attempts were made to launder these gloves between times of use. They usually came back from the laundry in a semi-solid ball. We found a rough, neoprene-coated glove, which offered not only a safer, better grip, but also laundered well. Cost per dozen pair of gloves was about equal, but we obtained much longer life—thus effecting a reduction in cost, while increasing the safety factor.

Without doubt, much of the successful reception of this safety training course by foremen was due to their increasing awareness that the atmosphere for accident prevention was improving as a result of top management's awakened interest and activity. All about him, a foreman was able to see real evidence of this, for perhaps the first time.

More important, committee members regained confidence in the strength of their own unified accomplishments, and this gave them courage to proceed towards larger and more important projects.

At meetings, in talks with individual members, at every opportunity, the seed of the safety training program idea was planted. All were in favor, but all were concerned with the problem of turning it into a reality. A subcommittee appointed to study this problem reported in August, 1958, that there were two alternatives: (1) by mailing a

monthly accident prevention training letter to foremen, or (2) by giving foremen personal training in Accident Prevention and First Aid. An outline of a program in support of the latter alternative was distributed to the committee, which approved the program after thorough study and discussion.

Correlated Area Accident Prevention Program

- A. Area Accident Prevention Committee
 1. Establishes basic program
 - a. Subcommittee works out details.
 2. Promotes training for foremen
 - a. Accident prevention
- B. Individual companies
 1. Integrate program into own operations
 2. Promote and support
 - a. Constant instruction of men in Foremen in Accident Prevention
 - b. Safety training for foremen
 3. Instruct job-level safety committee representatives
- C. Accident Prevention Bureau
 1. Advises area accident prevention committee
 2. Advises individual companies
 3. Provides training instruction
 4. Provides statistical data
 - a. To area accident prevention committee
 - b. To individual members

In December, 1958, the committee was given a detailed outline of a proposed training course, along with the statement that "The course content must not be at variance with the safety attitudes of management; training given to supervisory employees, which conflicts with his experience with management will defeat itself." For this basic reason, training must actually begin at top levels, so that management has the necessary knowledge, the primary interest and understanding of the importance of safety in operations and its close relationship to production. Also stated at this time, was the importance of teaching a few, simple facts, rather than attempting to cover a wide range of subject matter.

In January, 1959, it was agreed to hold a full committee meeting to review the entire course, excepting the first aid portion, which was to be the basic American National Red

Cross course. This meeting accomplished a number of things: by editing the course content, we avoided future conflicts of ideas, we added to the curriculum and aided in setting up schedules for attendance and the actual instruction of foremen.

Our first course began in March, 1959, but not without misgivings. Many times we had discussed the problem of pay for time spent. After several head-splutting meetings, the committee adopted the point of view that our supervisory personnel (foremen and superintendents) should be voluntarily interested in such a course. Management would provide the opportunity for them to take advantage of the training, which would benefit not only their job progress, but their home and family lives as well.

Quite a number of top management persons attended our first course, along with several superintendents. However, the total number of foremen in attendance was somewhat disappointing. We finished the course out, issuing first aid certificate and letters of commendation from the Area Accident Prevention Committee to each successful student.

By word of mouth, during and after our first Course, word got around among foremen that the course was not only worthwhile, but actually interesting and enjoyable! Such response was evident that the second course was started in June, 1959, in the middle of the vacation period, when you might think it would be impossible to organize anything of this kind.

The second class added to the impetus of the first, and from this time on we have found it necessary to keep a waiting list of foremen who call and ask to have their names included for the next course. Now that more than two years have passed, we often experience individual foremen approaching to ask how the training program is progressing. Then they pull out their certificate from their wallets, check the date and remark, "It'll soon be three years since I went through the course. I'm ready to take it again, whenever you let me know." It is obvious that the course filled a need for closer contact between top management and foremen.

Our Foremen's Labor Relations Committee had recognized, in the interim, that to effect a completed training program required

some plan to indoctrinate newly appointed foremen. This has resulted in a plan, accepted by the Foremen's Union and management, that all probationary foremen must attend the next regularly scheduled supervisory safety training program to complete their probation.

Part II: The Supervisory Safety Training Program

Our Course is carried on at one location, a light and well-ventilated room of good size, made available to us by one of our member companies. Except for short periods when the ship's cargo gear model is shipped to another port for instruction purposes, it is kept available in this room.

Our course consists of eight, two-hour classes, conducted one day each week. We arrange to hold classes both afternoon and evening on the same day, so that both night and day men have equal opportunity to attend. Foremen are advised that they may transfer from class to class at will, so long as they do not miss any classes.

The beginning class is the most difficult of all. At this time, many of the men are strange to each other and to us. This has eased very noticeably as word of the course became widely known. It completely disappears by the second or third session.

Informality is the keynote. Questions and answers flow freely, but the course is steered so as not to deviate too far.

We begin our course with a brief outline of the history of waterfront accident prevention on the Pacific Coast, filling in the part played, the function and the purpose of the Accident Prevention Bureau.

Next, we trace the beginning of the "Pacific Coast Marine Safety Code," a major contribution to safety in the maritime industry, which had its beginnings in 1928. Tied into this is the much more recent "Safety and Health Regulations for Longshoring," which the entire industry assisted in promulgating. This latter fact is unknown to many foremen, and the explanation makes the regulations more readily acceptable.

We discuss safety programs in general, and specifically outline their purposes and objectives.

Many persons, foremen included, confused accidents with injuries. In discussing this, we are able to illuminate the necessity for

immediate and proper investigation of the factors which lead to accidents, and their need to be recorded, so that an accurate pattern of accident sources and causes may be disclosed. This is followed by a discussion on environmental accident causes as compared with behavioristic causes, and the relative importance of each.

Since poor housekeeping contributes to a substantial number of accidents, much emphasis is placed on the need for its correction.

Fire prevention problems, mainly from personnel smoking in unauthorized places, are outlined.

Personal protective equipment is discussed in sufficient detail so as to inform foremen when the various types of respirators should be issued to the men, along with proper directions to wear them.

Using a basic approach, we spend considerable time at several intervals during our course discussing ship's gear trimming practices, both safe and unsafe, demonstrating them on our gear model. The causes and the results of excessive strains are visible to all.

So that our course remains vital, we consistently ask for class comment on each subject. This often results in good exchanges which tend to clear up misunderstandings and open the way for fresh ideas. Also, such class participation makes the course doubly interesting to each of the participants. It also improves the quality of our course.

Portions of a standard first aid course are given during each session. We require active physical participation by each class member, so that we may be certain he grasps the information clearly. We stress what *not* to do in this phase of the Course more, perhaps, than what *to* do for injured persons. We concentrate on the three life endangering conditions: stoppage of breathing, excessive bleeding and treatment to prevent or control traumatic shock.

Stress is laid upon the key position held by foremen within the management framework. He is the catalyst who converts the plans of management into actual production. Production with safety results from his ability to properly coordinate people with equipment, materials and methods. Close relations

between foremen and management are an absolute necessity, since foremen are the final link in the management chain and, as such, must be motivated and instructed to carry out the plans and policies of management.

Foremen are management's safety representatives on the job. Given the right training and the proper stimulus, foremen are a major factor in reducing the accident frequency.

As of this date, we have been able to train a large number of foremen, superintendents, port captains and others. The total approximates seventy-five per cent of the total supervisory force in our area.

With this broad and firm foundation under us, we have begun a somewhat different training approach which will continue during the next two years. This is to be based on an instructional program geared directly to each individual stevedore member company's needs and desires. I anticipate that management within these firms must participate directly in all phases of the instruction to obtain real effectiveness.

We, in the southern California area, believe in the management approach. We have already proven that management can assume leadership in accident prevention by accepting and energizing their inalienable prerogatives.

Addenda

When this paper was composed, during the first quarter of 1961, it was a fairly accurate description of the degree of progress of our area safety program.

Beginning in April, this year, two stevedore member companies initiated *operational safety meetings* with their foremen. The meetings were so-called because one of our most difficult obstacles is a tendency for operations personnel to think of safety as separate and distinct, a thing apart, and this coupling of operations with safety draws them together again, as they should be.

In May, the first two were joined by a third stevedore member company, each of which conducted excellent, business-like meetings, closely related to the normal staff meetings customarily conducted by top management to acquaint its key personnel with the company's policies, plans, decisions and purposes. Such meetings form an excellent

opportunity for management to seek the cooperation and help of its key men in problem solving. Similarly, operational problems encountered by key people can be brought to top management for guidance or solution. There is, also, the chance to air any grievances which may occur. Some of these stem from misinformation, or misunderstanding, which can be rapidly cleared away.

In June, the trend of companies towards holding their own operational safety meetings continued, with the two largest stevedore companies in the area making plans to follow suit.

This development is altering the type of safety program, followed for so long in our area where low effort level programs, without real depth or integration into operational control, has given way to a vigorous,

new program, developing out of, and directly benefiting operations.

Key to this change is the belated recognition that foremen, walking bosses and ship bosses are actually the keys to accident-free operations, which management controlled but seldom used, with the inevitable result that foremen, as a group, lacked interest in accident prevention efforts, not having been seriously charged with this responsibility in conjunction with their jobs.

Credit for a large part of the new-found recognition and regard for foremen must go to the supervisory safety training program and to the foremen themselves, who very humanly responded to the attention shown them during the course and to the knowledge that they had a responsibility to discharge.

THE LOST TIME INJURY

By CAPT. LEIF M. JONASSEN
President, Cleveland Tankers, Inc., Cleveland, Ohio

I have chosen this topic, "The Lost Time Injury," for presentation here today, not only because this is a safety conference, but because the lost time injury is a major problem confronting industry, and my company, more so today than ever before.

This is not necessarily because the lost time injury frequency is on the increase, but first, because of the humane and moral factor, and second, because of the increasing financial burden resulting therefrom. Because of this problem, we have just recently inaugurated a formal safety program in our fleet in an effort to curb the lost time injury.

The lost time injury is costly, not only because of the expense and the problems that it creates in obtaining a suitable and experienced replacement, but also the increase in expenses such as maintenance and repair, transportation, cost of defending suits, and the spiraling awards allowed by the courts over the past few years. Most of these costs have increased substantially, and because of these increases, sizable amounts are necessary to even endeavor to settle

a claim amply. More importantly, however, as already mentioned, is the humane and moral obligation that we have. None of us wants to see loss of life or limb and of course the subsequent pain and loss of earnings to the individual.

I would like to tell you what we have undertaken and are doing with the lost time injury problem. I would like to say that although we have always been safety-minded, we have never before had a formal participating safety program.

Late last year, however, we decided that something more should be done about this problem. To find a solution, we had first to determine, if possible, the type of accident causing the most injuries. We took a good look at our past experience record and found that it was not necessarily the type of accident for which we were really looking, but rather that in most cases accidents reported were those caused by carelessness on the part of the injured party. In other words, these injuries were those which probably would not have occurred if

the man had given any thought to safety or to consequences.

Men have violated a safety practice at the risk of personal injury to save time, because it was easier, or for many other reasons, including the fact that they just didn't think. We believe that the latter is predominant, although we have found that a new man in that industry unfamiliar with the operation is more apt to have an accident.

Thus, it was determined, in addition to what we could do physically to curb the lost time injury, that above all, these men needed to become safety conscious. So, how do you get a seaman to become safety conscious? We tossed this question around our organization, and although we possibly didn't find all the answers, it prompted our instituting a formal safety program and, in addition, joining the National Safety Council.

We formed a safety committee to administer the safety program with myself as an active member. It is my conviction that top management must play an active role in any safety program. It was the consensus of the members of this committee, also made up of our top operating people, that the job of making these men safety conscious was of prime importance.

I don't want to infer that we are blaming all personal injury accidents on carelessness. However, this we found was the basic fault. We are cognizant of the fact that we are in a hazardous business and that some injuries just cannot be prevented, due to the make up of the vessels and the trade in which they are engaged, and of course, the circumstances at the time. We are aware also that as management, we can eliminate to some extent, or possibly even lessen, some hazardous conditions which may have been a part of the cause of an injury in the past, or which conceivably may be a cause for an injury in the future. If we are also thoroughly convinced that a clean and tidy ship makes for a safer ship. In passing, I might add that this principle applies to any type of operation, whether it be on ship, shore or in the home.

In summary then, the purpose of our safety program was:

1. Endeavor to get the crew to become safety conscious.

2. Promote good housekeeping.
3. Promote good safety practices and habits.
4. Eliminate or possibly lessen hazardous conditions.
5. Eliminate injuries.

Secondly then, our next step was putting the safety program into effect. It was apparent that quite a selling job was required to put number one into effect—getting the crew to become safety conscious. Contests have always been popular in promoting sales, so why not in promoting safety? We were told that it works, so we decided on the contest idea. Much thought was given to the kind, how to administer it, etc., and the more ideas we got the more complicated it became. We are in the tanker business on the lakes, where most of our vessels for part of the year are laid up because of ice conditions. Further, general business conditions change so that even in the navigation season we may have vessels in lay-up.

These reasons, plus the fact that the crew, especially the officers, are rotated on vessels throughout our fleet, made it difficult to find a contest which fitted all circumstances, which was fair to all personnel, and which accomplished all of our objectives. We wanted something, too, which would continue to keep the interest of the crews throughout the year.

We finally decided to try two contests. The first was a contest for each individual vessel and was based only on the number of days without a lost-time injury. The second was a fleetwide contest and, in addition to being based on days without a lost-time injury, was based on good housekeeping and compliance with good safety practices.

To keep the interest of the crew, we had to create some incentive. So the first contest was designed so that the awards were gradually increased the longer the vessel operated without a lost-time injury. It is probably a contest which is familiar to many of you and, in essence, it worked as follows.

When a vessel, from the beginning of the season (or whenever the vessel goes into operation), has 30 continuous days without a lost-time injury, a drawing is held among the unlicensed crew and the winner

is given a \$5 gift certificate. Then twice a month thereafter, as long as the vessel operates without a lost-time injury, a drawing is held and the award increased to a total of four when the vessel has operated as such for 120 days. The drawing of four \$5 awards then continues thereafter twice a month until a lost-time injury does occur.

If an injury resulting in lost time does occur the program must start anew with 30 consecutive days without a lost-time injury being required before another drawing of one name is begun.

The licensed officers have a similar program except that the master and the chief engineer are included only in the fleet contest and the number of awards on each drawing is limited to one. The number of eligible officers (six) on board the vessel does not warrant more than one award.

Although not too much money has been involved in this contest, the comments from our crews have been very encouraging, and we think it has definitely developed safety consciousness. The results have been very gratifying. Not only have our lost-time injuries been reduced in comparison with past years, but the total reportable accidents have also been reduced.

You wouldn't think that the \$5 award would create much interest, but believe me, members of the crew are now afraid of having an injury. This, we think is good, except that it may possibly encourage a man not to report an injury. For that reason, we did not include in the contest as a element the injury which did not result in lost time. I am sure, should a man have an injury severe enough to warrant medical attention, he would not refrain from reporting and seeking the proper medical help.

The master of the vessel and the chief engineer, who could either make or break the safety program, depending on their attitude, belief and practice in safety, have a stake, too, for in the second contest, these officers are competing with officers of all other vessels in the fleet for awards which will be given toward end of the navigation season for the safest ship.

This second contest is a little different, but the purpose is the same—safety, with the intent of reducing the lost time injury. The other four objectives of our safety program come into play in this second con-

test, because we consider having no lost-time injuries as being important; but of equal importance is the elimination, as much as possible, of the physical causes of accidents. Each month each vessel is scored, first by being given points if it had no lost-time injuries, or fewer points if an injury did occur, and second, by being given points based on an inspection of the vessel.

The inspection is one that is made each month by a team made up of our marine superintendent and fleet engineer. An inspection check list has been prepared where safety practices, good housekeeping practices, Coast Guard regulations, etc., are listed. This check list has been given to all vessels where the men can be constantly reminded of what should be done on their ship. The items on the lists are not new to the officers by any means.

However, the knowledge that the check list will be used for grading purposes in the contest seems to magnify the importance of many things that at one time the men were apt to overlook as unimportant. The master, chief engineer and all other officers have been encouraged to use this list, have their own inspection and grade themselves. Although this grading by the officers is not part of the safety contest, nevertheless it emphasizes certain items which are apt to cause accidents and subsequent low scoring when inspection is made by the inspection team.

Six items from this list are checked by the inspection team and points given accordingly. The score received is added to the points received based on the number of lost-time injuries and a formula is then used giving the vessel a rating based on operating days. The formula is necessary in view of the difference in operating days by each ship at the end of the season. It is felt the vessel with the most operating days should have a slight edge over the others since it has the additional days of exposure. The vessels are given a rating sheet monthly, which is posted on all bulletin boards showing where the vessels stand in the contest. We believe this serves as an incentive for the top vessel to retain its position and the stragglers to fight for the top spot.

The awards presented to the men on the winning ship are not large. Nevertheless, these awards plus the natural desire of any man to be a part of the winning team are

incentives. Awards are given to the entire crew from the master on down. The individual awards are based on the number of days that each man served aboard the vessel. A pennant will be given to the winning ship and will be flown during the following season.

We are not giving all of the credit for our good record this year to our safety contests, but feel definitely they have played a part. We are operators of a fleet of tankers that are old in years, as such, were not equipped with the built-in safety features set by the standards of 1960-61. However, over the years we have made structural changes in these vessels in order to make them safer.

We are, as part of our safety program, doing something more at this time toward the elimination or lessening of hazards which we, as management, can do without major structural changes. We have placed more emphasis on the painting of tripping and striking hazards with Day Glo paint; installing more abrasives on slippery spots including steward, engine and deck compartments, with much emphasis put on areas around hose connections where the slightest spillage, even a few drops, could cause a slipping accident; installing additional guards and railings; having more frequent inspections and renewing, where necessary, boarding ladders, working gear, hand tools, etc.; completing the installation of a complete chemical foam and dry powder fire extinguishing system on all of our light product vessels, even though very costly and not required by any governmental regulation for vessels the age of ours; and installing improved and more adequate lighting systems.

We are also constantly bringing the subject of safety to the attention of the crews by the use of National Safety Council literature and posters. At our annual meeting, where all officers are brought into Cleveland for a mutual discussion of problems, etc., we are placing more emphasis on safety talks and safety movies to emphasize to our officers what can be done in fighting oil fires and preventing accidents. We are constantly stressing the need for prompt and complete personal injury reports and we are then following through with prompt investigation of cause, and how the injury could have been prevented. This by no means covers the entire scope of our program but does hit the high spots.

Has this safety program worked? Also, from a business standpoint, have the results achieved been worth the cost of administering it?

Well, first, there is no doubt in our mind that the safety program has resulted in making every one of our men more safety-conscious, which makes for a good start. This year with more operating days of exposure, the number of lost time injuries has decreased 22 per cent under the average for the last few years.

As to the cost of administering it, we have estimated that the total cost for this year is just a fraction of some of the awards which have been allowed by the courts for injuries we have had in the past. As to the actual dollars and cents saved, this is of course impossible to determine, however, you can't measure in dollars and cents the feeling I have personally, knowing that we are doing everything within our power to prevent an injury.

BUILDING SAFETY INTO OIL TANKERS

By ROYDEN H. ROGERS
Manager, Construction & Development Department
Esso Tankers, Inc., New York, N. Y.

I have been asked to speak about the safety factors we take into consideration during the design stages of tanker construction in order to eliminate or reduce the possibility of accidents to deck or en-

gine department crew members.

Therefore, let us separate into categories the basic features of tanker design that need to be properly engineered from the beginning if hazards are to be eliminated:

A. Hull Design—1. Structure; 2. Deck Equipment; 3. Quarters; 4. Navigation Lay-out.

B. Machinery—1. Location and Access Thereto; 2. Fire Fighting.

C. Cargo System—1. Design; 2. Venting.

We should keep in mind, however, when discussing the details that although such considerations are extremely important, they are relatively insignificant if any inherent weakness is designed into the hull of the vessel, or its main machinery plant, that could possibly result in loss of the vessel and all hands. Now, let us review the design of the vessel in detail on the basis of the outline just mentioned.

The governmental regulatory bodies and ship classification societies set the standards for hull design on the basis of many years' experience with many types and sizes of vessels operating under all conditions. Using such regulatory body regulations as a basis, we in Esso then take great care to ensure continuity of structure at termination of girders and webs, insist on use of arcs or curves in plates at transition points, use brackets constructed as arcs to eliminate so-called hard spots at their toes, and allow no brackets of any consequence to terminate in the center of plate panels.

We require more X-rays of what we consider crucial welds than do the regulatory bodies to satisfy ourselves that we have no incipient spots that might start cracks. We are strict regarding weld/riveting sequences, and take particular pains to see that no welding is done on riveted gunwale bars after riveting, or during the life of the vessel.

The classification societies require a certain number of riveted seams in the shell and deck of oil tankers but do not state their exact location, except in general terms, such as "near longitudinal bulkhead," etc. We have gone one step farther and located the required seams at carefully calculated positions on the shell and deck envelope so that any crack starting within a panel and completely severing it, but terminating at the two rivet seams bounding the panel, would leave a residual sectional modulus of such value that the remaining hull girder would not be stressed beyond the yield point in the damaged condition. We allow no shipyard to deviate

from these panel locations to facilitate erection procedures.

Now that we have done all that we can to insure the integrity of the hull structure, let us talk about auxiliary deck machinery, such as anchor windlasses, winches, steering gears, etc. We are great believers in the value of a stern anchor and I mention it here because, although it does not affect the safety of the crew directly, it does indirectly, in that it helps to prevent groundings, swinging in narrow channels, and reduces possibilities of collisions.

We also use mooring winches on all vessels from 27,000 DWT upwards to control these large vessels when moored in high winds, heavy currents, under surge conditions, etc. Lines from mooring winches are easier to handle and adjustments can be made in length of mooring lines much more safely than by manhandling lines on bits. In view of the high loading rates, often in the neighborhood of 40,000/50,000 barrels per hour, the draft of the ship varies considerably in a short period of time, and we consider a quick means of compensating for change in length of mooring line very desirable.

We consider a fast acting rudder very necessary to give maneuverability in narrow channels. We are designing our newer vessels with a rudder area 15 to 20% larger than normal, for 40° helm angles, in lieu of 35°, and for hard-over to hard-over time somewhat less than required by the classification societies. As the result of this, we have built extreme maneuverability into our vessels from 48,000 DWT and larger.

I should next like to discuss the subject of safety requirements as they pertain to layout and construction of crew's quarters. Danger from fire is one factor we always have uppermost in our minds when laying out quarters arrangements. Therefore, we keep combustible materials to a minimum and do everything possible to contain a fire once it starts. We never use combustible material for quarters' sheathing or sheathing grounds and always have at least one or more air ports in every room of an opening type for emergency access, even though not necessary from a ventilation standpoint in this day of air conditioning.

We build so-called steel fire towers in our quarters' space for vertical access. Such towers have steel boundary bulkheads and vertically they extend from the lowest deck to the boat deck. Access to the fire tower is through steel doors at each deck level. Once in the tower, a man can bypass a fire on a deck between the one he is on and the boat deck.

We never permit open stairways on our vessels, unless there is a metal door at the top or bottom of the ladder to act as a fire barrier. All semi and permanent awnings are constructed of fireproof or self-extinguishing materials and insulation used has to have such characteristics also.

Painting is kept to a minimum on newer vessels by use of self-colored bulkhead and ceiling panels. We are presently considering the use of a fire-resistant paint, where painting is required, now that such paint is available for application directly over previously painted surfaces to render them fire resistant.

We do not allow any opening-type air ports on the poop front at the upper deck level and those installed are of the fixed light type. In rooms so situated, breakout panels are installed in room doors in case a jammed door does not permit ready egress. We are presently looking into the possibility of installing room doors that overlap the jamb so that there can be no question of their jamming. No doors are permitted in the poop front bulkhead at any level. All access to the aft quarters is from doors located in recessed areas in house sides.

We firmly believe such construction reduces the chance for fire on deck or galleys from gaining entrance to what might be considered the heart of the tanker. No access is permitted to bridge 'tween-deck space from inside midship quarters. Such access is from outside only.

On our more recent construction, we have reduced the inclination of our ladders so that they more nearly approximate that of the normal house step. This has proved to be very worthwhile and has received much favorable comment. We also carefully check headroom clearances associated with ladders at angles of various degrees of slope, and use a standard diagram of clearances for such purposes, which has proved very useful. Vertical ladders are always installed continuous to a definite

step-off platform. None are ever allowed to terminate more than one step height above a suitable landing.

We are very insistent that all tripping hazards be eliminated insofar as it is physically possible to do so. We always cut down coamings in way of ladders and walkways unless required by regulatory bodies and will not allow grating runners to project above gratings transverse to line of travel. Generally, this means terminating grating runs at corners on non-skid floor plate platforms where right angle turns are necessary. Obstructions that have to be installed in line with normal passageways are painted white for quick visibility at night. All walking lines are covered with non-skid type paints whenever possible.

We are very careful to see that the scuppers do not discharge into lower decks in such a manner that water has to run across deck passageways in order to reach nearest scupper opening. In the winter, such scupper drainage water frequently freezes and presents a sheet of ice for the crew to walk across. We insist on carrying scuppers through deck and thence transversely across under overhead into nearest vertical scupper at outboard side of ship.

On our newer vessels, we have recessed all machinery casing doors that the heavy doors cannot be opened into the face of a person using the fore and aft passageways.

On practically all post-war construction, stores are handled by an electric crane, either through side ports aft opening up into a passageway providing ready access to adjacent storerooms, or by means of an electric monorail lift suspended from a structural support at fidley top level. This monorail extends from side to side of the vessel over the poop, and is so designed that stores and spares can be dropped through a hatch directly into storage spaces. With such equipment, no "make-do" skids or jury rigs are required to handle stores or equipment.

Due to the size of our 77,000 and 86,000 DWT class vessels, 835' in overall length, and 112'6" and 125' in beam, respectively, we have decided to increase wheelhouse visibility to the greatest possible extent. Under day operating conditions, a half-height folding door separating the wheelhouse from a chartroom can be folded back.

When this is done, a watch officer standing on the centerline has 310° visibility and as he moves six feet off the centerline he can look directly aft. We are also adopting the U. S. rivers system of sloping wheelhouse windows forward to reduce glare.

The various navigational and communication instruments are being installed in a console at the forward end of the wheelhouse. Under this arrangement, the watch officer has everything he needs to control his vessel in one spot, plus a practically unlimited field of vision. Over the wheelhouse doors, port and starboard, facing outboard toward the bridge wings are located a rudder angle indicator and an R.P.M. counter. These instruments are readily visible from the extreme bridge wings and enable the pilot or watch officer to confirm that his orders are being carried out. The rudder angle indicator mounted on the overhead in the wheelhouse has three faces so that it is readily visible from any position in the wheelhouse. Dial R.P.M. indicators are angle mounted overhead in the wheelhouse for quick reference from any location therein.

Having these navigation instruments readily visible from many locations on the navigating bridge deck is very important when one considers the time involved in moving 125 feet across the full width of the bridge.

For ready accessibility in an emergency, we are arranging to store the emergency lifeboat radio in the poop rather than in the midship house as formerly, so that any severe damage amidship will not result in complete loss of radio facilities aboard ship. For the same reason, we are providing for a supplemental supply of medicines to be stored aft under the control of the chief engineer.

In the case of the power plant, we do our utmost to see that safety is designed into it from the very beginning by using suitable materials, equipment of robust construction, and providing easy access to the various components thereof. Suitable ladders and gratings, floor plates, steps, platforms and properly located lifting devices are provided for as required. Headroom on ladders and over gratings is carefully reviewed to make sure clearances are adequate. For this purpose, our design group for several years has been using a diagram giving

body clearances for different slopes that has proven very satisfactory. Handrails are in at least two tiers and single handrails are seldom used, and never on any grating from which a man could fall from any height.

Rotating equipment is provided with adequate guards and hot pipes are located away from normal access, or if this is not possible, are adequately insulated so that no member of the crew can inadvertently come into contact with such pipes and suffer burns.

We take great care to see that ventilation openings and water pipes are not installed over switchboards, control equipment and generators, in order to prevent any water dripping on such vital equipment. Motor starters are arranged with door interlocks so that the power and control circuits are completely de-energized when the door is open and, also, the internal arrangement is such as to prevent personnel contacting the hot leads when working on the starter. Suitable block valves and interlocks are provided as necessary to protect engineers working on equipment from being injured accidentally by coming in contact with live steam or electric current when starting up equipment.

We are using open type chemical feed tanks with pump injection, rather than feed through a pressure tank, so that accidental blow back of chemical is not possible with boiler water treatment.

The fire fighting system is carefully designed to cover every possible contingency. On our newer vessels, we are replacing the steam smothering system for the cargo tanks with an on-deck foam system having monitors mounted at strategic locations at the after end of the forecabin, midship house, poop front and on the fore and aft walkways. On the 77,000-86,000 DWT vessels, we are installing a diesel-driven fire pump under the forecabin. With such an arrangement, any of the crew isolated forward would be able to fight fire if an explosion amidship should cut them off from the fire fighting pumps aft. To ensure that every crew member in the deck department knows how to use it, we are insisting that this equipment be used every time wash-down water is required forward.

The on-deck firemain is constructed on a loop basis with suitable cross-connection

and block valves located so they can be utilized to make the firemain intact again if they are severed by an explosion or collision. Such a system of firemain enables water, or water fog and foam, to be used on deck at one and the same time if required.

The storage room for the CO₂ bottles used in fighting fire in the pumproom and machinery spaces is ventilated by a separate natural or mechanical system and all bulkheads and doors are of gas-tight construction so that there is no possibility of gas entering the quarters in case of accidental discharge of the bottles. On our newer vessels, we are installing water fog in fight pumproom fires. This has certain advantages; for when CO₂ is used for fire protection it is necessary to provide some built-in time delay to allow all personnel to be evacuated from the space before releasing the gas.

In the case of water spray protection, this can be put into use immediately without harmful effect to anyone in the space. On our newer vessels, we are installing a series of spray nozzles to protect the poop house front with a water curtain to prevent spread of fire aft which might destroy a major portion of vessel's fire fighting capacity. At the same time, such curtain protects members of the crew assigned to use foam monitors at poop front.

On our newer constructions, we are placing the cargo discharge lines in the cargo tanks with cargo discharge riser penetrating the deck directly under the crossovers. As the size of vessels increased, we have finally reached lines 20" in diameter. With the high cargo loading rates in use today, and the need for the crew to constantly cross the lines, even on suitably designed walkway crossovers in the most inclement weather, it was decided that, from a safety point of view, a hazard could be eliminated by clearing the decks of the cargo discharge lines, on crude carriers where product contamination from any leaky joints would not be any real problem.

On our two new U. S. flag tankers, *Esso Boston* and *Esso Baltimore*, the discharge lines in the cargo tanks were not fitted with couplings but were fitted with expansion loops to eliminate the possibility of leaking joints that might contaminate cargo if the vessels were placed in clean service. The

installation of large diameter lines in the system also meant that the valves were increased in size and we have had to consider power as a means of actuating them. Such valves are too large to be operated manually, except by a major effort on the part of the deck crew which often results in wrenched backs, muscular injury, etc.

Consequently, the valves of the main cargo system in tanks and in the pump room of our latest 47,000 DWT tanker, *Esso Norway*, and of the six 77,000 DWT and six 86,000 DWT vessels under construction, are, or will be fitted with, hydraulically operated cargo valves arranged for local operation.

In our cargo pumping system we have emergency pump shut-offs located at the pumproom entrance aft, amidship on the bridge deck aft (with shut-off buttons both inside and outside house) and on the midship house front bulkhead. The stop inside the house was installed so that if access to the outside stop was impossible because of fire, or because of blowing of product from a burst loading connection, the cargo pumps could be shut off from inside the midship house, with protection given the crew member by the steel house bulkhead.

On new construction, we are interlocking the mechanical ventilation system of the midship house with the emergency cargo pump shut-offs, to further limit any possible chance of drawing oil or vapors into the midship house, in case of a broken discharge connection amidship that would spew oil and vapors over the house.

Generally, the Esso family design their vessels to operate under a closed system of loading and discharging. This means all ullage covers are closed, vapor is discharged through risers at mast heads and all ullages are taken from tapes on sealed float gauge recording devices.

There are literally hundreds of ways of promoting safety by incorporating safety features into tanker design from the beginning. I have mentioned only a few because of time limitations. All this attention to safety detail will be of no avail, however, unless crew members are made safety-minded by constant drilling on the subject. No design can overcome a lackadaisical attitude about this subject on the part of either employer or employee.

CAUSES OF CLAIMS AND THEIR EFFECT ON CLAIM COST IN VESSEL OPERATION

By EARLE SMITH

Safety Dir., Waterman Steamship Corp., Mobile, Ala.

Before we have a look at some of the causes of claims and increased claim cost in vessel operation, let us have a look at the claim consciousness of the American public today as represented by the two following incidents, which involve a relative and a friend.

One of my aunts had occasion to visit one of Mobile's modern super markets, and while shopping, she stepped on a green bean which had apparently been dropped by one of her fellow shoppers. She slipped and fell, injuring her right wrist. On visiting one of our outstanding orthopedic physicians, he was very quick to inform her of the claim possibilities of her injury, even to the point of suggesting a capable attorney.

The second incident which indicates the trend of the times involves a young man whom I had coached in football. He was driving to work early one morning and as he approached a traffic light, it changed from green to amber. When he suddenly stopped, a city bus ran into the back of his car. There was no damage to either vehicle, but he probably suffered a mild back strain. He was able to secure competent medical evidence that the injury was of such severity as to justify a sizable settlement from the city bus lines insurance carrier.

On the surface, this would seem a legitimate claim, but early in his college career, and long before this happened he suffered a very severe back injury resulting in his being placed in a plaster cast and rendering him unable to play any more football. While he had been able to lead a fairly active life, his back continued on occasions to give him trouble. However, he maintained that for sometime prior to the bus accident, his back had not bothered him at all and that the sole cause of his present condition was the bus striking the back of his car.

These two incidents, I am sure, are very

similar to experiences all of you have occasion to deal with everyday. For this reason, I should like to talk to you about causes of claims and their effect on claim costs. In other words, factors which motivate claims and thereby result in increased cost of personal injuries in connection with vessel operation.

We have found that one of the most important factors in the motivation of claims is the lack of ability on the part of a Master and/or his officers to get along with ships' personnel. Master's or department head's ability to run an efficient ship or department and to treat men under their supervision as human beings can greatly reduce claims as opposed to accidents and consequently reduce operating expenses.

Last year, one vessel in our fleet cost us only \$600.00 in claims. We attributed this almost entirely to the ability of this vessel's Master to get along with his men. He always took time to give a man a draw if he had one coming. He always saw to it that a man got proper treatment if he was injured. He also gave time off to men in their home port and granted extra shore leave in foreign ports.

Actually, his lost time record has never been good because he is very quick to knock a man off if he gets hurt. However, his claim cost record has been fantastically good. By contrast, another ship had \$13,000.00 in claims against it in the same year. The Master on this vessel always seemed to have bad luck in that he was never able to pick up a good crew (according to him).

Late one afternoon while I was sitting in his office, one of the crew came in for a draw. Although he was allowed to make the draw against his earned wages, he had to take a lot of verbal abuse from the Master because he was late in making his request. At the vessel's next port of call, the man requested a Master's certificate—received a "not fit for duty" status report from Public Health on some trumped-up

illness and was able to take some time off at our expense.

If the Master had given the man the draw and told him to have a good time, he probably would have finished the trip and we would have heard nothing from him but because he did not stop to consider the man's feelings or treat him as he would have wished to be treated himself, the company had to pay out \$720.00 it might otherwise have saved.

It seems more than a coincidence that those vessels on which the Master is concerned with the welfare of his men always wind up in the group that has the lowest claim cost.

Failure of the Master to report an accident or illness promptly to the claim department often results in increased claim cost. Many times the man is put off until a report is received from the vessel. He feels he is being deprived of something that is his due and will seek legal advice which almost invariably results in higher settlement than if the claim is settled directly with the seaman.

Failure to report *factually* has also proven to be an important factor in increased claim cost. Distortion or omission of facts which are favorable to the injured employee can only result in failure to offer proper compensation in which case he secures legal advice with invariably a resulting higher claim cost.

Of even more importance is the failure to give the claim department the facts it needs to equitably dispose of the claim. Often the question of the injury report as to whether the man was sober is filled in with a question mark. A report which says the man slipped and fell on a ladder, or was hit by a 4 x 4 which dropped into the hold, does not tell the claim department anything. Was the ladder clean and dry? Was the location adequately illuminated and were the treads and handrails in good condition? Was the 4 x 4 left in a precarious position by someone for whose actions the ship would be responsible—or was it knocked into the hold by a longshoreman, or dropped on the man by another seaman? These are the things that the claim department needs to know—and the failure of the Master to report these facts costs the company money.

Misrepresentation of facts, for example, saying that the ladder was clean and dry when it was dripping with freshly applied fish oil, also costs the company money. It does no good for the claim department to deny liability in a case like this and at the time of trial have the seaman show up with two or three witnesses and a pair of oil soaked pants to prove his point. The claim department needs to know the truth, the whole truth and nothing but the truth if it is to operate efficiently.

Poor investigation and reporting of all conditions causing the accident has contributed more to increased claim cost than any other cause. For example, an able seaman was pulling the slack out of a tent gantline prior to raising gear when the tent gantline slipped off of cleat causing him to lose his balance and fall backwards, striking the back of his head and right shoulder on a winch cylinder.

This accident was reported promptly and the report apparently was a good one, but the condition of the deck was not noted in the report nor were there any photographs taken of the accident scene. Consequently, we were unable to refute the claim of an unseaworthy condition, "Grease and oil on deck." The result was a \$30,000.00 claim loss, where a complete and proper investigation would have resulted in about a \$5,000.00 claim.

Another example, late one afternoon after securing for sea, a day man came to the chief officer and requested some liniment, saying that while driving wedges, he had struck his knee and that it was not bad, but as a precautionary measure, to keep it from getting sore, he wanted to use some liniment. Sometime later, after the voyage payoff, he requested a Master's certificate again saying the knee was O.K., but since he was getting off the vessel, he had better get the knee checked at Public Health. Our next contact with this seaman was through his attorney stating his client had a knee operation for an injury caused by his slipping in grease and oil on deck.

We were unable to refute his claims because the Mate had not examined the accident site or looked at the injured knee or tied down the cause of the accident by getting a statement signed by the seaman set-

ting forth facts as to how the accident happened.

These are only a few examples of the many such instances where the failure to establish all of the facts relative to an accident scene has resulted in increased claim costs.

A very important cause of claims and increased claim cost can be a feeling among a vessel's personnel that the company's interest in them is only for its own personal gain. This is, indeed, one of the causes we have spent a great deal of time on.

First, a great effort has been made on the part of our claim department to treat an injured or ill employee fairly—thus establishing a reputation of fair play. They try to make an employee "whole" again, i.e., where the injury is an established fact and due to the vessel's fault, the employee receives lost wages and overtime.

If there is a permanent disability and/or if an unseaworthy condition was the cause, the employee is paid an additional amount. We feel this policy has paid off since we are getting fewer and fewer claims where the claimant is represented by an attorney. One of the important reasons we have been able to follow this policy has been the insistence on the part of our operating and claim departments that all incidents be reported *promptly and factually*.

During 1959 and 1960, the vessel in our fleet that had the highest claim cost as well as the highest accident frequency was proving to be a real accident prevention problem, in that the answer was not apparent as to just what we could do to help them attain a better record.

One week-end late in 1960 an emergency arose and it was my duty to sail a vessel. Shortly before sailing, the bos'n and the ship's delegate came to me and reported the cat walk over the after deck load was not properly secured. Inspection verified their report and the Master, as well as the traffic department, were informed the ship would not sail until the cat walk was properly secured.

When the vessel next called in Mobile, the bos'n and ship delegate met me and took me to the crew's mess where they showed me a bulletin board they had made indicating the number of days by department, since the last lost time case. They

also informed me that in the future, they would do everything possible to promote safety among the unlicensed personnel and that they were going to strive to make their ship the safest in the fleet.

To date, there have been no lost time cases and less than \$2,000.00 in claims on the vessel.

This is an example of how claims can be reduced and accidents prevented when seamen feel you are not only interested in their welfare, but are willing to do something about it.

Failure to join a vessel by a seaman quite frequently results in a claim. Since one of the few acceptable excuses to avoid a fine by the Union is a "Not Fit For Duty" slip because of an injury or illness, the seaman will make sure he has such an excuse. On one such occasion, a seaman was injured while wrestling in a local bar. This, plus an over-consumption of alcoholic beverages, caused him to miss the vessel at sailing time. The next morning he promptly reported to Public Health and secured a "Not Fit For Duty" slip for a back injury which he had reported on the vessel some two weeks prior to his failing to join, but which had not caused him any disability up to this time.

Another example of failure to join, which increases claim cost even more is when the seaman is on foreign articles. Recently, one of our vessels sailed from New Orleans and an A.B. failed to join. Some several months later, he appeared in our claim department with information showing that his reason for failing to join was an automobile wreck in which he had been quite severely injured and was hospitalized for an extended period of time.

Our investigation revealed that he had been on a frog gizzing expedition near his home in Mississippi and on the way back to the vessel, the car in which he was riding became involved in a wreck—thus we were responsible for his wages to the end of the voyage as well as his maintenance and care until he received a "Fit For Duty" status.

Lack of transportation rights as a claim cause is a constant problem since an injured or ill seaman always has transportation rights back to the port he joined. Recently, we had a vessel pay off in a gulf

port where the voyage began. Several of the seamen on this vessel had joined on the West Coast, so that when the vessel paid off they had no transportation rights back to the port they joined.

Consequently, these seamen all asked for Master's certificates since they wanted not to return to the West Coast but to collect the transportation in cash due them under the contract. Five of them were successful in getting "Not Fit For Duty" status from Public Health on such vague representation that they had coughed up blood or had black-out spells.

If the Master had not been alert to the situation and reported to the claim department, these men would have collected transportation. As it was, transportation was denied until we got a definite diagnosis from public health, and only one ever received any subsequent treatment.

In summation, the controllable factors which are causing claims and increased claim costs are:

- (1) Failure of the Master or department head to get along with vessel personnel.
- (2) Failure to promptly, correctly and completely report an accident or illness.

- (3) Failure to create a feeling among personnel that the company is interested in their welfare.

- (4) Failure to promptly and properly investigate accidents.

The final analysis of these controllable factors causing claims and increased claim costs clearly indicates that *better personnel relations* is of paramount importance in the prevention and control of claims. There is a further indication that better personnel relations will be of aid in controlling "Failure to join," and "Lack of Transportation" types of claims.

Finally, the cost of personal injuries in connection with vessel operation may be more adequately controlled with:

- (1) A well rounded joint labor management accident prevention effort.
- (2) Good employee relations.
- (3) Prompt and factual reporting of accidents.
- (4) Prompt and proper investigation of accidents.
- (5) Prompt and fair handling of legitimate claims.

THIS IS A SAFE SHIP

By H. C. ELLIS

Manager, West Coast Division, Marine Transportation Department
Socony Mobil Oil Company, Inc.

One of the reasons I am talking with you today, I feel quite sure, is because someone aboard our ships in our small West Coast tanker fleet took us seriously.

Many years ago we instituted a formal safety program aboard our ships, and part of the culmination of this program is the fact that last year we placed first in the National Safety Council Tanker Section Safety Contest with a record of no lost time accidents. This fact, I feel, helped contribute to the request that I present a paper here today.

This accomplishment has given me a great deal of personal pride and satisfaction, not so much because our ships took first place,

but because I know that through the hard work of everyone concerned—no one aboard our ships was seriously hurt last year. Of course, we had the usual run of minor burns, something in the eye, and slips and falls. No one, however, was hurt seriously enough to lose time from the job. We thereby avoided a lot of pain and suffering, as well as cost, that goes along with lost-time accidents.

Needless to say, a lot of effort has been made to try and keep the slogan, "This Is a Safe Ship," a true statement of fact. This message, in various ways, is imparted to every crew member who comes aboard our ships. It also serves as a reminder to the

regular crew. This is accomplished in many ways, and I'd like to tell you about some of the things we do and some of the things that have happened to us.

As on many other ships, a regular monthly safety meeting is held by the officers to discuss and argue out any safety problems that have arisen and to keep continuously in front of all concerned the fact that we have an official safety program and are vitally interested to see that its purpose is accomplished.

One of the most successful aspects of our program is that from time to time informal safety meetings are held by the unlicensed crew, usually supervised by an officer, in which again our safety program is brought to the fore. Occasionally attention is called to infractions of our safety rules. When this happens the infraction is discussed, and we always make sure that the correct way of doing the job is explained and demonstrated.

You might think that these meetings of the unlicensed people would turn into "bull sessions," but we have found this not to be the case. We are of the opinion that the men actually doing the physical work can make or break our safety records, and this is where we endeavor to concentrate our efforts.

We have found that this generates a considerable amount of "esprit de corps" when it comes to safety aboard our ships. For example, several years ago one of our stewards came aboard his ship in Seattle, and, in proceeding along the deck to his room amidships, ducked underneath the loading/discharge hoses at the manifold, lost his balance, fell overboard and landed on the dock. He was seriously injured and lost a leg as a result of it.

While this was not a matter for levity, the captain nevertheless later said to me, "You can't charge us with a lost-time accident when the steward fell off the ship. He was all right when he left the ship. He wasn't hurt until he hit the dock." Needless to say, his ship was charged with a lost-time accident. We have since prohibited this practice and installed an access ladder from the deck to the catwalk amidships.

There is another area of management that we think can be used with success to help improve or keep your safety record. We try

our best to see that men returning from leave or vacation are re-assigned to their old ship. This contributes to morale and helps the men keep an interest in their work and accomplishments they have achieved aboard their ship. We have also found that this pays off in helping to keep a tight, well-run ship. With a tight, well-run ship you have not only economy in operations, but you have economy in maintenance as well.

Why should a first assistant overhaul a valve he has just removed from a pipeline just so some new first can use it when he comes aboard and doesn't have to do the work? Why should a chief mate paint over the side just so his successor can take the credit for it later when the port captain from the home office comes aboard?

We feel that as a result of their lack of interest, which is understandable, the company suffers and in the pocketbook, too! Shipyard bills go up and the feeling of the men is that "What the hell, why should I knock myself out, I'm not coming back here after vacation!" This attitude also generates carelessness and the first thing you know the accident record takes an upward spiral.

Coming back to your old ship is like coming home. You know where everything is, how to take this corner slow, and how to duck here. You can even find your way around in the dark sometimes if necessary.

Picture what could happen when you go aboard a strange or unfamiliar ship. A wiper could fall down a ladder because "they didn't have one in the same place aboard my last ship." A cook gets his fingers mashed in the galley door because "there was a door closer on the last ship I was on."

We are all strained and ill at ease in strange or unfamiliar places, and being so, we think, helps make for accidents. So we try to make every effort to see that each member of the crew when he returns to work is put into familiar and safe working places and living quarters—his old ship.

One of the unions on the West Coast has made it a practice, in order to spread the work and jobs, to rotate their men on the ships every seven months. This means that at the end of a seven-month period, a man has to get off and make room for another union member. You can imagine how this affects a safety program. There just isn't

any! We are not placing any blame on the union; they have their problems, just like we in management, but it's too bad that such a thing has to be.

This is an area where management could and should try and work something out to make sure employees are kept aboard for longer periods of time, say at least two years, so that the men would have the opportunity of developing safe work methods and habits the way the company feels they should. This is for the men's protection and could certainly save some grief and misery.

As you all know, no matter how hard you preach and hammer away on safety, sometimes a bad accident happens and is difficult to explain. We had one in 1959. One of our ships left her moorings at a submarine line up the coast from Los Angeles at 7:45 one night, headed for San Pedro. The ship was about 2 miles off at full speed when the third mate reported he heard a faint cry for help. The ship immediately was turned around and steered on a reciprocal course.

It was then discovered the Bos'n was missing and was presumed lost overboard. The mooring launch at the submarine line terminal was asked by telephone to help in the search and the Coast Guard was notified by radio. The launch and a plane from the Coast Guard immediately set out. However, over two hours later the body was sighted floating face down in the water by the ship's lookout. The body was recovered, and, although artificial respiration and oxygen were applied for over an hour, the ship's crew was unable to revive the Bos'n. A doctor later attributed his death to drowning.

Our investigation of what happened could only determine that upon securing all the mooring lines and gear after sailing, the Bos'n dismissed his gang and was last seen going aft toward the fantail. Earlier in the day he had a couple of sailors move a large, full trash can from under the fo'c'sle head to the fantail to be emptied after leaving the moorings. His cap and bits of trash were found next to the railing on the port side and laying on some of the lines that had been used at the submarine moorings. The large trash can was missing. We can only presume that he fell overboard in attempting to empty the can. Fortunately, he had no wife or children.

Now, here is one of those unexplainable accidents that we mentioned. We don't mean the accident itself, but why and how did it come about. We can't explain it. Here was a very capable and experienced seaman. He had gone to sea for us for 15 years and had been Bos'n for 13 years. He had never had a really serious accident before, yet he violated two basic safety rules that we know of, maybe more. The first one is "Don't rely on Do It Yourself, get help if you need it." It goes without saying that if it took two men to move the trash can, it certainly would take two men to empty it.

The other rule or regulation violated was that it was apparent he had tried to empty the can over the railing, possibly standing on a bit while doing it (his cap was found next to the bit) instead of using the trash chute provided on the railing on the stern. Another rule he might have violated is "One hand for yourself—one for the ship" in doing any precarious job. We feel that if he had followed this rule he might have saved himself when he lost his balance.

Why did this experienced seaman fail to follow these rules after all the safety meetings he had been in and all the demonstrations and instructions in safety he had given to new men under him? This is why we say that sometimes accidents are unexplainable. Maybe we all can learn a lesson from this that no matter how experienced you are and how much you know, no one should take safe working habits and practices for granted.

And then, there are the thoughtless people who know better, but just didn't think. We recall the case awhile back of a cook telling another cook that when grinding meat in the meat grinder to always use the wooden tamper to press the meat into the grinder and not to use fingers "like this." He then proceeded to push the meat into the grinder with his fingers and promptly got the tip of them cut off! What can you do about a person like this? We think he learned his lesson the hard way!

Another and very pertinent part of our safety program can be likened to one of the slogans by the National Safety Council, under whose auspices we are meeting here today, in connection with their drive on automobile accidents and deaths—"Drive Defensively." Our men are urged to "Work Defensively." Don't rely on an accident not

happening because all the mechanical safeguards are provided for a given job or because your fellow worker is experienced and trained to work safely. Our men are urged to discover potentially dangerous conditions and work methods and correct them *before* we have to analyze an accident to see what went wrong. Yet, despite all this, a serious accident occurred that is a good example of not "Working Defensively."

A fireman was instructed by the second assistant engineer to renew the packing on the steam valve on the soot blower line in back of the port boiler, a job he had done before and with which he was familiar. He apparently had difficulty in removing the packing after removing the packing gland and decided to remove the bonnet in order to complete the job. He claimed he opened and closed the valve two or three times to see if there was any pressure on the line and decided it was safe to remove the bonnet. He then slacked off the four bolts of the valve bonnet and turned the valve wheel to break the joint. The bonnet blew off, and the man was scalded by steam about the chest, arms, neck and face. This caused him to fall from the grating where he was working to the floor plates, a distance of about ten feet, breaking his left leg.

Why didn't he check to make sure steam was off the line and that the drains were open before doing the job? We feel that he didn't "Work Defensively"! All the safeguards were there, and he was well trained. Somewhere in his safety education the "Work Defensively" attitude was missed. Somewhere we missed!

I'd now like to quote to you an excerpt from a talk given by our port captain in 1959 before the annual Western Oil & Gas Association Regional Safety Conference in Long Beach, California, which we believe pretty well hits the nail on the head in summing up our attitude toward a good and efficient safety program:

"I believe we should all be reminded that safety aboard ship is the day-to-day constant supervision to correct, educate, to show, and to explain. Chip away at carelessness, negligence and foolhardiness, little by little, until you have a reasonable amount of safety."

"The problem is to find some way to remind the men of the established safety procedures. These procedures are not the whim of the people who suggest them, but the result of a detailed analysis of accidents that have occurred and the best way to prevent them in the future."

"The methods of reminding men of safe practices are many and varied. You can literally kick a man when he violates a rule of safety, but this obviously is not good motivation. The most practical way is repetition. You remind the men at every occasion, by sign, by word of mouth, commendation, and by every means of communication known to man. And then you Repeat, Repeat, Repeat and Repeat. Time is not a factor when it comes to promoting safety."

"When you have done all this and continue to do it, we believe you can then go aboard one of your ships and say with a great deal of satisfaction and pride—"This is a safe ship."

SAFETY CONTROL — NS SAVANNAH

By CAPT. GASTON R. DeGROOTE
Master, NS Savannah, States Marine Lines, Inc., Camden, N. J.

I have great respect for the accomplishments of the National Safety Council—particularly in the maritime field. As a ship's master, I know first hand the importance of what the Council is doing to encourage safe practices and prevent accidents. Your sponsorship of this panel to-

day is an outstanding example of your desire to probe deeply into this vital subject.

The papers committee has asked me to speak on the nuclear ship *Savannah*, of which I have the privilege to serve as master. States Marine Lines considers it a great honor to have been appointed as general

agent for the government in operation of this vessel, the world's first nuclear powered merchant ship. As you may know, she is now undergoing final tests and systems checkout in Camden, N. J., and will shortly receive her first loading of nuclear fuel.

By way of introduction may I point out that this paper must—of necessity—take a somewhat different approach to the subject of safety than that followed by your past speakers.

For example, it would be superfluous to discuss here the conventional safety features of the *NS Savannah*, which are similar to those found in any modern vessel built in the United States. I will also limit references to radiation safety measures—designed to protect the health and well being of personnel. Although this would be a logical topic to include in any discussion of the *Savannah*, there is a more detailed paper covering that field already on your agenda.

Instead, my discussion will deal with safety as demonstrated—first, in the construction of the *Savannah's* nuclear system, and second, in the controls which assure safe operation of the reactor plant. My remarks will be of a semi-technical nature rather than a presentation of safety ideas or results.

It should be noted at this point that the systems I shall describe were determined to be necessary, not just for this type of reactor, but for this specific reactor, installed in the *Savannah*. Different reactor types that may be used in future ships may or may not require these particular safeguards. Similarly, advanced concepts of the pressurized water reactor itself could call for completely different methods.

It should also be noted that in this project the Government has an active upgrading program in continuous operation, whereby we hope to simplify equipment and controls as much as possible. I should probably emphasize at this point that in addition to safety instrumentation, the *Savannah* is equipped with a number of control systems that serve other purposes, such as automatic operation.

The *NS Savannah* is a single screw passenger cargo vessel of advanced design. Her length overall is 595 feet 6 inches; her beam, 78 feet. She will draw 29 feet 6 inches, loaded. Her displacement is 22,000

tons, and her cruising speed is 20 knots. Maximum shaft horsepower is 22,000. There are accommodations for sixty passengers, who will also have the use of attractive dining and recreation facilities including a swimming pool. The *Savannah* will require a crew of about 110. Some 9400 tons of cargo can be carried in her seven cargo holds.

Approximately amidships, abaft of No. 4 hold, is the reactor compartment. The nuclear reactor is the heart of the *Savannah's* propulsion system—it can take her 14 times around the world without refueling. The world's fossil fuels—oil, coal and gas—are ample for years to come, but are not inexhaustible. So we look to the atom for a new kind of fuel to meet future needs. In merchant shipping the prospect of nuclear power is extremely attractive because cargo capacity can be increased by eliminating the need for storing a large fuel supply.

It is important to point out that the *Savannah* is not expected to be economical at this time as compared to conventional ships. Instead, its purpose is to demonstrate to the world that the force of the atom can be harnessed and put to peaceful use for the benefit of all mankind. Also, to allow American steamship companies to observe the possibilities of nuclear power for future vessels, and thus to foster the growth of our American Merchant Marine.

Now let us look at the *Savannah's* nuclear plant. As you are already aware, I am sure, the reactor generates heat—which raises steam to run the turbine. Fuel is placed in the core of the reactor in a unit consisting of pellets of enriched uranium oxide encased in stainless steel tubes. A controlled nuclear reaction takes place, causing tremendous heat. Water is circulated around the hot fuel, carrying heat to a secondary water system in a heat exchanger. This secondary water supply, converted into steam, drives the turbine.

The reaction is controlled by twenty-one boron stainless steel control rods. When the reactor is shut down, all the rods are fully in place within the core, and neutrons released by the fuel are absorbed by these rods. When the plant is started up these control rods are withdrawn, singly or in groups, and the number of neutrons available to split the atoms in the uranium is increased.

The *Savannah's* reactor system was designed and constructed with safety as a paramount consideration. Under no circumstances will passengers or operating personnel be exposed to dangerous, uncontrolled radiation. Operation of the ship will not adversely affect any environment in which it is located. The nuclear plant will be completely protected from any possible damage due to ship movements, at sea or in port. With this in mind, we first observe that the reactor core—where nuclear fission takes place—is sealed within a carbon steel pressure vessel with a wall 6½ inches thick, clad internally with stainless steel. This vessel is approximately 27 feet long and 8.2 feet in diameter.

The pressure vessel, in turn, is enclosed by primary shielding which consists of a steel and lead tank filled with water.

Next, there is a steel containment vessel which surrounds not only the core, the pressure vessel and its primary shield tank, but also most of the associated reactor systems, such as heat exchangers, pressurizer, pumps and related valves. This containment vessel is a structure 50 feet long and 35 feet in diameter.

In addition, the ship's hull is specifically designed to protect the containment vessel against damage from collision.

An egg crate structure of steel on the bottom protects the *Savannah* from being pierced through grounding.

A concrete wall four feet thick holds the containment vessel firmly in place, and also serves as the secondary shield. As a further cushion against any possible damage, there is a special resilient collision mat which lines the sides of the compartment in which the containment vessel is located. It consists of alternate layers of redwood and steel, and is two feet thick.

There are sway brackets, designed to support the containment vessel in the event that the ship is rolling or pitching. This possibility has been further dealt with by installing the latest type stabilizers which function to reduce the "roll" of the ship.

The upper portion of the containment vessel is provided with extra protection by an envelope of lead and polyethylene. Finally, the base of the compartment has an insulating water shield.

This adds up to approximately 2400 tons of steel, lead, concrete and polyethylene which shield the containment vessel—and the reactor plant—from any possible damage.

Needless to say, the designers rightly feel that more than adequate safeguards have been built into the *Savannah*. Indeed, it will be one of the safest vessels afloat.

A complex system of instruments constantly monitors reactor performance, as well as operation of the pressurizer, pumps and other parts of the plant. These instruments transmit signals to a main control panel, and also to the automatic safety and control systems.

The safety system is designed so that, if conditions develop which could be hazardous to the reactor or to personnel, the reactor will immediately and automatically shut down. To do this, all control rods which have been withdrawn are returned to their original position in the core, instantly stopping the fission process. At the same time there also are visible and audible alarms.

This automatic shut down is accomplished by either of two methods, depending upon the type of emergency—one called scramming and the other called fast insertion.

In a scram action, it takes only 8/10 of a second for hydraulic actuators to insert all withdrawn rods into the core.

In the case of fast insertion, electric drives are used, taking a maximum of about 4 minutes.

Either a fast insertion or a scram signal over-rides all control signals, manual or automatic. Once a scram is initiated it cannot be stopped by the operator. Fast insertion can be stopped by the operator by means of an over-ride switch on the control console. A manually operated switch also permits the operator to cause a scram at any time.

There are two alarm panels and two amplifiers. All scram signals enter these panels. From there they are applied to safety amplifiers which trip and release the scram action in the control rod system.

Now what are the conditions in the reactor plant which will activate the safety system for automatic shut down? One condition would be an abnormal nuclear level

—another condition could be non-nuclear, such as abnormal temperatures, pressures, and flow rates—items familiar to us in conventional marine power plants.

Nuclear conditions in the reactor are measured continuously by 10 measuring channels which cover the entire neutron flux range of the reactor. These channels receive their signals from 10 neutron detectors located in vertical wells around the shield tank of the reactor. There are at least three detectors for each of three power ranges—start up, intermediate, and operating power. Therefore, situations which would lead to an unsafe condition in the reactor at any power range are always monitored by at least three detectors and at times by seven detectors.

During plant start up, an unsafe condition—measured by any one of four detectors—will scram the reactor. In the intermediate and power ranges, at least two detectors must signal an unsafe condition before a scram is initiated. This guards against shut down caused by instrument failures, but still provides for maximum reliability and safety.

In addition to nuclear protection, the power plant is also instrumented to prevent unsafe conditions of a non-nuclear nature. This non-nuclear instrumentation is a network of standard reliable indicators, controllers, and equipment to provide information and to control the primary, secondary, auxiliary, propulsion, and ship services systems. The basis for design of the non-nuclear instrumentation is two fold: a) simplicity, and b) fail safe—that is, to fail to the more favorable non-operating condition upon failure. Also, alarms are provided to indicate equipment or instrument conditions which would place the plant in an undesired operating condition.

Of course, the containment which encloses the nuclear portion of the plant must contain penetrations of piping and instrumentation cables. To keep these penetrations at a minimum we have converted many of our pneumatic controls to electrical, using multi-conductor cables for penetration, then reconverting to pneumatic control at the main control console. Thus, it is possible to have the more rapid response of a pneumatic system, and still maintain integrity of the containment design.

Both the nuclear and non-nuclear characteristics of the *NS Savannah*, therefore, take into account all the possible consequences of nuclear power plant operation and operator error. This design and the built-in safety features have been reviewed by at least six independent organizations, including government agencies and independent nuclear engineering consulting firms, during the construction and testing phases. Therefore, the *NS Savannah* incorporates the latest and most reliable safety features known to the nuclear and conventional power industries today.

I have just described for you the safety system and related instruments of the nuclear ship *Savannah*. Because a nuclear reactor, like a conventional plant, requires skillful operation by well trained personnel, I would like to mention in conclusion the training participated in by her deck and engineering officers.

The 21 engineering officers, all hand picked by States Marine Lines, began their training in September, 1958. This group successfully completed a fifteen month course at Lynchburg College and in the field at such sites as Hanford, Washington; San Jose, California; and Idaho Falls, Idaho. Simulator training at Lynchburg in the summer of 1960 completed the field training. Following this training these officers joined the vessel at Camden where they are participating in equipment testing as the machinery is installed. In addition to being licensed by the United States Coast Guard as marine engineers, these men also successfully passed the reactor operators' two day written test required by the Atomic Energy Commission.

Six deck officers, all holding masters licenses, were selected to participate in training for the *Savannah*. Although this course was in less detail than that undertaken by the engineers, it was designed to provide a good appreciation and understanding of the limitations of the reactor.

It included schooling at Lynchburg and training at Argonne National Laboratory, Chicago; Taft Engineering Center, Cincinnati, Ohio; and the Damage Control School at Philadelphia, conducted by the United States Navy. After completing this twelve month course, the master, chief officer and second officer were selected.

The *Savannah*, in addition to being equipped with the latest safety control devices, will be manned by the best trained personnel to be found on any merchant vessel in the world.

Speaking in their behalf, and in behalf of States Marine Lines, I wish to ask for your continued interest in the *NS Savannah* as she takes her place in the American merchant marine.

A P. & I. UNDERWRITER'S PART IN MARITIME SAFETY

By JOSEPH E. DOTI
Vice President, Marine Office of America

For the benefit of any who may not be familiar with marine insurance terminology, I would like to explain that "P. & I." in the subject of this talk, stands for "protection and indemnity." P. & I. insurance is a form of marine insurance which shipowners carry to protect themselves against various legal liabilities arising out of the operation of their vessels including claims for loss of life, injury and illness of seamen, passengers, longshoremen and other third parties; loss of and damage to cargo and damage to docks, bridges or other property. However, the Marine Office of America has expanded the traditional "protection" concept to bring it up to date by providing extensive services to our assureds on behalf of Maritime Safety, through its Division, the United States P. & I. Agency.

Our Company became a leading pioneer in the cause of Maritime Safety more than thirty years ago, at a time when the movement was still in its infancy. Although a substantial proportion of American industry already had committed itself at that time to the doctrine of safer operation, the movement had made little progress among the seafaring community.

There were various reasons for this—first and foremost, was the fact that sailors generally are conservative men by nature. That is, they are conservative in their opinions and ideas but not always in their conduct. They are inclined to view innovation with skepticism and change with caution. Generally, they take pride in their profession, particularly in its virility and the capacity it generates to endure hardship and danger. Consequently, there was re-

sistance to a movement which preached care and caution, as being too "sissified" for hard-boiled seamen.

Shipowners, in general, reflected these views of their men. In addition, they were confronted with the inevitable obstacle of costs. Setting up a Safety program and providing trained personnel to operate it cost a considerable sum—even in the Thirties. While it was urged that the expense would be small in comparison with the benefits derived, the fact remained that costs would be immediate and specific but benefits slow in appearing. Many of them, though real and important, necessarily fall into the category of intangibles.

Still another difficulty was an apprehension that the Safety program might breed legal difficulties. Some of the more conservative legal advisers of shipowners were worried that any record of a ship's deficiencies—actual or suggested—might provide a damaging background in the event of litigation over personal injuries or property damage, claimed to have resulted from such shortcomings.

Another concern was that some shipowners felt that Safety Meetings, even those limited to officers—might encourage criticism of working practices and working conditions and develop influences which would tend to undermine discipline on board ship. Some shipowners saw this as a very real hazard.

In spite of great resistance, our Agency as then represented by its recent former President, Edward C. Holden, Jr. (whom most of you know well) persevered in persuading our Assureds to embark on

such new course. Progress was slow but steady. By the end of that decade, many companies had established safety departments and programs in their organizations.

Then came World War II which dealt a severe blow to marine safety. With men dying all over the Seven Seas, there was little opportunity to strive for safe working practices and conditions but at the end of the War, interest was not long in reviving. For one thing, shoreside industry had made great strides in safer operations. The safety movement there had not been impaired seriously by the War. The effect of this shoreside safety progress now carried over into the maritime industry and the ground lost during the War was regained quite quickly.

Within a comparatively short time, no large company operating ocean-going ships could afford to operate without a safety department. Smaller companies soon were following suit. Our own Safety Department increased in activity and size. I might mention here that this renewed interest in maritime safety was pretty well confined to ocean-going tonnage for some years. In the past few years, however, the inland operators have been making impressive strides in catching up.

Results of the revival in marine safety interest have been impressive, as shown by the Safety records of the leading shipping companies, and there can be no question but that the maritime industry has accomplished significant safety progress during the period since the end of World War II.

We like to think that the part played by our Company in this advance has been constructive and significant. A glance at the activities of our Safety Department gives an idea of what an underwriter can contribute to the cause.

SAFETY INSPECTIONS

For one thing, at the invitation of our Assureds, our Safety Inspectors try to visit their vessels and conduct Safety Inspections at reasonable intervals. Ocean-going vessels are usually inspected at New York, New Orleans or San Francisco and inland craft at these and various other ports including Houston and Chicago. On each such visit, the vessel is inspected for Safety hazards in company with ships' departmental heads,

when available—and often with Safety representatives of the shore establishment.

What do our Safety Inspectors look for on their ship inspections? Certain basic conditions are familiar to all ship inspectors—defects on ships which, like original sin, have been with us since time immemorial. I refer to things like unsafe gangways, rickety ladders, missing handrails, bad lighting, cluttered decks, home-made benches, jumbled storerooms and similar items of bad housekeeping. However, as Underwriter's representatives, our Safety Inspectors are in a position to compare ships of many different lines and thereby gain a range of experience considerably greater than that available to the average owner's representative.

Thus, when a new product is being widely accepted in the industry and suddenly reflects a new hazard, our men are able to look for trouble on all ships equipped with the product without waiting for each shipowner to learn the hard way by suffering similar casualties separately. If old equipment that is common to many ships of about the same age suddenly starts giving way in unexpected places, our people get the word quickly and not only pass it along but are alerted as to what to look for on their inspections.

Synthetic mooring lines and stoppers are examples of new products with new hazards, where our experience has been of value to some of our Assureds. As another instance some of our Companies began using a new soogey compound which they did not know had an acid base. It worked fine, as it was an excellent cleanser, until on one ship a new manila gantline was made up and the forward face of the bridge was soogied down. Some of the soogey inadvertently got on the gantline, as it usually does. When the soogeying was finished, the gantline was coiled up and hung in the forepeak. Two months later, still looking brand new, it was broken out and rigged with a bosn's chair to paint the stack. A seaman was hauled up and had just made himself fast when the line parted, dropping him to the deck 40 feet below. Investigation revealed that the inside of the line was completely rotted. The result—a permanently injured seaman and a claim that cost the shipowner in excess of \$60,000.00.

On another ship, the booms were soogied, the guylines triced up against them, and when the booms were raised and a strain taken on the guylines, they all parted promptly. On a third vessel, a manila mooring line was coiled near a bulkhead that had been soogied. When the line was used next time, it gave way as soon as a strain came on it.

Speaking of chemicals commonly used on board ship, a not infrequent cause of bad race and eye burns has been the partially open can of lye or other bowl cleanser left on a shelf and ready to fall or to "spit" into the face and eyes and even to blind the next luckless user because of built-up pressure.

Old equipment is even more guilty than new in presenting hazards. Wastage of material and objects in the less accessible places—inside of objects and underneath painted or protected places—is something that our Safety Inspectors are particularly alert to detect.

A few years ago we had a rash of injuries to longshoremen when runners whipped out of runner guides because the guides were rusting loose or were excessively worn on one side or had been knocked out of alignment. Minute, careful inspection was required to detect these faults but it was found that the condition was quite general and that many guides were being held in place by only a fraction of the original metal.

Many stewards and galley personnel cover sebox gratings with plastic-sprayed cardboard runners. These are dangerous as tripping hazards and also, as slipping hazards. Sometimes they conceal a further hazard arising from a broken or missing section of the grating. We had two nasty ankle fracture claims as a result of such missing grating boards where the space was covered by cardboard. In new construction, lightweight aluminum gratings, which give better traction than the old wooden ones, are being introduced.

Other items for which our Safety Inspectors have learned to keep wary eyes, include square cornered stack hooks which have carried away at the corners in the past because of metal fatigue—rounded stack hooks are much safer; welded hold ladder rungs which crystallize when struck

repeatedly by cargo drails and may drop a seaman or longshoreman into the hold; inoperable fire dampers, frozen by rust or paint; lack of identification plates on valves, lines, etc.; missing warning signs around switchboards, overhead obstructions, "No Smoking" areas, etc.; and the absence of Safety color code painting on deck obstructions and other tripping hazards.

Reports of inspections, listing deficiencies with recommendations for correction, are promptly submitted to the Assureds who usually forward copies to the Master of the ship concerned. Should the shipowner so prefer, written reports are omitted and our Safety Inspectors report directly to Assureds' representatives. In any event, it is understood by all that our recommendations are merely suggestions. We have neither desire nor authority to force our attention on any assured who does not wish to avail himself of our Safety services.

Sometimes for one reason or another, the recommendations of our Safety men are not carried out—at least, not carried out promptly. For example, when one of our Inspectors noticed that only a single line was rigged around the top accommodation ladder platform, leaving an open gap of about three feet between the line and the platform, he recommended that a double line be installed. Somebody "did not get the word" and nothing was done. On the very next voyage, when the vessel returned to the same port, a seaman coming back at night fell from the top gangway platform to the pier below and was crippled for life. No one knew exactly what had caused the man to fall but from the start his lawsuit alleged "failure to provide double hand lines"—the inevitable result: \$75,000.00 payment.

More recently, one of our Safety Inspectors recommended that open manholes in the resistor houses be kept covered in port, that signs to this effect be stenciled inside the covers, and that the covers be painted white. A few weeks later, an electrician stepped into an open manhole in the resistor house. Again, an accident that could have been prevented and a claim that could have been avoided.

SAFETY MINUTES

Next, at the request of certain of our Assureds, we review all Safety Minutes submitted by their vessels and comment upon

them by letters to the Assureds. Copies of our letters or transcripts of their contents are then forwarded to the ships concerned, with covering letters by the shipping companies.

In our review, we consider and offer suggestions on specific Safety problems raised in the meetings but basically, we look for compliance with Assureds' directives, genuine Safety interest and regular and reasonably frequent meetings with sufficient membership participation to show that all hands are interested and thinking about Safety.

DIRECT CONSULTATION

Another service is conducted by way of direct consultation with appropriate personnel in the marine departments of our Assureds. Their own particular problems are analyzed and discussed with them. Very often we are in a position to offer suggestions as a result of similar experiences sustained by other of our Assureds, which have not yet become general knowledge.

For example, a ship sustained a casualty when a winch drum collapsed, revealing that the shell of the drum had been badly worn down. Quick drill testing of the winch drums on other ships of the fleet showed that a number were in similar condition. Because of our position as a clearing house for such information, we were in a position to warn other Assureds before they found out for themselves—the hard way.

On another occasion, we warned our Assureds of a series of accidents involving aluminum stepladders. They are popular on board ship because of their light weight but have a tendency to collapse without warning once they are bent and then straightened out. Magnesium ladders have proved to be even more treacherous and both can be dangerous around electrical equipment.

An example of new hazards reaching our attention promptly through reported injuries concerns a piece of equipment which has made its debut on new ship construction as a replacement for the time-honored Lyle gun. A rocket is now used, presenting the great advantage of mobility and adaptability for use in the most favorable location on the ship. The apparatus is equipped with a circular shield to protect the operator from blast. The illustration in the accompanying instructions shows it held at arm's length,

shoulder high when firing, but in practice, it has been found that it is so heavy (about 20 lbs.) that when held in this position men do not have strength enough to cope with the recoil and the shield is apt to fly back and strike the operator in the face.

As a precaution against such mishaps, a line may be rigged between two stanchions, on which to rest the appliance—or it can be tied down to a pipe rail with the shield outboard. When tripods are provided on which to mount the apparatus, they take care of the recoil problem. I might add one final precaution to take in practice firing and that is to make sure that enough line is attached to the rocket to provide a "tail", otherwise, the rocket may fly aimlessly and even boomerang back on the ship.

SAFETY LETTERS

A major method of distributing centralized information to our Assureds for their ships is by means of Safety Letters published by our Safety Department twice a month under the authorship of Arthur E. Willis, a member of our Staff. These are of various types: a supervisory series, a series of oil tankers, a special for dry cargo ships, another for inland marine and a series of general Safety Letters more or less suitable for all mariners. Since 1955, when these letters were initiated, the circulation has increased from 150 to around 1500. The increase has been accomplished solely by individual request. I might add that we have not restricted distribution of these letters to our Assureds. The members of our Executive Committee felt that any responsible shipping company, so desiring, should have the benefit of these Safety Letters, and we have put many applicants on our mailing lists from all over the world.

Inspiration for our Safety Letters comes from many sources such as, the frequency and character of injury claims reported to us; reports by our shipboard Safety Inspectors; suggestions by our Assureds; material in Safety literature, etc. As an example of a Safety Letter's causation and function, one of our Safety Inspectors was aboard a tanker one day when he noticed a corroded strongback bolt from a tank top, which had just been removed for replacement. This formed the theme of one of our earliest Safety Letters and proved of much interest. I brought this bolt with me and you may wish to pass it around. You

can imagine what might have happened if that bolt had carried away while a man was looking down into the tank—there would have been a decapitation job which every guillotine would have envied.

When we issued a special Safety Letter dealing with Radar some five years ago, world-wide requests for copies were received including many from foreign ships. This was shortly after the collision between the STOCKHOLM and the ANDREA DORIA and among the applicants for copies of our Radar Safety Letter were half a dozen officers from the DORIA who walked into our office one morning. Several thousand copies of this letter were issued, three editions having been printed.

Another special Letter dealt with the characteristics of modern tanker cargoes and was in such demand that the American Petroleum Institute requested several hundred copies for distribution among its membership. Still another on Weather Routing resulted in a request from the United States Weather Bureau for several thousand copies.

Many of the Safety Letters have been reprinted by various agencies; such as, the Marine Section of the National Safety Council; the "Proceedings of the Merchant Marine Council of the U. S. Coast Guard"; the M.S.T.S. Magazine and various publications issued by individual shipping companies.

Proof that our letters are "getting through" to the seamen came as a suggestion from an unlicensed man on one of the ships. He was much impressed by a particular letter and suggested to his Company that it be reproduced and mounted for distribution and permanent display on all the ships of that fleet. The idea was well received and was carried out by having the substance of the letter printed and mounted on a card between sheets of plastic. I brought a sample with me in order that you might pass it around among you.

SAFETY MANUALS

In another effort to reach the personnel on the ships, our Safety Department prepared two separate manuals as "Guides to Accident Prevention"—one for Tankers and the other for Cargo and Passenger Ships. These manuals contain specific instructions for setting up a Safety program aboard

ship, advice on safe practices for most shipboard operations, procedures for conducting Safety meetings together with an abundance of material for discussion. After approval by each Assured, copies are distributed to the Master and department heads on all of their vessels. These manuals are highly prized and have been in great demand. They have even been made a part of the curriculum of one of the major maritime academies.

DISCUSSION GROUPS

To help in the creation of a forum for shore personnel actively concerned with Safety, Captain Robert H. Smith, Manager of our Safety Department, took an active part in bringing about the formation of a "Tanker Safety Discussion Group" in New York City in 1952. This was followed shortly by the organization of the "Dry Cargo Discussion Group." Since their formation, we have actively participated in the monthly meetings of both groups.

The training film devoted to modern methods of fire fighting on oil tankers recently completed by the U. S. Coast Guard in conjunction with other industry groups was first conceived at a meeting of the Tanker Discussion Group and several of its members took initial steps towards its preparation. We are hopeful that this film will constitute a major contribution toward dealing with a terrible and much-too-frequent form of ship casualty.

ADVISORY COMMITTEE

Another Safety forum has developed in the Advisory Committee of our Agency. This Committee, which meets monthly, includes top Management Executives of several of our Assureds and our own Company.

In order to widen the Agency's usefulness to shipowners and operators, the Committee includes in its discussions major Safety problems and matters of industry-wide importance, such as, proposed international Conventions, new or proposed legislation or regulations, etc. The recommendations of the Committee are followed through by appropriate action on the part of the Agency's Safety Department or by our Assureds.

I mentioned some time back the obstacles encountered during the early days of Mari-

time Safety pioneering. It is interesting to note how time has dealt with some of them. The fear that Safety Meetings on board ship might undermine discipline has been well dissipated. True, some such meetings occasionally degenerate into "gripe sessions" where some individuals seek "to rebuild the ship." However, this only occurs when the individual in charge does not preside with a firm hand. That is a fault of that individual, rather than the system, and emphasizes a point which shoreside industry learned long ago; that is, the need for Safety training of supervisors.

On the other hand, when their officers have interested themselves in the Safety program sincerely and have put genuine effort into helping it to succeed, the men have been quick to recognize it and have responded appreciatively. Under such conditions, discipline and morale have definitely benefited.

As I have mentioned, industry generally has long realized the need for special training in Safety for its supervisory personnel and ships' officers are, of course, supervisors in the fullest sense. It is not news that the effectiveness of a ship's Safety program depends on the attitude and interest of Management toward it, but it is important that such interest be demonstrated.

We had a case not long ago of an Assured whose fleet had a very poor loss record. This fact was not surprising since it had no Safety program whatever. A new President took office with this Assured and soon became "sold" on the value of a good Safety program. After broad consultation with several Safety activities, including our Company, a program was drawn up carefully for the ships of the fleet. Suitable directives were prepared to launch the program—but they were not put in the mail. Instead, this busy executive got up early and met every ship of the fleet as it came

back to the home port. As soon as he got aboard each ship, he went to the Captain's cabin and handed the new Safety directives to the Master, sitting down with him to explain in detail just what was wanted and how to go about producing it. It is hardly surprising that this crash program achieved remarkable effects in record time.

The cost bogie has retreated from the foreground in the Safety picture. True, today's Safety costs are higher than ever, but much more so are the costs of accidents. Direct costs including jury awards, settlement and expenses of litigation have reached startling proportions and indirect costs still are conservatively estimated as more than four times greater than direct costs.

The consideration of public relations is, perhaps, the most intangible of all, yet also, perhaps, the most cogent. Public goodwill is as vital to the owner of cargo-carrying ships as it is to the owner of passenger ships. Unfortunately, many maritime casualties are very spectacular in their nature and as such, attract the attention of the newspapers and fire reportorial imaginations until the public image of the shipowners involved is very badly damaged. In fact, more than one shipping company has been seriously affected or put out of business by one or more such casualties—not by the actual direct costs of the claims settlements (most of which are insured) but by the force of public opinion causing a boycott of their ships or products carried. And more than one shipowner who survived such an experience has been converted from scepticism into strong advocacy of an aggressive Safety program.

To conclude briefly, our Company is proud of its efforts in the cause of Maritime Safety and of the results which the industry has achieved. It has been a most pleasant and rewarding experience.

ELECTRICAL SAFETY IN SHIPS

By CAPTAIN O. T. ESTES

Chief, Electrical Engineering Branch, Merchant Marine Technical Div.
United States Coast Guard, Washington, D. C.

Electrical safety in ships includes the prevention of shock, fire and even panic; I propose to take these one at a time and tie them into everyday experiences.

Much has been said and done to protect the unsuspecting person from electrical shock. Suppose you wish to install a washer or electric dryer in your basement. Or possibly you are remodeling your bathroom. Whether you do this job yourself or have a contractor do it, the work should be examined by the local city or county electrical inspector. Following the National Electrical Code (210-22 and 410-93) this inspector will require grounding type receptacle outlets in kitchens, workshops, garages, etc., where the outlet may supply equipment used by persons standing on the ground or on grounded conductive materials. Metal enclosures for lighting fixtures, faceplates etc. in these areas must be grounded. The purpose of all this is to eliminate the possibility of a person bridging across a source of voltage.

For example, a person in a bathtub shouldn't be reaching over to touch the faceplate on an electrical outlet or a mirror light. However if he does he will not be shocked if the bathtub, radiator, faucets, faceplate and lighting fixture enclosure are all properly connected together to ground. The same is true of your electric dryer or washer and set tub or pipes in the basement.

The same is true aboard ship and this principle is applied to large vessels inspected by the U. S. Coast Guard under the "Electrical Engineering Regulations" CG 259 (46 CFR 111.05 and 46 CFR 111.60). In a steel hulled vessel everyone is walking on or touching ground wherever they go. You might say that aboard a steel vessel one foot is always in the bathtub. And the hands and other parts of the body are nearly always within reach of power cables or electrical equipment containing lethal voltages. Aboard ship the cable armor, the enclosures of lighting fixtures and other electrical equipment should all be grounded to the hull of the vessel, thereby bringing all exposed

metal to a common potential and eliminating shock hazard from this source.

The portable tools used aboard ship are good examples. The metal enclosure of the tool, that part carried in the hands of the operator, is connected directly to ground (vessel-hull) through a third conductor in the supply cable. This requires grounding type plugs and receptacles. With this grounded enclosure arrangement the operator is safeguarded against holding a "hot" (faulted) tool in his hands while touching ground with other parts of his body.

This rule of connecting all exposed metal to ground potential is simple and direct. Unfortunately it is sometimes not followed. During the last year our record of marine casualties listed three deaths by electrocution.

While working on a barge in Florida a young shore worker was stripped to the waist. When he reached over to pull on a portable fan his bare sweating chest touched a hatch coaming as his hands contacted the faulted electric fan. Death resulted. This would not have happened if the exposed parts of the fan had been held to the potential of the barge by a grounding connection.

Similarly a death occurred during repair work on the Dutch yacht *Frieda* in a U. S. port when a worker's body was in contact with the metal hull while his hands held a "hot" electric sander. Here a jury rig extension cord had been employed which did not contain a grounding conductor to ground the tool housing.

A real booby trap was set up on a T2 tanker. The ground strap to one propulsion cable armor was defeated by someone who insulated it with tape. This permitted 2300 volts on this cable armor when a ground fault occurred and an unsuspecting engineer was electrocuted.

I could go on and on giving examples such as shock to welders or shock by tools and resulting falls off ladders. The latest published figures indicate that 12 deaths were

caused in 1957 by electric shock on U. S. Navy ships.

What is the answer to this electrical shock problem? Whether in your small boat or in an ocean liner, it boils down to not bridging parts of the body across a voltage source. If the electrical device is completely disconnected by a disconnect switch then it can be touched in safety. Disconnect switches which open all supply conductors are needed in order to service equipment without exposure to shock. The servicing personnel sometimes fail to use the disconnect and work "hot."

Preventing this is a matter of indoctrination and education. But for electrical equipment that is energized and running, reducing shock hazard is a matter of connecting all exposed metal to ground potential. In a metal hulled vessel the ground is the hull. In a plastic or wooden hulled small vessel ground it is the bonding system which connects all metal enclosures together.

One caution to you who may be doing it yourself. The grounding conductor that connects the tool frame to ground should be of good size and with tight connections so it will be of minimum resistance. This is to insure that on tool fault this grounding conductor will carry sufficient current to interrupt the fuse or breaker and keep the tool housing at ground potential. The same size for grounding conductor as for supply conductors is a good rule.

The best scheme is to have a multi conductor supply cable for all tools with the green colored wire used for grounding. Frequent maintenance checks to see that the grounding connections are properly connected and of low resistance is a good precaution. An ohmmeter check between tool housing and ground should read less than 3 ohms.

Fire is the greatest dread of seamen, and rightfully so. In the last three years our casualty report files indicate 163 fires attributed to electrical origin. One half of the vessels were a total loss, and 15 deaths resulted. So as not to alarm you who operate large ships, let me quickly point out that these fires, loss of vessels and deaths were primarily attributed to small pleasure vessels and fishing vessels. On large Coast Guard inspected vessels of over 500 gross tons, during this period there were 25 fires reported but no loss of vessels and no deaths.

Being an electrician I feel that electricity is blamed for many casualties without justification. When the investigator doesn't know what caused the fire he "presumes" it to be of electrical origin. However there is one statistic I cannot deny—the reports for year 1960 show 14 small boat fires started at the instant the engine starter button was pushed.

Oh yes, it could be argued that this doesn't mean that there was any faulty electrical equipment. The starting battery, contactors and starting motor were probably operating in a perfectly normal fashion and if the explosive vapors had not been in the engine compartment these fires or explosions would not have occurred. It could be argued that the presence of gasoline vapors, propane gas or other combustibles was the proximate cause of the fire. But this is a fine point because the normal sparking of contacts or motor commutators can ignite explosive vapors.

The problem is solved equally well by removing either the electrical equipment or the hazardous vapors so that the two are not present together. The vessels involved in these reports were generally small in size and gasoline was the principal source of explosive vapor. In small boats we rely on the use of a blower system to clear out any explosive vapors prior to energizing the electrical equipment in the engine compartment. A good sniff with the nose before starting is also highly recommended!

In large ships the accumulation of combustible gases in the engine room is less likely since this is a manned and well ventilated space. However to be safe from fires of electrical origin large and small vessels must be designed, built and maintained with precautions in mind. Fire hazard can exist wherever electrical potential is present and the electrical installation covers a far greater area on a vessel than any other type of installation. We must guard against over fusing circuits, locating electrical equipment in spaces where flammable vapors or gases may normally accumulate, using equipment with less than minimal electrical clearances, and overheating, particularly of lighting fixtures, in proximity to combustibles. Much of electrical safety is just common sense.

Finally, consider panic. When in 1904 the *General Slocum* burned in New York Har-

bor with 957 victims mostly women and children there was panic. In 1912 when the *Titanic* sank with loss of 1,517 lives, and in 1932 when the *Morro Castle* burned with a loss of 124 lives, there was panic aboard.

One of my jobs today is to "sell" you on the idea that electricity can add safety to a ship by reducing panic. The human being is by nature afraid of the dark. Place him in the dark, in a strange place, with other people, in threatening circumstances, and the stage is set for panic. Part of the answer to panic aboard ship, even in the time of great danger, is to keep the lights on and to tell the person how to help himself, all of which can be done with proper electrical arrangements.

The SOLAS conventions have brought about international recognition of this fact but it is sometimes hard to "sell" to the man who pays the bill for an emergency lighting system. SOLAS 1929 first required emergency lighting systems in passenger ships and SOLAS 1960 has extended this requirement to cover international cargo vessels.

The idea of protecting the unsuspecting passenger by furnishing him with sufficient lights to find his way to the lifeboats as required by the SOLAS Conventions is sound. Having emergency lights to assist the crew in restoring normal services or to better employ fire fighting and damage control methods is also sound.

For example, recently on a cargo vessel an electrical failure to the only electrical system, left the ship in total darkness below decks. The chief engineer in his one man panic and haste to restore service tripped over a deck plate, fell, struck his head near the switchboard, and died. If his ship had been built under the present requirements he would have had sufficient emergency lighting to effect repairs.

None of us will quarrel with the need of emergency lights in the operating rooms of hospitals. How would you like to be performing a delicate operation on a person or on machinery in the dark? You are seven

decks down in the bowels of the ship, how do you get to safety?

Probably the best argument I can give for keeping the lights on in an emergency is the case of the *Andrea Doria*. True there were 43 lives lost in this collision, but about 1700 were saved. I make the statement: All the while lifeboats were being lowered and even as the ship was over at 45° and sinking the emergency lights were burning.

Now I ask the question: How many deaths might we have had that night on the *Andrea Doria* if the ship had been in total darkness, with no guiding lights or announcing system to lead the passengers and crew from the underdecks to the boats?

With this "panic argument" I hope to have "sold" all of you on the need for an emergency lighting system, that lights are needed to restore services after casualty and lights are needed to guide passengers to the open decks and lifeboats or liferafts.

To summarize, we have discussed shock, fire and panic hazards aboard ship. The remedy to the shock and fire hazards lies in well designed robust electrical equipment with the exposed metal parts grounded, proper protection against overcurrents, good connections, isolating high temperature items from combustibles, etc., and proper maintenance. Fortunately the electrical industry has generally supplied equipment which has been designed to combat shock and fire. Unfortunately the human doesn't always install or use this equipment properly.

The remedy to panic is in not letting a panic situation arise. A partial answer to the casualty and panic situations lies in providing an emergency lighting system. Lights under emergency conditions give those on board a better chance.

In the marine electrical safety field as in any safety field the continuing efforts of the National Safety Council, ship owners, ship operators, the Coast Guard and others is needed to educate those who haven't yet learned.

REVIEW OF MARINE CASUALTIES

By COMMANDER JOHN H. HAWLEY
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At the entrance to the Archives in Washington is inscribed "What is Past is Prologue." One story has it that a visitor to the Capital asked his taxi driver what it meant. The cabbie replied "It means we ain't seen nothin' yet."

From a marine casualty point of view, at least, we've seen plenty. In many areas we've profited by past mistakes. In others more effort is indicated. A brief review of some of the significant aspects of more recent casualties may light the way.

You no doubt will recall the *Amoco Virginia* disaster on November 8, 1959, in the Houston Ship Channel. The vessel was loading automotive gasoline and number 2 heating oil at the Hess Terminal.

The evidence developed by the Marine Board of Investigation was largely circumstantial but it appears that there was accidental discharge of gasoline into the water from the tanker which was ignited by open flame oil lanterns used as running lights on a loaded sand barge being pushed or towed past the area.

Incredible as it may seem, the evidence indicated that the night mate in charge of loading aboard the *Amoco Virginia* and the master of the tug *Pan Six* who was the tancer in charge of the pumping operations on two tank barges alongside had both been put on notice an hour or more before the fire that there was gasoline on the water around the vessel but pumping operations were continued. Six crew members from the *Amoco Virginia* and one fireman lost their lives as a result of that casualty.

Aside from the more obvious lesson, this casualty pointed up the problem created by accidental spillages of any commodity which might create a hazard to safety. In the *Amoco Virginia* case, the Board also found that at some time prior to the casualty a tank barge had been holed while being shifted and as a result gasoline flowed into the channel. While not contributing since it preceded the fire by 12 hours, it unquestionably created a dangerous situation at that time.

Largely as a result of this casualty, the entire problem of spillages, leakages or discharge of hazardous or dangerous material into navigable waters of the United States has been made the subject of a special Coast Guard study. That study is still going on. The problem is vast and goes beyond the basic responsibility of the Coast Guard for safety of life at sea.

While petroleum products in the water are primarily a hazard to ships and water front facilities, the spillage of other dangerous materials such as poisonous chemicals into rivers which provide water for drinking and industrial purposes could conceivably imperil the lives and livelihood of thousands of people. The solution is basically simple. Prevent spillages and discharges to the extent possible.

This is nothing new. Normally, no vessel will purposely dump cargo into the rivers. On the other hand, accidents do happen. Recognizing the potential danger if some commodities are accidentally spilled, extra care is indicated when they are being handled. Greater attention to navigation and the placement of barges strategically within a tow are two of the more obvious considerations.

When accidental spillages occur, immediate reporting by the master, operator, owner or person in charge is essential so that precautions may be taken to close off water intakes and protect water front facilities as well as other shipping. For the present time at least, such reports should be made to the nearest office of the Coast Guard.

Undoubtedly when the Coast Guard study is completed, there will be recommendations for specific regulations in this regard.

A 14 year record for U. S. ocean-going certificated passenger ships was broken on October 22, 1960, when the combination freight and passenger vessel *Alcoa Corsair* collided with the Italian freight vessel *Lorenzo Marcello* in the lower Mississippi River. Five passengers and five crew members lost their lives and six passengers and four crew members were injured in this casualty—all from the *Alcoa Corsair*. Not since 1946 has

a passenger been killed aboard an inspected U. S. ocean-going passenger vessel as a result of a vessel casualty. It was in that year that the passenger vessel *Yukon* stranded on the shores of Cape Fairfield, Alaska, with the subsequent loss of nine passengers and two crew members and the total loss of the vessel.

The *Alcoa Corsair*/*Lorenzo Marcello* collision, typical of most other collisions, was due to personnel fault. The *Alcoa Corsair* was downbound and rounding Sixty Mile Point which entails about a 90° right turn over a 2-mile course. The *Lorenzo Marcello*, upbound, was heading for the Point as is the custom and the *Alcoa Corsair* was keeping to the bend. It was a clear, dark night. The vessels were in sight of each other when over two miles apart and when within one and one-half miles, two-blast signals were exchanged. There were conflicting versions as to what subsequently occurred but two facts were indisputable. The *Alcoa Corsair* was permitted to swing about 16° further right than the axis of the channel below Sixty Mile Point and the *Lorenzo Marcello* turned right at the last minute in the face of the *Alcoa Corsair*.

It was the opinion of the Coast Guard that this casualty was caused by the failure of both vessels to navigate with caution. The *Alcoa Corsair* failed to make a timely and sufficient alteration of course to port to insure a safe starboard-to-starboard passing and the *Lorenzo Marcello* failed to recognize the increasing danger of the situation which should have been apparent.

The case was unique in one respect. In the face of the traditional master/pilot relationship, it is seldom that the vessel's officers do not share the blame for an accident. In this instance the situation was more than just a case of meeting vessels, but one of vessels meeting in a river where a knowledge of local conditions and customs dictated the special qualifications of a pilot.

In addition, it was considered that under the circumstances, the officers on the bridges of the two vessels who were not pilots would not realize that their vessels were standing into danger prior to the time collision was imminent. Hence, it was concluded that the responsibility for this collision rested solely with the pilots of the two vessels.

No review of past casualties would be complete without comment about radar. In the past two fiscal years there have been two particularly significant radar cases. One was the collision between the SS *Mormacpine* and the fishing vessel *Jane* off Cape Flattery, Washington, on September 27, 1959, and the other was between the British freighter *South African Pioneer* and the fishing vessel *Ponchaton* off Cape May, New Jersey, on April 10, 1961.

In the first case, the *Mormacpine* was proceeding full ahead at 11.5 knots on a northerly heading off the Washington coast early on the morning of September 27, 1959. Upon sighting a fog bank ahead, the lookout was posted on the bow and fog signals were commenced. The engine was placed on standby but no reduction in speed was made. The radar was on and appeared to be operating satisfactorily showing a good presentation of land mass but no vessel targets were observed.

The vessel had entered the fog bank and visibility was between 500 and 1,000 yards. At 0746 the master ordered right rudder to enter the Strait of Juan de Fuca. At this time, the lookout reported by phone to the master that he heard a whistle ahead. Immediately the engine was stopped and the master checked the radar which was on the eight-mile scale but observed no vessel targets.

Approximately one and one-half minutes later the lookout reported sighting a vessel 1,000 feet ahead fine on the starboard bow. This later proved to be the *FV Jane*. The *Jane* appeared to be underway with little or no way on and was heading across the bow of the *Mormacpine* from starboard to port. Upon receiving the report from the lookout, the master ordered full astern on the engines. The rudder was already hard right. The response to the engine order was immediate but these maneuvers did not succeed in evading the *Jane* and at about 0755, with the *Mormacpine* making an estimated three to four knots through the water, her bow struck and holed the *Jane* on her port side.

The *Jane*, a 49 foot, wood hull fishing vessel, was en route Neah Bay, Washington, to Destruction Island. After clearing the harbor, she headed west at half speed—approximately five knots—into a nine foot

westerly swell. At 0720 fog was encountered. Fog signals were commenced and speed was reduced to four knots. The *Mormacpine* was first observed bearing down on the port side of the *Jane* about 50 to 60 feet away. The *Mormacpine* was undamaged but the *Jane* was severely holed and sank three minutes after the collision. Three of the five crew members aboard the *Jane* were rescued but the master and the fifth crew member were lost.

In the second case, the *South African Pioneer* was en route to New York from Charleston, S. C., heading on a course of 015°T at 14 knots. At about 0542 on the morning of April 10, 1961, visibility decreased to one and one-half miles. Fog signals were commenced and the engine was placed on standby which would result in a reduction of speed to 10.2 knots as the vessel reached maneuvering rpm. The radar was on the eight-mile scale. Sea return extended three miles from the center of the cone and rain areas appeared beyond this range. No contacts were observed on the scope.

At 0545 the lookout was sent below to call the stewards' department. Between 0549 and 0550 a red light was observed close ahead 10 degrees on the starboard bow. Hard right rudder was ordered and moments later was shifted to hard left, then amidships and full astern. At 0551 the stern of the *Pioneer* struck the *Powhatan* amidships on the port side at a 60 degree angle. The *Pioneer's* speed was estimated to be slightly under 10 knots.

The *Powhatan*, a 78 ft. wood hull fishing vessel was proceeding south-southwest at a speed of seven knots toward Hampton, Va., through rough seas and heavy swells. There was no lookout on the bow. There was a helmsman at the wheel and the master was making a loran fix from the receiver located in his room immediately abaft the wheelhouse. The *Pioneer* was first observed by the helmsman who shouted the warning. When the master came out of his room the *Pioneer* was so close he could not see her navigation lights.

Almost immediately thereafter the *Powhatan* was struck and cut in two. The speed of the *Powhatan* at the time of impact was estimated somewhat less than seven knots. There was no damage to the *Pioneer*. Out

of five crew members aboard the *Powhatan*, four lost their lives.

In both of these cases personnel fault was considered to be the principal cause. Both the *Mormacpine* and the *South African Pioneer* were going at an immoderate speed. On both fishing vessels there was evidence of improper lookout. In both of these cases sea conditions were such that the fishing vessels could reasonably be expected to be obscured as radar targets. Both of these fishing vessels were constructed of wood and could further be expected to produce poor radar returns and on both the *Mormacpine* and the *Pioneer* the navigation personnel was undoubtedly influenced by the absence of any radar targets on the scope.

You are all familiar with the recommendations annexed to the International Rules of the Road adopted at the 1960 SOLAS Convention concerning the use of radar. The following is quoted from recommendation 2:

"... Information obtained from the use of radar is one of the circumstances to be taken into account when determining moderate speed. In this regard it must be recognized that small vessels, small icebergs, and similar floating objects may not be detected by radar..."

If heeded this recommendation should go far in preventing the type of casualty suffered by the *Jane* and the *Powhatan*. These two casualties also indicate the need for increasing the radar reflectivity of wooden vessels. Radar reflectors are available and prudence dictates that small seagoing vessels install such devices. But as pointed out by the Commandant of the Coast Guard in action on the *Mormacpine/Jane* case, "The increase in radar detectability presently offered by this equipment is definitely limited and offers no assurance that vessels so equipped will be observed by radar." In heavy seas the odds are even further reduced.

From the safety point of view another particularly significant casualty was the breaking up of the T2 tanker *Pine Ridge* off Hatteras on December 21, 1960. The résumé and Commandant's action in this case appears in the November issue of the Proceedings of the Merchant Marine Council. Briefly, the vessel, in ballast, was heading into heavy weather. Speed had been reduced to about nine knots. She was roll-

ing and pitching heavily and possibly taking green seas over the bow, but none of the witnesses had the impression that she was pounding or slamming hard. At 1145, December 21, without any warning, there was a loud crack and the vessel forward of number six tank was observed to raise up out of the water. On a subsequent sea the vessel tore across the deck and the bow cleared around to the right, then broke completely off.

At the time of the casualty the master, chief mate, second mate, third mate, radio officer, chief steward and quartermaster were in the midship house which was on the forward section. As the forward section separated the bow was observed to be high out of the water and the after end awash up to the boat deck. No lifeboats were launched from the forward section, and sometime during the late afternoon or early evening of December 21, the forward section sank. There were no survivors from the forward section, nor were any bodies recovered.

The Marine Board convened to investigate this casualty found that the failure was primarily of the ductile type indicating a high stress condition. In this connection, the Board found that the loading distribution of the vessel resulted in a sag numeral of almost plus 150 and a hog numeral of almost minus 20, calculated in accordance with the American Bureau of Shipping publication "Guidance Manual for Loading T-2 Tankers." The maximum sag numeral recommended in the manual is 100 and the figure of plus 150 reflects a dangerous condition of stress.

In addition to improper ballasting, the Board concluded that the weakened structural condition of the vessel was also a contributing factor. Audio gauge readings of the main hull structure after the casualty indicated a generally borderline condition, and some areas where wastage was actually excessive. The vessel had been drydocked two months before the casualty and was attended by a Coast Guard inspector, as well as a classification surveyor and the owner's representative. There is no doubt that they did what they thought should have been done, and their requirements for repairs and renewals were made in good faith.

The problem they faced is the most difficult one in the field of vessel inspection;

that is, the determining of the condition of an aged vessel and deciding what must be done to permit the vessel to continue operating with safety. It seems logical that as a vessel advances in years, examinations and inspections must necessarily be increasingly detailed and critical. Beyond that there must be a satisfactory resolution of the differences of opinion which are bound to arise. In his action on the *Pine Ridge* case, the Commandant commented as follows in this regard:

"Obviously the proper balance between economy of operation and safety can only be achieved with full cooperation, mutual assistance and a frank exchange of information between those directly concerned."

During fiscal 1961, there were 2,015 casualties to commercial vessels reported to the Coast Guard. This compares with 1,988 the year before. In fiscal '61, 156 persons lost their lives in vessel casualties aboard commercial vessels of all sizes as opposed to 133 in fiscal '60.

Forty of these deaths occurred on inspected vessels and 116 on uninspected vessels. Among the uninspected vessels, those engaged in commercial fishing once again accounted for the most deaths, with a total of 58. Uninspected tugs ran second with a total of 21. The classification of vessel casualty which accounted for the greatest percentage of these deaths on uninspected vessels was flooding, sinking and capsizing. In the case of commercial fishing vessels, 29 lost their lives in casualties of this type, and on uninspected tugs, 16 lost their lives.

In our tabulation of personal accidents aboard commercial inspected vessels the category which accounted for the greatest number of deaths in fiscal 1961 was death from natural causes. The total was 165. In this category 80 of the deaths to crew members resulted from one of the cardiovascular diseases.

The second largest number of deaths from personal accidents on board inspected vessels occurred as a result of falling overboard. Sixteen persons were killed from this cause, of which nine were crew members.

Aboard uninspected commercial vessels the situation was reversed. Natural causes was second, having accounted for 26 deaths

of which 21 resulted from cardio-vascular disease to crew members.

The major cause of death from personal accidents aboard uninspected commercial vessels was falling overboard. A total of 70 lives were accounted for in this category of which 28 were crew members off fishing vessels and 27 were crew members off tugs and tows. These figures on deaths from falling overboard are the most disturbing of the year. On uninspected vessels this was the greatest single cause of death.

In June 1959, when the Coast Guard issued its first approval on the work-vest type life preserver it was hoped that deaths due to falling overboard would be materially reduced. They haven't been. The reports of investigations received on these cases indicate that in most instances on tugs, tows and dredges, life vests were available. How can we get people to wear them? Stating it more broadly, how can we get people to take safety precautions of any kind?

Scare statistics obviously have little effect, and certainly our seamen if not our entire population are safety educated. The problem seems to lie in the same basic human weakness that keeps us from taking our doctor's advice. If this is true, it would appear that more forceful leadership on the part of ships' officers, and other designated supervisors among the unlicensed persons, can go a long way towards correcting the unsafe conditions and preventing unsafe practices which cause these casualties.

Our records appear to indicate that in the lower echelons particularly there is a marked reluctance on the part of supervisors to insist on safe work methods. This is especially true if the subordinate himself is known to be an experienced man. Going back for a moment to the figures on deaths resulting from falls over the side, if the masters or supervisors required that life jackets or life vests be worn, and accepted no deviation, it is reasonable to assume that many of those who died would still be with us.

The third largest number of deaths from personal accidents on inspected commercial vessels occurred as a result of suicide. Twelve persons died in this manner, of which nine were crew members and three were passengers. In addition, 11 crew members disappeared from inspected vessels

under circumstances which suggested the possibility of suicide.

The third largest number of deaths from personal accidents on uninspected commercial vessels resulted from disappearances of which there were nine cases, eight of which involved crew members. While some of these cases might have been suicides, six cases were on fishing vessels, which tends to increase the probability of accidental falls.

On commercial uninspected vessels, positive suicides were almost inconsequential, with only two cases tabulated.

Among categories which account for the greatest number of non-fatal personal accidents, resulting in incapacitation for a period in excess of 72 hours—slips and falls on deck and other ships and falls—the same level accounted for most of them with a combined total of 202 injury cases on all commercial vessels, both inspected and uninspected. In these categories no one was killed aboard inspected vessels, but two were killed on uninspected vessels. The principal causes of these accidents were unsafe practices and poor maintenance or housekeeping, which accounted for 57 cases; human error not otherwise classified, which means a misstep on the part of the individual, accounted for 46 cases; and weather conditions were given as the cause in 53 cases.

The second largest group of injuries occurred as a result of slips and falls on ladders and stairs. There were 116 injury cases in this group covering all commercial vessels, plus two deaths on inspected vessels but none on uninspected vessels. Principal causes were unsafe practices or conditions and missteps in that order.

Our casualty reports in recent years are beginning to reflect a greater number of personal accidents being attributed directly to intoxication. During fiscal 1961, 11 deaths and 41 injuries were considered to have been caused primarily by intoxication. Fights aboard ship are also accounting for more casualties. There was one death and 92 injuries recorded in this category. It is doubtful that this reflects a true increase in casualties of these types, but rather that reporting superiors and even witnesses are becoming less reluctant to call a spade a shovel.

From an analysis of the death and injury

statistics it is apparent that continued efforts to make vessels safe have paid off and this is particularly true of inspected vessels. Of course, there is still plenty of room for improvement as evidenced by some of the individual cases we have discussed here.

On the other hand the sum of our casualty

experience for fiscal 1961, supported by figures for previous years, indicates that greater effort must be exerted to get individuals to work safely. It is in the area of personnel fault, both from the standpoint of vessel casualties and personal accidents, that the greatest strides towards maximum safety remain to be made.

MARINE SECTION BUSINESS SESSION AND COMMITTEE REPORTS

ANNUAL BUSINESS MEETING OF THE MARINE SECTION

By W. M. GAGE

Secretary, Marine Section, National Safety Council, Chicago

The annual business meeting of the Marine Section, National Safety Council was opened by general chairman, Richard W. Berry at 10:00 a.m., October 18, 1961 in the Lincoln-Douglas Room of the La Salle Hotel, Chicago, Illinois.

After a brief word of greeting to the members present, Chairman Berry introduced Mr. Merrill W. Pollard of the National Safety Council staff, who spoke on the reorganization of the industrial services activities of the Council in order to best serve the needs of the membership. Mr. Pollard emphasized the need for interesting top management in industries in safety promotional work. He pointed out the need for wide dissemination of information on safety practices and for safety men to assist in this by writing up such material for publication. Member companies were urged to take an active part in Council activities.

Mr. L. W. Dutton, Marine Section staff representative spoke briefly on the National Safety Council's campaign to increase the use of automobile seat belts and solicited the cooperation of the Marine Section. He also referred to the recently issued brochure on industrial safety services and to the Council's publicity activities.

Reports of committees and groups were made as printed below.

Staff representative, Mr. L. W. Dutton, reported on a number of matters currently

under development by the National Safety Council of concern to the Marine Section. He noted the excellent work done by outgoing general chairman, Richard W. Berry during his term of office. The work of the industrial conference was described. While each section seems to feel it has problems and interests differing from the others, in the final analysis, there are much greater similarities than differences. Mr. Dutton spoke briefly on the proposed activities manual for the Marine Section. After noting the importance of the safety discussion groups now operating, he proposed that an additional group be formed on the West Coast. The section was advised that the Marine Section now has two representatives on the American Standards Association Committee responsible for 210 code matters. An attempt will be made to have the code modified to take into account that Marine accidents are counted on a 24-hour-a-day basis, while credit is given toward exposure for 8 hours only.

General chairman Richard W. Berry reported on the activities of the Marine Section during his term of office. At the conclusion of his report, he paid tribute to Mr. Harold M. Wick for his many years of untiring service to the Marine Section. He was directed by unanimous vote of the members present to write to the American Bureau of Shipping expressing the appreciation of the Marine Section for the bureau's

generosity in making it possible for Mr. Wick to devote much time and effort to the Sections' affairs.

The report of the nominating committee, Mr. Robert E. O'Brien, chairman, was received and the committee discharged with thanks. After minor amendments, the secretary was directed to cast one ballot for the revised slate.

The new general chairman, Mr. W. Lyle Bull, and vice general chairman, Capt. R. E. Mackey, were then introduced and expressed their appreciation to the membership for their confidence. Mr. Bull invited the members to a reception to be held in the Century Room of the La Salle Hotel at 6:00 p.m. that evening.

Presentation of Special Awards was made by Capt. Hewlett R. Bishop, Atlantic Coast Director, U. S. Maritime Administration. In preliminary remarks, Capt. Bishop endorsed the National Safety Council's campaign to encourage the use of automobile seat belts, noting that statistics showed that 73 per cent of all auto fatalities occurred within 30 miles of the victims' home, and at speeds of less than 30 miles per hour.

Special awards to authors of the best papers read during the past year in the different categories were made as follows:

Shipbuilding: Mr. Douglas Mansell (Award accepted by Mr. W. D. Brown)

Cargo and Passenger: Capt. Barrett (Award accepted by Mr. R. E. O'Brien).

Inland Waterways: Mr. John Kern (Award accepted by Mr. Bowden).

Stevedoring: Mr. Alex Chopin (Award accepted by Capt. Buxton).

Tankers: Capt. R. E. Mackey.

Special awards were made to the following for their work in preparation of the film "Fire Fighting Aboard Tankers": Mr. James Hughes, Mr. Charles A. Culver, Mr. Wallace M. Gage.

In connection with the latter awards and in recognition of the needs of the Marine Industry for safety training films, the following committee was appointed by the general chairman to study the matter: Mr. Charles A. Culver, Mr. James Hughes, Capt. Coe, Mr. Warren D. Lindsay.

Presentation of a testimonial in the form of a plaque and a set of book ends was made to retiring general chairman, R. W. Berry by Harold M. Wick on behalf of the Marine Section, in appreciation of the outstanding service rendered by Mr. Berry during his term of office.

Mr. Wick was presented with a testimonial certificate in recognition of his many years of service as a member of the Marine Section executive committee and for the excellent work he has done as program chairman.

REPORT OF MST'S SAFETY ACTIVITIES

By VICE ADM. ROY A. GANO

USN, Commander, Military Sea Transportation Service, Washington, D.C.

This past year has been one of increased world tension with a corresponding demand upon MST'S. At the same time, our activity in the field of special projects has increased. Both situations have created some different safety problems for us requiring much of our attention. Nevertheless, there are a few items from our overall operations which can be reported on as being of general interest to the Marine Section.

Some years ago, MST'S developed standard station bills for each of the types of ships operated. The advantage of this uniformity is obvious. An MST'S seaman

on transfer from one ship to another or from one command to another and find the same emergency procedures in effect.

This year we revised and updated our station bills. The primary change of interest here is the standardization of optional internal ship emergency signals. The Coast Guard has designated basic signals for fire, abandon ship, handling boats and dismissal from drills but authorizes masters to establish such other emergency signals as they may consider necessary. We found that these signals varied widely from ship to ship. Accordingly, we have standardized certain signals within MST'S.

a. For *Man Overboard*, we use three long rings, the letter "O", on the general alarm bells.

b. For *ABC Defense*, we follow the general alarm signal with short and long rings, the letter "A", on the alarm bells.

c. For directing the emergency boat, when there are no other ships in the vicinity, we use one blast to turn to starboard, two to turn to port, three for dead ahead, four to head towards the ship and five for stand off—we are maneuvering.

d. For *Steering Casualty*, we use a long and two short rings on the general alarm bells, the international signal for "keep clear of me—I am maneuvering with difficulty."

As you can see we have tied these in with existing signals where possible. We feel

these additional signals give all hands prompt notice of an existing emergency and that they have helped improve and standardize shipboard organization and readiness to cope with emergencies at sea.

2. At the present time we are in the process of training our officer personnel in external cardiac massage as a first aid technique to be used in combination with mouth-to-mouth respiration.

3. As a final item, I want to say that we were pleased that the National Safety Council's "Industrial Supervisor" reprinted an article entitled "Remember the Human Factor" written by one of our masters. This article first appeared in the Navy's *Safety Review* and was reprinted in the May issue of *Industrial Supervisor*.

REPORT OF MARITIME ADMINISTRATION SAFETY ACTIVITIES

By CAPT. M. I. GOODMAN

Acting Chief, Officer of Ship Operations, Maritime Administration, Washington, D.C.

As reported last year, throughout the past several years ship operations under General Agency Agreement have remained at a low level and the Maritime Administration has only four GAA ships in operation. There has been little activity, therefore, in our ship operating safety program. There are several other administration activities that are closely related to the safety of ships at sea and these will be the subject of this report—the improvement of ships' operational and navigational equipment through research and development, and the incorporation of improved design and equipment specifications in new ship construction.

Research and development relating to public safety in prevention of collisions at sea which have been completed, are in progress, or under negotiation under the Maritime Administration research and development program are as follows:

Human Factors in Ship Navigation—An investigation in man-machine relationship of ship control, to measure casualties of ship collisions, degrees of human problem awareness and reaction to danger, equipment layout and limitations in assisting or detracting

from human decision making and initiation of action.

Study of Collisions—A study of ship collisions for a sample period to determine the distance that first detection of the ship were made using radar, sighting, and sound related to the sizes of vessels.

Experimental Radar Data Computer—The design and development of an experimental prototype computer system utilizing radar information capable of automatically or manually detecting and tracking ten ships movements, projecting their half hour estimated future position, warning of cautionary and danger situations, and indicating safe turn or speed to avoid collisions.

Steering Control and Course Computer—A design and mathematical investigation of means of improving automatic steering of ships, development of ships route, and recording of present position.

Bridge Control Systems Console—The design, mathematical investigation, and prototype development of an integrated bridge console with the objectives of improving gyro steering in rough weather, continuously

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determining ships stability condition and best loading, improving communication and radar for collision avoidance and narrow channel operation, use of weather routing in optimum course determination, and improvement of ships navigational aids.

Controllable Pitch Propeller—(under negotiation) The development of a 20,000 shaft horsepower controllable pitch propeller capable of permitting more rapid reverse thrust in stopping a ship.

Study of Merchant Ship Automation—A study of feasible systems of ship automation particularly for routine monitoring and tasks where inattention and deviation could contribute to equipment casualties.

Ship Maneuvering and Control—Investigation and model tank tests to develop design data for improved maneuvering and control responses of ships.

Ship Seakeeping Tests—Instrumentation tests and analyses of ship responses in bad weather to improve design of ships operation under adverse conditions.

In addition to the improvements under

study and developments in the field of research, plans and specifications for new ship construction incorporate new and improved features which have been fully tested and accepted. These features not only provide more economical ship operations, but greater safety.

They include the use of self tapping metal screws in floor plates, gratings and flat plate with abrasive overlay for engineering spaces which has proven safer for personnel with less cost. This is in lieu of the old raised diamond plate that was used for floor plates.

Another example is the use of lightweight reinforced plastic foam filled rectifier doors which also has proved safer for personnel, and is just as economical.

Under consideration is the use of a non-acid electrolyte for batteries. Tests are being made of Blue Dye aqueous cobalt sulphate electrolyte; so far it has proven to be safer for personnel in that it is less toxic and it allows for greater life for the batteries.

REPORT OF PASSENGER AND CARGO SERVICES

By SYDNEY BLACKLEDGE

Vice Pres., American Export Lines, Inc., Hoboken, N. J.

During the year the members of the Passenger and Cargo Services continued to be represented at meetings called by the chairman of cargo discussion group. In addition to these meeting our members also attend joint meetings with the tanker group.

We continue to recommend that safety programs be maintained and strongly en-

dorsed by ship operators in order to control accident rates among passengers and crews aboard American vessels.

With a view to avoiding repetition I close my report at this time and submit that the particulars of the various meetings will be aptly covered in the individual reports given by the respective chairmen of the concerned discussion groups.

REPORT OF AWARDS COMMITTEE

By CAPT. R. E. MACKEY

Asst. Mgr., Operations Div., Marine Dept., Texaco, Inc., New York City

On Wednesday, August 23, 1961, the awards committee of the National Safety Council met in the New York Office of Texaco. The committee came to the meeting after having studied all of the presentations at the New York and Chicago safety conventions, and the following decisions were made as to which papers were to receive an

award:

Shipbuilding and Repairing, Douglas Mansell, Bethlehem Steel Co.: "A Practical Safety Program for a Shipyard".

Inland Waterways, John Kern, Southern Industries Corp.: "On Deck Safety".

Passenger and Cargo Ship, E. G. Barrett, Moore-McCormack Lines, Inc.: "Safety On

Board Cargo & Passenger Liners".

Tankers, R. E. Mackey, Texaco Inc.

Stevedoring, A. Chopin, New York Ship-ping Association.

Government, None.

Over my protests, the other two members of the awards committee voted that my paper be given an award, and when you

take into consideration all those in the marine department of Texaco who put work and effort into it, the award would be accepted by me for them and not for me personally.

I would like to extend my sincere thanks to Capt. Renahan and Mr. Dempsey for their hard work in the selection of these awards.

REPORT OF TANKER SAFETY DISCUSSION GROUP

By JOHN R. WOLFE

Safety Dir., Military Sea Transportation Service, Washington, D. C.

A comprehensive program was carried out by the tanker safety discussion group during the past year. Discussion subjects, topics and activities which occurred are as follows:

September 1960

Organization and program planning meeting.

Election of chairman.

October 1960

"Safety and Fire Training for Foreign Flag Vessels" was discussed by Frank Konchalski, Esso Tankers and J. F. Acker, Jr., MSTS.

November 1960

Review of tanker paper, "Who's Setting the Course?" which was presented in Chicago by Captain R. E. Mackey, Assistant Manager, Operations, Marine Department, Texaco, Inc. Captain Mackey discussed his paper with us and, with Messrs. R. A. White and B. K. Stephens, explained the Texaco safety program in greater detail.

14 persons attended.

December 1960

We received a "snow job" from the weather man. Our scheduled speaker and many of our regular members were unable to attend.

February 1961

Annual U. S. Coast Guard session for discussion of marine casualties, Captain J. D. Craik, USCG and Captain F. K. Arzt, USCG, discussion leaders.

13 persons attended.

March 1961

"In-port Organization for Shipboard Fires" was discussed by a panel consisting of Mr. Charles A. Culver, The Atlantic Refining Co.; Mr. Vernon B. Johnson, Bureau of Ships, Navy Dept.; and Mr. William B. Marx, International Assn. of Fire Chiefs.

22 persons attended.

April 1961

Meeting cancelled due to conflict with the spring meeting of the Marine Section.

May 1961

Mr. Charles L. Boyle, Mgr., Marine Dept., Sun Oil Co., discussed, "Handling of Kerosene-Type Products."

25 persons attended.

Joint meetings with the dry cargo group were held in January and June. These will be reported on by Captain Smith.

The movie "Firefighting on Tank Vessels" which was produced by the U. S. Coast Guard assisted by a liaison committee from the Tanker Group was made available to the industry this year.

On September 13, 1961 the program for the coming year was planned at an organizing meeting held in New York. Captain G. P. Hersom, Marine Dept., Sinclair Refining Co., was elected chairman. The group decided to have a vice chairman to concentrate on improving attendance at monthly meetings. Mr. R. B. Davidson, Sun Oil Co., was elected as the first vice chairman.

Last evening the tanker group held an informal get-together and dinner meeting at George Diamond's. We hope to make this an annual feature of the National Safety Congress for members of the tanker group.

REPORT OF CARGO SHIP SAFETY DISCUSSION GROUP

By RICHARD N. LEPAGEE
Safety Dir., Farrell Lines, New York City

The cargo ship safety discussion group met at the Maritime Exchange in New York once each month throughout the period from September, 1960, through June, 1961. Two of these meetings were held jointly with the tanker safety discussion group, as reported by Captain Smith.

At the commencement of the 1960/61 year, attendance by representatives of Marine Section member organizations was at a less than satisfactory level to obtain the greatest possible value from the meetings. Gradual improvement in meeting attendance has been realized throughout the year, as a result of providing adequate notification of meetings and interesting topics of discussion. Notices of scheduled meetings were mailed to the full address list following the organization meeting in September, 1960. Approximately one week prior to each scheduled meeting, a "notice of meeting" advising the principal topic and/or speakers was sent out; so that, in addition to the safety representative of the various member organizations, other operating personnel interested in the subject could arrange to attend. Further, regardless of whether or not an organization was represented at the meeting, a resume of each meeting was mailed to the full address list for their files.

Some improvement in regular attendance was realized, which resulted in lively and interesting discussions of the various topics covered during the year. Frequently, the group was addressed by persons eminently qualified to advise on specific topics under discussion. Some topics that highlighted the meetings of the past year were: comparison of qualities of synthetic lines to the basic manila; reflective materials and shipboard uses; duties of a master to sick or injured seamen; discussion of material, size and proper method of applying T/L chain stoppers. This latter subject was extremely

interesting as considerable research by several group members established that this information was not readily available to the marine industry.

Following the two-month summer recess, the cargo ship safety discussion group held its annual organization meeting on September 14, 1961. At this time, the undersigned was re-elected chairman for the 1961-62 year. The members present approved the suggestion that a Vice-Chairman be appointed to assist in the attendance drive and conduct the business of the group during an absence of the chairman due to business or other reasons. Mr. R. W. Snow was unanimously named vice-chairman for the coming year.

We were pleased to have Mr. L. Dutton present during our meeting of October 2, 1961, and look forward to his attendance any time his visits to New York coincide with a scheduled meeting.

The agenda for the coming year has been sent to all member organizations. We are sure that the topics for discussion will result in a very interesting series of meetings.

It has been noted that an organization situated in the Port of New York, which is very active in Marine Section activities has not been represented at any meeting of the cargo ship safety discussion group throughout the past year. It is well understood that full attendance enhances the value and scope of the discussions of this group. Accordingly, it is respectfully requested that the general chairmen of the Marine Section urge that principals of the member organizations assure regular attendance by a representative of their organization at the 1961-62 meetings of the cargo ship safety discussion group.

As a final note, I would like to express my appreciation for the opportunity to serve the Marine Section last year, and again during the forthcoming year.

REPORT OF JOINT CARGO AND TANKER SAFETY DISCUSSION GROUPS

By CAPT. ROBERT H. SMITH
Mgr., Safety Dept., United States P & I Agency, New York City

During the past season, regular monthly meetings of the cargo and tanker safety discussion groups were held and individual reports have been submitted by their respective chairmen.

Two joint meetings were held. On January 11, 1961, Mr. Henry Lamb of the American Standards Assn. discussed the Smith serious injury index before the group. On June 14, 1961, the tanker fire fighting film was previewed and the possibility of producing a similar film for specific cargo ship use was discussed. Every one of the cargo operator's representatives present was of the opinion that this should be done and

that a good part of the present tanker fire fighting film could be used.

For the coming year there will be two joint meetings, one on January 10, 1962, at which we are hoping to secure a speaker from the Maritime Safety Foundation and the meeting of June 13, 1962, which at the present time has been left open.

The success of these meetings depends upon the attendance and participation of the person within each company who is assigned the safety responsibilities and we again urge that every effort be made to attend these meetings.

REPORT OF GREAT LAKES SAFETY DISCUSSION GROUP

By ROBERT E. KRATZERT
Vessel Personnel Mgr., Columbia Transportation Div., Oglebay, Norton & Co.
Cleveland, Ohio

The Great Lakes safety discussion group consists of representatives of steamship companies, towing companies, admiralty law firms, marine insurance brokers, Lake Carriers' Association, and the United States Coast Guard. It is concerned with the safety of 10,000 seamen on three hundred Great Lakes ships. Most of the participating companies are members of the National Safety Council and participate in the marine safety contest.

Monthly luncheon meetings, held on the first Tuesday of each month, were very well attended this year. Attendance was between twenty and twenty-five persons at each meeting, and was not restricted to members of the National Safety Council. We have invited anybody in the marine industry who is interested in safety to attend the meetings.

A brief run-down of the agenda for each monthly meeting follows:

December—The program for the coming year was discussed. J. W. Manning of The

M. A. Hanna Company was elected Chairman for 1961.

January—Each company presented a report on the manner in which shipboard safety measures are used in their fleet.

February—A discussion on methods of communicating safety messages between company office and ship. This covered magazines, newsletters, bulletins, awards, etc.

March—A discussion on disciplinary action taken aboard ship as a measure of safety.

April—Coast Guard Day. Introduction of Captain James McIntosh, newly appointed chief, Merchant Marine safety division for the Ninth Coast Guard district. Discussion on cooperation between industry and Coast Guard.

May—Discussion of certain lost-time accidents—their cause, prevention and claims involved.

June—A new film, "That They May Live", describing in detail the mouth to mouth method of resuscitation, was shown. An excellent film. This group highly recommends its widespread distribution.

July—Discussion on lost-time accidents—a statistical review and classification on Interlake Steamship Co. ships presented by Dick Weckel.

August—A discussion on *Safe Sailing*, the revised edition of the Lake Carriers' Association manual for prevention of ship-

board accidents. A reminder that copies are available for distribution.

September—A number of dock superintendents were guests to discuss safety on and around the docks as pertains to seamen.

October—A film, "Firefighting Aboard Tankers", was shown through the courtesy of the Coast Guard. A discussion on firefighting followed.

No new members were recruited for the National Safety Council or the safety contest. However, all concerned felt the meeting this year accomplished a great deal.

REPORT OF SAFETY INFORMATION AND POSTER COMMITTEE

By CAPT. MILTON BREECE

Mgr., Port of New York Office, Esso Standard Div. of Humble Oil & Refining Co., New York City

The safety poster material developed by this committee at its meeting held in New York on August 3, 1960, was approved by the general chairman and submitted, during the early part of this year, to the Council with the request that every effort be made to make available to the Marine Section new safety posters geared to our particular industry. We are advised by Mr. L. W. Dutton that three new posters with a maritime theme are now being processed with three more scheduled for processing in the next few months. These posters will be reproduced in miniature as they become available and appear in the *National Safety News* and *Marine Section News Letter*.

No further business has been conducted by the poster committee this year to date because the back-log of suggested poster material, submitted by the committee during previous years, appears more than adequate to cover the section's existing quota.

The safety poster committee will meet in the near future to develop additional material and ideas for subsequent poster series. In this regard, the committee invites and would welcome any suggestions from the members. It is planned, also at this meeting, to review the poster ideas previously submitted, but not yet processed for production, and, if deemed necessary, to up-date and/or modify the material to meet new requirements.

The worth of having safety posters available that relate directly to living and working on board ships is surely recognized by members of the Marine Section. We, therefore, appeal not only to the members of this section, but to all of the marine industry to actively support this program and to evidence this support through purchase and display of all available safety posters developed by the Marine Sections Committee.

REPORT OF MARINE SECTION NEWSLETTER

By MR. WARREN D. LINDSAY

Dir. of Safety, United States Lines, New York City

The Marine Section published 10 monthly issues of the *Newsletter* and the eleventh issue is now at Council headquarters for printing. The December issue is edited by the National Safety Council for all sections.

The editor wishes to thank all of those companies who regularly submit their safety publications which furnish the bulk of the material for the *Newsletter* as well as the United States Coast Guard for their "Proceedings of the Merchant Marine Council" and M.S.T.S. for their magazine *Sealift*.

Any member company which publishes a safety periodical or house organ is requested to send a copy to the editor of the *Marine Section Newsletter* so that their safety experiences, problems and solutions may be passed on to other members thru this medium.

I wish to acknowledge the great help of Wally Gage, your assistant editor and a special acknowledgment to Harold Wick for his many contributions to the *Newsletter*.

REPORT OF INLAND WATERWAYS COMMITTEE

By F. A. MECHLING

Vice Pres., A. L. Mechling Barge Lines, Joliet, Ind.

Safety activities in the inland waterways industry during the past year centered about the continued activities of two working groups.

The American Waterways Operators, Inc., produced and distributed upwards of 1,500 safety posters to the industry each month, and in cooperation with the National Safety Council, once again sponsored the barge and towing vessel industry safety contest. Awards for the top winners in the safety contest were presented at a luncheon in New York last May. The association continues to cooperate with other groups engaged in promoting safety throughout the industry.

The Inland Waterways Safety and Health Association, composed of a group of inland water carriers, marine insurance underwriters, labor union executives and representatives from the U. S. Coast Guard and U. S. Army Corps of Engineers, expanded their very successful program of activities from the previous year. Through the efforts of this group, the U. S. Public Health Service established an out-patient clinic for the treatment of seamen at Joliet, Illinois. The group developed and distributed to the industry a directory of all U. S. Public Health Service hospitals, clinics and doctors.

Their very excellent safety poster program was continued and expanded during the past year, as was the publication *Towboat Tips* for distribution to boat personnel.

The association has several working committees, one of which is presently engaged in developing data on the handling of dangerous cargoes, principally chemicals and petrochemicals, the carriage of which is becoming so prevalent on the inland waterways.

Another committee of the association is developing a safety contest for boat personnel, while a recently-formed committee is working to develop standards of safety in towboat and barge construction.

In other activities, the group once again developed and published personnel injury statistics, and is now planning to produce its second film, this one devoted entirely to the *Handling of Rigging*.

Other committees of the association are working on developing a standardized Station Bill for use in towboats; specifications for life vests for use by deckhands and ship repairmen to be Coast Guard approved; and, improvement in the design of towboat ratchets.

In an effort to expand its sphere of

activities, the Inland Waterways Safety and Health Association, at its regular bi-monthly meeting earlier this week, appointed a committee to explore the possibility of forming a southern division of the association to bring together marine operators

along the Gulf Coast into a common safety activity.

An inland waterways session will be held as a part of the forthcoming Louisiana safety conference which will be held in New Orleans, December 11, 1961.

REPORT OF GULF AREA

By ROBERT RADER

Vice Pres., Lykes Bros. S. S. Co., New Orleans, La.

During the past year, the marine and stevedoring industry in the gulf area has displayed a far greater concern in the promotion of accident prevention than in prior years. This additional interest can be credited to many factors. Management and labor has learned that a safe operation is an efficient operation and the returns in reduced human suffering and increased productivity outweigh the time and effort expended to advance safety on all fronts.

Sponsorship of educational activities has progressed in the Gulf Region—

The U. S. Coast Guard Auxiliaries, Power Squadrons, private yachting associations, state and municipal commissions; in addition to the many private clubs in the area; have concentrated upon educating the boating public in the safe and proper manner of operating small pleasure craft. These educational functions become more important each year, due to the tremendous increase in recreational boating activities in the gulf states.

The U. S. Maritime Administration, and MSTSS has conducted the atomic, biological and chemical defense school. This facility, in addition to the radar observer's training school, continues to train Merchant Marine personnel in the area.

The Bureau of Labor Standards has presented safety courses in the principal gulf ports dealing with longshore work hazards. A large number of stevedoring supervisory personnel have completed these courses, thereby attaining a better understanding of the safety problems confronting the industry.

Technical schools, colleges and universities in the gulf states, continue to include accident prevention courses as part of their evening classes.

Several stevedoring companies throughout the area have adopted the policy of conducting safety lectures at shipside, during stand-by time or when work has stopped temporarily due to late arrivals, rain or breakdowns. This method of teaching the man on the job has gained popularity because of the obvious advantages in alerting the workers themselves to the hazards of their occupation.

These excellent educational media serve the public interest by emphasizing the dangers encountered on our waterfronts while extending specialized training to those persons who are responsible for protecting their employees from bodily harm.

There has been innumerable advancement of safety movements in the individual ports along the gulf coast. A few of the more noteworthy are—

Brownsville, Texas—Responsible parties at this port have intensified the promotion of safety activities to a fine degree. Shipping and stevedoring interests have responded with whole-hearted participation.

Corpus Christi, Texas—The Navigation District and various oil companies at this port have organized a special fire fighting unit to combat liquid fires around the harbor area.

The Sabine Area, Beaumont, Port Arthur and Orange, Texas—These ports, as always, have continued their very active participation in safety promotion. The enthusiastic support from the oil companies, marine interest and stevedores residing in the area, has gained national prominence by their improved records.

Lake Charles, La.—This port has concentrated on a local comprehensive educational program directed to the men on the job. The success of this campaign is reflected in

a steadily decreasing insurance rate and reduction of accidents in the stevedoring industry.

Houston, Texas—This port has made great strides in accident prevention, primarily due to the concerted efforts of various organizations devoted to marine safety. The port advisory committee, and the marine safety steering committee, composed of members from warehouse terminal, dock board, stevedore, steamship and towing companies, bring their combined efforts together to improve port conditions and safety factors for the betterment of all persons engaged in the marine industry.

Lubbock, Texas—The marine safety council of this port has made vast progress in the promotion of waterfront safety and has received area-wide attention during the stevedoring safety month of March, 1961. Regularly scheduled monthly meetings at this port, attended by union officials, Dept. of Labor consultants, stevedores and insurance company engineers have led to an impressive improvement in the safety record.

New Orleans, La.—This port has progressed greatly in safety promotion during the past year. The marine section of the delta safety society and the marine section, metropolitan New Orleans safety council, continued their furtherance of accident prevention into all phases of the marine industry. These organizations participate vigorously in the Louisiana safety conference, held in December of each year, which attracts important industrial leaders from all parts of the country.

Mobile, Alabama—The port authority of Mobile has become the first on the gulf coast to install a VHF-FM intraport radio-telephone system to facilitate the safe movement of ships in the harbor area. Pilots in this vicinity will be provided with portable units for direct communication with interested parties to insure better control of ship traffic.

Tampa, Florida—As the hub of a rapidly expanding section of the gulf coast, this port displays an increasing awareness of the need for safety in every phase of its waterfront activities. Shipyards, terminals, stevedores and other marine interests, in addition to city and county authorities, have separately and collectively adopted progressive programs of accident prevention which has checked the accident growth in the area. Because of the zeal exhibited by the civic and industrial leaders of the Tampa area, this port has taken an important place in the field of safety.

It is apparent that safety awareness has become an integral part of the everyday port activities in the gulf region. This trend is evidenced on the federal, state, municipal and port authority levels by the visual safety improvements in wharf areas and port facilities. The intensification of safety meetings and discussions, in an effort to introduce safety factors into every endeavor, where the possibility of accidents exist, is a credit to the industry. Considerable advancement was achieved during 1961 and even better results are expected in the coming year.

REPORT OF GREAT LAKES AREA

By DAVID L. BUCHANAN

Dir., Claims Div., Pittsburgh S. S. Div., U. S. Steel Corp., Cleveland, Ohio

Members of the Marine Section, National Safety Council have been active in promoting marine safety. The group has worked closely with the Lake Carriers' Association in the preparation of a new booklet entitled, *Safe Sailing*, which is a manual for the prevention of accidents aboard Great Lakes ships. This booklet is very attractive, with illustrations and cartoons, and it is believed

will be an excellent aid in promoting marine safety.

The monthly meetings of the Great Lakes discussion group have been informative, interesting, and well attended. In addition to discussing physical conditions, much attention has been devoted to personnel indoctrination and procedures in promoting safety consciousness among crew members.

The shipbuilding companies on the Great

Lakes have been active in marine safety activities and all of them have representatives at the 1961 Marine Section, National Safety Council.

There is keen interest in the Marine Sec-

tion safety contest by Great Lakes vessels, in which there are 13 fleets participating. Representatives of the U. S. Coast Guard have been active in the furtherance of marine safety in the Great Lakes area.

REPORT OF PROGRAM COMMITTEE

By HAROLD M. WICK
Asst. Vice Pres., American Bureau of Shipping, New York City

Your program committee is pleased to report that once again, as in the last three years, we have found it necessary to expand the number of sessions conducted at our annual meetings. This year we welcome the new session on shipbuilding and ship repairing which has been reactivated after a lapse of some ten years. However, this will not affect the similar session which has always been a very popular feature at our spring meetings in New York. We indeed hope it will be feasible to conduct a shipbuilding and ship repairing session at future annual meetings.

The addition of this new session has forced us into a situation whereby we had to conduct simultaneous sessions for two segments of the Marine Section, as no other time could be provided for us by the National Safety Council. Therefore, we had to schedule the inland waterways session and the shipbuilding session for the same time on Monday afternoon, October 16. This is a rather awkward situation for those of us who are interested in both of these sessions. Whether anything can be done about this for next year's session is a question.

The other new additions in the last four years have been the stevedoring session and an inland waterways session. Of course, a stevedoring session is also held at the spring meetings.

Before proceeding any further with this report, the program committee wishes to express its appreciation for the fine cooperation extended by our retiring general chairman, Richard W. Berry. Great assistance was also received from Mr. John G. Canerott, of the American Waterways Operators in lining up the inland waterways program. As usual, David L. Buchanan

provided the Great Lakes participation in our program once again, and Robert P. Robert was instrumental in reviving the shipbuilding session.

We would like to call to the attention of the members the list of organizations participating in our annual meeting as shown on the cover of our leaflet program. I think all will agree this is an impressive list. While talking about the printed pamphlet program, we would like to call your attention to the fact that 3,000 copies were printed for us by the Marine Office of America. More than 2,200 of these copies were mailed out by the participating organizations mentioned. Marsh and McLennan paid for printing 3,000 copies of the Spring Meeting program.

A total of 19 speakers and 15 presiding chairmen were secured by the program committee for the current annual meeting, divided into seven sessions. Individual written instructions were issued to each man. In addition, the annual business meeting was scheduled. A joint luncheon with the Propeller Club, Port of Chicago, was arranged as usual, and Vice Admiral Roy A. Gano, Commander, Military Sea Transportation Service secured as the principal speaker.

A business meeting and luncheon of the executive committee and the members was arranged by the program committee during the past year. This was held in New York at the Downtown Athletic Club on February 20, 1961. It was particularly well attended, with members coming in from the Great Lakes and the gulf region. Presiding over the meeting was general chairman Richard W. Berry. Interesting reports were received from various committee heads. Wally Gage of Soccony Mobil Oil Co. acted as secretary

The annual spring meeting was arranged by the program committee, this being a two-day session in New York and held, as usual, in conjunction with the Greater New York safety council annual convention and exposition. This was held at the Statler Hotel, April 12 and 13. The committee secured nine speakers and the services of three session arrangers and nine presiding chairmen. There were three sessions, these being the annual shipbuilding and repair yard session; a ship operator's session, and a stevedoring session. A joint luncheon was arranged with the Propeller Club, Port of New York, at the Waldorf-Astoria Hotel at which Vice Admiral James A. Hirschfeld, Assistant Commandant, U. S. Coast Guard, was the principal speaker.

The committee wishes to express appreciation to the staff of the National Safety Council at Chicago, in particular to Mr. L. W. Dutton for the considerable assistance rendered in arranging with the LaSalle Hotel for the details of our luncheon with the Propeller Club, Port of Chicago.

The committee also wishes to express appreciation to various maritime organizations for assistance rendered in distributing copies of the spring meeting program and the annual meeting program. These were the American Merchant Marine Institute, the Lake Carriers Association, the American Waterways Operators, The Shipbuilders Council of America, the New York Shipping Association, the Propeller Clubs, Port of Chicago and Port of New York, and the National Cargo Bureau.

I commend to . . . good graces the new chairman of the program committee, Mr. Robert P. Robert, of the Todd Shipyards Corp. He has had an excellent experience cooperating in the past in the work of the committee and I am most happy to turn over the reins to such a worthy successor. It has been my pleasure to serve the Marine Section for the past twenty years, the last fourteen as program chairman, and I extend to all my best wishes for continued success in the good work we have been accomplishing.

REPORT OF PUBLIC RELATIONS COMMITTEE

By FRANK BRAYNARD
Dir., Bureau of Information, American Merchant Marine Inst., New York City

With the cooperation of the ship safety achievement award committee and many others, the Marine Section's publicity efforts have continued to serve our industry by putting before the public the story of ship safety. Publicizing the various safety awards, frequently with top Coast Guard officers making the presentations, has kept a steady stream of news stories and pictures on the marine pages and in the marine journals, with an occasional breakthrough into the general news sections.

It is true that we are in a sense talking to ourselves with most of these events. When and if we as the marine section feel the need of reaching larger segments of the public, your committee will be happy to discuss a program and a budget.

We have continued to send out news releases to papers throughout the country about the March and October Marine Section meetings. We are also supplying individually written stories to the three New York newspapers about each day's events at the meetings.

Considerable publicity was won through the new Jones F. Devlin awards presented by the American Merchant Marine Institute entirely on its own and without the joint sponsorship of the Marine Section. Forty-three ships earned these citations for going two or four years without a lost-time accident. I am happy to be here this year under the houseflag of the White "M", having been asked by Admiral Moran to continue serving the Marine Section.

REPORT OF THE SHIP SAFETY ACHIEVEMENT AWARD COMMITTEE

By CAPT. JONES F. DEVLIN, JR.
Vice Pres., United States Lines, New York City

Only one ship safety achievement award proper was made this year for a safety achievement taking place during 1960. However, five citations of merit were presented. Our committee met several times and was distressed at the lack of entries submitted for consideration.

May 1 review by division the awards that were made:

Tanker Division. Winner . . . *Esso Belshiem*, Marine Division, Humble Oil & Refining Company, for rescuing five from a disabled craft under difficult circumstances May 10, 1960.

Award 3 citations of Merit. M. E. Lombardi, California Shipping Company, for saving the crew of the *Tiviana Maru*.

February 13, 1960; Sheldon Clark, Sinclair Refining Company, for rescuing two Air Force officers from ditched plane March 30, 1960.

Dry Cargo Division. Citations of merit awarded to: *President Van Buren*, American President Lines, for transferring ship's surgeon under difficult circumstances to aid ill passenger, June 5, 1960; *Pioneer Main*, American Pioneer Lines, for saving life on a swamped trawler under difficult circumstances, April 8, 1960; *American Clipper*, United States Lines, for searching under difficult circumstances for survivors of ditched plane December 22, 1960.

Passenger Division. No winner for 1960. No citations of merit.

REPORT OF STATISTICS AND CONTESTS COMMITTEE

By J. L. MORROW
Safety Dir., Grace Line, New York City

The method used to arrive at the published figures and a report made to the general chairman. He thereupon initiated a further investigation with the assistance of our staff representative, Les Dutton. The results were of general interest and will therefore be outlined.

It was noted first that the "marine transportation" accident rates are actually an average of several industries, namely: harbor equipment; river & other craft; stevedoring; and tanker and cargo vessels. The effect of this combining is shown in the published figures for 1960, which list Marine Transportation with a frequency of 20.61, fourth from the bottom in a listing of 42 major industries, and far above the all-industry average of 6.04. However, the detailed breakdown of marine transportation shows:

Harbor Equipment . . . 51.15
River & Other Craft . . . 10.91
Stevedoring . . . 14.50
Tanker and Cargo Vessels . . . 6.44

It is notable that the rate for tanker and cargo vessels, which in the public mind is synonymous with the category marine transportation, is only about 1/3 of that published as the industry figure, and in fact is almost exactly equal to the all-industry average. This pattern is the same for past years as for 1960, and both the general chairman and myself advised the Council through Mr. Dutton that we felt this to be open to misinterpretation and it should be changed.

While Mr. Dutton expressed agreement in principle with our request, as did Gene Miller of the Council's Statistics Division, they called our attention to difficulties that stand in the way of the revision we hope to obtain. They pointed out, first, that the lumping together of the four groups previously mentioned into a category labelled "marine transportation" was done largely because none of the four sub-groups was large enough to be representative, due to the small number of companies reporting, so that they could not be listed separately. In 1959, for example, the tanker and dry cargo sub-group consisted of nine companies, principally operators of cargo vessels on the Great Lakes, and including no ocean-going vessels.

It is our feeling that grouping together four admittedly unrepresentative figures and calling them "marine transportation" does not result in an accurate figure, since the four figures so grouped are practically unrelated. Further, as previously stated, the figure resulting is such as to misrepresent what is usually thought of as marine transportation; that is, ships.

Mr. Dutton felt that the situation could be resolved and ships listed separately in the published figures, if more ocean-going ship operators would report their figures to the Council. This, it developed, led to still another problem. The steamship figures for the Accident Rates and Accident Facts publications are calculated, not in the manner of our contest rules, but according to American Standards Association pamphlet Z16.1.

The big difference in the two methods is that under Z16.1, a steamship company is required to report all disabling injuries 24 hours a day, but manhours are limited to eight hours a day. For this reason, most companies have understandably declined to report data to the Council.

The Z16.1 rules are an all-industry standard, and are made up by a committee comprised of representatives from various industries. The marine industry has never been on this committee, but at Mr. Dutton's suggestion, Capt. Mackey and myself were recently appointed to represent the ASME on the committee. It will be our purpose to try to change the Z16.1 rule to eliminate the disadvantage mentioned previously. If this can be done to the satisfaction of our industry, it should be possible to get a greater number of steamship companies to report to the Council with the result that accurate accident rates can be published for our industry. If Capt. Mackey and I are not successful, then we shall probably have other recommendations to make to the Marine Section next year.

On the matter of the Marine Section contest, the general chairman and I have agreed that a change should be made in the definition of reportable injuries, in order that the question of delayed disabilities can be resolved. As presently written, the rules make an accident reportable only if the injured man is unable to stand his next watch or perform his next assigned duty. The proposed change would amend Rule 7(a) (2) approximately as follows:

"If it prevents a man from standing his next scheduled watch or assigned duty or if as a result of the accident and while still in the company's employ he is later unable to perform his duties."

This proposal was discussed at a joint meeting of the tanker and dry cargo discussion groups, and as a result of an objection made by a tanker company representative it was suggested that the words "while still in the company's employ" be changed to read "during the same voyage in which the injury occurred."

REPORT OF GENERAL CHAIRMAN

By RICHARD W. BERRY
Asst. Vice Pres., United Fruit Co., Boston, Mass.

I have the following to report at the close of my term as general chairman:

a. A program has been initiated under which a set of working rules is being prepared for the guidance of section officers in conducting the business of the section. It is hoped the plan will be ready for presentation at the winter, 1962, meeting.

b. The contest and awards committee has recommended a change in the definition of "lost-time accident" under the contest rules. This will be available for adoption at the winter, 1962, meeting. Favorable action is recommended.

c. Progress has been made toward resolving the problem of statistical distortion of marine industry figures in National Safety Council published records. The industry, through the American Merchant Marine Institute, has nominated two members to serve on the American Standards Association Z161 committee to help deal with the problem and full cooperation of the National Safety Council staff has been generously extended.

d. Increase in membership was pursued with somewhat disappointing results this year, although there was a net gain of one major company.

The year was generally successful insofar as section activities are concerned and the ever increasing response and enthusiasm at the spring and annual meetings as well

as at discussion group meetings is most gratifying.

The presentation of the National Safety Council award of merit to the U. S. Coast Guard for its publication "Proceedings of the Merchant Marine Council" is noted as being most highly deserved.

Most regrettably, the death of Mr. Carl Vander Clute is here recorded. Mr. Vander Clute, former General Chairman and a very active and valuable friend of the Marine Section for over twenty years passed away on June 1, 1961. His wisdom, wit and vitality will long be remembered by his host of friends.

At this session of the safety congress, Mr. Harold Wick has declined to stand for re-election as program chairman due to his intended retirement from the industry early next year. Mr. Robert P. Robert has been nominated in his stead. Mr. Wick has consented to continue as a member of the executive committee in the newly created post of administrative consultant, where his experience and advice will continue to be available to the section. On behalf of the membership here and now is recorded the heartfelt gratitude the section bears toward Mr. Wick for his selfless and unstinting efforts in its behalf for a period of over twenty years. His devotion is without doubt the greatest single factor in the successful conduct of the section affairs. The best wishes of each and every member go with him always.

REPORT OF THE SHIPBUILDING AND SHIP REPAIR COMMITTEE

By ROBERT P. ROBERT
Chief Safety Engr., Todd Shipyards Corp., New York City

Of principal interest to the industries concerned and to interested Marine Section members in allied fields is the reactivation of a session for shipbuilding and ship repair yards during the National Safety Congress in Chicago.

Initial plans for this session were discussed at a meeting of the executive committee members in October, 1960 and with continued interest on the part of these members an excellent program was completed.

The shipbuilding and ship repair committee arranged an interesting session for the spring meeting in New York and were gratified to see a large attendance as well as excellent advance publicity. Three fine, constructive papers were read and it should be noted that subsequent to this meeting extracts from these papers have appeared in quite a few trade publications.

With cooperation on the part of the Atlantic Shipyard Safety Exchange, short articles which had been written for the Marine Section's Newsletter were given to the editor for copy in the monthly newsletters.

During the year members from the executive committee assisted in redrafting the U. S. Department of Labor, Bureau of Labor Standards' preliminary draft on safety and health regulations for demolition.

The shipbuilding and ship repair committee has assumed an active role in fostering both interest and action to determine

procedures for dealing with the toxicity, flammability and explosive qualities of preservatives used in confined spaces. Included in this procedure is research on the development of a quick method for determining the three aforementioned qualities. It is hoped that this project will produce effective, definite conclusions.

The chairman wishes to extend thanks not only to members of the executive committee for their assistance, but also to other members of the Marine Section, for cooperation received during the year. We would be remiss if we did not extend our sincere thanks to Mr. Harold Wick for his many suggestions and the time he took to discuss matters with us.

In relinquishing the chairmanship, we would like to recommend to our successor, Mr. Dawson, that:

1. The shipbuilding and ship repair section be continued in Chicago.
2. The executive committee promote a drive for new members.
3. A procedure be developed to insure continuation of copy for the monthly Marine Section Newsletter.
4. Shipbuilding and ship repair yards on the West Coast be contacted and brought into the activities of the October Session.
5. Continued publicity be used to promote the sessions under the auspices of this committee.

OFFICERS OF THE

MARINE SECTION

NATIONAL SAFETY COUNCIL 1961-62

General Chairman—W. LAYE BULL, Exec. Vice Pres., American Export Lines, New York, N. Y.

Executive General Chairman—CAPT. R. E. MACKEY, Asst. Mgr., Operations Marine Dept., Texaco Inc., New York, N. Y.

Vice General Chairmen (Atlantic Area)—JOHN H. HANER, Asst. to Pres., Todd Shipyards Corp., New York, N. Y.; H. G. HOPWOOD, Vice Pres. and Operating Mgr., Grace Line, New York, N. Y.; CHARLES L. BOYLE, Mgr., Marine Dept., Sun Oil Co., Marcus Hook, Pa.; W. N. DAMONTE, Vice Pres. and Mgr., Marine Dept., Sinclair Refining Co., New York, N. Y.; C. I. MELLENDRECK, Marine Mgr., Eastern Div., Tidewater Oil Co., New York, N. Y.; J. V. C. MALCOLMSON, Vice Pres., Marine Dept., Texaco Inc., New York, N. Y.; DOUGLAS MAXWELL, Mgr., Brooklyn Yards, Bethlehem Steel Co., Shipbuilding Div., New York, N. Y.; ROBERT J. TARR, Exec. Vice Pres., Luckenbach S. S. Co., New York, N. Y.; PARKER WISE, Mgr., U. S. Operations, Marine Transp. Dept., Socony Mobil Oil Co., New York, N. Y.

Vice General Chairman (Gulf Area)—ROBERT RADEN, Vice Pres., Lykes Bros. S. S. Co., New Orleans, La.

Vice General Chairmen (Pacific Area)—LAWRENCE C. FORD (Chairman), Pres., California Shipping Co., San Francisco, Calif.; RANDOLPH SEVIER, Pres., Matson Navigation Co., San Francisco, Calif.; CAPT. T. C. CONWELL, Vice Pres., Operations, American President Lines, San Francisco, Calif.

Vice General Chairmen (Great Lakes Area)—DAVID L. BUCHANAN, Dir., Claims Div., Pittsburgh S. S. Div., U. S. Steel Corp., Cleveland, Ohio; JOHN L. HORTON, Asst. Mgr., Marine Dept., Cleveland Cliffs Iron Co., Cleveland, Ohio.

Vice General Chairmen (Inland Waterways)—Operations—F. A. MECHLING, Vice Pres., A. L. Mechling Barge Lines, Joliet, Ill.; Membership—WM. C. McNEAL, Vice Pres., Oil Transport Co., New Orleans, La.

Vice General Chairman (Shipbuilding)—HENRY Z. CARTER, Pres., Avondale Shipyards, Inc., New Orleans, La.

Vice General Chairman (Passenger and Cargo Services)—SABNEY BLACKLEDGE, Vice Pres., American Export Lines, New York, N. Y.

Vice General Chairmen (Tankers)—CAPT. WM. B. CHATFIELD, Keystone Shipping Co., Philadelphia, Pa.; CHARLES A. CULVER, Marine Safety Engr., The Atlantic Refining Co., Philadelphia, Pa.

Vice General Chairman (Coastal Regions and International Safety Conventions)—ADM. ALFRED C. RICHMOND, U. S. C. G., Commandant, U. S. Coast Guard, Washington, D. C.

Chairman, Nominating Committee—RICHARD W. BERRY, Asst. Vice Pres., United Fruit Co., Boston, Mass.

Secretary—WALLACE M. GAGE, Supvr., Operations Sec., Marine Transp. Dept., Socony Mobil Oil Co., New York, N. Y.

Advisory Committee (Past General Chairmen)—ROBERT E. O'BRIEN (Chairman), Vice Pres., Operations Moore-McCormack Lines, New York, N. Y.; RICHARD W. BERRY,

Asst. Vice Pres. United Fruit Co., Boston, Mass.; L. H. QUACKENBUSH, Vice Pres., States Marine Lines, New York, N. Y.; CAPT. JONES F. DEVLIN, JR., Vice Pres., United States Lines, New York, N. Y.; JOHN D. ROGERS, Gen. Mgr., Marine Dept., Humble Oil & Refining Co., Houston, Texas; HARRY X. KELLY, Mississippi Shipping Co. (Delta Lines), New Orleans, La.; JOHN G. PEW, JR., Vice Pres., Sun Shipbuilding & Drydock Co., Chester, Pa.; REAR ADM. GEORGE WAUCHOP, Exec. Vice Pres., Farrell Lines, New York, N. Y.; LEIGH R. SANFORD, Shipbuilders' Council of America, Pelham Manor, N. Y.; LOUIS B. PATE, Consultant Nat'l Cargo Bureau, San Francisco, Calif.; REAR ADM. ROBERT C. LEE (Chairman), Moore-McCormack Lines, New York, N. Y.; VICE ADM. EDWARD C. HOLDEN, JR., USNR, Ret., Dir. of Safety, Maritime Safety Foundation, New York, N. Y.

Administrative Consultant—HAROLD M. WICK, Asst. Vice Pres., American Bureau of Shipping, New York, N. Y.

Assistant General Chairman (Programs, Conventions)—ROBERT P. ROBERT, Chief Safety Engr., Todd Shipyards Corp., New York, N. Y.

Assistant General Chairman (Membership)—SYDNEY WINE, Asst. Gen. Mgr., Marine Div., Humble Oil & Refining Co., Houston, Texas

Director, Safety Information and Posters—CAPT. MILTON INFECT, Marine Dept., Humble Oil & Refining Co., Houston, Texas

Vice General Chairmen (Stevedoring)—ANDREW D. WARMICK, Pres., T. Hogg & Sons, Inc., New York, N. Y.; ROBERT P. ALDEN, Safety & Wage Adm., Castle & Cooke, Inc., Honolulu, Hawaii

Director, Public Relations—FRANK BRAYNARD, Dir., Public Relations, Moran Towing & Transp. Co., New York, N. Y.

Director, Maritime Associations—CARL E. McDOWELL, Exec. Vice Pres., Am. Inst. of Marine Underwriters, New York, N. Y.

Editor, Marine Newsletter—WARREN D. LINDBAY, Dir. of Safety, United States Lines, New York, N. Y.

REGIONAL ACTIVITIES

Assistants to Vice General Chairmen (Coastal Regions and International Conventions)—REAR ADM. EDWIN J. ROLAND, Commander, 3rd Coast Guard Dist., Custom House, New York, N. Y.; CAPT. A. H. MCCOMB, JR., U. S. C. G., Chief, International Maritime Safety Coordinating Staff, U. S. Coast Guard, Washington, D. C.

ASSISTANT CHAIRMEN

Atlantic Region—Tanker Operations—CAPT. WILLIAM G. ANDERSON, Mgr. of Operations, Marine Div., The Atlantic Refining Co., Philadelphia, Pa.; CAPT. WALTER MATSON, Mgr., Gulf-East Coast Operations, Soccony Mobil Oil Co., New York, N. Y.; H. S. BREWSTER, Dir. of Operations, Marine Dept., Gulf Oil Corp., New York, N. Y.

Gulf Region—Ships, Stevedoring—CAPT. J. B. RUCKER, Mgr., Accident Prev. Div., Lykes Bros. S. S. Co., New Orleans, La.; EARLE SMITH, Safety Dir., Waterman S. S. Corp., Mobile, Ala.; O. P. VILAKURUJA, Claim Agent & Safety Mgr., T. Smith & Son, Sec. Orleans, La.; E. R. SEANEN, Safety Dir., Mississippi Shipping Co. (Delta Lines), New Orleans, La.

Pacific Region—Ships, Stevedoring—J. ROBERT SKYDER, Dir., Accident Prevention Bureau, Pacific Maritime Assn., San Francisco, Calif.; L. O. COFFMAN, Safety Engr., Matson Navigation Co., San Francisco, Calif.

Great Lakes Region—Bulk Carriers—WM. ECKERT, Mgr., Safety Dept., Interlake S. S. Co., Cleveland, Ohio; L. C. MATIA, Vice Pres., The Wilson Marine Transit Co., Cleveland, Ohio; CAPT. J. MCINTOSH, Marine Inspection Officer, Cleveland, Ohio

Director, Inland Waterways, Operating and Shipbuilding—BRANTON B. CARR, Pres., The American Waterways Operators, Inc., Washington, D. C.

Assistant Directors, Inland Waterways—ROBERT L. GRAY, Mgr., River Operations, Ashland Oil & Refining Co., Ashland, Ky.; G. A. PETERKIN, JR., Pres., Dixie Carriers, Houston, Texas

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1961 National Safety Congress

NON-DESTRUCTIVE TESTING OF METALS

By D. P. WALSH

Mgr., Distributor & Representative Sales, Marketing & Development Dept.
Magnaflux Corp., Chicago

The purpose of non-destructive testing is to provide decision-making facts. With these facts you make judgments and take appropriate action. In your case the decision is also based on considerations of safety and plant productivity.

In this discussion, we are concerned with minimizing injuries to personnel and loss of production by detecting fatigue cracks in parts or equipment—before a breakdown and/or accident occurs. Metal does not crystallize and break suddenly. This fact has been proven by the National Bureau of Standards. Actually, a fatigue crack initiates in a highly stressed area and grows gradually.

In a shaft that broke on the job, the fatigue crack started at the top and gradually grew in size. Flexing caused a second crack to initiate at the bottom of the shaft. Both grew in size until the remaining sound metal could not bear the load. Then the shaft broke suddenly. This condition could have been detected at any stage of the growth period. It should have been detected while servicing, repairing, or overhauling the equipment. The breakdown could have been averted.

Experience has taught us that "visual observation, even with magnification cannot readily locate all small, tight-lipped cracks. Various non-destructive methods of testing will reveal all such defects positively." (N.S.C. Data Sheet #448). This discussion will confine itself to magnetic particle inspection methods which are relatively simple in operation and are in extensive use.

A bar magnet attracts magnetic particles because of magnetic leakage from its north pole through the air to its south pole. Break it in three and there are three complete magnets, each with a north and a south pole. Reassemble it with north pole of one touching the south pole of the other, sprinkle on magnetic particles, and the particles are attracted and held by the magnetic leakage from a north pole to a south pole. In other words, the magnetic

field crosses the break and the particles are attracted. Similarly, in magnetic particle testing, a magnetic field is made to cross the crack. Particles are applied, and are attracted and held right on the crack itself.

A dense abrupt leakage field is caused by a crack. The particle buildup is dense, or closely packed, and has height. A less dense, flatter leakage pattern is caused by a sub-surface defect. The particle pattern will be less dense, relatively flat, and broader.

Crack detection involves the use of a small seven-pound yoke kit powered by 115-volt A.C. or a 12-volt battery. It is energized, the magnetic field crosses the crack, as particles are applied lightly. They instantly mark the crack, and its true extent right on the part itself, even though the crack be filled with contaminants. Because of the speed of inspection and low cost of expendables, this yoke and a companion coil are used fairly extensively in maintenance programs.

One of the important functions of inspection is to point up the true extent and direction of cracks. Another is to be sure that cracks are completely removed by salvage methods, or before repair, as by welding. A third is to determine that the salvage or repair method is in itself satisfactory.

Because there are two principal reasons for using non-destructive testing methods, namely personal safety and economy, their use has grown rapidly. The value of safe practices cannot be over-emphasized or indexed in dollars. The value of time wasted on defective raw material, time and material wasted by unsatisfactory processes, or lost production due to equipment breakdown are somewhat more tangible. The result is that non-destructive testing methods are used in practically all industries. A few examples of magnetic particle inspection in maintenance programs by various industries follow:

1. A fork lift was magnetized by high amperage current flowing through a coil formed by three or four turns of cable.

While the current flowed magnetic powder was applied. The powder formation marked the crack adjoining the radius. To demagnetize after inspection, the coil is energized and then drawn two or three feet away from the work before de-energizing.

2. A crack in a crane hook could be magnetized with cable as described, or with a small portable yoke or coil kit. Though magnetic powder can be used, fluorescent magnetic particles would be preferable.

3. A large crack in a cast valve resulted from a refinery flash fire. This crack occurred on the side opposite to that which was exposed to the fire.

4. A large dock unloading tower had been in service for several years. Its 315 welded clusters were magnetic particle inspected. 15 per cent of the welds had fatigue cracks. All cracks were chipped out, checked to be sure they were removed completely, re-welded, and the welds checked for reliability.

5. Inspection of welds on the bottom of a jacketed reaction tank was made during overhaul. Two things may be of interest: (1) contact is made with prods and the current flows, the powder is applied, and (2) the equipment used provides A.C. current or half wave D.C. The former will locate cracks and crack-like defects. The latter is used to reveal sub-surface conditions such as slag inclusions, open root, etc.

The preceding examples illustrate the "dry" method, where magnetic particles in the form of powder are sprinkled or blown on the section being inspected while the part is being magnetized. This method is recommended for castings, welds, and other relatively rough surfaces and also for the detection of sub-surface defects.

In the wet method, particles are suspended in a liquid. Fluorescent magnetic

particle inspection is recommended for practically all other applications. The reasons for this are (1) rapid coverage of the part with the inspection medium, (2) lowest cost in expendable materials, (3) most rapid inspection as cracks glow and attract attention under black light, (4) the tiniest cracks are made visible so that salvage as by grinding and polishing can be performed readily and at lowest cost.

Sometimes the question arises "how deep is that crack?" With a fatigue crack depth is important only if salvage or repair is possible. If so, the magnetic particle build-up can be indicative of the depth. Close observation will reveal that the build-up of particles mark a series of small cracks or one continuous large crack with a high, dense buildup. In the former, the small cracks will be relatively shallow. In the latter the large crack will be much deeper. In either case, a rule of thumb is that the depth of a fatigue crack will approximate 25 to 30 per cent of its total length. With small cracks actual depth can be determined accurately by alternately grinding and re-testing until the root is removed.

With large cracks a hole may be drilled to determine depth. Where salvage or repair is impractical and a replacement cannot be made, small holes drilled at the extreme ends of fatigue cracks will retard failure.

Practical men with practical problems involving the very important aspects of safety and adequate production are probably quite aware of the benefits which can derive from good inspection and good maintenance. Considerable savings and added safety result from a good planned maintenance program. They are also probably aware of the areas of interest of various responsible department heads, and their feelings with regard to the action of others as it concerns them.

THE FOUNDRY BUFFOON— AN INDUSTRIAL MENACE

By HERBERT J. WEBER

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American Foundrymen's Society, Des Plaines, Ill.

We know that, for safety's sake, horseplay cannot be tolerated in the foundry. Although the original joke could be embarrassing, or even slightly painful, it is the secondary reaction that is fraught with danger. The pranks played in the foundry are as old as the industry itself.

Some time ago a Detroit newspaper carried a story about a maintenance man who climbed inside the concrete mixer of a ready-mix truck to do some repairs.

The driver of the truck, having a reputation as a practical joker, then decided to throw the mixer in gear for laughs. The maintenance man was mangled to death.

When the police asked the unfunny joker why he did such a thing, he answered, "I just wanted to see what would happen." Yes, that story is true!

We have similar clowns in the foundry who insist on being the show-off or the life of the party. Like spoiled kids, they want to draw attention to themselves . . . they want to be noticed. Following are some true accounts of these menaces.

There is the "look-Ma-no-hands" type of lift truck driver. One of these show-offs was driving his truck at full speed with his hands placed behind his head to show his skill. The truck ran over a casting causing the truck to swerve into a pit mold. The driver smashed his leg and the mold, too. The mold damage is regrettable.

The yo-yo crane operator is particularly funny.

This type of clown takes a ladle of molten metal down the bay and by adroitly jerking the crane, gets the ladle to swing in pendulum-like fashion. One of them, while playing yo-yo, struck a pile of flasks and splashed metal on two men, causing severe burns.

The lunch box joke always draws a laugh but sometimes a broken toe or sprained back. In this comical scene, a molder's lunch

box was emptied and lead pigs put in. At noon time, the molder picked up his lunch box but was off balance and the unexpected weight caught him unprepared. The sudden twist sprained his back and he was off work for a week.

Another hilarious joke was pulled by a crane operator who was holding a ladle of metal on the hook while the man below was skimming it. The crane man threw the aluminum rod from a cigaret pack into the ladle . . . just for laughs. The sudden flash caused the skimmer to jerk the skimming bar and he got a splash of hot slag on his face.

Then there were the two buffoons who used to turn off the exhaust system over the degreasing tank just to watch the elderly degreaser operator get drunk from the vapor and stagger around. The humor in this lay in the fact that the old man was a teetotaler. It was fun to make him drunk. One day the jokers left the exhaust off too long.

Now let me tell you about the spit fire trick. As you know, phosphorus, when exposed to air, will ignite spontaneously. Hence it is kept in water.

In order to make phosphor copper, a stick of phosphorus is taken from a water container and rapidly plunged into molten copper. The man doing this job in a certain foundry used to show off in front of visitors by putting a small piece of phosphorus in his mouth and spitting it out just in time to ignite as it hit the floor. The scene is dramatic. The man spits fire.

One day, his timing was off and he burned a nice hole in his jaw.

I must tell you also about the hot-stream trick. In this display of daring, the show-off runs his finger rapidly through a stream of hot metal without getting burned. This can really be done if the finger is turned out and down.

However, one ham actor tried it with the finger turned out and up. He caught a pool of metal in the palm of his hand.

Any molder who has filled a flask from a sand heap knows the nerve shocking sensation of driving his shovel into a buried mild-weight or pig. Seldom is the weight buried at the end of the shovel stroke where it will only slightly affect the molder's arm.

The shock of a shovel hitting metal can be heard for a distance of six floors on either side of the victim. This allows the audience to howl with glee while the victim's hand and arm go numb and his shoulder feels as if it had been pulled from its socket. If the victim will utter a stream of profanity while he grasps his broken hand, the thrill of enjoyment will be even greater for the jokester's public.

The greased handle gimmick is as old as grease and handles. Only once have I seen this script develop into an unusual ending. A gangwayman on the shift had been the butt of this trite joke so often that he had lost all appreciation of the humor in it. He felt it was time he called someone's attention to the inhuman treatment he had been receiving. Setting his wirebarrow in the gangway where he knew the inevitable would happen, he retired to the restroom. Upon his return he stood beside the halted vehicle until the superintendent wandered up the gangway. When the superintendent drew alongside, the sand buggy jockey suggested that the superintendent test the weight and balance of the prehistoric device.

In the hierarchy of this foundry the superintendent was protected from the humor of the pranksters. No practical joker who had developed a habit of eating would satisfy his sense of humor by making the superintendent play straight-man. Without giving it a second thought, the superintendent stooped and grasped the handles. Gobs of grease oozed between the fingers of both hands.

The superintendent had perfect control of a violent temper. Rising slowly, he stood glaring at the gangwayman while a crimson wave of color rose from his throat to the roots of his closely cropped light blonde hair. He took the handful of waste proffered by the mute former gangwayman.

Slowly, he removed the greater part of the grease from his hands.

Softly and through clenched teeth he said, "You will get your check in the office."

Fraught with danger is the ferro-silicon gag. This is usually practiced on the greenhorn who is hired as a melter's assistant. His job is to charge the electric furnace with the materials comprising the heat, one of which is ferro-silicon which is very *phoney*.

The jest consists of soaking a small piece of ferro-silicon in water. When the greenhorn charges this material, the unexpected spatter and roar from the charging door will make him jump like a scared rabbit. Of course, the singeing of his clothing and skin is incidental.

Another gag that's good for an illiterate laugh or two—and a ruptured vertebral disc—is to fill a large coke wheelbarrow with pig covered and hidden by coke. More than one back has been permanently bent by this hilarious prank. A rod wired to the wheel in such manner that the wheel will make almost a complete turn before coming to an abrupt stop will result in a lot of fun for some people—and a broken rib or two.

I suggested in the beginning that the secondary reaction is often more dangerous than the prank.

The court jester usually selects his victim with great care. It is the person least able to defend himself who becomes the butt of his cowardly humor. He doesn't appreciate a joke that misfires. He will do his best to make up the loss and regain his public. Being stupid or ignorant of the danger involved, he will use fire, water, air or electricity to maim his uncooperative victim.

We once hired the quietest, best-built jolt-squeezer man in the business. In the same shop we had Bugs, the buffoon who had developed into a science the art of snapping cigarette butts into a pocket. It was just a matter of time before the two got together.

One day, Bugs slipped one butt too many into the big boy's pocket and the race was on. The big boy caught him by the belt and one leg; turned him upside down and drove his head into a soft sand heap.

This should have ended the incident but it didn't. The next day, Bugs was caught, unfortunately, wiring the big boy's squeaker handle to a 220-volt line. Had the molder grabbed that handle, I'm sure he would have been severely injured or even killed.

All these incidents that I have reported involved only one prankster but when you have two practical jokers in competition for top entertainer in a shop, the problem really becomes complicated. This is because there

can be only one star and the process of elimination becomes primitive.

The Haynes Stellite Co. of Kokomo, Indiana, holds the best all-time, no-injury safety record known in the foundry industry. This foundry has operated 7,407,010 continuous man-hours without a disabling injury. I don't think that record would be possible if the company had buffoons on the payroll.

WHEN MEN BEHAVE LIKE BUFFOONS

By LEON BRODY

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A buffoon is a clown. Etymologically, he is first cousin to a buffo, a male singer of comic opera roles. Of the latter there are two main types: tenor buffo and basso buffo. Tenor is the highest male voice next to the *falsetto*. So one is tempted to say that a foundry buffoon is likely to be a "phoney." Or, since basso is the *lowest* singing male voice, one could also say that the foundry buffoon is just a plain low character.

In any case the *kinds* of hazardous things such persons do in a foundry have been dramatically illustrated by the preceding speaker. So I should like to concentrate on the *reasons* for such actions, and on some remedial measures.

Safety directors or supervisors are naturally inclined to look for clues or suggestions couched in the language of their specific industry. This, however, is not all-essential for effective understanding and programming. Whether an organization is engaged in producing donuts or manufacturing wing nuts, the basic safety problems are the same. For there is a major common denominator to all production, to all services, and to all levels of production and service. That common denominator is *people* . . . the human element. It underlies efficiency . . . it is fundamental to safety.

Now back to buffoons. Nearly every one is a buffoon at one time or another because of temporary stresses or disturbances on and off the job. And then there are some

—a small minority, fortunately, who have more or less gotten into the habit. This is usually a matter of ancient history, with foundations in early childhood. It's like the iceberg with seven-ninths of its volume hidden below the surface of the water. To understand all this we need to know something about the basic motives or needs of man.

In general, people are moved to do things, or to resist doing them, because of three fundamental needs. These are: the need for security; the need for self-esteem; and the need for affection. When these needs are reasonably satisfied, a fellow is more or less at peace with his physical and social environment. Block the satisfaction of a basic need—for example, arbitrarily assign him a menial task, make him feel like a fool in front of his work group, or let a thoughtless wife belittle a reasonable effort—and down goes self-esteem, up goes tension, out comes an impulsive act, and high rises accident potential.

On the other hand, oversatisfying a need is dangerous too—like overeating or overdrinking. For if we let a fellow get away with things and shirk responsibilities, if we let him feel too big, he may also feel master of things of which he is not master; he may take risks; he may become aggressive and incontinent. And these are traits that we know don't mix with safety, on the job or off. The tough part about all this is that most often the motivation is in the

sub-conscious. The guy isn't aware of why he is doing what he is doing; he isn't aware of its significance for his safety and the safety of others.

Permit me, now, to cite an actual case history illustrating how this general theory of accident causation can be used to advantage. Potentially, steel mills are dangerous places in which to work. Yet the steel industry in Pennsylvania, for example, possesses a lower accident rate than do the state's 5-and-10 cent stores! How has this come about?

In part this accomplishment has been due to a steady hammering at accident reduction through insistence on the use of safety equipment; through such measures as posting colored flags in danger areas, marking building corners with yellow and black stripes, painting hand railings yellow, etc., etc. But primarily the accomplishment of greater safety stems from industry recognition that knowing is not enough—that things like attitudes are involved. Operations Attitude, as it came to be known, was born in a Chicago plant.

Company officials a few years ago came to the conclusion that the problem of safety ought also to be tackled in the light of psychological knowledge of the motivating forces that influence human behavior. Specifically, in drawing up safety rules, should not consideration be given to workers' views and feelings and intimate knowledge of the work? Would not the men be more willing to assume and accept responsibility for following safe procedures if they themselves had a chance to contribute to their formulation? Might not their attitudes then change from "I've got to do it" to "I want to do it"?

Well, the men were brought into conference, two or three at a time, to get their thoughts on safe procedures and to help formulate them with their supervisor and a safety coordinator. In this particular plant the accident rate had been the highest for any of the company's main plants—229 accidents for every million manhours. Some two years later the plant had achieved an all-time low. And in fact the accident rate at plants where Operations Attitude was subsequently tried out dropped to less than a third of the frequency rate of the steel industry as a whole. Moreover there is

reason to believe that the increased safety consciousness of the men carried over to their homes and communities. That's important, because you know how much industry is concerned, and properly so, with off-job safety of employees.

Why does worker participation in safety programs have such a favorable effect? Boiling it down, we are involving men in something important to their security; and by giving them an active voice in decisions pertaining to safety, we are helping them to satisfy their need for self-esteem. It is in the latter regard, perhaps, that the greatest opportunity resides for effective programming. Let's analyze this need for self-esteem a little further, in terms of what might be called a "worker's creed."

—We . . . as workers . . . like to give and get a word of encouragement, a friendly pat on the back, and recognition for work well done.

—We like to talk things over, to express ourselves, just as much as we believe it important to listen to others.

—We want to hear about our mistakes when we make them, but in a manner that we can learn from them.

—We believe that purely personal feelings should be kept out of the picture insofar as our jobs are concerned.

—We recognize that modern business and industry are pretty complicated, that many people have many different responsibilities for its success.

—We like to be kept informed of matters affecting our jobs, like changes in policies or procedures—and if possible, we like to have a voice in their development.

—We believe that "Will you . . ." gets a thing done better than "Go and . . ." and that "Thank you" is something to say as well as to hear.

—We know that a smile is an important aid to good human relations. (And by the way, they say it takes 72 muscles to frown, only 16 to smile.)

—And finally, we believe it most important to be genuinely interested in people—that is, cordial, considerate, and helpful.

Now this may sound like a sermon, but I can't emphasize enough that accidents—like absenteeism, poor production, and labor friction—are essentially symptoms of conditions that are not right, and more often than not they are not right because of undesirable human relations.

Needless to say, there is a variety of programs that management can provide to help meet the worker's needs and thereby make him a safer worker. But obviously, in terms of our worker's creed and organizational structure, nothing is more im-

portant than the man-to-man relationship of supervisor and worker. It has properly been emphasized that direct responsibility for safety should be placed as near as possible to where the action takes place—at the level of the first-line supervisor.

To help him carry out this responsibility most effectively it is essential that the supervisor understand (1) himself; (2) his men. If this means anything, it means training in human relations. Emphasized here should be the realization that there is a reason for unusual behavior; and that such habits or attitudes may be pretty deeply entrenched, therefore not easy to change. When a supervisor has mastered this understanding (and the support of top management is essential to help make this possible), then he has mastered half of the job of getting along with people.

Of course there are other, more specific training requirements if maximum safety is to be achieved. Not too widely recognized are these:

(1) Supervisors should be trained to spot indicators of potential accidents, such as unusual errors in work performance, changes in everyday manners, exceptional absence, changes in simple habits, and near-accident occurrences.

(2) Supervisors should be trained in the ability to talk with a worker (true communication)—and in the knack of listening, an indispensable tool in the relief of mental or emotional tension and in the revelation of facts important to management and the worker.

Now I had previously indicated the possible deep-seatedness of the problem of buffoonery and related questionable behavior. Supervision, naturally, cannot be expected to resolve this situation. So permit

me to say a few words about certain aspects of the long-run approach to the problem.

A world-famous psychiatrist once observed, "Among all my patients in the second half of life there has not been one whose problem in the last resort was not that of finding a religious outlook on life. It is safe to say that everyone of them fell ill because he had lost that which the living religions . . . have given to their followers and none of them has really been healed who did not regain his religious outlook on life."

This dramatic statement is something to ponder. As true as it may be, it is still lacking in one respect. The inadequacy is to be found in the words, "lost" and "did not regain." Countless persons who are mentally ill never had a religious outlook to lose. Their childhood and youth were weakened for want of religious education.

In an infinite universe which the finite human mind can never fully penetrate, faith and spiritual values are the greatest human asset, the greatest aid to a sense of security. Such faith and values cannot be acquired by a smattering of indoctrination. Religious education, formally and informally, and in the broad sense of the term, must begin early and persist if it is to have any profound effect on mental health—if it is to produce the calm of mind and emotion that go hand in hand with a basic feeling of belonging to a meaningful, eternal order.

Finally, it goes without saying that the full elimination of buffoonery and other undesirable traits is a matter of character development that can be accomplished only with the aid of wholesome home influences and competent, dedicated effort in our schools.

THINGS MONEY WON'T BUY

By J. S. HARRISON

Vice Pres. in Charge, Personnel & Industrial Relations, Aluminum Co. of America, Pittsburgh, Pa.

Terrific strides have been made since the first Safety Congress was held in Milwaukee in 1912. As you know, out of that conference—which was attended by 300 men from 40 organizations—came the idea of a national organization to promote accident prevention efforts in industry. Today, through its nearly 13,000 members, working in 250 state councils and local chapters, the National Safety Council continues to give force and direction to the solution of one of America's most persistent and destructive social problems.

Since the year of the Council's birth, a steadily reduced death rate has brought a saving of nearly a million lives.

And yet, because it is concerned with *prevention*—as is any important institution—the National Safety Council will never find its work all done. For example, today—October 18, 1961—during the brief time I will be talking with you, at least four lives will be lost in accidents, 350 more people will be injured, and accident costs will mount to the tune of half a million dollars.

Little wonder that your company and mine are concerned about accident prevention and how to minimize the loss of life, resources, and efficiency.

Alcoa is proud of its continuous affiliation with the National Safety Council since 1917, when the Foundry Section and the Iron and Steel Section merged to form the Metals Section. We are pleased that Will Gilliland, our Assistant Manager of Safety, is serving as general chairman of the Metals Section this year, and that Byron Kent, of our Davenport, Iowa Works, heads the section's non-ferrous industry committee.

It is good to see, too, that a number of our other safety managers, from as far away as North Carolina and the West Coast, are present for these sessions of the 49th National Safety Congress. Alcoa also heartily endorses the work of local council and is glad to have its personnel participate in the vital work carried on in our plant communities.

It is interesting to take a look at the scope of the accident prevention programs of 1961 against the background of history. This backward glance, I believe, helps us see more clearly not only where we are but also what our future course should be.

There has, of course, been concern about safety throughout man's history. For example, Cicero, the Roman orator and statesman, in the year 50 B. C. declared that "the safety of the people is the supreme law."

And the late Bishop Charles E. Woodcock, who held pastorates in some of our large industrial centers during the late 19th century, once said, "There is nothing under God's heaven that justifies your creation or your citizenship but this gospel—that the next greatest thing to creating a life is to save a life."

Nevertheless, there have been times when relatively little was done to conserve human resources.

History shows that the Industrial Revolution of the 18th century was not accomplished without its toll of human life. The new machines meant the end of much back-breaking work, but people became the "shock troops" in industrial progress. The Industrial Revolution yielded great benefits, but its harvest also included such things as crowded tenements, child labor, and a high accident rate among workers ill prepared to cope with the new tolls of production.

From our vantage point today, it is difficult to understand the spirit of fatalism with which most people regarded accidents a century ago. Accidents and loss of life were regrettable, but all too often they were accepted as part of the price of industrial progress.

Safety leadership among industrialists was woefully weak at first. You may recall, however, the significance of an event which took place not far from here in 1892. That was the organizing of a safety department in the Joliet works of the old Illinois Steel Co. As you know, because of this definite

start and because this program spread to many other mills, Joliet has been called "the birthplace of the American industrial accident-prevention movement."

About this time, companies began to show more interest in the behavior of their employees. The early minutes of Alcoa's Board of Directors bear this out in a way I thought you might enjoy.

The minutes of June 3, 1889—our company was less than a year old at the time—show that the following resolution was adopted by the Board of Directors:

"WHEREAS, Mr. Scott reported that he had visited the works several times and found the condition of affairs rotten to the core, as exemplified by his visiting the works on May 31st, and finding no one there after waiting about 15 minutes in the hot and engine rooms, but finally found Bouger asleep behind the engine and was only able to waken Bouger after striking him hard four times with his umbrella, when Bouger got up immediately and went into the office . . .

"RESOLVED, that we take immediate steps to disinfect the disgraceful state of affairs and to procure a manager to look after the plant and improve the morals of the employees."

We regard this as a bit of whimsy today, but it was a serious matter in 1889. Alcoa's early minutes also show that in 1892 the directors appointed a committee to investigate the circumstances surrounding an employee's eye injury. And, just a few months later, a committee was named to secure liability insurance.

So, here and there, as the 19th century came to a close, industry was becoming more aware of hazards and began to do something about them.

But at the beginning of the present century, there came about a dramatic change as the result of public opinion. People were no longer willing to accept conditions just because they had always been that way. Therefore Roosevelt in the White House was pointing a guilty finger at those who were failing in their duty to society. The clergy joined the press in shouting for industrial legislation. The old philosophy of "the public be damned" was giving way—and fast.

One of the dramatic events which hastened the spread of industrial safety-consciousness was the famous Triangle Shirt Waist Factory fire in New York in 1911, in which over 100 young girls lost their

lives. By 1917, at least 41 states had passed new or improved laws which more specifically defined safety regulations in factories and provided more severe punishment for violations.

But meanwhile, industry was getting its own house in order. It was in 1913 that a small group of far-seeing men, appalled by the human tragedy of accidents and abhorring waste in an otherwise efficient society, met in Milwaukee and laid the groundwork for what was destined to become the National Safety Council. In 1915, the slogan "Safety First" was coined. This little epigram was destined to become a household word—and the "granddaddy" of many another safety slogan.

There were skeptics, of course, who doubted that anything could be done about human carelessness. But the record soon began to speak for itself, as a virtual science of safety emerged to prove that accident prevention works.

Yes, accident prevention is possible, but no one need tell you men that it is an easy job. The diagnosis of the problem is easy; it's the cure that's difficult.

All of us would agree that some degree of accident prevention can be accomplished through the improvement of physical environment, tools, and equipment. We can make some progress by means of regulations and proper supervision, but I would like to say at this point that I am not at all sure that our supervisors have effectively instructed and then insisted that the safe way to do a job is as much a requirement of fulfilling the job classification as that of proper quality or quantity of production. Maybe the lack of grievance on this subject is evidence that we really are not enforcing this requirement. Maybe management at higher levels has not adequately educated our supervisors in this concept.

Because accident prevention is chiefly a problem of human motivation, however, the only truly effective way to meet it is to have the individual accept it as his own responsibility.

I believe that this matter is symptomatic of a much larger problem—one with which every individual must be personally and intimately concerned if we are to survive. Safety can mean survival in an immediate sense. Beyond this, however, the acceptance

or rejection of individual responsibility for the consequences of our own behavior can mean the difference in our collective survival.

Leaders in the safety movement have a tremendous challenge and responsibility in the life-or-death struggle in which we are now engaged for men's minds and hearts. And the measure of this success or failure will, in my opinion, go far beyond injury frequency and severity rates.

Let us take a look at our behavior in regard to some aspects of this problem as it stands today. How have we as individuals accepted our personal responsibility for our own and our brother's well-being? What, for example, is our present approach to the matters of individual and collective security?

We have, by and large, willingly helped to create billions in expenditures to realize "security." Consider for the moment the money which we as Americans spend each year for such security measures as national defense and insurance against every conceivable kind of risk from death to unemployment. Security has become so important that today millions of people look to the government for the answer to all their many needs.

Security itself has become a commodity instead of a matter of personal responsibility. A price tag has been attached to it. It is purchased much as one would purchase an automobile—on the installment plan.

It seems to be the prevalent American attitude that all one has to do to obtain what he wants is to spend money for it. Even our foreign policy is chained to this belief. We are now reaping the benefits of this policy in too many of the world's areas.

What really is the true basis of security? Isn't it this same individual sense of accountability for our own actions—a reflection of our maturity and common sense in our behavior?

Accountability is also the thing upon which safety must be built. Personal responsibility is the key to security, and it is also the key to safety. It is the basis of our survival as individuals and as a nation.

Safety is still free for the asking. It involves no payroll deductions, no billings

from the government. However, all too often the safety message has fallen on deaf ears. Why has safety received this brush-off from the public? Is it because it lacks a price tag? Must we make a commodity of safety to have it accepted? Is this the only way that it will assume any value in the minds of our people? If this is true, then I say we as a nation are in a bad way!

The individual must identify safety with the way he lives. He must make it his way of life—not just on the road over the Fourth of July, or boating on Labor Day weekend, or in the plant—but everywhere, all the time.

The real task ahead of us is to keep on showing the American public that safety must become an intrinsic part of their individual way of life. In a democracy, the only way to do this is to mobilize public opinion. This was demonstrated in World War II. The American people, after being told what had to be done and their part in the job, pulled together as a team and accomplished the goal against great odds.

In its war on accidents, industry has worked to do just this sort of mobilizing. In large part, this effort—this job of getting the individual to become personally involved with safety—has been extremely successful.

The most salient reason for a decreased death rate among workers is that industrial organizations have waged an unending campaign to mobilize employee opinion against accidents. Through you and your counterparts, workers have been made constantly aware of the dangers inherent in doing their jobs carelessly. They are subjected to safety through meetings, campaigns, equipment design, work procedures, slogans, posters, and word of mouth. As you men know, often one employee will remind another that he's doing right by safety. He'll do this because he knows that one slacker can endanger the lives of those around him.

You men are here today because much remains to be done in cutting down industrial accidents. We should not be satisfied until we have reached the point where we can devote all our time and effort to prevention instead of correcting the errors and repairing the damage after the accident.

One careless moment can stain many months of alert attention to safety precau-

tions. We must find ways and means of making people everywhere conscious of this urgent need to constantly "be where they are with all their minds."

We had a tragic reminder of this last May at one of our plants. An employee in the sand foundry was working on a sand mold that weighed nearly a ton. Dissatisfied with the position of the wooden members upon which the mold rested, he hoisted the mold a couple of feet above the floor with the crane in order to re-position the supports.

Standard procedure for this operation which had been discussed with this same man only two weeks before, requires that all four legs of the sling be used in hoisting a mold. Also, the mold is to be moved off to one side of the timbers so that at no time will it be high enough off the floor to be suspended above the worker.

In this case, the employee used only two legs of the sling and failed to move the mold off to the side. He had been warned of the possible tragic consequence of this practice on previous occasions but chose instead to take the obvious chance.

That moment in May was his moment of truth. The mold fell on him, as he crawled under it to move the timbers, and it crushed his skull. We were criticized by the union on grounds that the equipment was "unsafe."

In the majority of our accidents and probably the majority of yours as well, the basic cause is not unsafe equipment but unsafe use of the equipment. This is the point we must continue to emphasize to people everywhere. Any equipment will be unsafe when it is used unsafely. It is the individual's personal responsibility to insure his own safety by his own behavior.

Management itself must not only feel a great deal of responsibility for safety, but must also constantly back up the efforts of the safety department.

One of Alcoa's operating division managers and an outstanding supporter of our safety program, Ben Sloane, worked his

way up through the plant organization, became a works manager, was later operations manager at one of our largest operations, and is now manager of Alcoa's smelting division.

Ben has always been vitally interested in this subject of safety, and a few months ago, he directed the following remarks to his Works Managers:

The trouble with our safety record is that we have put too much confidence in the poster, the safe guard, the safety-toe shoes, and the mechanical device. At the same time, we've put too little confidence in the human equation—such as the foreman-to-man relationship, the foreman's attitude, and the general safety consciousness of our people. A marked improvement will not be a spontaneous reaction; it will of necessity await your personally pushing the starter switch and guiding the program.

Ben went on to say: "The safety record of your plant is a criterion of your ability as a manager, just as costs and quality continue to reflect efficiency in management."

We subscribe to Ben's theory. Safety must be the concern of all management at all levels. I'm sure that one of the most frustrating experiences some of you may have had comes from the feeling now and then that you are carrying on the safety battle all alone. Too often it appears that safety is assigned to the safety manager and then forgotten by the people whose interest and support are essential to success.

It's possible, of course, for the safety function to become merely another box on the organization chart, but the responsibility for making safety a state of mind rests with all of us.

If our management appears not to be as concerned with safety as we think it should be, it may be time for us to take stock of our approach in getting our story across. Conveying the safety message—up, down, and across—is an obligation.

I submit that the price of safety is identical with that of freedom. The two run parallel courses; they are inseparable. They are things money won't buy!

PSYCHOLOGICAL APPROACH IN JOB TRAINING

By JOHN NEUMANN

Senior Training Instructor, Timken Roller Bearing Co., Canton, Ohio

At the Timken Roller Bearing Co., when we list the duties of a foreman, topmost on this list would be the duty—"dealing with people."

Trump card when we deal with people is—"proper communications." We at Timken know that the ace in this game of dealing with people is a clear and thorough understanding of the foreman's responsibility to safety.

The Timken Roller Bearing Co., as producers of tapered roller bearings, high quality alloy steel and nick bits has the knowledge that it takes people to produce these products. It takes healthy, safe employees. The man who directs and supervises these employees, the man who is in immediate contact with the employee is the best means by which to arrive at a successfully-working safety program. Timken's program is aimed at the floor supervisor with the intent and purpose of keeping him mindful of safety and supplied with all pertinent safety information.

Safety in any industry must have a beginning, and the place for this is with the new employee; but safety must also have a continuation—it must become a vibrant, living part of every individual in an organization. To accomplish this aim, safety cannot be narrowed down to guards, protective equipment, housekeeping, etc., but must be looked at from every angle. At the Timken Roller Bearing Co., we have looked at safety from many angles and we know that there are many views that we have yet to see.

The mechanics of presentation of our safety program involve a safety meeting for supervisors once every two months. The material covered in these presentations looks seriously into all facets of safety. After the foreman's meeting there is a two-month period of time in which each foreman contacts the employees at their work stations, on an individual basis, and stresses safety. It is during these informal talks that safety knowledge and awareness takes place. Each of these contacts and the material discussed

are recorded by the foreman on an employee's safety contact sheet. Statistics tell us that lost time accidents have been reduced by approximately 80 per cent since the beginning of this safety program.

It is our intention to give you a sample of what our presentations to the supervisors are like. This is the sixth of fifteen that have been produced.

Instructor's Lesson Plan

Course No. 6

A Practical Approach to Safety Talks with Employees

Many people have the idea that a person's mind is like a tape recorder with the ears as two small microphones. They further believe that all information that goes through these two microphones is recorded on the tape. So it's an easy thing when we want to recall something to switch to rapid rewind, going back on the tape to when we heard that information and then switching to "listen" on the recorder so that the mouth can spout out this information.

Contrary to this belief, this is not the way that real learning takes place. In fact, a very small percentage of learning takes place under a strictly listening-type situation. In addition, we can say that under the situation just described, a "get through the course and please the teacher" attitude is usually in existence.

How then is real training accomplished? Let's mention some important points necessary to good instruction.

To accomplish good instruction, arrange for the learner to make discoveries. These should fall into:

- mental discoveries,
- physical discoveries.

The studio, field trip, laboratory, experience-type of training is far superior to a formal lecture.

As an example—reading a book may help you to build a house, but until you experience the actual work involved in building, you haven't accomplished the real job

nor can you say you are a builder. This same point holds true in safety—you can read about safety on posters, in pamphlets, etc.—you can attend safety meetings where you hear talks, see slides and movies—but none of these or other devices will give you a safe department until you campaign, instruct, or in other words, personally take safety to your employees.

Training should reorganize a person's life. Personal talks with employees must be so planned and so presented that they will reorganize the employee's thinking and action in respect to safety on the job.

A bright lad somewhere back in time once made an illuminating remark when he said, "I think the best thing for us to do is to begin at the beginning." This piece of logic is very applicable to safety—proper indoctrination of new employees in respect to departmental concentration on safety is one of the supervisor's prime responsibilities.

Let's back that last statement up with an example: "I, as a new employee of our department, I can't stress strongly enough the importance we put on safety on the job."

This kind of an introduction to the new employee with an explanation of the additional emphasis placed on safety will create a long-lasting impression.

What we have just covered is beginning at the beginning—but naturally, not all of your employees are new employees, and it is in the area of discussions and contacts with your older, more experienced employees that your tools of experience, tact, sincerity, and psychology must be used to do a good job. No, we don't mean a heart and flowers approach, but a sincere, man-to-man, adult exchange of facts and viewpoints.

Related to every area of advancement, be it technical, physical, chemical, medical—every area, spare none—is this unavoidable fact—progress comes from one source: the imagination, inspiration and thinking of people—progress toward safer and, in combination, more efficient work; progress toward more concern for the employee's well-being must also come from people—yes, the supervisor.

Who's responsible for safety?

The answer is obvious—everybody!

Personal contacts with employees to talk about safety should not be regarded as an additional job tacked onto existing work, but as a regular prime responsibility of supervision.

Two general areas, or we might say conditions, contribute to accidents and in-

Area 1—consists of material or physical objects such as equipment, machinery, tooling, materials, etc. Equipment, machinery, and tooling can be guarded or designed to incorporate safety. Material can be properly stacked or stored to make handling safe. The ability to take the danger out of the material things involved in work is usually an easy accomplishment.

Area 2—consists of human knowledge, remembrance, and movement. The ability to take the danger out of the human elements involved in work is an extremely difficult accomplishment. The best approach is the same as the approach used in looking at any job: it must be logical and systematic.

We said that the most prevalent human factors involved in work are knowledge, movement, and remembrance. Think seriously a moment on knowledge and movement. Knowledge a person gains from effective teaching and experience. Movement is a physical coordination which also comes from effective training and experience. So it is possible for a supervisor to remove the two human elements of danger (lack of knowledge, improper movement) by effective training and supervised experience.

The most difficult of the human elements of danger (not remembering) is the area in which we must direct all possible effort. It's true, of course, that effective training and supervised initial experience eliminate to a degree the danger of not remembering. However, it's a known fact that we, on occasions, forget—and this forgetting can only be eliminated by repetition of important facts that have been forgotten.

Repeating a message again and again is not an easy task. If you don't believe this, ask the advertising men who have to prepare T.V. commercials to sell soap, cigarettes, toothpaste, etc. The head shrinkers bring a word into this type of situation—motivation. They say that people must be motivated—and what they say is true.

But to say that people must be motivated, and to motivate people, are horses of differ-

out colors. There are a lot of channels through which people can be motivated. Let's list some to provide you some fuel for thought:

- individual and family security,
- individual and family health,
- personal recognition,
- economic reward,
- increased status,
- individual creativity.

These channels can apply to the person to be motivated, or to the person motivating toward the goal of safety awareness.

Over 80 per cent of the visitations that take place at our company hospitals because of injuries are due to minor cuts, lacerations, abrasions, contusions, and bruises. Of all the types of injuries to eliminate, this category is the most difficult. If we could give you a solution—a cure-all—humanity would probably put up a statue of us. We won't hold our breath for that statue, for we know that the cure lies with you—not with us.

The first step towards the solution of the problem of cuts, lacerations, abrasions, and contusions is the recognition that the problem exists. Your knowing that a problem exists and keeping yourself and your employees aware of this problem will provide the solution to it. This solution is not an over-night deal—but can be obtained by adding the magic element of perseverance.

Flag waving is a bunch of hog-wash! A great many people called the great strides of advancement in the technological fields hog-wash. One of these strides was the establishment of a preventive maintenance program for all machines. This has long since proven highly successful.

The first and most important tool necessary to a successful human preventative maintenance program is a good supervisor. A good supervisor, like any good man, does not live in that dismal swamp land called "indifference"; nor does he look at friends, employees, or problems with all the enthusiasm of a corpse.

Boil it all down and it condenses to a priceless, magical element (that we all possess, but which, through lack of use, has for most of us become rusty), common sense. If we were to tear down this tool of common sense, we would find that it's made up of these important parts:

1. Ability to think logically and systematically.
2. Control of emotions.
3. Just and high ideals.
4. A control of egotism.
5. Belief and practice of the golden rule.
6. Courage.

It's possible to shine these parts—lubricate them with usage—and apply them to the important job of protecting your employees from physical injury and pain.

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Accidents to employees involving material handling regardless of their severity if studied by methods personnel might indicate the need for a change. Manual labor today is expensive in any plant. A study of contributory causes of accidents might show that we can anticipate future incidents which would involve delay, or damage, and consequential increased cost of operation. A change to conveyors or use of portable power tools might be the economic solution.

If accidents occur because of congestion, the layout department can use the data to eliminate an unnecessary operating cost.

If certain motions in the feeding of a machine require an excessive amount of reaching, and because of this condition accidents are reported, the planning department has an opportunity to make the operation more efficient.

A simple case of an employee who was injured when he tripped over the curled edge of one of the steel plates that were used to protect a wood floor during hand trucking operations illustrates what can be done to reduce costs when accident data is properly utilized. In this case investigation disclosed that it was extremely difficult to see the floor directly ahead when pushing a loaded truck. Moreover, these curled edges had frequently hindered the operation when the wheels struck the plate and swung the truck around. Merchandise had been knocked off and damaged. Time was required to clean up such spills. Other trucks were held up and employees were developing an attitude that management was not interested.

A study of the job offered several solutions to the problem that not only reduced the probability of injury but improved the operating efficiency. Use of accident data in this manner provides the means of improving maintenance programs, storage facilities, job training, communications and employee morale.

The proper use of accident data will provide management with material that can be used effectively to improve the quality of supervision. Supervision fundamentally is the art of controlling the performance of workers. If they do something contrary to the right way, it is an indication that supervision is weak.

Some of the reasons for unsafe performances frequently found will bear repeating.

Individuals are unaware that what they did was wrong.

They misunderstood the instructions that were given.

They didn't consider the instructions important.

They weren't given specific instructions.

They found it awkward to follow the instructions that had been given.

They were handicapped by some physical impairment.

They were mentally upset because of financial worries and personal problems.

They were obviously prone to recklessness or day dreaming and easily distracted.

They deliberately disregarded instructions.

Economic advancement therefore, can be realized when management fully utilizes the potential gains that are possible from an effective accident prevention program. What constitutes an effective program and what does it cost should be considered.

Accident prevention does not differ from any other management function. Certain procedures are essential for achieving the objectives. The application of these procedures does require the time of various personnel but while this is being done primarily to prevent accidents, we are contributing in no small measure to the overall operating productivity of the company. For this reason, it is very difficult to separate the cost and profit of an effective program.

Perhaps if we had the answers to such questions as the following, it might be done with some degree of accuracy.

What does it cost to have a working force whose morale has been undetermined?

What does it cost to have supervisors who do not know how to detect evidences of inefficiency?

What does it cost to operate under the handicap of impending fear of breakdown, delay, insufficient manpower?

What does it cost to attempt spasmodically to inaugurate a safety campaign when an accident stirs up critical comment and puts the limelight on your company?

What does it cost to let employees learn from personal experience instead of taking advantage of the past experience, as the basis of training?

Management considers it profitable to improve its operating efficiency in every practical way. To accomplish this, they make job studies to eliminate loss motion. They study plant layout and material handling methods to reduce transportation costs. They spot check operations to determine the causes of down time of equipment.

A properly developed accident prevention program can be the vehicle for successfully accomplishing these studies. But it does not seem fair or reasonable to charge the time required to do this entirely to a safety program. In addition, management considers it profitable to provide development courses for their supervisory personnel.

Participation in accident prevention gives the supervisor the opportunity of exercising his ability to deal with people to a much greater degree than he finds possible in many of his other duties. He gets to know their attitudes better, he improves on the quality of giving instructions, he has experience in getting people to work cooperatively in solving a problem and he increases his power of observation. The benefits of course are not limited to the prevention of injuries.

A brief consideration of the procedures of a program will show that they are activities closely identified with similar procedures that are accepted as essential for the successful operation of any business.

1. The indoctrination of employees—

Employees should be instructed as respects their participation in the overall program. They should understand interest management has in their safety. They should be told what management has done to make their job and working environment safe.

2. Development of operating rules—

Each job should be studied and specific rules developed that reflect the experience of individuals plus the knowledge gained from past accidents.

3. The instruction of supervisors—

We cannot assume that supervisors will automatically shoulder a full share of responsibility for their part in an

accident prevention program. They should receive instructions that specifically explain the practical approach to each part of the program as it affects their daily activities.

4. Inspections and observations—

Standards of performance the same as quality control, can only be maintained by frequent checking. It is essential, therefore, that supervisory personnel initiate a regular program of observing workers performance and check for compliance with instructions.

5. The reporting and investigation of accidents—

Regardless of the severity of personal injury, all accidents should be investigated. Unless the cause can be determined and the reason for the cause established, we cannot assume that similar accidents will not occur.

It is the severity potential represented in the accident cause rather than the extent of injury that should influence our action.

6. The correlation and study of accident data—

Unfavorable trends or items deserving of preferred attention because of the serious potentials can only be determined from a careful study of the accumulated data on individual cases.

7. The management control unit—

Management should establish a procedure that will enable the safety administrator to make direct contact at a level where executive action can be taken when the need arises. This control could be an individual or a group but in any case, it should have the authority to make decisions and to act when facts are presented.

If these procedures are followed conscientiously, they will not only reduce the probability of injury but will aid materially in reducing operating costs. Management has said that costs can be reduced by—

The proper training of individuals to do the job assigned.

The standardization of work methods.

The development of supervisory personnel. The establishment and policing of procedures and controls.

knowledge of which would be of assistance to any supervisor in the event of a mine fire.

Lecture and demonstrations of sampling and analysis of mine atmospheres; causes of underground fires; methods of fighting underground fires—directly and indirectly; construction of all types of barricades; recovery of a sealed mine fire area—when and how; and supervisory duties at the time of an emergency.

In the event of a mine fire, a trained supervisor would be available to accompany a rescue team underground. We emphasize that he would not take the place of a regular team captain, but would take the position as number two man. The captain is still responsible for his team, including now the supervisor, but the latter might direct some special operation not a part of regular training, and would be in a position to make a full report on conditions to management on his return to surface. He would be an ideal person to act as a guide in the event it became necessary to use teams from other mines.

In 1957, the department received a request from a manager of one of our mines to provide a course designed to assist a mine manager and mine superintendent in making decisions in the event of a fire in his mine. This was done, and the management course in mine rescue has been well received throughout the industry. Two hundred and twenty managers, mine superintendents, chief engineers, safety directors, chief electricians and mechanical superintendents have attended.

The management course consists of a prepared paper dealing with such topics as: limitations of rescue teams and equipment; care of teams—health, meals, rotation, age limits, medical examinations; fires in mines—causes, stages, control of; gas sampling, analysis, interpretation of results; recovery following mine fires, and fire procedure, fire organization and control headquarters.

Originally this course was designed for approximately four hours, but generally the discussions and the relating of personal experiences on the part of those attending have extended it to a full day or even more. Printed copies of the paper are distributed before the class begins.

There is always a concern in the minds of us who are responsible for conducting mine rescue training that the subject may become boring to some of the older men, who have worked the same problems, used the same instruments, worn the same apparatus, sat through the same lectures and even listened to the same jokes, time after time. There is a limit to the type of work that can be done while wearing breathing apparatus, and there are just so many words to be memorized in the text book. We do re-word the problems in the hope the men won't recognize them as ones they had last year, but there's a limit to that, too.

The apparent solution to this vexing problem has been mine rescue competition. Now we may be "babes in the woods" in competitions, referring of course only to length of time, when compared to coal mining areas in other Canadian provinces, or in the United States, but we have developed a system of competitions that works, that suits our particular needs, and does create the necessary spark needed to maintain interest.

Ontario's first official mine rescue competition in 1950 was a purely local event between the mines in the Porcupine mining area of Northern Ontario. The site, by the way, of the Hollinger fire. Word of this competition spread to other districts and interest increased until three years later, four districts entered teams. Now, 11 years later, eight mining districts are taking part in Provincial mine rescue competitions. Each year some 45 teams enter into a round of competitions to produce eight district winners, and out of that, one team emerges as the provincial champions.

Originally the winning teams of the district competitions were brought to a central point and a "big day" was held. As teams began to be entered from distant points, as far as 1,200 miles apart, it became necessary from a cost standpoint to discontinue a central competition. In its place, and to keep the provincial competition operating, a team of three judges, consisting of the Inspector of Mine Rescue Training, the Assistant Chief Engineer of Mines, and a District Engi-

neer of Mines, the latter chosen by rotation, travel to each of the eight districts. An identical problem, oral examination and test of apparatus work is presented to each team that has already become district champions. Of course every precaution must be taken to guard against advance information getting ahead of the judges, so each of the provincial events must be held indoors, and admittance must be restricted. All problems are conducted in total darkness—illuminated only by miner's cap lamps, to add reality.

In 1958, following a suggestion by one of our mine rescue station superintendents, it was decided to make use of the trained supervisors as briefing officers in our mine rescue competitions. The plan has been very successful, and it does help to keep up the interest of this category of men.

Each mine entering a team in competition must provide a briefing officer from among its supervisors taking rescue training. He is given the narrative or story of events leading up to the moment at which he appears on the scene. The chief judge will answer any reasonable questions the briefing officer may ask, and will then leave him alone for 10 minutes to prepare his plan of action.

With as many as eight teams entered in a single district competition, there could be eight different plans of action, some good and some not so good. In order to not handicap the team, the chief judge will receive the briefing officer's plan, and then hand a standard problem or directive to him to study and pass on to his team. The briefing officer's plan will be marked but only nominal demerits are given. It is primarily the team that is in competition, and nothing must be done to jeopardize its chances.

The Mine Safety Appliances Co., has, since 1950, presented a fine trophy to the provincial champions, and cash prizes to each member of the first three teams.

The work-horse and the back-bone of mine rescue training in Ontario is the McCaa 2-hour, self-contained breathing apparatus. By far the greatest percentage of our training involves this piece of equipment. Where mines are deep and

large, even two hours is too short a time for some operations, without frequent trips back to fresh air for re-charging.

However, we do have a number of small metal mines, where fire hazard is at a minimum, labor turnover is high, and where it is not practical to try to maintain one or more full teams intensively trained with the McCaa apparatus.

In 1952 it was decided to experiment with the use of half-hour demand apparatus in the Cobalt district, where the mines are comparatively shallow and distances from the shaft are not too great. A system of re-charging demand apparatus while it is being worn in contaminated air was developed by the Ontario Department of Mines together with the Scott Aviation Co. This became an immediate success, and we now have some 60 half-hour air-demand apparatus in use in Ontario.

Improved methods have been developed for the transportation of large air cylinders underground, and all air-demand teams must be thoroughly familiar with re-charging techniques.

In conclusion, in case there are still some skeptics that don't believe a fire can occur in a metal mine, I would point out that we have had in our Ontario metal mines 186 underground fires in the period from 1947 to 1960. Of these, 109 were electrical, 27 were caused by burning or welding operations, 20 from smoking, 10 due to spontaneous combustion of sulphides, 2 from overheated air receivers, 3 resulting from blasting, 3 spread down the shaft from surface, 3 set for warmth, 6 by friction, 2 by diesel equipment, and one, believe it or not, by lightning.

We are happy and proud to say, however, that no lives were lost as a result of any of those 186 fires. Rescue teams were used in 33 of them, and it was only because many of the others were discovered in time that teams were not used more often. One of the extra dividends derived from mine rescue training is that the thousand or more individual trainees become automatically fire hazard conscious, and whether they realize it or not, are continually on the lookout for conditions that could lead to an outbreak.

PREVIEW OF SLIDE-SCRIPT ON UNDERGROUND HAULAGE SAFETY

By HERBERT A. WENDEL
Chairman, Bureau of Safety
The Anaconda Company
Butte, Mont.

The initial reception and response to the first Script-Slide production by the Visual Education Committee in 1959, "Safety in Open Pit Operations," indicated the need for additional similar Mining Section service projects. During 1961 the Visual Education Committee has been quite active and has accomplished the following objectives:

1. Produced a Script-Slide series of 101 colored 35 mm slides with a suggested script on Underground Haulage Safety.
2. Submitted a series of 12 posters to the National Safety Council for consideration in producing a series of posters for the Mining Section's Falls of Ground Campaign in 1962.
3. Recommended changes on the series of four Accident Preventers, used in the previous Falls of Ground Campaign, to produce a new series for the 1962 campaign.
4. Submitted pictures and posters to the Newsletter editor.
5. Sent a questionnaire to Mining Section member organizations to determine future visual education needs.

6. Developed and produced a Script-Slide program for the 1962 Falls of Ground campaign.

7. Cooperated with other Mining Section committees on committee projects.

Active members of the Visual Education Committee during 1961 were: H. A. Wendel—Chairman; A. W. Ness—American Smelting and Refining Company, Salt Lake City; Fred Pearson—Noranda Mines Ltd., Noranda, Quebec; Melvin Taylor—Compania Minera de Cananea, S.A., de C.V., Cananea, Sonora, Mexico; and Morgan Wadsworth—American Metals Climax, Climax, Colorado.

The Script-Slide program on Underground Haulage Safety consists of a total of 101 colored 35 mm slides. This type of visual education material allows a mine organization to use or delete any slides not appli-

cable and makes it convenient to separate the slides into a series of shorter presentations. The script may also be altered or changed as desired.

The National Safety Council plans again to have several sets of this program available for free use by member organizations on a request basis as a Council service. Duplicate sets of slides were available immediately following the preview at the 1961 National Safety Congress.

SUGGESTED SCRIPT FOR SOUND-SLIDE PROJECT ON UNDERGROUND HAULAGE SAFETY

1: Safety in underground haulage concerns everyone who works in an underground mine. Because heavy equipment—motors, cars and trucks—are operated in narrow tunnels, often at considerable speeds, there naturally are a number of hazards we must know about and guard against.

As in all places where safety is important we can avoid or eliminate the hazards if we know what they are and where danger exists.

This series of pictures we are presenting today show some of these dangers and how accidents and possible injuries can be prevented. Not only motor crews are involved in haulage safety but also everyone who works on the level, especially along or near haulage ways.

You will notice that the pictures show different types of haulage equipment, some with trolley locomotives and others with battery powered locomotives. Some of the men pictured are wearing safety glasses in addition to hard hats and safety shoes as some operations require all employees on surface and underground to wear safety glasses.

And, although some of the equipment may look strange to you the same hazards exist here at our operations and result in the same kind of accidents and injuries.

2: Probably more motor crew members are injured while performing the rather simple act of coupling cars together—the sensible safety conscious person always stands well back in the clear and waits for the train to stop before trying to couple. Here the cars have been stopped about two feet away from the car to be coupled on. Notice that this man has a whistle he uses for signaling his partner.

3: Now we see a swamper who has given the motorman a stop signal and in perfect safety steps in between the cars to align the couplers.

4: Then before signalling the motorman to push the cars together, the swamper has stepped back in the clear.

5: Then as the couplers come together properly they are securely coupled and the swamper has avoided possible injury.

6: Some operations require the use of safety chains on couplers to prevent cars from breaking away if they should become uncoupled. This is a good precaution where grades are steep.

7: But sometimes the couplers do not mesh properly. . . .

8: Then it is necessary for the swamper to have the cars pulled apart again so he can re-align the couplers. Ordinarily this is a safe procedure if all safety rules are followed, but this man is taking a short-cut—he is trying to line up the couplers with his hand while the train is in motion. He is so careless that he has his head and body in danger and does not have his whistle where it can be instantly used. This man is asking for it!

9: Men can get in even worse predicaments, this fellow could not get in the clear if he wanted to.

10: Another unsafe act is that of kicking the couplers in line while the train is moving. Even with the whistle in his mouth this man could suffer a serious foot injury. . . .

11: Which is exactly what did happen!

12: Of course you can buy feet and legs in a store but you probably won't be able to run or dance any more. Always think of the consequences before taking a chance or a short-cut.

13: Another very dangerous practice is trying to couple cars while standing in the

inside of a curve or other restricted place. . . .

14: Because you can get caught, and pinched or rolled between the cars and the timber or ground. This type of accident always involves very serious or fatal injuries. . . .

15: And such accidents can be so easily avoided if men remember to stand on the outside of a curve or in a place with proper clearance. You must also remember never to expose yourself or reach in between cars unless they are stopped.

16: Another dangerous practice often indulged in by motor crews is to leave cars or locomotives parked in very tight places. This not only endangers their safety when coupling or uncoupling cars, but also creates a hazard for pedestrians. . . .

17: This swamper is really in a tight and dangerous spot where he cannot get in the clear if the cars accidentally move. . . .

18: As happened here, and the result—a serious head injury.

19: And how easily this accident could have been prevented, simply by parking cars in places of proper clearance. . . .

20: In places with good clearance you can easily get in the clear if something goes wrong.

21: In order to provide safety for pedestrians along haulageways, safety zones are established. Men walking along haulageways must ever be on the alert for trains approaching from either direction. Watch out for lights and signals; listen for bells, whistles or sirens. Motorcrews have the responsibility to keep headlights on and sound warnings, especially at curves and when men are observed along the haulageway. Some safety zones are in untimbered areas.

22: Safety zones may also be in timbered areas, but in either case pedestrians must be sure to get well in the clear and wait until the train has passed. It is a good practice to look up and down the track before stepping out again, as a car may have become uncoupled and could strike you.

23: Here is a man who didn't quite reach a safety zone in time. Note how close he is to a possible accident, especially if a car should jump the track. Motorcrews should slow down or stop if pedestrians are not in the clear.

24: Locomotives, like all other types of running equipment, work better and safer if they are kept in good working order. Good motor men always check brakes, controller and clean out the cab at the start of every shift. . . .

25: They also check the sand boxes and fill them up before starting the shift's work.

26: A little sand on a slippery section of track will produce more work and may also prevent a serious or fatal injury.

27: It is very important for the motorman to always sound the bell before starting the motor after any stop. A railroad engineer always sounds a warning before moving the train. You never know who may not be in the clear.

28: Some underground locomotives have air whistles or sirens for warning devices. Whatever warning device you have, use it! It is better to make too much noise than not enough!—

29: Because when a locomotive is moving at full speed it may not be able to stop in time to prevent an accident.

30: Flesh and bone are no match for this monster, don't run too fast.

31: Motormen, like other men who use equipment, often get careless in their habits, especially while operating the locomotive. "Familiarity breeds contempt" and often bad habit as well. These could, and often do result in serious consequences. Standing up in the cab may be alright if the motor is stopped but should never be done when the train is in motion as low clearances may exist along the way. You could also be thrown out of the cab if the train suddenly stopped.

32: One of the worst of these careless habits is shown here—a motorman with his feet out of the cab and resting on the bumper. What if the bumper should strike something?

33: Suppose the motor coupler strikes a car coupler—this man could easily lose a foot. . . .

34: Or he could fall out of the cab and get caught between the motor and a car and lose his life.

35: However, the man who sits properly in a locomotive cab has little to fear, and can do more and better work.

36: Some very dangerous habits are devel-

oped by the men who operate trolley locomotives. One of the most hazardous of the common unsafe acts is the practice of "back-polling." This means that the motorman is too lazy or careless to turn the trolley pole when the locomotive is to move a short distance in the other direction!—

37: This unsafe practice can be done in either direction, whether the train is going forward or backward.

38: Sometimes they get away with it but at other times this short cut becomes a short-cut to the hospital or to eternity!

39: This is worth another look. Look and Remember! This could happen to you.

40: How easy it is to avoid accidents and injuries if every job is done the right way. Always turn the trolley pole, even for very short distances when backing up or changing direction.

41: Motormen are charged with the responsibility of protecting their own safety and also safeguarding others. Caution must be exercised when the locomotive approaches curves or intersections as men or other equipment may be in the way. Sound a warning at all curves! . . .

42: And when approaching any intersection, especially if other locomotives are operating on the level.

43: Don't forget to sound a warning. Slow down or stop when approaching ventilation control doors as men or equipment may be right behind or ahead of that door.

44: The swamper or switchman of a train crew also has a responsibility for his personal safety and for the safety of others. For this reason he often rides in the front car when a train is pushed; here he can watch out for rocks on the track and warn pedestrians. When riding in side dump or bottom dump cars the swamper must brace himself with his hands. It is very important that he keep his hands in the clear; the end of the car is best for this purpose.

45: Never place your hands on the sides of a car as they may get pinched or crushed by falling rocks or obstructions, especially in tight places where timbers may be squeezing.

46: Some mines require that the swamper or switchmen walk ahead of the train. When this is done be careful not to slip and also keep well ahead of the train at all times.

47: Swampers, like motorman, also engage in some very dangerous practices like this man who is riding with his feet on the car coupler.—Not a very secure position if the car runs over a rock, or if his boots, or the coupler is slippery.

48: Remember to wait until the car or locomotive stops before getting off. Jumping on or off moving cars is a very foolhardy stunt! . . .

49: Ending like this—not a very healthy position to suddenly find yourself in. . . .

50: If you were lucky enough to escape with your life. This type of accident almost always results in disability or death. Again, Don't Take Chances!

51: The same thing is true when you get into a car—never board a moving train, wait until it stops.

52: Probably one of the easiest ways for a motorman to get injured is through the use of unsafe practices when pulling or pushing cars or trucks loaded with timber or materials. This locomotive is pulling a loaded truck, if the motor stops suddenly the truck may not, some material may slide forward and strike the motorman.

53: How much safer a person feels when an empty car is placed between the locomotive and the loaded truck. How much better for the material to strike the car than you.

54: It is even more dangerous to push a loaded truck ahead of a locomotive. . . .

55: As timber or materials may strike against ground or timber. Not a very pleasant position for the motorman. Many men have been seriously injured or killed in this manner.

56: Again, this type accident can easily be prevented by placing an empty car between the motor and the loaded truck.

57: At times it is easier to put pipe, rails or timber on top of a car as a truck may not be handy.

58: In this case it is even more important to have an extra margin of safety—an empty car—between the locomotive and the loaded car. . . .

59: If I were the motorman I would feel better and safer with two cars between me and that load of pipe.

60: This is what can happen to you when you neglect to protect yourself. This one kind of accident is so unnecessary.

61: Here is an example of another equally dangerous and senseless practice often indulged in by careless motor crews—carrying tools and materials on top of the locomotive. These objects not only restrict the motorman's view, but may be pushed back against him, especially if an obstruction or low place is encountered. . . .

62: Keep the top of the locomotive clean and free of materials. Always use a car or truck to transport materials and equipment. . . .

63: So you will never be the victim of an accident like this.

64: This scene is worth another look. I hope it impresses you of the terrible consequences that may result from violation of safety rules and practices.

65: But above all, never try to commit suicide by being careless in transporting explosives such as placing a carton of dynamite on top of a trolley locomotive. Think what would happen if the trolley pole broke or there was a short-circuit in the armature.

66: There is only one safe place to carry explosives and that is in an explosives or powder car. . . .

67: Otherwise the locomotive may look like this. Imagine how the motorman looked. Life is too precious for us to take needless and foolish chances.

68: Sometimes an explosion may cause a fire that not only destroys a valuable piece of equipment but may endanger the life of every man in the mine.

69: Runaway cars can be a menace to anyone working or walking along a mine haulage way. The only way to be sure cars will not run away, especially where grades are steep, is to block them securely. This car is not blocked and could start moving quite easily if accidentally pushed or bumped. Men have been seriously injured or killed by runaway cars or trucks.

70: There are many ways of blocking cars such as with timbers, wedges, chains or blocks. Here is a simple effective way to block cars on steep grades, a block and a piece of lagging.

71: Specially constructed car blocks, held in place by chains to prevent slipping, provide a safe means for blocking cars. Notice that this type has a handle so you can keep

to their own actions, but the inexperienced men present a great hazard. First, they must be trained in doing their particular job and only their job. One of the biggest accident hazards is the man doing someone else's job. We find that an electrician rarely injures himself doing his regular work. The same goes for a carpenter or a mechanic.

Trouble always starts when one of the tradesmen start to do the other fellow's job with which he isn't familiar, such as burning or connecting up a live wire, or trying to take short cuts. Our usual procedure is to take men entirely unfamiliar with tunnel work and put them in the top gang on the surface, the track gang, or the bull gang, until they become familiar with the general procedure of drilling, blasting, and mucking out.

Shaft sinking is started by using a crane to excavate down to solid rock. Exterior forms and liner plates are then installed. The exterior of the shaft was 24 feet and the interior 14 feet. When the 100 foot mark was reached the temporary headframe was set up.

A crew of 12 men was used in sinking the shaft, composed of a walking boss, a shifter, six miners, a pumpman, a compressor operator and a bellman.

As soon as the temporary headframe was installed, a Joy grapple, air operated on a Chicago boom, was used to muck out. The grapple was equipped with a 3½ cubic yard bucket. The shaft, 800 feet deep took 129 working days, and then the shaft was belled out to allow room to bring in the track and other equipment. When the tunnel grade was reached a pilot tunnel of 50 feet was driven in each direction from the shaft. The sides of the pilot tunnel are then slabbled in to enlarge the tunnel to a 15 foot horseshoe shape. The mucking was done with a #630 Eimco mucker, air operated. Usually a 3-track transition took 17 working days with a 3-shift operation; this included a double track section to the face alternating both sides of the shaft to 200 feet. A sump 30 feet deep, 14 feet in diameter was sunk with conventional shaft methods.

The ventilation in the shaft was supplied by a Buffalo 5000 cubic foot capacity blower fed through the utility lines.

Upon completion of the sump and the transition the permanent shaft steel was

erected. This included the guides, fan line, landing chairs, mucklopper and gates. The shaft steel was placed at 80 feet per shift taking about four days to erect. The permanent headframe, cages, etc. took about two weeks to complete.

Permanent equipment was then taken into the tunnel consisting of two model 40 Eimco muckers, air operated, a drill jumbo with five Gardner Denver 93 liner drills, one Gardner Denver model 143 down the hole drill, all hydraulically controlled booms and positioners. Attached to the drill jumbo is a steel car with drill steel, roof bolts and other equipment.

Roof bolts were installed with an R.B. 94 Gardner Denver stoper drill. The roof bolts were Republic steel 1½ inch by 72 inch expansion shell with a one inch split wedge type.

The tunnel face was drilled with a crew of six miners, four chuck tenders, one shifter, one walking boss, two electricians, one mechanic. Drilling time for the operation was usually one hour. The drill pattern was 38 to 40 holes, 12 feet deep, a burn hole 12 feet by 8 inches. Usually the loading time was one-half hour. Two hundred forty to 260 pounds of Gelex #2 powder with 45 delays including double priming, no stemming was used. Smoke time was twenty minutes maximum.

Ventilation was supplied by a Ruth Conover 15,000 cubic foot blower, supplied through a 26-inch vent line of 14 gauge spiral Naylor pipe.

In the tunnel the roof is constantly watched by the entire heading crew because long experience has proved that falling rock usually means serious injury. After the tunnel face or heading has been blasted, the broken rock, or as it is known to tunnel stuffs, muck, must be removed from the tunnel and the drilling of another round starts all over again. Today, we have roof bolts that are driven into the roof in a pattern that covers the roof so that unless we strike very bad ground or roof bolts prove to be a wonderful protection. Lagging had been the sole roof support for all past tunnel operations.

The purpose of the roof bolts is to squeeze layers of rock together to form a beam. This beam supports the rock above, therefore, prevents roof falls. This is accom-

plished by anchoring one end of the bolt in a hole about 6 feet deep in the rock and screwing a nut and washer on the outer end of the bolt. The anchoring is done by expanding a corrugated shell until it tightens against the sides of the hole or by driving a wedge in the slotted ends of the bolt. Both methods do a very good job.

A stoper drill is used to drive the wedge into the slotted rod and an impact wrench is employed in tightening the nut on the bolt. Two bolts are connected by a flap strip of steel one quarter of an inch thick by five inches wide by about four feet, six inches long. This assembly is called one-roof bolting unit. The units are spread in a pattern across the arch of the roof generally parallel to the center line, and arranged so as to give maximum protection to the miners; such protection was unheard of in previous years. The roof bolts also serve to hold up loose sections of the rock to prevent sliding of one layer on another. They also act as supports for the ventilation pipe that furnishes free air directly to the heading and the electric cables.

The chief hazards encountered in roof bolting are the flaking off of small fragments of rock while a hole is being drilled and the breaking of the stoper drill steel. Roof bolts have proven to be an almost foolproof method of supporting the roof. They have given the miner a real feeling of safety.

The mucking operation usually took one hour and 20 minutes after which the track laying took 25 minutes, using a 60 pound rail or short 10 or 12-foot temporary sections. Temporary electric lights were strung in the heading and scaling down was done during the mucking operations. The face was always wet down during the mucking operations and carried on during the entire mucking operations. Side dump cars of 6 cubic yards capacity were used and 15 or 16 cars of muck usually were loaded after each shot. Muck trains were operated by 10-ton diesel locomotives equipped with scrubbers to eliminate carbon monoxide conditions. Car passers were shot every 90 feet to facilitate moving empty cars for loading.

Water supply lines were 4-inch, air lines were 8-inch and discharge lines were 6-inch. Electricity was supplied with 23,000 voltage reduced by transformers every 3000 feet to

44 and 250. Light and pump switches were placed every 1500 feet to 2000 feet with variations.

We find that inattention to the job details is the main cause of our accidents. Next comes inexperience, and then finally, the fellow who takes chances. A miner may get injured by falling rock, or from lifting. A chuck tender usually gets injured in moving the machine or setting a stoper drill or vertical drill for roof bolting. Pinched fingers and hand injuries are caused in the ratchets of the drills.

Our safety program is aimed at instilling the superintendents with the need of indoctrinating the walking bosses in safety procedures. The walkers, in turn, set them across to the shifter or foreman. The State laws governing working conditions are clear and understandable, and all real construction outfits live up to each code rule. Where they find that a rule causes a hardship, they petition the Board of Standards and Appeals for a variation. After an extensive investigation the petition is either granted or denied. All tunnel work is done under State Code No. 30.

There is no work in the world like driving tunnel as it comprises all the crafts and all types of work. The men on the job are never interfered with. If the safety engineer in his inspection sees a workman doing something in an unsafe manner he immediately finds the shifter and sees to it that the shifter corrects the man immediately. The safety engineer makes a thorough inspection of the entire job starting at the face and working along the entire job. He may see a man riding on the front end of a locomotive, or in between the motor and a chuck car. He immediately stops the motor-man and has the man get out of the danger zone. To sell safety to every man on the job, you must have some knowledge of the work. This is gained only from experience. In our 25 years of experience we have seen the results of all kinds of serious accidents. Therefore, we are able to explain to each man the reason why he should do things the right way.

Hazards are encountered by men who want to do things the lazy way, and the safety engineer must be alert to these hazards. On starting a job, each shifter must take a few minutes before each shift to hold a short safety meeting. The hazards to

be encountered by that particular crew are discussed, also the different phases of the work, and who is to do what is thoroughly gone over. When excavating the blasted rock the chuck tenders are usually the car passer crew.

Because of the small diameter of the tunnel it is necessary to have one car positioned off the main track. The device for doing this is called a car passer. The car passer crew sees to it that the empty cars are put into loading positions. Serious accidents have occurred in this phase of the work, and the men are cautioned continually on where to stand, how to move the cars, and how to position the cars on the car passer. This is one phase of the work that must be watched carefully. Railroadings is a great hazard, and some of our most serious injuries occur when a workman takes chances in this operation.

The State law demands periodic checking of all locomotives underground. Frequent inspections must be made with a carbon monoxide tester to check all exhausts on every motor. Motors are also checked daily for brakes, lights, and warning signals, and to see that they are operated properly as to speed, etc.

All of our key men are experienced tunnel men and have been in tunnel work more than 25 years. Many of us have worked side by side all these years. Each of us knows what to expect of the other, and what to do when the unexpected happens. Every one of our supervisory personnel is fully cognizant of the working conditions and would not care to be in any other work. For this reason, each old-timer knows that tunnel work can be just as safe as any other kind of work.

The safety engineer must check all equipment to see that it is in good working condition, must check to see that all hoisting cables have been greased properly. All elevators must be checked once a month to see if the safety catches or dogs work properly. This is a must, and a record is kept of the distance the cage drops, after engaging the safety dog, which is usually one to two inches. All hoisting cables carrying the elevator must be resocketed at least every six months, at which time several feet of cable is cut off. All bearing points are changed by this shortening of the cable and it is then resocketed by factory men of

the cable company. New York State has a very highly trained personnel in the Bureau of Mines, Division of Industrial Safety Service of the Labor Department. These men make periodic inspections to see that each safety device is in good working condition; check to see that all regulations pertaining to explosives are adhered to; make tests for gas; make sure that all ventilation is adequate and that the fans supplying the ventilation meet the State requirements. These men have been a great help in maintaining safety standards and cutting down on accidents. The B.V.S. and the State Insurance Fund have also contributed to accident control with their safety inspectors.

Some methane gas has been encountered in the excavation of our tunnels, so the shifters must make a test for gas at the heading on every shift. They use an explosive meter and a flame safety lamp for this purpose. The explosive meter will give him a fairly accurate reading on methane or natural gas. The flame safety lamp will also signal any gas conditions, as well as to give definite warnings of lack of oxygen. In the early part of our work at the Intake Tunnel, one of the miners stood on the muck pile and started to scale the roof of the tunnel at the face after blasting. He knocked one of the P.A.R. lights off the steel pin that was holding it overhead. The miner reached down to pick up the light, the filament of which gives off a small flame, and as he got it waist high there was an explosion; three men were severely burned about the face and hands. They were treated immediately by the registered nurse who prepared them for removal to the hospital.

Due to prompt attention and medication we use for such emergencies, the men escaped without even a facial disfigurement. This accident, like all such accidents, was reported by phone to the New York State Bureau of Mines and Tunnels, who in turn asked the Federal Bureau of Mines to make a thorough check on all our gas conditions. The finding of natural gas pockets led us into a strenuous training project which, while costly, definitely paid off in safety.

After our gas explosion, with the cooperation of the U.S. Bureau of Mines, its Wilkes Barre, Pa. office sent us three exceptionally qualified experts to conduct our training classes. The men were first trained in Mine Rescue work, which includes the

use of all types of gas masks, how to detect gas and what to do in the emergency. Secondly, they were trained in accident prevention. This training includes all the phases of our particular job, and finally each man was trained in first aid. The men were, and are, paid straight time for attending classes and a light lunch was served. Upon completion of our training program, a first aid contest was held in Roscoe, New York. This was the first hard rock mining contest ever held in New York State.

In October of 1956 one of our men was seriously injured by a rock fall and sustained a broken back. He was placed in a local hospital under the care of our attending surgeon who produced wonderful results, but the prognosis was that it would be a permanent total disability. During the treatments over a period of eight months, the injured man was seen by three top neurosurgeons, two from New York City and one from Binghamton, New York. All three of these men, who are tops in their profession, diagnosed the case as a hopeless total disability and that rehabilitation was out of the picture. With this staring us in the face, we felt that we had come to an impasse and had even made tentative arrangements to have the injured man flown by ambulance plane to North Carolina to be near his wife and children.

Even though we had the medical reports stating that there was little or no chance of further improvement we did not give up. The man himself has been a tower of strength as he has never once complained, but has steadfastly maintained that he was going to walk again. In talking to some insurance friends I heard of a similar case that had been handled by a Doctor Hoen in New York City. Our doctor immediately got in touch with Doctor Hoen who came up and made a thorough examination. Doctor Hoen stated in his report that he was very much impressed with the patient's attitude and that he felt he could have him up on his feet with braces and crutches in three months and eventually have him drive his own car to North Carolina instead of going by ambulance plane.

This was such wonderful news that we made immediate arrangements for his removal to the New York Rehabilitation where he is now and making good progress. We feel that our personal supervision of these

serious cases, paid off in this instance, as this man might have remained a bed patient for the forty-two months life expectancy in these cases, and that would be it.

We report every accident through the proper channels. When a man is injured he must report to the nurse. If additional medical care is needed, he is immediately taken to the doctor's office or to a hospital in our own ambulance, one of which is garaged at each construction location. Our medical service is watched very carefully and I am notified immediately of every accident requiring medical attention, regardless of the hour of the day or night. If it is a hospital case, I go immediately to the hospital to see that all necessary medical care is available, such as blood plasma, an eye specialist, or any other form of medical attention or medication. We have lists of public blood donors of all types available for any emergencies. This is very essential where there may be more than one injured man.

Should there be a shortage of any requirement, we immediately take the necessary steps to get it. In such instances, we call on local police or the state police. Through the years we have found that by looking after an injured man, he rarely forgets it, and, on future occasions he is more cooperative in following the instructions of the safety engineer.

Safety on any job is a matter of common sense, education, experience and most of all, active interest and cooperation of top management. This top interest is not something just to be talked about or sloganized, but top management must work at it continuously. We are fortunate in having our project manager and all our top management thoroughly active in our safety work. It is a proven fact that the rising costs in compensation have caused definite action to be taken by management in looking at safety programs that must meet the particular job requirements.

We firmly believe that compensation costs will demand that every large construction company will eventually have to maintain a safety department with a thorough knowledge of compensation matters as the injured man is a direct result of an unsafe practice and getting the man back to work will be a direct cost. It is going to be necessary to train each crew in safety procedures of their

particular job. General safety programs will not suffice as conditions on one project are foreign to conditions on the other.

While progress is the most important part of every project, progress without safety is foolhardy and safety without claim supervision is too costly. In many cases the humane element is lacking and the injured man becomes a compensation number.

We firmly believe that it is very essential that every man injured should know that management is interested in his getting better and back on the job. We make it our business to see every man who has a lost time accident to inform him of his compensation rights and our help. We consider this an important element in safety work.

Over the years we have found it necessary to attend compensation hearings on all serious and phony cases. We not only help to save thousands of dollars but do a great

deal to straighten out cases that could hang on indefinitely, because we feel that usually the injured man never gets enough to compensate him for a real serious injury and usually we can suggest to the carrier that certain procedures be waived and the man be given additional help. We also invite the compensation personnel to the job so that they may get a first-hand picture of the entire operation.

Each month we get out a bulletin in which we give our progress figures at each location and we discuss each lost time accident, also listing our frequency and severity records. This keeps every man on the job informed as to why they should work safely and to prove to them that they are personally the losers every time they get hurt, bringing home to them that they cannot afford to have an accident. It also makes them feel that they are an important part of the job.

SAFETY ASPECTS ON THE USE OF MECHANICAL RAISE CLIMBERS

By LEONARD P. COLVIN

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Mining companies are intensely interested in new equipment to help increase production, lower costs, and improve working conditions. The mechanical raise climber contributes to all three goals. Properly used, it will increase production, cut costs and has a number of important safety aspects which are the subject of this discussion.

The raise climber is an elevator that eliminates timbering while driving a raise. It facilitates the movement of men and materials safely to and from the working face and provides a platform to make work at the face easier and safer.

An extensive time study of Butte raise climbing operations showed that a greater percentage of the mining cycle is spent in effecting the direct advancement of the raise, with much work required in our conventional raises being eliminated. As a result, the raise climber has cut the mining cycle time required to less than half. Lifting large

timbers, installing bulkheads, drill stagings, lining chutes and climbing ladders are elements not present in climber-driven raises.

While the raise climber does away with many of the usual hazards of raising, others in connection with the climber operation have developed. Proper ventilation of climber raises; the correct design of storage room for the climber and equipment; and the type of mucking or raise chute lay-out are of prime consideration in the prevention of accidents.

The climber is considered an elevator and should be maintained as one. Miners and maintenance men must be trained to follow a daily and weekly lubrication and inspection schedule. Daily testing and inspection of the safety brakes is essential.

Through experience we have added and changed some mechanical features of our raise climbers. Raise climber manufacturers are also constantly trying to improve the

versatility and safety features of their climbers.

When the miners are unable to descend a raise on a climber due to mechanical failure or lack of air power, a definite mechanical procedure is followed. For unforeseen emergencies a long nylon rope and two safety belts are provided on all climbers in Butte.

Summarizing, the climber has cut the time of a complete raise cycle by half and lessened the preparation work and fatigue accordingly. Many of the hazards of driving timbered raises have been eliminated by the use of the climber; however, it is apparent that the first-line supervisor, maintenance

men, and the miners greatly influence the safety aspects of the climber.

To obtain optimum safety of the personnel operating the climber requires of all concerned, that lubrication, inspection, maintenance and correct handling be rigidly adhered to. Also, the training of personnel for correctly operating and maintaining the climber is necessary. The storage room design used in raising is of primary importance and certain mechanical changes in some climber models are desirable.

All of the foregoing elements should contribute to a reduction in the number of accidents in driving raises.

STOPPING METHODS IN THE LAKE AMBROSIA URANIUM MINES

By H. J. ABBISS

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The Lake Ambrosia uranium mines are situated in an area some 30 miles northwest of the town of Grants in New Mexico. Underground mining started approximately four years ago and today there are more than 18 companies active in mineral extraction. The mining methods described in this paper are those being used by the majority of the operators in the area. Due to the different types of ore bodies it is not uncommon for a company to extract the ore in a mine by a combination of these methods.

Prior to describing the mining methods a brief description of the geology of the area is necessary.

The ore is found in two formations, the Todilto limestone and the Westwater sandstone. Most of the ore bodies in the Todilto are small and discontinuous. My paper will therefore deal with the Westwater ore bodies.

These ore bodies may be classed as trends, pods and stacks. The term "stack" arose from the early conception of the thick ore bodies wherein the geologists pictured them as being a point of intersection of numerous trends—or a "stacking" of trends. Most of the ore bodies in Ambrosia Lake are of the trend type, some being over 2000 feet long

and ranging from 50-200 feet in width. Pods or kidney shaped ore bodies may be as much as 1000 feet in their long dimension.

Delineation of the ore prior to stopping is done by extensive long hole drilling from development drifts. These holes quite often perform a dual function in that they provide good drainage for the water in addition to providing geological data.

The stopping methods used in the Lake Ambrosia mines fall under the following headings:

1. Trackless Room & Pillar
2. Slusher Room & Pillar
3. Long Hole Room & Pillar
4. Cut and Fill
5. Modified Shrinkage and Others

Trackless room and pillar mining is carried out in areas where the ore ranges from 5 to 15 feet in thickness. Drifting was done on a predetermined grid pattern, usually 50 foot centers. The basic development drifts are usually 7 by 10 feet or 7 by 14 feet in cross section, which leaves pillars of varying dimensions. In the majority of cases these pillars are 36 by 36 feet or 40 by 40 feet in area.

Pillar removal is accomplished by splitting pillars with a trackless or slusher drift

and removing subsequent pillar stumps by slabbing into adjacent pillar crosscuts. Trucking is done from the pillar crosscuts (or drifts) where remaining pillars provide protection. Occasionally stulls or clusters of three stulls are installed on the stopping line or cave line for temporary protection while drilling and mucking. If required then timber cribs are installed. Retreat mining is started from an ore fringe and an attempt is made to proceed with pillar removal in a uniform retreat line.

Where mucking cannot be done from a safe position near the cave line, scrapers are used to pull the broken ore back to a safe place for subsequent loading with diesel front end loaders or trucks.

Drilling for pillar removal is done with drills mounted on air legs, using 1½-inch hexagon drill steel with carbide bits. Rounds vary from 6 to 13 feet in length.

Blasting is done electrically using 1¼ by 16 inch semi-gelatin dynamite and milli-second blasting caps. Condenser discharge blasting machines are used to detonate the rounds.

In general, slusher room and pillar methods are used for mining thin horizons of ore (less than 5 feet thick) or areas inaccessible to trackless equipment. The basic development for slusher room and pillar stopping is done with drifts driven on 25 by 50 foot centers or 50 by 50 foot centers ranging from 6 to 8 feet wide. Broken ore is slushed to properly spaced raises and transferred to the haulage level through chutes into cars or trucks.

In most retreat work the pillars are slabbed along a retreating face perpendicular to the 50 foot grid dimension. The broken ore is cross slushed to the drifts and then to the extraction raises. Lines of stulls are carried behind the mining face.

In some cases where the back is weak the retreat mining is done by driving panels 8 feet wide through the pillar leaving an 8-foot pillar. A 40-foot pillar would be split with two panels 8 feet wide leaving three 8-foot pillars. After each panel is driven and supported the remaining 8-foot pillar is slabbed into the panel and slushed out. In some cases small stumps are left for support as well as slabs and cribs.

Drilling and blasting procedures are the

same as used in the room and pillar method of mining.

Slushing is done with two and three drum 15 and 25 H.P. electric hoists pulling 48 and 34-inch light weight welded scrapers.

In many instances ore pods will be thicker than 15 feet but not thick enough for cut and fill mining. Where this is the case pillars are removed by room and pillar methods using sectional drill steel for blast hole drilling. In most cases the basic development drifts are driven on a 50 by 50 foot grid pattern and the ore removed to full height before pillar removal starts. After the rooms are excavated to full height, the pillar is split with a drift approximately 8 feet high in the bottom section of the ore. From this drift one-half of the pillar (approximately 20 x 40 ft.) is ring drilled with sectional drill steel to reach the top and lateral extent of the ore. Burden on the rings is usually 3 feet. The holes are loaded with 1¼ by 16 inch sticks and primed with milli-second caps. Usually the broken ore can be blasted into an area next to the remaining pillars and away from the cave area.

Usually the stopes are too high to use stull or crib timber effectively and much removal must be done with slusher hoists and scrapers. Men are required to stay out of these open stopes and safe access must be provided to reach slusher tail blocks. In most cases muck removal after a blast can be completed before excessive cave from the back causes too much dilution of the ore.

Slushing equipment and techniques are similar to those used in other stopping methods. Ore is slushed to extraction raises or to points where it may be loaded with diesel powered loaders.

In one mine where the ore is approximately 500 by 180 feet in area the ore is mined by cut and fill stopping methods. Within the ore body stopes have been laid out approximately 25 feet wide and perpendicular to the long axis.

Initial development of the cut and fill area was done by driving raises from slusher rooms which were below the ore. From these raises, which were driven into the various stope panels, stope drifts were driven on the bottom of the ore to the ore limits in each panel. These drifts provide a start-

ing point for "slibbing out" each panel in the cut and fill stopes.

To date horizontal cuts have been taken in the cut and fill stopes which vary from 8 to 15 feet high. After the cut is mined, the back is bolted with studded roof bolts of the 1½-inch expansion shell type. Chain link fencing is installed on these bolts before the broken ore is removed.

Mucking is done with diesel powered front end loaders or scrapers and the broken ore dumped into a raise or chimney where it is dropped to the loading scum below.

Drilling is done with air leg mounted machines and similar drill steel and bits as those used in other stopping operations.

Blasting procedure is the same as in the other stopping areas.

After the broken ore is removed from a cut or lift, vertical "gob fences" are constructed along the stope boundaries and cabled together in order to confine the fill material in the stope. Gob fences are constructed of 2-inch lagging nailed on the inside of 8 by 8 inch posts spaced on 5-foot centers.

Waste back fill is dumped into the stope through fill raises and spread with scrapers or diesel powered, front end loaders. Fill is spread in the stope so that it will range from 3 to 8 feet from the back and ore extraction chutes are constructed or extended to the top of the fill.

As mining commences on the next lift or cut the chain link fencing is removed from the back before blasting. This fencing is rolled up and stored for re-use on the next cut.

Mining is continued to the top of the ore and the back supported with cribs which are placed on top of the fill after mining the last lift or cut.

Subsequent stopes or panels will be mined in sequence along side of the completed stopes or panels. Considerably more timber will be used in these subsequent panels to provide temporary support in the brow area adjacent to the mined out and filled stope. Mining will commence in the original stope panel drift and the ore will be slabbed out to the gob fence of the adjacent filled stope.

Fill material used for stope back filling is mine waste from early development work and is transferred into the mine through a 32-inch borehole and hauled by truck to the

stope fill raises on a level above the Cut and Fill stopes.

In one operation where the ore is relatively thick, that is 60 feet or more and long and narrow, a modified shrinkage stope method has been adopted. Scram drifts and cones are driven under the ore body with raises driven at 30-foot centers along the strike. After the under cut is completed the ore is blasted by drilling flat long hole mines from the raises. Since the raises are inaccessible after the first blast, the ore is shot from bottom to top in one blast, the rings being drilled on 5-foot centers.

In another mine where the ore is of high enough grade to require 100 per cent extraction, the ore body has been developed with three parallel sub-level rail headings on 200-foot centers with ore passes on 75-inch centers. Slusher slots are cut between draw points on adjacent rail headings perpendicular to the rail. These slots are cut through the full thickness of the ore and supported with square set timbers. The 75- by 200-foot blocks thus delineated are being mined by driving a series of drifts 6 feet wide and 9 feet high through at right angles between two adjacent slots and shrinking the ore over these drifts. The muck in the shrink slot is slushed out and replaced with sand containing Portland cement (1 sack per ton). The shrink slots are accessible from both ends for slushing the broken muck and filling.

Development drifts outlining the pillars are usually supported by the use of rock bolts with chain link fencing or steel mats. The New Mexico Safety Code states that any place over 10 feet in height or over 8 feet wide will have permanent support to within 10 feet from the face. In some cases drift sets are used for support. During pillar extraction the extensive use of stulls or cribs in conjunction with rock bolting is the general practice.

Due to the presence of radon and the daughter products, coupled with the use of diesel equipment, it is necessary that each mine has an effective ventilation system. In stopping this is accomplished by fresh air being constantly supplied to all working headings. Mechanical ventilation with the use of brattices, auxiliary fans and vent tubing is used.

In the past, all operations were faced with

problems during the stoppage cycle but with constant research, good planning and supervision plus the help from certain agencies

it has been proved that the mining of uranium ore in the Lake Ambrosia area can be done effectively and safely.

THE 1962 CAMPAIGN TO REDUCE INJURIES FROM FALLS OF GROUND

By AL KOLU

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Those who were active in the 1955 National Safety Council's international campaign for the prevention of injuries from falls of ground at metal and nonmetal mines (other than coal) will recall that it was the first major campaign conducted by the mining section; and, while participants lacked experience, they made up for it in enthusiasm. I would like to refresh your memories on what happened.

First, we had active participation in United States, Canada, South Africa, Cuba, Cyprus and the Philippine Islands; and second, we got results.

The 1955 frequency experience, compared to the base period of 1954, fell 29 per cent. Three out of every four of the 250 participating mines reported improvement; and this improvement ranged from 24 per cent in Canada, 30 per cent in the United States, to 43 per cent in the group including South Africa, Cuba, Cyprus, and the Philippine Islands.

Certain mining areas showed even more startling results. For example, participating mines in the southwest United States showed an average improvement of 36 per cent. Those in the eastern part of the United States showed an improvement averaging 46 per cent. British Columbia achieved the largest improvement, with 56 per cent. It was estimated that at least 245 lost-time and 15 permanent total disabilities and fatalities were prevented in the participating mines.

Unquestionably, that campaign was worth all the effort and enthusiasm that was poured into it.

Let's examine what has occurred in the years following that campaign. In 1955, the

frequency rate for fall-of-ground accidents in the metal and nonmetal mines in the United States averaged 6.6. Comparing this with the last complete figures available for this group in 1958, we find there has been an increase to 7.63. Preliminary 1959 figures indicate a rate still higher—8.4. The 1960 over-all Canadian experience shows similar high rates.

We all know that falls of ground lead as a cause of serious disability and death and that their prevention is one of the most rewarding objectives. An analysis of years prior to 1955 indicated that more than 3 per cent of all lost-time injuries from falls of ground are fatal, 80 per cent are serious, and less than 17 per cent are minor. 1959 figures indicate that the 3 per cent has now grown to more than 4 1/4 per cent.

You can well appreciate, therefore, why there is a great need for a concentrated attack on falls-of-ground accidents, and since we now have not only the enthusiasm but the experience, the campaign we plan for 1962 should deal a hard blow to this persistent hazard.

Now for 1962. Our goal is a reduction of 30 per cent or more in the frequency rate of injuries and fatalities from falls-of-ground accidents in our participating mines. The campaign will run from January 1, 1962, to December 31, 1962. We intend not only to intensify our effort, but to broaden the coverage by enrolling more mines in the campaign.

The campaign is sponsored by the mining section of the National Safety Council under the direction of an advisory committee composed of Al Kolu, Pickands Mather & Co., Inc. chairman; Edward C. Leonard,

Inland Steel Company; and John A. Cooke, Falconbridge Nickel Mines Ltd. Endorsing and cooperating in the campaign are federal, state, and provincial mining departments, mining associations, mining publications, insurance carriers, and others having an interest in the welfare of the mining industry.

All underground noncoal mines are urged to participate in the campaign, including mines in Canada and other countries outside the Continental United States. Membership in the Mining Section of the National Safety Council is not required.

The only requirements for participation are:

- 1) If the company operates two or more mines, each mine must enroll separately.
- 2) Each participant agrees to furnish a simple report of injuries resulting from falls of ground for 1961, a report at the end of the first six months of the campaign, and a report covering the last six months.

The Council will make awards to mines and supervisors achieving the campaign goal and meeting the other campaign requirements.

The National Safety Council has produced various materials to assist participants to achieve an effective campaign, which are as follows:

- 1) Announcement poster.
- 2) A scoreboard poster.
- 3) Twelve posters, one for each month of the year, emphasizing an important safe practice for avoiding injury from falls of ground.
- 4) A series of twelve information sheets, one for each month of the campaign.
- 5) A set of four illustrated booklets, each containing illustrations emphasizing safe practices pertaining to the prevention of falls of ground.
- 6) Reflecting safety signs for mounting at strategic points underground. (These come in sets of four, made up in two colors

and bearing various phrases pertaining to the prevention of falls-of-ground accidents.)

7) Reflecting Scotchlite stickers for hard hats which have the green cross for safety on an off-white background, with the phrase "Prevent Falls of Ground" imprinted. (These are to be distributed to all underground employees of all mines enrolled in the campaign.)

Other bulletins and promotional material will also be mailed. A new slide film has been prepared. All campaign materials are now ready and available for purchase from the Council.

Committees and their members have worked hard in developing the above aids for the Campaign. I want to express my appreciation for the cooperation of all committee members, and I wish to thank the many others who contributed statistics and material. Clint Hoch, staff representative, and the staff of the National Safety Council deserve special mention for their hard work in preparation of the campaign.

The campaign is on. Now it is up to each of us to see that as many mines as possible are entered, to see that campaign material is used, and to see that there is no letdown during the entire year of 1962. This is no small job. It's a big-scale operation that deserves and must have the all-out efforts of every safety man. You should get this program before your top management immediately and see to it that every supervisor is keyed up to top effort.

The material and program prepared by the National Safety Council will be a valuable aid, as will the various agencies and departments mentioned previously, but the final results will come from your supervisors' know-how and enthusiasm. This is your opportunity to make one of the biggest possible contributions towards saving life and limb. We want the campaign big, and we want it successful. Let's give it everything we've got.

LOW-COST BLASTING AGENTS

By GLENN H. DAMON

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The cost of blasting is important to the development of many mineral deposits. Since the introduction of explosives to the mining industry in 1627, when black powder first was used at the Royal Mines of Schenitz, Austria,¹ explosives have played an ever increasing role in the mining industry. In the United States alone, over one billion pounds of explosives are used each year and approximately 75 per cent of this total is used in mining. Thus, until recently, the American mining industry was spending approximately \$175 million per year on explosives, exclusive of detonators and blasting supplies.

While this cost is not large in comparison to the value of the products from the mineral industries, any saving in the cost of the explosives is reflected in lower mining costs, provided this change does not result in increased costs for drilling or for handling the broken ore. In addition, any decrease in the cost of blasting should be accomplished without a decrease in the safety of the mining operation.

Attempts to lower blasting costs by the use of cheaper or more efficient explosives are not new. The development of nitroglycerin-based high explosives resulted² from efforts to find an explosive more efficient than black powder. Even before this, chlorate explosives³ were investigated and were rejected because of their hazards. In 1871, Sprengel⁴ patented a series of explosives intended for mining which gave promise of reducing blasting costs. These explosives combined certain oxidizing and reducing substances which could be mixed just before the explosive was used.

The original "Sprengel explosives" used oxidizing materials, such as potassium chlorate, nitric acid, and nitrogen tetroxide, with combustible materials such as nitrobenzene, nitronaphthalene, carbon disulfide, and petroleum. Liquid oxygen explosives were introduced later and proved moderately successful in the United States, particularly in strip mining coal. Although Sprengel explosives are generally very powerful and moderate

in price, they have never seriously challenged the nitroglycerin dynamites. Some, such as nitrogen tetroxide mixed with a hydrocarbon, are too hazardous to be practical for general mining.

Explosives composed of mixtures of ammonium nitrate and a fuel were first suggested by Ohlsson and Norrbein⁵ in one of the earliest patents covering commercial high explosives. The first practical, commercial "blasting agent" using the ammonium nitrate-fuel system was introduced to mining about 1935. This type blasting agent, sometimes called "nitro-carbo-nitrate," was noncap sensitive, but could be readily and reliably detonated by a strong primer.

However, the full economic advantage of the ammonium nitrate-fuel system was not realized until the introduction of Akremite⁶ to coal stripping operations in 1955. This system employed a porous, fertilizer-grade, prilled ammonium nitrate sensitized by carbon black. The ammonium nitrate and the fuel were mixed at or near the site of the mining operation and the product was packaged in polyethylene bags. Under the confinement provided by the borehole, this oxidant-fuel system could be detonated with a dynamite primer; the primer comprising from 5 to 25 per cent of the weight of the final charge.

It was soon apparent, however, that a liquid fuel such as diesel oil could be applied more readily and would have many advantages over a solid fuel. The economic advantage of this blasting system is apparent since oil is very cheap and fertilizer-grade ammonium nitrate (FGAN) sells for approximately 31 cents per pound. Equivalent-strength dynamites sell for 15 cents to 22 cents per pound.

Prilled ammonium nitrate is relatively porous, but the carbon black in Akremite reached only the outer surface of the prill which was already covered with a diatomaceous earth, anti-caking agent. Now a large proportion of the blasting agents are prepared from uncoated prills and a liquid fuel.

Most of the ammonium nitrate produced and used in the United States is made by reacting ammonia with nitric acid. The bulk of the production is used by the fertilizer industry and most of the remainder (approximately 700 million pounds per year) is used in the explosives industry. To a considerable extent, the physical properties of the ammonium nitrate are controlled by the method of manufacture or production. Particle size and particle density are important for material used in the explosives industry, but are relatively unimportant in the fertilizer industry. Also, ammonium nitrate is extremely soluble in water and tends to harden into a solid mass when exposed to atmospheric moisture. To prevent this caking, it was formerly common practice to add one to three per cent of a petroleum wax coating to prevent setting. After the disastrous explosion in 1947 at Texas City, Tex., involving such organic-coated ammonium nitrate, the use of wax anti-caking agents was discontinued for fertilizer material and an equivalent effect was obtained by adding two to four per cent kieselsguhr.

Until about 1947 nearly all the ammonium nitrate produced in the United States was made by graining process. Here the water is evaporated from the ammonium nitrate solution at atmospheric pressure and the size and density of the product can be controlled by the rate of heating and the amount of stirring. This process still is followed for most ammonium nitrate used in dynamite. A moderately dense uniform-particle-size material can be made by this method.

The largest percentage of ammonium nitrate produced in the United States is made by the prilling process. In this method, a hot, 95 per cent solution of ammonium nitrate is sprayed down through a counter-current stream of hot air rising in a prilling tower. As the material solidifies, most of the water is removed and the resulting product becomes moderately porous and almost spherical. By carefully controlling the conditions in the prilling tower, it is possible to vary the particle density of the prills from approximately 0.76 to 0.95. This density is appreciably lower than that for grained ammonium nitrate, which averages approximately one.

Experience indicates that a relatively

porous, prilled ammonium nitrate produces the most satisfactory blasting agent when compounded with the proper proportion of fuel oil. The principal disadvantage is the relatively low density. It has also been found that uncoated prills produce better all-purpose blasting agents than similar prills containing three or four per cent kieselsguhr. To meet this demand, industry now is producing prilled ammonium nitrate with either no anti-caking agent or with only a very slight coating. In more recent developments, a surface active agent is added to the ammonium nitrate to insure a more intimate contact between the oil and the surface of the prills.

Number 2 diesel fuel has been found most satisfactory for producing these low-cost blasting agents. More volatile fuels, such as gasoline, should not be used because of the fire and gas-explosion hazards. The ready availability of diesel fuel and its low price make it particularly attractive as the combustible material in blasting agents, but almost any oxidizable material can supply the fuel requirement and, to varying degrees, the sensitization to initiation. Pulverized coal, chars, nitromethane, and even such improbable fuels as molasses have been employed, often in combination with some fuel oil.

Most prilled, fertilizer-grade ammonium nitrate will absorb up to 6 or 8 per cent oil. Excess oil tends to drain off and collect at the bottom of the container. Since approximately 6 per cent oil with the ammonium nitrate forms a stoichiometric mixture, the preparation of the blasting agent should be moderately simple. However, experience has shown that accurate compounding and careful mixing gives a decidedly superior product.

The most common practice for field mixing is to pour a measured quantity of fuel oil into each bag of ammonium nitrate. If the amount of oil added is carefully controlled, and if time is allowed for the prills to absorb the oil, a moderately satisfactory product is obtained. The mixed product then can be poured directly into the boreholes.

The most uniform product is obtained by stirring in any of a number of conventional mixers. Careful compounding and thorough mixing give a product of quite uniform characteristics which can then be loaded

or poured directly into dry boreholes or packaged in a plastic or other waterproof container for use in wet boreholes. The mixer should be so constructed as to minimize confinement, frictional heating, and crushing of the prilled material.

Most, if not all, the explosives companies in the United States produce and sell a blasting agent or agents similar to, and competitive with, the field-mixed ammonium nitrate-fuel oil. The product is either delivered in bags for use by pouring directly into dry holes or in waterproof containers for either dry or wet holes. In addition, the companies traditionally provide technical assistance for the blasting operations.

Most vertical holes are loaded by pouring the premixed product directly into the borehole. Pneumatic loading is generally used for horizontal boreholes. Where boreholes cannot be completely free of water, it is now rather common to employ a waterproof explosive such as Pelletol (TNT), slurry explosives, gelatin dynamite, or a blasting agent packaged in a waterproof container to fill the hole to the water level. If more explosive is required, the remainder of the charge consists of loose prills and oil.

Research, to be described later, has shown that adequate initiation is one of the most important factors in the successful performance of low-cost blasting agents. In the early work with ammonium nitrate-fuel oil (AN-FO) blasting agents, initiation was accomplished by using a high-strength dynamite for 3 to 25 per cent of the entire charge. The desire to lower the overall blasting costs has caused many mines and quarries to decrease the quantity of primer and substitute a cheap, low-strength dynamite for the high-strength gelatin dynamite. While the AN-FO mixtures now being prepared are generally more sensitive than those made several years ago, most explosives people agree that improper or poor initiation decreases safety and increases the overall cost of blasting.

Detonating cord has been used with moderate success to initiate AN-FO mixtures. While this may have some advantages from the standpoint of safety, it is doubtful whether maximum performance can be obtained by this method.

A more recent method of initiation involves the use of pentolite or composition B

primers. Although these primers are moderately expensive, they have proved very effective, even when used in sizes from $\frac{1}{8}$ to $\frac{1}{2}$ of a pound. Even smaller primers have been used successfully in relatively small boreholes. The use of this type initiator is increasing in popularity and may eventually replace many of the other forms.

The success of AN-FO blasting agents in open pit mining and quarrying has stimulated efforts to apply the same materials to underground mining. Experimenters have been able to produce ammonium nitrate with physical properties which, when fuel oil is added, makes it sufficiently sensitive to propagate (under borehole confinement) in columns down to approximately 1 1/4 inches in diameter.

The first extensive use of AN-FO blasting agents underground was at the Eagle-Picher lead and zinc mine near Picher, Okla. Mine operators found that uncoated ammonium nitrate prills were much more satisfactory in the small-diameter holes used. About the same time, the International Salt Co. began an investigation at its Detroit (Mich.) mine. This mine proved to be almost ideal for studying this type because it is relatively dry, ventilation is excellent, and all shooting is done off shift. Mine officials found also that uncoated prills were more satisfactory than the normal fertilizer-grade prills and that pneumatic loading of the holes was a necessity.

Efforts are being made to introduce AN-FO blasting agents to underground potash, gypsum, and limestone mines. These mines are generally quite dry and ventilation is generally not difficult. However, the practice is still not widespread and many problems are still unsolved.

Any discussion of blasting developments using AN-FO underground would be incomplete without mentioning the work being done in Sweden. In that country, a fine-grained ammonium nitrate is used instead of the prilled product employed in the United States. Pneumatic loading is used. Swedish users report successful blasting in borehole diameters as small as one inch.

The economic advantage from using blasting agents based on AN-FO has stimulated an unprecedented amount of research on explosives and blasting. Before 1955, most

research on commercial explosives was performed by explosives companies, a few mining schools, and governmental organizations, such as the Federal Bureau of Mines. Chemical concerns manufacturing fertilizer-grade ammonium nitrate suddenly became interested in the potential market for their product afforded by the shift in explosives technology.

Almost all ammonium nitrate used in dynamite is the grained type and usually it is prepared by the explosives companies. On the other hand, the physical characteristics of ammonium nitrate prills made them generally more suitable for compounding the simple, low-cost blasting agents. As a result, several chemical concerns have supported research leading towards the development of improved blasting agents. Some of this work has been by the concerns themselves, but much has been done by various mining schools, research institutes, and consulting firms.

To meet this new competition, explosives companies have increased their efforts to produce a product with performance equal to or superior to the field-mixed product, and competitive in price with that product. In addition to the previously named groups, several of the larger mining companies have performed experimental work on the application of this product to their specific problems. The Bureau of Mines has also been engaged in research on two of the most important safety aspects of this material. These are: the sensitivity of the blasting agents, and the relationship between the toxic fumes evolved by the detonation of the blasting agent and the physical and chemical factors associated with the compounding, mixing, and use of the materials.

Without doubt, the most comprehensive series of research reports on ammonium nitrate-fuel oil blasting agents was given at the Fifth Annual Symposium on Mining Research held at Rolla, Mo., in November, 1959, and at the International Mining Symposium at Rolla, in February, 1961. Papers from all segments of government and industry were presented. Another excellent review of the entire subject of modern blasting agents is given in a recent article by Cook¹. This summarizes much of the research at the University of Utah and provides some theoretical explanations for the behavior of this type explosive mixture.

The results of these research studies will form the basis for my discussion of performance variables.

No absolute standard of blasting performance has been developed. Therefore, performance cannot be judged solely on the number of tons of rock loosened per pound of explosive used. It must be judged on the basis of the overall cost of the mining operation, over a sufficiently long period to average out the effects of uncontrollable variables.

The most important variables in determining the performance of a blasting explosive are:

1. The strength or maximum available energy.
2. Detonation rate.
3. Detonation pressure.
4. Borehole pressure.
5. Density.
6. Sensitivity.

Some of these variables are more or less interrelated.

The true strength of an explosive should be measured in terms of the total energy released (per unit weight) by the explosive reaction. In practice, the strength of an explosive is determined by the ballistic mortar and is expressed in terms of its equivalence to a given strength of straight dynamite. Thus, a 60 per cent dynamite gives the same ballistic mortar reaction as a 60 per cent straight dynamite. While this method gives useful information, the results cannot be translated directly into performance.

Detonation velocity is usually taken as the basic criterion of the intensity of explosion or detonation. Explosives having a high detonation rate usually give high shattering effect or brisance. Such explosives normally are used for blasting extremely hard rock. Low-velocity explosives are more effective where a heaving or pushing action will loosen the rock or consolidated earth. In general, the detonation velocity varies linearly with the density of the explosive.

Detonation pressure and borehole pressure depend upon charge density; the amount of gas released by the chemical reaction; the total amount of energy evolved; and the rate at which that energy is released. If the explosive charge completely fills the

cross section of the borehole, the detonation pressure and the borehole pressure will be approximately the same. These parameters are evidently of importance in calculating the theoretical performance of an explosive, but it is difficult for the practical mining engineer to use this data. Therefore, the remaining discussion in this section will be confined to variables more directly under the control of the explosives engineer.

Composition of a blasting agent is a controllable variable that materially affects both safety and performance. Maximum explosive strength is obtained with a stoichiometrically balanced (fuel-oxygen) mixture consisting of 94.3 per cent ammonium nitrate and 5.7 per cent fuel oil. Such an oxygen-balanced composition is approximately equivalent to 60 per cent (weight strength) dynamite. Maximum detonation rate for such a mixture of 0.90 bulk density is about 13,000 feet per second.

However, detonation rates actually attained are usually lower than the theoretical, due to compositional variables and, often, to less-than-optimum initiation. Bruzewski, Clark, Yancik and Kohler report¹¹ that an excess of oil is less detrimental to the detonation velocity than a deficiency of oil.

Other factors being equal, oxygen-balanced mixtures give maximum strength and produce a minimum of toxic fumes. This is especially important if AN-FO blasting agents are to be used underground. Van Dolah, Hanna, Murphy, and Damon¹² found that the volume of toxic gases per pound of explosives used is at a minimum with an oxygen-balanced composition; the amount and nature of toxic fumes produced being very sensitive to the concentration of the fuel in the mixture.

Since the initiation of a high-rate detonation is essential to the safety and the performance of a blasting agent, the sensitivity of various AN-FO mixtures is of interest. Van Dolah and associates¹² found maximum sensitivity in somewhat over-oxygenized compositions containing about four per cent oil. However, Yancik, Bruzewski, and Clark¹¹ reported finding little difference in sensitivity among compositions that varied between one and seven per cent in oil content. In any case, it is better, safety wise, to adjust sensitivity to desired levels by means that do not involve fuel-oxygen imbalance.

While most AN-FO mixtures are insensitive to a No. 6 or a No. 8 blasting cap, it is possible to produce cap-sensitive mixtures. When a stoichiometric mixture of prills and oil is crushed, the sensitivity of the pulverized material is higher than the original mixture. Brinkley, Sykes, and Myers¹³ report on a method of particle size reduction which produced a uniformly cap-sensitive product. Hino and Yokogawa¹⁴ comment that it is possible to produce an ammonium nitrate-fuel mixture in which high-rate propagation is achieved in cartridges less than one inch in diameter, even when initiated by a No. 6 detonator. For these results, the mean particle diameter of the ammonium nitrate is reduced to less than 20 microns. Thus, particle size reduction is a means of eliminating or reducing the size of the primer.

It has been shown also that uncoated prills produce a more sensitive blasting agent than the same mixture composition using inert coated prills. Still greater sensitivity has been obtained by the incorporation of a surface active agent into the uncoated prills.

The appearance of brown oxides of nitrogen indicates an incomplete detonation reaction with resulting poor performance and increased fume hazard. Figure 1 shows the effect of primer strength on the production of toxic gases from AN-FO compositions. On the right side of this figure is shown, for comparison purposes, the results obtained with a typical dynamite when initiated by a No. 6 electric blasting cap. Data on the detonation rate of similar mixtures, using various strength initiation, confirms the conclusion that the better the initiation, the more complete the reaction.

The ready solubility of ammonium nitrate in water makes it uneconomical to use such a blasting agent in wet boreholes. However, it is interesting to note the effect of water on the detonation properties of AN-FO compositions. If the production of oxides of nitrogen can be taken as a criterion of the completeness of a reaction, Figure 2 shows that small amounts of water appreciably change the reaction, even when the AN-FO charge is initiated with a PETN (pentaerythritol tetramitate) primer.

Much has been written about the safety of AN-FO blasting agents. We must admit that the safety record of these new blasting

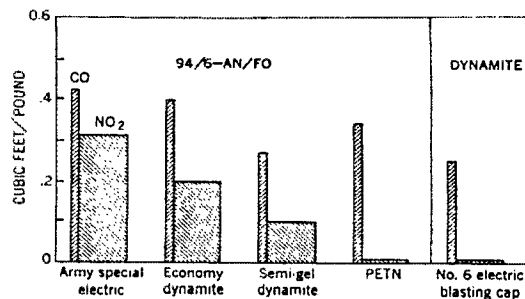


Figure 1

agents is excellent, but we would be naive to assume that accidents cannot and will not occur. Any tendency toward considering these materials as being perfectly safe creates a hazard which will eventually lead to serious mishaps.

If AN-FO blasting agents are treated as high explosives, the safety record of these materials should continue to be outstanding.

On the basis of present information, the Bureau of Mines has published¹⁵ what it believes to be the best general safety recommendations. A recent publication of the National Fire Protection Association¹⁶ gives much valuable information, but is not as detailed as the Bureau of Mines circular.

Most ammonium nitrate-fuel oil blasting agents are insensitive to the usual impact

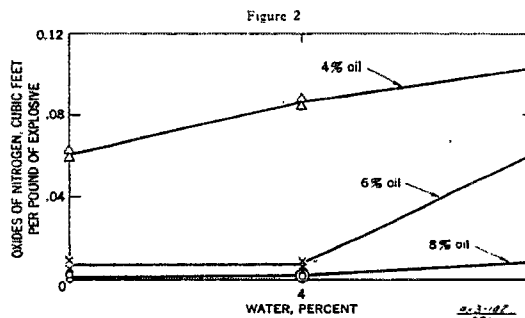


Figure 2

and friction tests that are applied to high explosives. However, because of their low sensitivity, a relatively high-strength booster must be used. This in itself does not create a hazard, provided handling, loading, and firing are performed in the same manner as that employed when dynamite is used as the entire charge. However, ammonium nitrate-fuel oil mixtures have another disadvantage in that propagation through an air gap is poor. Therefore, it is essential that the column of blasting agent be continuous. For example, the detonation reaction with most dynamites will propagate across an air space varying from 3 to 25 inches. On the other hand, an air gap of from one to two inches in a column of AN-FO blasting agent will usually result in detonation failure.

Cap-sensitive AN-FO mixtures can be prepared. Evidently, these mixtures must be considered as high explosives. Some information indicates that repeated temperature cycling of ammonium nitrate prills through the 90°F phase-change region may result in a "cap-sensitive product" when treated with oil.

Fire is probably the greatest hazard connected with the handling and use of ammonium nitrate and blasting agents produced from ammonium nitrate. Without doubt, the addition of fuel oil to ammonium nitrate increases the fire hazard. However, small quantities of AN-FO mixtures are difficult to burn. For maximum safety, the Bureau believes that the blasting agents should be prepared, stored, and handled as an explosive. If these precautions are taken, the safety record for these new blasting agents should be equal or superior to that of dynamite.

Because of the low sensitivity of blasting agents, some users have suggested that these compositions need not be stored in bulletproof magazines. A recent study throws some doubt upon this general conclusion. The standard military rifle bullet test did not provide initiation, even under high confinement. However, it was found that certain high-velocity sporting loads can cause bullet initiation of some of the more sensitive blasting agents.

Many new hazards may be encountered when AN-FO blasting agents are used underground. Toxic fumes are of minor importance in open-pit operations, but they

are a serious hazard when produced underground where ventilation may be marginal. Properly prepared, well initiated charges of AN-FO produce fumes comparable with good dynamite, but slight variations in composition, confinement of charge, moisture or initiation may materially increase the hazard. Also, the generation, accumulation and discharge of static electricity, which may be produced in the pneumatic loading of small boreholes, is a matter of considerable concern. The information about these problems is still inconclusive.

Ammonium nitrate-fuel oil blasting agents have proven amazingly successful, but the search for lower cost blasting has not been confined solely to this system. Several fuel-oxidant systems of other characteristics have been, or are now being, investigated. Since American experience with these other types of blasting agents is generally not extensive, they will not be discussed in great detail in this presentation.

Ammonium nitrate-fuel oil blasting agents have many advantages for open-pit mining, but their solubility in water and their relatively low density are definite disadvantages. Through research performed in the United States and Canada², relatively low-cost slurry explosives have been developed, with densities comparable to gelatin dynamites. These slurry explosives consist principally of ammonium nitrate, TNT, and water. A typical composition will contain about 65 per cent ammonium nitrate, 20-25 per cent TNT, and the remainder water. In some cases, sodium nitrate is substituted for part of the ammonium nitrate and RDX or other explosives may be substituted for TNT.

The ammonium nitrate-TNT-water system cannot be used successfully in wet holes because of the added dilution effect and the gradual segregation of the solid particles from the solution. It has been found, however, that the addition of a small percentage of a guar gum and small amounts of stabilizing agents will give a product which is more nearly a gel than a slurry. These relatively cohesive slurries can be packaged in polyethylene bags or the slurry can be forced directly into the borehole. Since the density of the mixture is higher than that of water, no difficulty is encountered in placing the explosive at the bottom of a water-filled borehole.

Slurry explosives are more expensive than AN-FO blasting agents, but they appear suitable for hard-rock blasting operations and also where water is present. In general, these slurries are not cap-sensitive and are normally initiated with a small pentolite booster. These explosives now cost from 12 to 14 cents per pound at the mine.

Explosives employing sodium or potassium chlorate as the oxidizing agent were suggested before Nobel's discovery of dynamite. However, the practical use of chlorate explosives in mining operations is relatively new. Records indicate they have been used in Finland since the mid-1920's and they have been under extensive development in Sweden³ since 1937. These explosives are now being exploited in several countries under the names of "Imatrex" and "Snoratrex."

Imatrex consists of potassium chlorate so prepared that it will absorb a definite quantity of a mineral oil to form the final explosive mixture. Imatrex representatives propose that the impregnation with oil be made at or near the blasting site. Thus, the method of preparation and use is similar to AN-FO blasting agents.

The second product, Snoratrex, is prepared from sodium chlorate and is said to have characteristics more nearly like those of the slurry explosives mentioned earlier.

Chlorate explosives have not met with general favor in the United States. While pure potassium or sodium chlorate are not particularly hazardous to handle and use, they may become highly hazardous when contaminated with organic material. Additionally, the cost of the chlorate salts, in comparison to ammonium nitrate at approximately 3½ cents per pound, does not make the chlorates too interesting from an economic standpoint. However, American and Canadian interests are investigating the economic possibility of using sodium chlorate impregnated with a mineral oil.

One hazard with chlorates in explosive mixtures should be noted. Chlorates and ammonium salts must never be used in the same mixture because of the possible interchange of ions to produce the hazardous ammonium chlorate. The Interstate Commerce Commission classes any such mixtures as "forbidden" from all shipments involving interstate commerce⁴.

A discussion of low-cost blasting agents would be incomplete without mention of liquid oxygen explosives. Liquid oxygen explosives (LOX) were introduced in 1895⁵ and since have seen intermittent use in various countries. The extensive investigations on this type explosive make it unnecessary to describe the system in detail. Both safety and performance depend largely upon the character of the absorbing carbonaceous material. In the United States, certain carbon blacks have given the most satisfactory results. However, other types of carbonaceous materials have been used satisfactorily in France and India.

The most comprehensive review of the safety characteristics of LOX is given in a Bureau of Mines publication by Tournay, Bower, and Brown⁶.

The development of AN-FO blasting agents in the United States has resulted in the virtual elimination of LOX. However, LOX still has economic possibilities where a high-strength, high-rate, and moderately low-cost explosive is required.

An explosive system based on sensitized nitromethane is reported to be under development. Details are not available, but the relatively high cost of nitromethane may restrict its use to special applications.

A new explosive and blasting technique has been recently announced⁷. This system is reported to be under field development in the taconite deposits of northern Minnesota.

A stoichiometric mixture of ammonium nitrate and fuel oil has given the mining industry a low-cost blasting agent which has proven surprisingly efficient in a wide range of applications. This low-cost composition is particularly suited for open-pit operations where relatively large-diameter boreholes are in common use. The generally good results obtained are believed to be due partly to the close coupling (contact) between the charge and the material being blasted, yielding borehole charge densities essentially equal to product bulk density. Application of AN-FO blasting agents to underground operations is still limited. Many problems still must be solved before this material can be employed safely in small diameter holes. One of the principal concerns is providing adequate ventilation for the rapid removal of toxic gases that may be produced on detonation of such charges.

A brief description is given of several other promising systems that employ relatively low-cost fuel-oxidant materials. More complete investigation will be required to determine the relative merits of these systems.

The types and uses of low-cost blasting agents are many. Because of this diversity, they cannot be judged solely on the basis of physical and chemical tests. Furthermore, complex interrelationships must be considered. As a possible example: An AN-FO mixture which has been found ideal for certain surface blasting may be somewhat hazardous and too costly for ready adaptation to certain underground sites; on the other hand, there may be conditions in which the same AN-FO mixture might be used safely and economically in another underground mine. Because of these many complexities and the wide range of possible variations in the composition and use of low-cost blasting agents, the Bureau of Mines will diligently continue its long-range studies. When significant findings are made, these will be reported to the public through the Bureau's technical publications.

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OBSERVATIONS ON UNDERGROUND BLASTING WITH AMMONIUM NITRATE-FUEL OIL EXPLOSIVES

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The purpose of this paper is to present available factual data relative to health and safety in connection with the use of field-mixed ammonium nitrate-fuel oil (AN-FO) compositions used for underground blasting.

The information presented is intended to help the mining industry to use cheaper explosives safely rather than to oppose their use. Although the Bureau of Mines recognizes the inherently insensitive nature of AN-FO explosives, it is also aware of potential hazards introduced by the do-it-yourself features of mixing, handling, and using such ingredients on the job. The Bureau of Mines believes that control of these hazards is best accomplished through research, dissemination of vital information, education of supervisors and workmen, maintenance of close supervisory controls, and adherence to basic explosives safety practices. Any relaxation of care in handling materials used for blasting regardless of their insensitivity or other inherent safety features will inevitably lead to serious accidents and loss of life.

Following the introduction of Akremite for blasting overburden in strip mining of coal in 1955 and the ease with which acceptable cheap explosives could be made by mixing carbon black with fertilizer-grade ammonium nitrate on the job site, numerous mine operators were attracted by the cost advantages of utilizing such products for blasting. Many began experiments of their own and soon found that diesel oil was a suitable sensitizing agent that was easily mixed with ammonium nitrate. This product gained widespread use in open-pit blasting operations.

Ammonium nitrate-fuel oil blasting agents were introduced in underground mining on an experimental scale in a lead-zinc mine near Picher, Okla. in April 1958. There it was found that uncoated pills mixed with six per cent diesel oil would, under certain

conditions, pull satisfactory blast rounds in dry small-diameter holes in hard rock. About the same time similar successful tests were undertaken in an underground Michigan salt mine. Later that year a potash mine in New Mexico conducted an investigation in an underground mine situated on the public domain and operated under federal-lease provisions, with cooperation from the Bureau of Mines.

At present efforts are being made by some operators to extend the use of AN-FO blasting agents to other underground mines, most of which are generally quite dry and well ventilated; however, the practice is still not widespread and many problems concerning safety in their use are still unsolved. The mining industry on numerous occasions has expressed vital interest in safety considerations and problems concerning the application of AN-FO blasting agents. To understand these matter better from the safety point of view, a short synopsis of the basic properties of ammonium nitrate and review of certain disasters and accidents involving this substance is presented.

Basic Properties of Ammonium Nitrate

Authorities have not always agreed on the degree of hazard involved in the manufacture and handling of ammonium nitrate. For example, Munroe¹ quoted the following from Turner's *Chemistry*, published in 1835: "When this salt is exposed to fire, it liquefies, emits aqueous vapor, dries and detonates." And Aufschlager² in 1924 concluded:

To summarize . . . it appears that the observed velocity of detonation of about 2,500 meters per second removes all doubt as to the character of ammonium nitrate as a brisant explosive.

but Norman³ in 1924 stated:

I consider that ammonium nitrate is

not an explosive by itself because millions of pounds of it have been and are now being made every month in Europe and in this country. . . . Ammonium nitrate, in my opinion, does not constitute anything more than a fire hazard when handled by itself.

and Parisot¹⁰ in 1939, considered pure ammonium nitrate to be a feeble explosive and its explosive character to depend upon impurities present.

Ammonium nitrate is ordinarily a white crystalline solid with an oxygen balance of plus 20 per cent (20 per cent of its weight is comprised of oxygen available for combustion of other material in addition to complete combustion of the ammonium nitrate), a melting point of 337°F, a boiling point of 356° and reportedly begins to decompose slowly at about 392°F. It may exist in six different crystalline forms in the solid state depending upon temperature and pressure.

Ammonium nitrate is hygroscopic; that is, it may take up from or give off water to the atmosphere, depending upon temperature and relative humidity. This property causes caking of the salt and presence of water may cause marked increase in production of oxides of nitrogen when detonated.

Decomposition of ammonium nitrate may involve as many as eight different reactions; however, in general, all products are gaseous, being transformed into nitrogen, oxygen, water, and oxides of nitrogen. Generally, decomposition results in evolution of heat and is reported to be promoted by the presence of organic and carbonaceous matter and by metallic powders, such as aluminum, iron, and zinc. Various metals react with ammonium nitrate at elevated temperatures and some, such as zinc, at ordinary temperatures.

There is no recorded instance of spontaneous heating in pure ammonium nitrate; however, easily oxidizable metal powders in contact with wet ammonium nitrate may heat spontaneously.

When heated under confinement, or partial confinement it can explode. For pure ammonium nitrate the required temperatures for detonation have been reported from 572°F to 662°F. The required temperature

for detonation is lowered by the presence of certain impurities.

Ordinarily it is considered very difficult to detonate pure ammonium nitrate by ordinary impact or friction; however, crushed prills containing four per cent oil at a density of approximately 0.8 when confined have been detonated by impact of .30 caliber bullets.

Detonation velocity of ammonium nitrate increases with density but presence of an air gap in a train of the material may stop further propagation.

For mixtures of ammonium nitrate with sensitizing agents, such as fuel oil, sensitivity to detonation appears to increase with the age of mixture and decrease with greater density of compaction (28).

Major Disasters Involving Ammonium Nitrate

Appendix A lists nine major disasters involving ammonium nitrate together with a brief resume of what occurred.

These major disasters (single accidents that cause loss of five or more lives) point out the need for thorough understanding of the inherent hazards of ammonium nitrate by all persons who work with it and the dangers involved where large quantities are stored or handled. While it is true that certain conditions were necessary to cause detonation of this rather insensitive material, the fact remains that detonation did occur in these disasters, and caused the loss of more than 1,300 lives, injuries to more than 5,500 persons, and uncalculable property damage.

Explosives Accidents at Mines Using AN-FO for Blasting

The mining industry, by virtue of assuming responsibility in the do-it-yourself compounding and use of blasting agents, holds a vital trust in both public and private safety for the explosives it uses. A brief review of appendix B listing eight explosives accidents at mines using ammonium nitrate in their blasting operations will illustrate the extent to which this trust must be guarded to safeguard lives and health in future years.

Five of the eight accidents cited in appendix B may be considered typical run-of-the-mill blasting mishaps that could occur with any type of explosives. They are

characterized by human error and faulty judgment. One can only hope in these cases that carelessness among the injured workmen was not induced by "overselling" the safety features of ammonium nitrate blasting agents. Four of the mishaps recorded in appendix B illustrate the need for strict application of long-standing safety methods and procedures for initiating blasts after the explosives have been placed in blast holes.

The other three accidents indicate that special precautions should be adopted (1) when using air-placement methods and equipment for charging bore holes, (2) when transporting sensitized AN-FO, and (3) when disposing of bags used for mixing AN-FO and explosives containers, wrappers, and scrap lengths of detonating fuse. Suitable recommendations covering these problems have been published in Bureau of Mines Information Circulars 7968, Tentative Safety Recommendations for Field-Mixed Ammonium Nitrate Blasting Agents, and 7315, Destruction of Damaged, Deteriorated, or Unwanted Commercial Explosives.

The following observations have been extracted or evaluated from unpublished reports of investigations, safety inspections, and memoranda of field trip data submitted to the Bureau's Washington Office of Health and Safety Activities.

Fume Production from AN-FO Blasting Agents

Study of data concerning seven series of controlled tests involving 16 blasts in a potash mine and 15 blasts in an iron ore mine reveal that, under certain conditions and with well-regulated controls, the fume production of toxic gases from AN-FO blasting agents can be comparable to that from lime class one dynamites manufactured for underground use.¹¹ The necessary conditions include exact proportioning of ammonium nitrate prills and fuel oil, intimate mixing of the ingredients, avoiding contact of water with the blasting agent, maintaining a well-compacted uninterrupted train of explosives charge in the borehole, and strong initiation to insure complete detonation of the charge.

Erratic and excessive fume production in one series of test blasts was attributed to marginal initiation with a low-cost dynamite primer.

The most consistent and successful blasts were produced by air-placed AN-FO in dry holes and priming with high-strength dynamite initiated by No. 6 millisecond-delay electric detonators.

The most unsatisfactory blasts resulted from use of paper-wrapped AN-FO cartridges and low-strength dynamite primer cartridges. In the latter instances fume production was erratic, breakage was standard, occasional misfires occurred, and unexploded blasting material was found in "bootlegs" and in the muckpile. Separations of the "powder train" by cartridge wrappers and poor airgap sensitivity of AN-FO was, reportedly, one cause of detonation failure.

In conducting these tests, the toxic fume production was evaluated in terms of cubic feet of carbon monoxide (or oxides of nitrogen) generated per pound of explosive used. Fumes from AN-FO were compared to those produced from dynamite under standard test conditions. Generally the total weight of charge of air-placed AN-FO blasts exceeded that of standard dynamite blasts by as much as 75 per cent. Where paper wrapped cartridges of AN-FO were employed, the total weight of charges with AN-FO was somewhat less than that of the standard dynamite charges, because of the lower density of the cartridge materials.

Of psychological note regarding fumes from AN-FO underground blasting is a statement made to the author by a field engineer of the Bureau who said that some miners had no fear of fumes from AN-FO because their odor was not as objectionable as that from dynamite fumes. These miners have been observed returning to the work face too soon; that is, before such blasting fumes had been dissipated.

Static Electricity Hazards

The Bureau of Mines for many years has conducted demonstration lectures on hazards of static electricity for petroleum seismograph crews who use electric detonators in arid areas. These demonstrations illustrate how energy from static electricity can cause unexpected premature detonation of electric caps. Discharge energy of accumulated static electric charges under some conditions can detonate caps between the bridge wires of the cap and the shell of the cap or through energy flow through one unshunted leg wire across the bridge

heating element of the cap and through the other leg wire. The sources and means of generation of static electricity are many and varied and can include electrification of solids, liquids, gases, dusts, and vapors."

Generally, static electric charges result from the contact of separation of similar or dissimilar materials.¹⁰ However, static electricity sparks can be induced from thunderheads, dust storms, waterfalls, and charged bodies of air¹¹ several miles from apparent center of storms. Flowage of materials through nonconducting pipes or tubes and impingement of particles on insulated surfaces cause accumulations of electric charges. Roof falls, rock bursts, and gunniting operations in mines have been known to cause static sparks. Electrostatic charges expressed in volts alone are of little practical value in evaluating the hazards of detonating electric blasting caps by static electricity. The capacitance of the system must be considered and the evaluation expressed in terms of energy units.

Since the introduction of pneumatic equipment to air-place AN-FO compositions in last year, the Bureau of Mines has conducted certain tests to explore the degree of hazard of static electricity as a possible cause of premature detonations underground and to formulate safeguards against such possibilities. At present these tests, conducted on a limited scale underground, have been of exploratory nature and are not considered sufficient for reliable assessment of the magnitude of the hazard. The following summarizes known data:

1. Tests prove that relatively high voltages of static electricity can be generated when AN-FO is blown through pipes or tubing. Electrostatic charges ranging from 1,000 volts to over 8,000 volts have been measured. The magnitude of such charges depends on the velocity of the moving drill stream, the particle size, the temperature of the particles, the relative humidity and temperature of the surrounding atmosphere, and the conductivity of the wall surfaces.

2. Individual electric detonator caps of the same manufacturer showed wide variation in sensitivity to detonation by static electricity energy. Tests revealed that considerable special requirements are necessary to fire caps by static electricity. For example, corona current induced by a charge

of 42,000 volts through the detonator to its shell failed to fire the cap, yet 15 microamperes of current induced by 4,000 to 5,000 volts of static electricity fired a cap covered by soil in five seconds.

3. An insulated electric cap (not grounded to earth) is considerably more difficult to detonate by static electricity than a cap in contact with the ground.

4. Extensive tests involving several thousand readings under varied atmospheric and ground conditions would be required to assess the retentivity of electrostatic charges in boreholes due to impingement of AN-FO from pneumatic loading methods. Such tests are not conducive to reproducibility.

5. Use of conductive tubing, positive electric bonding of such tubing with the pneumatic loading equipment, the loading platform, accessory equipment (such as compressor), and ground will prevent accumulation of dangerous charges of static electricity. High resistant conductive clothing and footwear is considered advisable for operators of air-placement equipment.

6. From priming minimizes possibility of premature detonation from static electricity where air-placement of AN-FO is employed.

7. Aluminum or other metal inserts in plastic tubing are hazardous and not recommended because this metal can cause sparking hazards and galvanic battery effect action in presence of solutions. Use of aluminum tamping sticks has been known to cause premature detonations in geophysical blasting operations.

8. Atmospheres of low relative humidity favor generation and accumulation of high charges of static electricity.

Unsafe Practices Noted

Because widespread dissemination has been made of known safety features of AN-FO agents, Bureau of Mines safety personnel's comments on unsafe practices observed in mines where such blasting materials are used are worthy of consideration from the entire mining industry if maximum safety is to be achieved. Let us review just a few of these unsafe practices.

1. There are hundreds of tons of ammonium nitrate stored in barns, chicken coops, garages, or under tarpaulins throughout the area. It is being mixed with vari-

ous kinds of oils by all kinds of methods, such as in gasoline or electric motor concrete mixers, in steel wheelbarrows with steel shovels, and on concrete floors with steel tools.

2. No "Danger" warning signs or "No Smoking" signs were displayed at the AN-FO mixing station, the detonator magazine, or the explosives storage magazine underground.

3. A hand pump and nozzle were used to squirt oil into the ammonium nitrate bags. Generally, two strokes of the pump were made in adding two quarts of oil to each bag; however, the operator added more to some bags when he felt they needed more. The bags were left to soak for eight hours then emptied as needed into the air-placement machine. No other mixing provisions were performed at this underground operation.

4. Oil spills and spillage from ammonium nitrate bags were allowed to accumulate, both at the face and at the underground mixing station.

5. Two hundred sacks of untreated ammonium nitrate were stored under three unguarded electric light bulbs.

6. One bag of sensitized ammonium nitrate was touching the diesel engine of the explosives jeep. The detonator box was piled loosely on top of the explosive storage compartment and one case of the 70-per cent strength dynamite was lying next to the driver's seat.

7. Caked fuel-sensitized ammonium nitrate was found on the loading jeep.

8. Cuttings were not cleaned out of boreholes prior to charging with explosives.

9. Electric detonators were inserted in the ends of dynamite primer cartridges and the primed cartridges were laid loosely on the handrailing of the loading platform. No attempt was made to secure leg wires to the primer cartridge, and no attempt was made to insure that detonator caps remained inside the dynamite cartridge when inserted in the blasthole.

10. Primers are made by rolling one end of the dynamite cartridge to loosen the wrapping and then pulling out the crimped paper and inserting the detonator.

11. Electricity was not demerized from

the explosives loading jumbo during charging and priming of blastholes.

12. Open end plastic tubing used in air-placing AN-FO has been used to insert primers and for tamping them in place. Sharp thin-walled tubing is potentially capable of cutting through the wrapper and contacting the blasting cap. Mechanical damage to the cap could cause premature detonation.

The foregoing information presents case arguments that safety precautions are needed where field-mixed AN-FO compositions are used in mines, particularly in underground operations. By this means it is hoped that safety will be supplanted by real concern for corrective measures where indicated and needed. Fortunately many of the above-mentioned unsafe practices have been eliminated at some mines visited by Bureau of Mines safety or inspection personnel. In at least one instance, mine management has decided to eliminate uncertain mixing of ammonium nitrate and fuel oil underground—it has promoted the local establishment of a commercial mixing plant to insure uniform compounding and mixing of its blasting materials and elimination of fire and ignition hazards associated with mixing such ingredients underground.

Much effort and study have been expended in compiling Bureau of Mines Information Circular 7988, Tentative Safety Recommendations for Field-Mixed Ammonium Nitrate Blasting Agents, which is designed to help guide the mining industry in providing safeguards against hazards attendant to field-mixed explosives. Revisions of this circular will be forthcoming when significant findings warrant changes or additions to the recommendations previously published. On the basis of present information, the Bureau of Mines believes that I. C. 7988 presents in detailed form the best general safety recommendations covering field-mixed ammonium nitrate blasting agents.

In conclusion, we wish to emphasize once again that ammonium nitrate-fuel oil mixtures under some conditions can generate severe hazards from toxic fumes. To safeguard the health and well-being of underground workmen exposed to fumes from AN-FO, exact control of composition, moisture control, placement, and initiation in blasting are of utmost importance, and ade-

quate positive ventilation to reduce the fumes to acceptable limits is a necessity. Your attention is also directed to the fact that no blasting agent is currently approved by the Bureau of Mines as permissible for use in underground coal mines.

I sincerely hope this paper and its contents will help in accident prevention and industrial health improvement programs.

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APPENDIX A
Major disasters involving ammonium nitrate

Date	Location and reference	No. killed	No. injured	Cause of disaster and remarks
Sept. 19, 1916	Aetna Company plant, Oakdale (near Pittsburgh), Pa.	6	5	3,000 lbs. of ammonium nitrate exploded while being concentrated in an evaporating pan. Shock was felt 7 miles away.
Oct. 4-6, 1915	Extruding plant of the T. A. Gillespie Loading Company, Morgan (near South Amboy), N. J.	70	—	Fire started in plant where ammonium nitrate was being loaded. Shells detonated causing bombardment for 2 days and a number of storage piles of ammonium nitrate caught fire and some exploded—explosion left a crater 150 feet long, 140 feet wide and 30 feet deep. Estimated damage \$15,000,000.
Aug. 26, 1921	Factory, Kriewald, Upper Silesia, Germany	19	—	Two cars of ammonium nitrate exploded during unloading operations. Explosive charges were being used to break up the cake. The factory was demolished leaving a crater approximately 90 feet wide and 20 feet deep.
Sept. 21, 1921	W. Silber plant, Oppau (near Weinheim), Germany	5/6	1,942	An estimated 10 per cent of a 1,300-ton storage pile of 56% mixture of ammonium nitrate and ammonium sulfate exploded during blasting with "coal-mine explosives" to break up the caked material. The town of 6,000 persons was virtually wiped out and a crater 260 feet across and 50 feet deep was made. It was stated that about 16,000 explosive charges had been fired previously without mishap and that blasting had been performed under expert supervision.
Mar. 1, 1924	Ammonite Company plant, Nixon, N. J.	17	15	Approximately 1,500 lbs. of ammonium nitrate exploded in a vacuum granulator during recovery processing of ammonium nitrate. It was believed to contain TNT or nitroaromatic impurities.
Apr. 29, 1942	S. A. des Produits Chimiques de Tessenderloo, Belgium	More than 100	—	Approximately 150 tons of ammonium nitrate exploded killing all witnesses. No evidence of fire preceding explosion was found and the cause was not definitely determined; however the report infers the cause could be from unauthorized blasting of caked material normally broken up by picks. One expert expressed an opinion that presence of free hydrochloric acid or other sensitive volatile compound may have rendered the storage pile sensitive enough to explode under impact shocks from picks or hammer mill. The disaster had been preceded by dry weather.
Apr. 16-17, 1947	Texas City, Tex.	562 (est.)	3,000 (est.)	Charge of between 1,000 and 2,000 tons of ammonium nitrate fertilizer exploded from fire in steamship Grandcamp and set off chain of fires and another explosion of 900 tons of ammonium nitrate fertilizer in nearby steamship High Flyer. Reportedly the initial fire was fought by sealing the hold containing the ammonium nitrate and flooding the hold with steam instead of water to avoid damaging the cargo.

Appendix A
Major disasters involving ammonium nitrate

Date	Location and reference	No. killed	No. injured	Cause of disaster and remarks
July 28, 1947	Harbor of Brest, France ^a	21	422	Fire in hold of steamship <i>Ocean Liberty</i> exploded cargo of 3,300 tons of ammonium nitrate fertilizer. Steam smothering was first attempted in fighting fire and then water was applied. The ship was abandoned and in process of being towed to sea when explosion occurred.
July 7, 1959	Roseburg, Oregon; truck explosion ^b	13	125	Heat from a fire in a building 3 feet from a parked truck carrying 4,000 lbs. of dynamite and 9,000 lbs. of AN-FO in 50-lb. paper bags caused explosion of the truck's contents. Damage estimated over \$10,000,000.

APPENDIX B
Explosives accidents at mines using ammonium nitrate field-mixed blasting agents^a

Date	Mine, company and location	No. killed	No. injured	Cause of accident and remarks
May 19, 1958	Muskingham (strip) mine, Central Ohio Coal Company, Cincinnati, O.	0	1	The bottom 3-foot deck charge of a drill hole failed to detonate in a blast. When the 30-cubic-yard shovel dipper dug into the mine, the charge detonated, damaging the dipper and injuring (slightly) the shovel operator by flying glass. The blast hole involved was 8 1/2 feet in depth and 8 inches in diameter. Because the bottom 3 feet was wet, this portion was charged with commercially prepared cans of AN blasting agent and primed with dynamite cartridges with detonator fuse strung from the primer charge to the collar of the hole. Four feet of clay stemming was placed over the bottom charge and the balance of the explosives column, consisting of bagged AN-FO with additional dynamite primers, was placed in the hole and stemmed. Failure of the bottom charge to detonate was attributed to damaging or cutting off of the detonating fuse during charging operations. The mine was not detected prior to the accident as the upper deck charge had detonated in the blast.
May 21, 1958	Cadiz No. 18 (strip) mine, Hanna Coal Company, Cadiz, O.	0	1	Premature detonation of blast occurred when the electric detonator cap wires were connected by error to an energized firing line. The blast holes, 8 1/2 inches in diameter and 70 feet deep, were charged with AN-FO in polyethylene-lined burlap bags prepared at the mine and were fired by dynamite primer charges initiated through detonating fuse and a No. 8 electric detonating cap.

APPENDIX B
Explosives accidents at mines using ammonium nitrate field-mixed blasting agents^a
(Cont'd.)

Date	Mine, company and location	No. killed	No. injured	Cause of accident and remarks
May 21, 1958				Prior to the accident the blasting machine had been repaired, tested, and returned to the blast site. Although the blasting machine featured four safety provisions (safety plug-in cord to power source, a short-circuit device, switch lock, and a blasting positioning switch) none of these devices was checked or in use at the time of the accident.
Sept. 23, 1958	Delta (strip) mine, Carmac Coal Company, Marion, Ill.	1	0	A drill helper was killed in a frame supply shed when struck on the head by a 100-lb. test load of earth expelled by blown-out shots. The shed was 22 feet from the nearest hole blasted and approximately 200 feet from two blown-out shots. Several other men had also taken shelter in the shed, but the roof failed to protect the deceased. A fire was used for blasting.
Apr. 2, 1959	Muskingham (strip) mine, Central Ohio Coal Company, Cincinnati, O.	0	0	A 3-ton truck loaded with 12,000 lbs. of AN-FO in bags, 150 lbs. of high-velocity gelatin dynamite in shipping cases, and about 2,000 feet of detonating fuse in containers caught fire and exploded. About 150 electric detonators were also carried in a wooden container in a steel compartment under the truck body near the front. Reportedly, the tarpaulin covering the load of AN-FO in bags loosened from its fastenings and caught fire from contact with the exhaust pipe of the truck. The fire was discovered after the truck reached the blasting site. All persons in the vicinity were removed to a distance of about 500 feet; guards were posted to prevent entry to the area, and the men ordered to let the truck burn. The fire burned about 1 hour and 40 minutes before the detonation occurred. The explosion left a crater 30 feet deep and 40 feet in diameter. Windows were broken in nearby homes, but no one was injured.
Aug. 12, 1960	Haverstraw Quarry, New York Trap Rock Corp., Haverstraw, N. Y.	0	0	While burning scrap materials from loading of blast holes, detonation occurred that cast flaming materials around several nearby workmen. The materials being burned consisted of polyethylene bags used for mixing AN-FO at quarry loading site, cardboard boxes which originally contained 1-lb. charges of Pentolite primers, wax paper bag scraps of detonating fuse. A fairly high stack of combustibles was burned. After the accident the following safeguards were adopted: (1) burning would be confined to small piles; (2) no detonating fuse scraps were to be burned; (3) careful search would be made to prevent burning of detonators and priming materials.

APPENDIX B

Explosives accidents at mines using ammonium nitrate field-mixed blasting agents
(Cont'd.)

Date	Mine, company and location	No. killed	No. injured	Cause of accident and remarks
Jan. 30, 1961	Jefferson Island Salt Mine Diamond Crystal Salt Company Jefferson Island, La.	1	1	Premature detonation occurred at underground face during charging operations while inserting primer cartridge. The cause was not definitely established but could possibly have resulted from (a) mechanical damage to detonator while inserting or tamping primer cartridge, (b) stray electric currents, (c) discharge of static electricity while using plastic tubing to place primer cartridge in the hole. AN-FO was pneumatically placed in the borehole prior to insertion of the capped primer.
Feb. 22, 1961	Flamingo (strip) mine, Fairview Collieries Corporation, Fairview, Ill.	0	1	Premature blast occurred while connecting leg wires of electric detonator cap to firing lines. The injured, while carrying the firing batteries, erred in placing the leg wires to the battery terminals instead of firing lines. The blast holes were charged with AN-FO with bottom priming and detonating fuse connected to a millisecond-delay electric cap.
Aug. 2, 1961	Little Cottonwood Project Centennial Development Company Little Cottonwood Canyon near Salt Lake City, Utah	0	0	Lightning detonated 6 of 108 charged blast holes in an underground construction project. Blast holes were 3 feet deep in the floor of the drift opening. The blast was intended to loosen floor rock to increase drift height. Each hole was bottom-primed with a millisecond-delay electric blasting cap in a dynamite cartridge and balance charged with AN-FO. The crew was withdrawn when the lightning storm developed.

*Abstracted from unpublished Bureau of Mines reports

DO INJURY STATISTICS HAVE TO BE DULL?

By R. F. WILSON

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It was with considerable apprehension that I accepted the assignment to present this paper on accident statistics. It is my understanding that your program committee put the finger on me because of my "experience." Namely, for the past seven years I have had the dubious honor of tabulating the accident records of all mining companies in the Lake Superior district. This information I have presented at the annual meeting of our Lake Superior Mines Safety Council.

This conference is held at Duluth, Minn., and it is generally agreed that it is a fairly good one. What makes it good, however, is the fact that nationally known speakers are obtained to address a gathering of 600 to 700 mine supervisors, on safety and allied subjects. The fact that I have shared the platform with these gentlemen certainly doesn't prove that my annual presentations of statistics are outstanding or even ordinary ones. All I can say is that there is considerable interest in my paper because everyone attending knows that when I get through they have a real treat in store for them for they will be hearing a fine speaker such as Fred Smith, Arthur Secord, G. Herbert True or Dr. Rosenstem, to name a few.

I don't think I'm telling you anything new when I say that statistical presentations, be they on accidents or any other subject, do not go over well. However, all of us in safety work are faced with the problem of presenting figures showing man-hours worked, days lost, frequency and severity rates, causes, types and much other information connected with accidents and their prevention. It is most important that we don't "bury" the people whom we are trying to inform in a maze of figures.

Many years ago, Benjamin Disraeli, at that time the Prime Minister of Great Britain, made a statement which I'm sure will never die when he said "There are lies, damn lies, and statistics!" Statistics can be misused to prove just about anything an irresponsible person may want to

prove, depending upon the type of approach taken.

For example: Mine "A" has one disabling injury—mine "B" has two. If we say mine "B" has 100 per cent more injuries than "A" this is true but we haven't told the whole story. It could well be that mine "B" has 10 times the number of workers than does mine "A." If that is the case, "B's" accident frequency rate is 300 per cent better. This certainly appears to be a more valid appraisal of the accident experience of the two mines.

Quite often we see statistics presented by means of line graphs. So let's assume, for illustrative purposes, that our accident frequency rate rose 10 per cent in one year. Let's present this same information three different ways.

No. 1

Here we have the whole graph in proportion. There is a zero line at the bottom for comparison. The frequency rate is up the side. The 10 per cent rise looks like 10 per cent. The upward trend is substantial but perhaps not overwhelming.

Now let's chop off the bottom.

No. 2

Now this looks more serious. The figures and curve are the same. It is the same graph. But you get a different impression. Our accident rate has climbed halfway up the chart in a year! What looked like a modest rise in No. 1 has become, in No. 2, a big one.

Now let's try a third method.

No. 3

Here we have changed the proportion between the ordinate and the abscissa. There's no rule against it and it does give your graph a nicer shape. What we have done here is let every mark up the side stand for only one-tenth of the frequency rate that it did before. There is no question about it, this is much more impressive and effective. This could well be called a "free-Whiz" graph. It demands attention.

In presenting statistics at safety meetings I feel it is most important to show them on a screen with figures large enough so that they can be seen by everyone. I don't think there is anything worse than putting up material that can be read only by people in the first few rows.

I also think it helps quite a bit to include a little humor in the material you present. I guess we are all agreed that statistics in themselves are pretty dry stuff. So we should try to spice them up a little.

Next, it's a big mistake to try to cover too much ground or go into too much detail. In an oral presentation of accident statistics—boil them down. Try to bring out the important facts and quit while you're ahead. If your full report has a lot of material in it provide copies that can be reviewed after the meeting.

Finally, try to end your presentation with some kind of a punch line or direct challenge to get action. The only reason for presenting statistics is to give the viewing group the accident "picture." If it's a good record you want them to keep up the good work. If your accident experience is poor you hope the presentation will help stir the group to take corrective action.

Now, in hopes of illustrating what I have just mentioned, I'd like to show the 1960 accident statistics presented at our last annual Lake Superior Mines Safety Council Conference.

No. 4

Here we have a Sherlock Holmes type of individual looking through a magnifying glass. You will notice I've used the same approach in

No. 5

We want to take a look at our accident experience. Another idea would be to have someone looking through binoculars, a spy glass or even a key hole!

No. 6

Here we are telling the viewing group that the yardsticks of safety performance are the frequency and severity rates. We spell out what each rate means.

No. 7

This shows the over-all experience of all mining companies with membership in the

Lake Superior Mines Safety Council. This membership last year was made up of 24 companies—21 were engaged in mining ore and 3 in the mining of copper.

These 24 companies worked a total of 50,970,338 man-hours. There were 678 disabling injuries. These injuries resulted in time charges of 112,498 days. The figure of 112,498 days includes actual calendar days lost and scheduled charges for permanent, partial and fatal injuries as set forth in the American Standard Method of Compiling Industrial Injury Rates, Z16.1 by the American Standards Association.

No. 8

This shows the number of fatalities and where they occurred. There were 13 fatalities. There were 3 fatalities in open pits, 9 in underground mines and one fatality was charged to a non-operating unit. Shops and plants operated for the fourth straight year without a fatal injury.

The fatality rate of .26 per million man-hours worked is the fourth best recorded. In the years of 1951, 1953 and 1955 we did have lower rates. The lowest rate ever recorded was that of 1955 when it was .17.

No. 9

Here is shown the injury rates for the entire Lake Superior Mines Safety Council membership.

The frequency rate of 13.30 is about 4 per cent higher than that of the preceding year. However, it represents the third lowest rate in 20 years.

The severity rate—2207 days lost or charged per million man-hours worked was down 31 per cent from 1959. Reviewing our past experience we find that only in 1953 and 1954 did we have lower rates.

No. 10

Here we show the 1960 accident experience in plants. Ore processing plants in the Lake Superior District worked 9,785,518 hours. There were 60 disabling injuries. These injuries resulted in 5,159 days being lost or charged.

The frequency rate of 6.13 is the second best we have ever had. Our best year was 1951 when a 5.69 rate was recorded.

The severity rate of 527 is up 14 per cent from that of the preceding year.

No. 11

Here is the accident experience of general shops. They worked a total of 6,694,043 hours. There were 37 disabling injuries which resulted in 1505 days being lost or charged.

The frequency rate of 5.53 is up 7 per cent from 1959 and is the highest in the past four years.

The severity rate of 225 is down about 18 per cent from the previous year and is the second best in the past twenty.

No. 12

This shows the record of open pit mines. Open pits worked a total of 13,207,299 hours. There were 87 disabling injuries which resulted in time charges of 24,294 days.

The frequency rate of 6.59 shows a 9 per cent improvement over 1959.

The severity rate was 1839 which is 22 per cent lower than that of 1959.

No. 13

This is the experience of the Lake Superior district underground mines last year. They worked 16,053,114 man-hours. There were 489 disabling injuries which resulted in 75,458 days being lost or charged.

The frequency rate of 30.46 is 6 per cent higher than that of 1959.

The severity rate of 4701 is 40 per cent lower.

No. 14

This shows the various types of operations ranked in regard to the frequency of disabling injuries.

The best frequency rate was made by general shops with 5.53 disabling injuries per million man-hours worked. In second place were plants with a rate of 6.13. Open pit mines were third best with a rate of 6.59. In fourth place and a poor last was underground mines with a frequency rate of 30.46.

Now let's take a "quick" look at the type of accident that occurred most frequently in plants, shops, open pits and underground mines. We should keep in mind that here we will be showing "how" the

greatest percentage of workers were injured and not the causes of the accidents.

No. 15

In plants the leading or most common type of accident was "falls of persons." This includes falls from elevations and also at ground level. There were 12 disabling falls. These falls made up 30 per cent of all disabling injuries in plants. Included were falls due to tripping over spillage on conveyor walkways, stepping back off unguarded elevated platforms, slipping on icy surfaces and falling into unprotected openings. Falls in plants resulted in 1336 days being lost or charged.

In second place were "handling material" accidents. These accounted for 18 per cent of the total number of disabling injuries. In third place was "moving machinery" with 17 per cent of the total.

These three accident types alone were responsible for 55 per cent of all disabling injuries and 70 per cent of all the days lost or charged.

No. 16

In general shops the leading accident type was "falls of persons." There were 11 disabling falls. These made up 30 per cent of the total number of disabling injuries and caused 266 days of lost time. Falling off an unsecured ladder, falling on icy surfaces in shop areas, and slipping and falling while emptying containers and while working on trucks give you some idea as to how some shop "fall guys" were injured.

Close behind "Falls" were "handling material" accidents which contributed 24 per cent of the total shop injuries.

No. 17

In open pits, yes, you guessed it, it was "falls of persons" again leading all other types of accidents. There were 21 disabling "falls." And due to those falls, 6755 were lost or charged. Here are some of the accidents: fell from top of drill mast; fell into improperly covered drill hole; misstepped from shovel platform and fell, striking shovel pads; fell off truck fender while pouring oil in engine, fell down steps of retreating building; fell while getting down from road grader, etc. Falls in open pits made up 24 per cent of all disabling injuries.

No. 18

In underground mines, like in all other operations it was "falls of persons" that lead all other types. There were 71 disabling "falls." These falls made up 15 per cent of the total number of injuries and resulted in 3,853 days of lost time.

"Falls and slides of ground" were in second place with 59 accidents and time charges of 27,773 days. These accidents made up 12 per cent of the total.

In third place was "handling material" mishaps which totaled 44. These resulted in 1,119 days being lost or charged and made up 9 per cent of the total.

No. 19—All operations

A total of 117 workers in Lake Superior area mines, shops and plants "fell down" on the job last year. These falls were responsible for 18,250 days of lost time and made up 17 per cent of the total.

Now it should be a well known fact that "falls" are second only to traffic accidents as the cause of accidental deaths in this country. It is estimated that every day 55 people are killed by falls. "Falls" are the most frequent cause of industrial injuries and, as I have pointed out on this and on many previous occasions when reviewing our annual statistics, "falls" are the leading cause of injuries in mining operations in the Lake Superior district.

The causes of "falls" are usually the obvious things that we all know about. But "knowing is not enough"—to reduce "falls of persons" accidents what is needed is a much more concentrated safety effort by all companies to:

1. Improve housekeeping standards.
2. Emphasize and re-emphasize to all workers the fallacy of using defective and improvised platforms and stagings.
3. Get prompt action in protecting floor openings, open drill holes, excavations, etc.
4. Stress and re-stress every phase of correct ladder usage.
5. Provide sufficient illumination.
6. Take care of icy walkways, steps and platforms before workers get hurt.

7. Provide hand holds and grab irons to the practical degree to aid workers in getting on and off equipment safely.

8. Analyze all work procedures to determine the "fall" hazard. Take corrective action promptly if a safer work method is indicated.

9. Make every worker aware of the fact that one out of every five—20 per cent of all injuries in Lake Superior area mines, plants and shops are caused by "falls of persons!" Do everything possible to get him to think twice—so he won't fall once!

Well there you have it. A brief review of the accident experience in the Lake Superior district mines in 1960. The full report which contains 32 tables is printed in the proceedings and copies are furnished to all persons who attended the conference.

In closing out the presentation I generally have something like this Supervisor's Safety Creed to wind it up.

1. I must have the proper attitude. When I see an unsafe act I will discuss it immediately with those who performed it. I will look constantly for a safer way in which will do the work.

2. At all meetings with my men, I will listen to the worker's point of view. I will make certain that all workers are aware of the safety rules that apply to their jobs and that they understand them.

3. I will observe the work habits of experienced as well as new transferred employees. Wherever necessary, I will review and re-emphasize the importance of my company's safety program.

4. I will accept my rightful safety responsibility. I will not assume that people working for me know or have been told. It is my job to know that they know. I will not assume that safety will take care of itself. I will not assume that I can get by today. Instead, I will teach, I will show, I will repeat and when necessary, I will act promptly to eliminate physical hazards and correct unsafe acts.

5. In all matters of job safety instruction, I will say what I mean and—I will mean what I say.

SUPERVISORY SAFETY TRAINING PROGRAMS FOR THE MINING INDUSTRY

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Supervisory safety training is a worthwhile investment for any mining company, and it should be a basic part of the safety activity of all mining companies, from the small concern employing a few supervisors and less than one hundred men to large mines with thousands of employees, hundreds of supervisors and a special safety department. Supervisory safety training may be likened to a seed which, properly planted and nourished in the supervisor, blossoms forth in the safe attitudes and work practices of the ten, twenty, or thirty employees whom the foreman supervises.

Even though supervisory safety training can pay numerous dividends in areas other than safety, many mining companies, especially the smaller ones, do little or no supervisory safety training because there is no course or program tailored for training mine supervisors. Most supervisory training courses and materials are general in nature and utilize factory type situations for examples or illustrations. Even if it were practical, it would be very difficult to devise a supervisory safety training program that would be acceptable to all mining companies, because of the diversity of mining methods, terminology and work practices.

Since supervisory safety training deals with universal principles which may be applied in any industry, it is to the advantage of every organization to utilize available supervisory safety training materials and adapt them as required to meet the specific needs of the organization.

It is my intent to suggest a range of supervisory safety training activities that will enable practically any mining company to engage in some supervisory safety training, despite varying operating, financial and other restrictions.

DOES YOUR COMPANY REALLY HAVE A SUPERVISORY SAFETY TRAINING PROGRAM?

Most mine managers, if asked whether their organizations had a supervisory safety training program, would unhesitatingly answer in the affirmative. Upon investigation, most of the programs would turn out to be composed of first aid training and mine rescue training courses in which the supervisors participate. Relatively few mining companies have developed their safety training programs beyond this point. What about your company?

It may very properly be pointed out that first aid and mine rescue training is definitely safety training and further that it should justifiably be classed as supervisory safety training because the supervisory force participate in the program and often furnishes the instructors. But does this really comprise a supervisory safety training program?

This question can be answered best by defining the term, "supervisory safety training program." It may be defined as a "plan to train supervisors in the art of accident prevention." A supervisory safety training program will contain all of the following components:

1. It will be a planned program.
2. It will consist of a comprehensive study of safety problems, rather than just one or two areas of safety.
3. Program material will be designed primarily for supervisors.
4. The primary objective of the program will be to motivate, and to enable, the supervisor to transmit the idea of safety to others rather than just to instill the idea of safety in the individual supervisor.

From the foregoing, it should be readily apparent that first aid and mine rescue training, while essential components of a program, do not of themselves comprise a supervisory safety training program.

Therefore, if your company is currently engaged in a program that meets all four

of the conditions listed above, it really does have a supervisory safety training program. If your company's training activities for supervisors do not meet the test of those four conditions, your organization is not utilizing supervisory safety training, a tool that will help to reduce accidents, improve production, and cut costs.

HOW YOUR COMPANY CAN ARRANGE TIME FOR SUPERVISORY SAFETY TRAINING.

Perhaps the most frequent reasons given by members of management for not initiating a supervisory safety training program are the lack of time to devote to training and the difficulty in assembling a sufficient number of supervisors for group meetings over a period of time in order to conduct training.

Managers are human, of course, and like most people, they often cannot find time for things in which they have only an indirect interest. In many cases, therefore, what is required is an abiding belief by management in the value and benefits of supervisory safety training. Once management has attained a sincere desire to train supervisors in the promotion of safety, it is surprising how easily the obstacles of lack of time and the difficulty in getting supervisors together can be overcome.

Therefore, one way to arrange time for supervisory safety training is for management to harbor a conviction that supervisory training is a valuable tool that will pay dividends in accident prevention, production, and cost reduction. If management has this attitude, training time will acquire a priority on the organization's activity schedule.

There are, however, organizations where the management has a sincere interest in supervisory safety training, but because of supervisors' shift schedules, finds it difficult to arrange suitable time for training. There are several suggestions which may be considered to alleviate this situation.

For instance, training sessions could be scheduled for off-shift periods, such as evenings or weekends, when a majority of the supervisors would be available. If these meetings were to be scheduled on a monthly basis, it would not be too great an imposition on the free time of supervision, al-

though some companies might find it advisable to pay their supervisors for such meetings.

If it is desirable to hold training sessions during normally scheduled working hours, regular supervisors might be replaced for a few hours each month by substitute supervisors such as those normally used during vacation periods. Depending on circumstances, it might be practical to hold evening meetings when most supervisors are not scheduled and replace with substitutes those supervisors who are on shift.

If it is not feasible to hold separate meetings for supervisory safety training, thought should be given to the utilization of a portion of other regularly scheduled meetings for this purpose. This type of training is suitable for inclusion in any safety meeting, but it should also be considered as a valid portion of a production or operations meeting, since safety training definitely affects both of these areas.

Many organizations who hold regular foremen's meetings often show films as a part, or as an added entertainment feature, of the meetings. This offers a way to introduce supervisory safety training without scheduling additional meetings. Simply schedule safety training films and your supervisors will continue to be entertained and they will also be trained at the same time. Of course, the program should later be broadened to include other aspects of supervisory training.

An opportunity for supervisory safety training which is overlooked by many mine managers is the use of periods of reduced operations for training sessions. Many companies periodically find it economically necessary to schedule mine operations for a three or four day week, but as a matter of company policy, salaried supervisors are usually scheduled for a five day week.

The non-operating day of each short-time work week provides an excellent opportunity for supervisory safety training sessions, especially since the usual excuses, such as interfering with production, lack of time, and the difficulty of getting supervisors together, have no validity. Since these specific training opportunities occur as a result of economic conditions, and are not prearranged, it is important that a supervisory training program be planned in ad-

vance so that it can immediately be put into effect when the opportunity occurs.

If no preplanning is done, these training opportunities slip past because when a period of reduced operations does occur, the schedule is often back to normal by the time a program is planned and training material obtained. However, if plans are set and training material is acquired in advance, a supervisory training program can be instituted during the first week of a period of reduced operations, thereby taking advantage of an excellent opportunity for supervisory safety training.

Several proposals have been considered which can aid companies in the scheduling of supervisory safety training sessions. If your company is not now engaged in a supervisory safety training program, one of these methods should be adequate for use or adaptation in order to initiate a program in your company. It all boils down to—"Where there's a will, there's a way."

SELECTION AND USE OF A SUPERVISORY SAFETY TRAINING PROGRAM FOR YOUR COMPANY.

Although some sort of supervisory training program can be devised to fit in with the limitations imposed by size, schedules, or operating problems, it goes without saying that every mine cannot, for various reasons, set up a full fledged training program. But every mine can set up a program in which its supervisors will get some supervisory safety training.

Listed below are a number of proposed training ideas arranged to suit varying conditions and operating requirements. If there is no current supervisory safety training program in your company, one of the proposed programs should fit your situation. Unless otherwise indicated, all training materials are available from the National Safety Council.

1. Program for Mines Which Have No Opportunity for Group Training

(Small plants or mines which do not hold meetings or those which have one or two supervisors in a number of isolated locations)

- Foreman's Home Study Course.
- Monthly Mailing or Distribution of the Following Pamphlets:

- Psychology of Safety in Supervision—
Set of Six Booklets by Dr. J. L. Rosenstein.
- Personal Development Series—
Set of Six Pamphlets containing talks given at the Early Morning Sessions of the last six National Safety Congresses.
- Men and Motives in Safety Supervision—
Set of Six Booklets by Glenn F. Griffin.
- Subscription to the "Industrial Supervisor" for each supervisor.

2. Program for Mines Which Have Limited Opportunity for Group Training (Plants or mines which have foremen's meetings on a weekly, bi-weekly or monthly basis)

Many medium-sized plants assemble most of their supervisory force at more or less regular intervals for operations, safety, or combined safety-operations meetings. If no other training opportunity exists, portions of these meetings can profitably be allotted to supervisory safety training.

a. Supervisory Safety Training Course Based on "Supervisors Safety Manual"

Requires approximately 40 minutes of each meeting.

Assign a chapter for reading prior to the meeting and have each supervisor complete the quiz, as given in the Instructors Guide, for the assigned chapter. Have the quizzes corrected during the meeting and discuss the questions at the end of the meeting to make sure all supervisors know the correct answers. The "Supervisors Safety Manual" can be covered in twelve meetings using this method.

b. Foreman's Home Study Course

Supervisors can be enrolled as a group and assigned lessons from the "Supervisors Safety Manual" on a group basis. Examinations, which are more comprehensive than in "a," can be completed by the individuals and sent in a group to the National Safety Council for

correction. Completed examinations can be corrected and returned in time for discussion at the next monthly meeting.

c. Men and Motives in Safety Supervision—

Set of Six Booklets by Glenn F. Griffin.

Leader's Training Guide available. Assign one booklet for reading prior to each meeting. Discuss subject during meeting.

d. Supervisory Safety Training Motion Pictures

1. No One Else Can Do It
2. Fact Finding, Not Fault Finding
3. Foresight—Not Hindsight
4. What They Don't Know Can Hurt
5. Call 'em on the Carpet
6. It's an Order
7. Fragile—Handle Feelings with Care
8. Let's Talk About Safety
9. Take a Talkie Break
10. Setting 'Em Straight
11. Let Everyone Help
12. Knowing's Not Enough (Available from United States Steel Corporation)

3. Program for Mines Which Can Schedule Group Training Sessions for Supervisors on a Regular Basis

a. Supervisory Safety Training Course based on "Supervisors Safety Manual"—

Eighteen class hours based on twelve or more weekly classes. Instructors Guide available.

b. Metal Mines Accident Prevention Course—

Can be arranged through U. S. Bureau of Mines District Health and Safety Offices.

c. Men and Motives in Safety Supervision—

Set of Six Booklets by Glenn F. Griffin.

Use as course of six class hours. Leader's Training Guide available.

d. Supervisory Safety Training Courses offered by some State or Provincial Industrial Commissions. Example: "J" courses in Canada.

e. Supervisory Safety Training Courses which may be offered by your Workmen's Compensation Insurance carrier or your Mining Association.

f. Review of your state or provincial mining act.

g. Review of your company safety rules.

h. First Aid Training Courses (Can be arranged through the American Red Cross, U. S. Bureau of Mines District Health and Safety Offices, or the St. John's Ambulance Corps).

i. Mine Rescue Training Course (Can be arranged through state or provincial Department of Mines).

j. Specific training programs developed by your Company Safety Department.

k. Preparation and use of Job Safety Analyses.

l. Arrange for a professional safety man to accompany the individual supervisor during his regular shift to give him on-the-job training from the viewpoint of professional safety personnel.

Although any company which uses these training ideas will find it difficult to measure their effectiveness, it is safe to say that supervisory training will result in the establishment of safer attitudes and work habits among the company's employees, and that the training can also be counted on to pay additional dividends in the form of fewer accidents, improved production and reduced costs.

NOISE ABATEMENT AT MINES AND QUARRIES

By JAMES H. BOTSFORD

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Noise has been an accepted part of the industrial environment for many years. Workers seldom complained about the noise associated with their occupations and in only a few instances was much consideration given to noise abatement. But with the spreading knowledge that sufficient exposure to excessive noise may impair hearing, an impairment which many jurisdictions have held to be a compensable occupational disease, noise and its abatement is currently receiving a great deal of attention.

Noise from certain equipment and operations has been more or less effectively controlled as some examples to be presented later will show. But there are many machines including some used in mining operations which are quite noisy and on which little control effort seems to have been spent. In mining, as in other industries, the tendency over the years has been toward increased production through use of larger, faster, more powerful equipment which, unfortunately, is also noisier in many cases.

It is usually difficult to quiet equipment which was designed without regard for the noise produced as seems to be the case with but few exceptions. Therefore, noise control devices of sweeping application in mining cannot be presented here as the role of this paper might lead some to expect. This paper must be limited to presentation of some fundamentals of noise necessary for an understanding of the problem, to descriptions of some mine noise control efforts which are in progress or completed and to some suggestions for approaching mine noise control in the future.

Noise and Noise Measurement

Noise has been defined as "unwanted sound." Physically, sound is a slight variation in atmospheric pressure which occurs quite rapidly. This pressure variation can be described in terms of its two physical attributes, the magnitude of the pressure variation and the rate of recurrence. The extent of the variation from atmospheric pressure due to a sound wave is generally referred to as the "sound pressure" and the rate of recurrence of the variation

is called the "frequency." As the sound pressure increases, a sound becomes louder; and as the frequency increases, the pitch becomes higher.

Noise is measured with a sound level meter. The sound level meter consists of a microphone and an alternating current voltmeter. The microphone generates a voltage which is a replica of the pressure variation associated with the sound. This alternating voltage is measured by the voltmeter which is provided with a range-selecting switch to permit measurement of sound pressures over a wide pressure range. The meter is calibrated to indicate sound level in decibels (abbreviated db) which is a logarithmic function of the sound pressure.

Three weighting networks are provided in an attempt to obtain readings proportional to the subjective loudness of the sound to the human ear but the correlation of meter readings with loudness is so poor that the weighting networks are seldom used for this purpose. Usually readings are taken using the "C" or "flat" network with which the meter indication is essentially independent of frequency throughout the audible frequency range (approximately 20 to 10,000 cycles per second). Sound level meters are manufactured and calibrated to the specifications of the American Standards Association.

The levels of some familiar sounds are indicated next, ranging from the threshold of audibility to the threshold of pain. Electric welding produces about the same overall sound level as that found inside an auto in city traffic and the level inside an airliner is the same as that inside a crushing and screening plant. From experience, these sounds are quite different subjectively but this difference is not apparent from the overall sound level. To measure the difference which the ear detects, it is necessary to determine the intensities and frequencies of the components of the sound using a sound analyzer.

The sound analyzer most commonly used is the octave-band noise analyzer. When connected to the sound-level meter, this

instrument resolves the sound into eight contiguous frequency bands which cover the audible frequency range, and allows determination of the sound level in each band. One band covers the range 20 to 75 cps; when set to "pass" this range of frequencies, the aggregate level of those components having frequencies between 20 and 75 cps is registered and all other components are ignored.

Another band covers the range 75 to 150 cps and permits determination of the sound level in this frequency range without regard for components of other frequencies. A third band covers the range 150 to 300 cps, etc. In this fashion it is possible to "break down" a noise into eight bands which indicate how the sound energy is distributed with respect to frequency.

Octave-band analysis are usually plotted on a chart. Intensity is plotted on the vertical scale for the various bands shown on the horizontal scale. Several analyses of familiar sounds show that the overall noise levels are much the same but that the octave band analysis curves vary widely indicating differences in sound pitch and quality which the ear detects.

Further information on noise, noise measurement and related topics may be found in handbooks.^{1,2}

Noise Abatement

Octave band analyses of noises at some typical mining operations indicate the range of noise levels encountered and, depending on the noise control adopted, the magnitude of the noise reduction problem. A fairly thorough search of the literature has uncovered very little published information on this subject. There is evidence that noise abatement work is in progress at several locations but the results of this research have not yet been released in printed form. Therefore, it is possible to give solutions to only a few mine noise problems and to indicate what is being done on others.

Pneumatic rock drills are probably the noisiest equipment used in mines and have received more attention in the literature than other sources. Chaffee³ discussed generation of noise by rotary, piston and percussion type tools pointing out that most of the noise comes from the exhaust.

Fisher⁴ found that rock drills produced noise levels 3 to 6 db higher underground

than in open air and that the underground noise levels increase considerably as the cross sectional area of the workings decrease. Tool noise level was observed to decrease slightly after the drill steel penetrated the rock; tool noise also decreased 1 to 3 db for each Kg/cm² (14.2 psi.) reduction in compressed air pressure.

Holmér⁵ began rock drill noise control efforts by investigating the noise produced by a standard percussion rock drill manufactured in Sweden which delivers about 3.5 horsepower to the drill steel. He found that .08 per cent of this energy was converted to noise producing a noise level of 119 db one meter behind the drill in normal drifting operations. Attachment of an exhaust hose and special muffler to the drill reduced the noise level to 110 db. From these measurements he calculated that 87.5 per cent of the drilling noise energy was due to air exhaust and 12.5 per cent was due to impacts in the drill and on the drill steel.

Another investigator⁶ has found that a drifter manufactured in the United States produced a noise level of 114 db alongside the drill at 2 ft. when operating in the laboratory with no drill steel. The noise level was reduced to 108 db when the main exhaust was muffled and to 101 db when the two remaining points of air escape were muffled. These measurements indicate that mechanical noise of the drill alone accounts for about three per cent of the total noise energy.

A Russian investigator⁷ of noise reduction in drilling machines reports that the main sources of noise during drilling are exhaust of used compressed air, vibration of drilling steel and impacts of parts in the drilling machine. These noises can be reduced by built-in and external exhaust mufflers, low-noise drilling rods and sound insulation of the body of the machine. Rod noise can be reduced by damping vibrations and by insulation.

The same investigator reported later⁸ on the development of mufflers for manual drills and stoppers which reduced noise levels 17 to 20 decibels. These mufflers were attached to the drills through vibration isolators, were covered with rubber to reduce vibration and were designed to enclose noisy parts of the drills.

Powell⁹ has measured noise in collieries in England and reported that he was proceeding on the application of noise suppression techniques in mining machinery and operations. Some of his developments may be applicable to equipment used in hard rock mines. From these reports, it appears that percussion rock drill noise is composed mainly of exhaust noise which can be muffled but that mechanical noise emanating from the drill casing and rod must be controlled if drilling noise is to be reduced by more than about 10 db.

The United States Bureau of Mines is conducting a rock drill noise reduction program which the principal investigator describes¹⁰ as follows:

"The United States Bureau of Mines is conducting an investigation of pneumatic rock drill noise at its Rolla Office of Mining Research which is located at Rolla, Mo. The objectives of this research program are to (1) develop methods and devices that will abate the high intensity noise generated by pneumatic rock drills and other mine equipment, (2) obtain fundamental technical data and information that can be applied to the investigation of noise problems occurring in the mining industry, and (3) transcribe the findings of the research into recommendations for practical applications in the mining industry. Descriptions of the research conducted and the findings obtained therefrom will be published in Bureau manuscripts as the material becomes available. Publication of the first paper on the noise abatement study is scheduled for this year.

"The first step in the research program was a determination of (1) the physical characteristics of the drill noise, (2) sources of the drill noise, and (3) environmental conditions in which the noise exists. Sound measurements were made of the overall noise levels of drills operated in a quarry and in underground mine workings. Analyses of the tape recorded sound levels were conducted in the sound laboratory to obtain the frequency spectra. Noise reduction criteria were established from data obtained in this study.

"The next step was to repeat the sound measurements when the same drills were tested with muffling devices attached to the exhaust ports, and when various drill

parts, fabricated from vibration damping alloys, were substituted for the standard steel parts. Findings obtained from this step and the preceding one indicate the avenues of attack that could be employed in the development of methods and devices for reducing drill noise.

"Investigations conducted to develop noise attenuating methods and devices include (1) the application of the principles of sound cancellation to a study involving the operation of two or more drills simultaneously, (2) design and utilization of laboratory models which simulate the acoustical properties of the exhaust systems found in pneumatic drills, and (3) freefield sound measurements conducted in an anechoic chamber.

"At the present time research is directed toward the development of noise attenuating exhaust devices for pneumatic drills and an investigation to determine if the noise levels can be reduced by modifying the design of the exhaust ports. The approach to this research is based on the principles and applications of dynamical analogies. The procedure used is to (1) develop acoustical networks of the devices, (2) construct analogous electrical networks, (3) determine and solve the electrical circuit that satisfies the conditions of the design goals, (4) convert the electrical answers into acoustical networks, (5) fabricate the developed noise attenuation devices, and (6) determine the performance of the devices on operating drills.

When a sound measurement is made of a rock drill operated with a muffler attached to the exhaust ports, the instruments used in the measurement are a 1/3 octave band audio spectrometer connected to a high speed level recorder. Gauges are used to record the air line pressure at the drill and any backpressure that may be built up when the drills are operated with mufflers."

Regarding rotary diamond drills, a noise reduction of 8 db was obtained through use of an exhaust hose and muffler. The muffler used was designed for silencing high velocity air exhausts; greater noise reduction would probably be obtained with a muffler designed to suppress pulsations.

Some drill manufacturers have directed their attention toward abatement of rock

drill noise. One manufacturer can supply a "rubber-muffler" for use on any of his diamond drills which is reported to reduce operating noise considerably. Another supplier offers a "muffler cover" for jack hammers which encloses the drill in a fabric bag lined with sound absorbing material to reduce exhaust and mechanical noise at the same time. One spokesman in the pneumatic tool industry feels that increasingly quiet tools can and will be provided to meet the ever stricter requirements of industry in general.

Thus it appears that rock drill noise has been studied, that the sources of noise are recognized and the methods of controlling them understood and that efforts to find practical means of reducing rock drill noise are continuing. However, general solutions have not been developed yet. There is little the user can do to reduce drill noise because drill design usually makes it difficult or impossible to attach mufflers or other noise control devices. The manufacturers alone are in a position to provide quieter drills and, no doubt, will do so when customers demand them.

Crushing and screening plants are also noisy mining operations and Hoffmeyer¹¹ has reported some noise control methods. In gyratory crushers, and old truck tire can be used for a spreader at the top to eliminate the noise produced when rock strikes a steel spreader. Noise is also radiated from the top opening of the crusher which can be prevented by covering the opening. The side walls of the crusher vibrate during crushing and radiate noise which can be reduced by enclosure where practical. Crushing plants which leave most of the crusher outside the building are quieter inside than where all equipment is contained in the building. Perhaps the simplest method of protecting operators from crushing plant noise is to provide sound proof control rooms.

Rock falling into chutes produces noise which can be reduced by some form of cushioning. Two steel plates were positioned at a conveyor discharge so that rock piled up on the plates before falling into the chute. This rock cushion reduced the noise level from 118 db to 103 db and increased the service life of wear plates in the chutes. An old piece of belting hung at the discharge of a conveyor to prevent the rock

from striking the steel plate behind it reduced the noise level from 106 db to 99 db.

A chute at the discharge of a conveyor was lined with rubber to reduce noise. Gaskets of vibration damping felt were installed behind wear plates in chutes on the theory that impacts would be cushioned and wall vibration reduced by damping. Little noise reduction was achieved but breakage of wear plates was lessened noticeably.

Another approach to crushing plant noise control which has been used is to prevent reverberant build-up of noise levels by providing sound absorbing interior surfaces. The interior panel of an insulated metal curtain wall has been perforated to expose the glass fiber thermal insulation so that its sound absorbing capacity may be utilized. The vapor barrier was placed in the center of the insulation rather than at the usual location next to the interior panel in order to avoid blocking the perforations with the vapor barrier. It is estimated that the crushing plant where walls of this design are being applied will be eight decibels quieter as a result of this simple, inexpensive variation of conventional construction.

Many types of self-propelled equipment produce excessive noise at the operator's location. Trucks, end loaders, tractors, graders, earth movers, drills, shovels, etc., may, depending on design and mechanical condition, fall into this category. The discussion which follows outlines methods of noise reduction, some of which are applicable to all such equipment whether it be powered by internal combustion or electric motors. Some of the suggestions may also be applied to trailer-mounted compressors, pumps or generators.

Exhaust noise predominates in trucks and other types of equipment powered by internal combustion engines. Frequently, exhaust mufflers are inadequate or are not used at all. Mufflers may become ineffective through deterioration of the exhaust system or deliberate destruction of the interior flanges or baffles of the mufflers. Modification of the exhaust system may be undertaken on the assumption that significant increases in power, engine life, and fuel economy follow from the reduced back pressures. While these effects are present, there are misconceptions of the degrees to which they obtain.

Adequate exhaust mufflers are available but muffler size rather than performance attainable is the limiting factor in applications. The volume of an adequate muffler ranges from four to eight times engine displacement and installation may require rearrangement of the exhaust piping. Recommendations of the engine manufacturer should be obtained when considering improved exhaust muffling. Muffler manufacturers can also recommend a suitable muffler for each engine type.

Installation of superchargers powered by an exhaust driven turbine reduces exhaust noise but experience to date indicates that additional noise reduction measures are necessary to obtain acceptable noise levels.

Engine compartment noise may be produced by the engine itself, the cooling fan, the air intake or engine accessories. Each of these sources presents a problem which likely is too complicated for a user to solve. If one such source is an outstanding noise producer, the engine manufacturer's advice on quieting should be solicited. Engine compartment noise may be reduced by providing a sound-absorbing lining constructed according to instructions given later. Transmission of engine compartment noise to the operator's position may be minimized by reducing the size of any openings in the separating wall to a minimum.

Operator's cab noise may be reduced by provision of a sound-absorbing lining on a large portion of the cab interior surface as is practical. The lining should consist of a fiber glass blanket attached to the interior surfaces of the cab and covered by a suitable protective facing if necessary. The fiberglass blanket should be at least 1 1/4" thick and of any density. Where the blanket must be flexible enough to fit contours, the density should not exceed 2.5 or 3 pcf. A covering of cloth may be desirable to prevent shedding of glass fibers or dislodging of trapped dust by vibration.

Fiberglass blankets designed for use in ventilating ducts are available with a special coating of neoprene or other material on the exposed face to prevent erosion, and such duct lining material could be used without the cloth covering and, perhaps, even without a protective facing. Facings of paper, foil, plastic, canvas or any non-porous material are unsuitable as they de-

stroy the porosity of the blanket on which the sound absorbing capacity depends. Where the lining is likely to be bumped or gouged, a protective facing of screen, expanded metal, perforated metal or other material having at least 10 per cent open area is required.

Attachment of the blanket to the surface may be accomplished with adhesive or by mechanical methods. Fasteners designed for attachment of thermal insulation could be used to attach the blanket and any covering or protective facing required. The sound absorbing capacity of the lining will be essentially unaffected if the blanket is compressed by the protective facing where it passes over projections or if there are air spaces behind the blanket or between the blanket and facing.

Electric motor-generator sets used in shovels may be equipped with noisy cooling fans. The noise from these sources may be reduced by (1) ducting the motor or generator cooling air inlet and discharge to the outside, (2) installation of ventilating duct silencers on the inlet and discharge, (3) construction of partial enclosures lined with sound absorbing material. Also, the machinery compartment may be lined with sound absorbing material as described above.

In purchasing new equipment, the vendor should be asked to supply octave band noise levels under operating conditions in the areas to be occupied by employees in order to determine whether hazardous noise exposures are likely to exist. The vendor might also be asked to bid on the equipment with noise control devices such as adequate mufflers provided, giving the noise data applicable to these conditions. With these data at hand, noise exposure may be given due consideration in making a selection from the several pieces of equipment offered.

Air exhaust noise can be reduced rather simply in many cases. A drill sharpener was fitted with a two inch pipe to carry the exhaust outside the shop; this simple alteration reduced the noise level from 122 db to 102 db. The shank hammer of the same sharpener was fitted with a hose to carry the exhaust outside the building which reduced the noise level from 125 db to 103 db.

Where air is discharged at high velocity as from pneumatic cylinders, high turbulence

is created in the region where the jet mixes with the relatively still room air resulting in the familiar hissing noise, which becomes intense for large jets. The muffler is designed to quiet such high velocity exhausts by spreading the flow over a large area permitting discharge to the room at low velocity. Air enters through the threaded fitting, passes vanes which spread the air stream, expands through a deflector and diffuses into the room through a porous disseminator.

Using this type muffler, noise reductions exceeding 20 db have been obtained which are usually enough to make the exhaust inaudible in the presence of noises from other sources. A muffler is available to fit each standard pipe size from 3/4 inch to 6 inches; when the proper size is used, flow is reduced only 3 per cent. The muffler will reduce the noise of pulsating exhausts such as from air motors but is less effective than a good automotive type muffler containing constrictions and expansion chambers.

Ventilating systems in mines can be noisy; an interesting case was found in a temporary system powered by a reversible positive displacement blower. An 18-inch steel line was used to provide air during drilling or exhaust air after blasting at the face about 3000 feet from the blower. When supplying air to the face an intense hammering noise was noticed along most of the pipe which was not present while exhausting blast gases.

The noise level was measured along the haulage way at various distances from the blower while supplying air to the face. It was seen that the overall noise level dropped slightly on moving away from the blower and then rose abruptly to a maximum at a distance of 240 feet. From this point, the noise fell off gradually with distance until at 2750 feet it died out almost as abruptly as it had started.

This behavior was not due to vibration transmitted along the pipe walls or to presence of other noise sources in the haulage way. Rather, the intense pressure pulsations at the blower discharge developed into shock waves after traveling a distance of 240 feet along the pipe. The shock waves were transmitted along the pipe for about 2500 feet before they died out as a result of sound energy loss to the pipe walls.

The need for a muffler was obvious but space limitations ruled out the use of certain types. After much consideration, an air conditioning duct silencer, consisting of a resonator with a section at either end containing sound absorbing splitters, was chosen. The muffler was installed 170 feet from the blower the haulage way noise levels after installation of the muffler was plotted.

The noise level rises near the muffler due to sound radiation from the muffler walls. A weaker shock wave was formed at 240 feet from the blower which died out after traveling about 600 feet down the pipe. These effects are more pronounced in the plot of noise levels in the 300 to 600 cps band. Although the shock wave noise could not be eliminated entirely due to the size restrictions on the muffler, the situation was much improved by the muffler installed.

Planning for Less Noise

Excessive plant noise can best be avoided by considering probable noise levels at the planning stage. Vendors should be advised that noise is a factor to be considered in selection of equipment for purchase and be asked to provide information on the noise output of equipment along with bids. Noise specifications have been used successfully to obtain quiet equipment. It has been found that higher priced but quieter equipment is sometimes more economical than lower priced but noisy competitors when the cost of noise control for the latter is considered. It is believed that vendors will respond favorably when they learn that customers want quiet equipment and are willing to make some sacrifices to get it.

Plant layout and construction can also be conducted so as to avoid noise problems. Noisiest operations may be grouped together and isolated from the rest of the plant. Sound absorbing materials may be used in building construction to prevent reverberant build-up of sound energy. Bare cinder block walls absorb about five to ten times as much sound as brick, steel or asbestos cement board. Acoustical form board is available for fabrication of built-up gypsum roofs which absorb sound effectively and insulate at the same time. Some of the insulated metal curtain walls are available with the interior panels perforated to utilize the sound absorbing capacity of the insulating material. Where high noise levels

are unavoidable, enclosed control stations may be provided for the operators.

A sound absorbing roof deck was installed on a new mill building. The plank is composed of wood fiber held together with a cement binder and is fireproof. It can be erected rapidly using clips for attachment to box-section sub-purlins. The material is also available in panels for curtain wall construction. Architectural supplies catalogs list many sound absorbing materials suitable for industrial building construction which permit economical reduction of industrial noise.

Objectionable noise is a by-product of some operations in almost every industry. Practical control measures are not easy to develop and few ready-made solutions are available. Control of noise at existing operations is the problem of operating management which is best solved by the cooperative efforts of engineering, operating, safety and medical personnel.

Control of noise from new equipment is the problem of the manufacturer who must be assured of the market for quieter equipment for quieter equipment before the cost of necessary modifications can be assumed. Safety engineers must make operating management and vendors aware of the noise

problem now if solutions are to be reached in the near future.

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EAR PROTECTION AND AUDIOMETRIC EXAMINATION

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Maintaining a comprehensive safety program is of prime concern to Pickands Mather and Company, the operating agents for the Erie Mining Company's taconite plant at Hoyt Lakes, Minnesota and other mining properties. The program includes not only physical devices and educational measures to prevent employee injuries and property damage, but also provides for working conditions which will afford the employees the greatest possible immunity from occupational diseases.

The desire to eliminate all potential causes

of occupational diseases led to the inclusion of noise abatement and hearing conservation as a vital part of the overall safety program. This added feature was installed with the acceptance of the fact that hearing impairment of a permanent nature can occur as the result of prolonged exposure to high noise levels. There are very few industries utilizing modern heavy equipment which do not have high noise levels associated with their operations.

The first step in establishing a Noise Abatement and Hearing Conservation Pro-

noise level. However, it is stressed that nerve type hearing loss does not occur overnight and generally requires many years of exposure to noise. The doctor is again able to put in a good word for a need of cooperation in audiometric testing, and the fact is stressed that tests are the only means of determining if the individual is susceptible to or has a degree of immunity from the harmful effects of noise.

Those in attendance are fitted with ear protectors at the conclusion of the meeting. The fitting of one employee generally takes only a minute or so, but it does give the employee an opportunity to ask the doctor any personal questions and, at the same time, it affords an opportunity for an ear examination.

It is extremely important that insert-type protectors be fitted properly. Ear protectors can be properly fitted by a trained technician or other qualified personnel, but the confidence afforded by a fitting from a doctor is most desirable.

Records of the type and size issued to each employee are maintained by the Safety Department. The employees are urged to report to their supervisor any damaged or lost ear plugs without delay. This information is relayed to the safety department and a duplicate pair is delivered to the employee's supervisor with a minimum of delay.

The doctor, who has displayed a great interest in our program and has conducted our "Hearing Conservation Meeting" is Dr. M. T. Sumner, East Range Clinic, Virginia, Minn. This graduate of Tulane Medical School in New Orleans is a practicing otolaryngologist. His decision to come and his tenure in northeastern Minnesota has been greatly influenced by the opportunity he was offered to participate in our program.

Employees are able to be fitted and receive an ear examination at our plant dispensary at any time the doctor is on duty. The doctor in charge is a general practitioner who is skilled in fitting ear plugs. This gives the employees a chance to be refitted or to change styles if this is indicated.

We have a few employees who are required to wear ear protectors as a condition of their employment. This restriction is based on audiometric test. The great majority of our employees are scheduled for meetings, fitted with plugs after the lecture

by the doctor and given the opportunity for refitting or exchange and this is the extent of our control over their participation. We are not able to say we have a given percentage of compliance compared to the number of ear plugs issued. A study to determine this percentage would depart from the theme of our program which is "education to maintain a high level of voluntary participation."

We do know that our employees are wearing their protectors based on the following: (1) casual observation by supervisors and safety representatives; (2) the number of replacements required for damaged or lost plugs and (3) the only true criterion, the results of the audiometric tests. The statement I made earlier to the effect that we are satisfied with our ear protection program to date means that we are pleased with results of our repeat audio test.

I was associated with a safety-minded construction company not too many years ago and when requested, we supplied ear plugs to drillers and equipment operators. We placed a supply in the accessible tool cribs and printed an announcement which showed that plugs were available, and that for the sake of the comfort and well being of the employee we encouraged their use. Our early supplies were quickly issued. However, it was hard to locate a driller or operator who was wearing them and our follow-up supplies gathered dust in the tool cribs.

This is all too typical of the approach given to this program by many well meaning firms. I don't think the benefits obtained from this approach are worth the cost of the plugs and the damage it may do to a well planned future program could be hard to overcome.

I do not believe the benefits of active medical participation in the establishment and maintenance of your program can be stressed too much. I restate this opinion because I firmly believe this is the most worthwhile piece of advice I have to offer you.

Ear protectors should be compared to other personal protective equipment. Safety glasses will allow the employee to work with complete safety in areas where many eye hazards are evident. Ear protectors will allow the employee to work in areas of high noise levels with the same assurance.

PHYSICAL CLASSIFICATION OF INDIVIDUALS IN THE MILITARY SERVICE

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The subject of my talk today is the physical classification of individuals in the military service, possibly more properly expressed as the classification of military personnel on the basis of their physical capacities. This is quite a broad and involved field and in view of the relatively short time allotted I will be required to deal with it in broad and general terms.

Since the earliest period of recorded history, personnel have been selected for military service against established standards of physical fitness and stamina. Necessarily, these standards have changed over the years to keep pace with the changing requirements of warfare and the increasing size of the manpower pool as basic factors, not to mention many secondary considerations which are constantly changing, requiring compensatory adjustments in basic personnel utilization policies.

In general, past policy has been to maintain relatively high physical, mental and moral requirements for peacetime military service, relaxing these standards during periods of national emergency sufficiently to provide functionally capable personnel in numbers required to meet the increased manpower demand. Although our present physical standards for entry into the military service are lower than at any previous peacetime period, this basic policy is still in effect.

Until we were well into World War II no attempt had ever been made to classify the soldier on the basis of his physical or functional capacity or incapacity. The prospective applicant for military service was evaluated against the existing physical standard and found either acceptable or non-acceptable for induction or enlistment on a go-no-go, pass or fail, black or white, ball or strike basis.

In consonance with this policy we adhered to what has been characterized as a concept of exchangeability, that is, the prospective soldier, having been found to meet

the current physical standards for service, was considered physically qualified for training in any military occupational specialty (or MOS), whether it be of combat or clerical nature and it inferred that since all acceptable applicants had survived the same medical screening one was as physically capable as another for purposes of assignment.

It had been long recognized of course that neither of these hypotheses was entirely correct and that there was in fact a wide variation in capability within any group of so-called physically normal men. Except in the case of a small number of individuals brought into service under a categorization of "limited service" during World War II there was no means whereby assignment and distribution agencies could identify or locate the combat fit.

This fact became of major importance during 1943 when the need for infantry replacements for the invasion of Europe became urgent. During the earlier stages of World War II the majority of the physically highly capable members of the manpower pool had been drained off and distributed to all branches of the Armed Forces to fill vacancies in all areas, regardless of the physical requirements of the job.

As a result, a significant proportion of our best physical specimens were serving in combat support or rear area service jobs in the Air Corps and Navy and in technical and administrative services of the Army. (Many of these jobs could have been performed adequately by less fit personnel.)

At this point in the war, draft calls were bringing up from the manpower pool many personnel whose physical stamina and trainability as Infantry soldiers were limited. The Army Ground Forces with the mission of supplying trained combat replacements called attention to the lower order of physical types they were receiving for combat training and pointed out the necessity of obtaining an equitable share of the better

physical specimens among those personnel still in the manpower pool.

In order to be able to identify the physically select and to classify all individuals on a physical basis, the Army, after considering various proposals, decided to adopt a system already in effect in the Canadian Army for use in the American Army. This device was called the PULHES system. The term PULHES was simply a mnemonic device to indicate the factors being considered in the physical evaluation of the individual. The decision was made not to include the individual's mental classification in the profile so the letter M was dropped and the system became known as the U. S. Army's PULHES system. As implemented by the Army in the Spring of 1944 each enlisted man was given a profile serial at the initial reception station, with a review and reprofile if necessary upon completion of basic training. It was not applied to officers and women in service until much later. The completed profile serial was intended to represent an indication of the individual's over-all physical capacity, to be used in channeling him into an appropriate form of military activity.

The system was simple in theory.

a. The individual was evaluated according to six categories of physical factors as follows:

- P—Physical capacity or stamina, organic defects, age, build, strength, stamina, height, weight, agility, energy, muscular coordination, and similar factors.
- U—Upper Extremities. Functional use of hands, arms, shoulder girdle, and spine (cervical, thoracic, and lumbar) to include strength, range of motion, and general efficiency.
- L—Lower Extremities. Functional use, strength, range of motion, and general efficiency of feet, legs, pelvic girdle and lower back (sacral spine).
- H—Hearing. Auditory acuity and diseases and defects of the ear.
- E—Eyes. Visual acuity and diseases and defects of the eye.
- M—Psychiatric. Personality, emotional stability, psychiatric diseases and history thereof.

b. For each of the six categories (PULHES) criteria were established so the examining medical officer could grade the individual as 1, 2, 3, or 4; a progression from above average to below average and unacceptable. In case of doubt, the individual was to be given a higher grade pending proof through performance that the soldier's profile was in error.

c. Suffixes were added to make the profile more informative:

R—To indicate that the individual has a defect usually remediable by corrective treatment. This suffix is still in use.

T—To indicate that the individual had a defect which is usually temporary in nature and to indicate the need for a period of convalescence. This suffix is still in use.

D—To indicate that the individual has a defect which renders him permanently disqualified for overseas duty. This suffix is no longer used.

The physical profile was given initially by medical officers at reception centers, hospitals and redistribution stations. Verification and revision of profile was accomplished by medical officers at hospital level and by a board of three officers known as a profile classification board at other locations.

Individuals with a physical profile serial containing only the numerals 1 and 2 were considered physically qualified for general military service. A profile with one or more numeral 3's indicated that the individual met the standards for the so-called limited service. The presence of a numeral 4 indicated that the individual had a defect making him unacceptable for entry into the military service being below minimal standards for induction.

Unfortunately the PULHES profile system was not implemented early enough in World War II to evaluate adequately its usefulness for the purpose for which it was intended. This purpose as already stated was its use as a gross screening device for the allocation of large numbers of individuals entering the military service.

In actual practice, the profile plan found limited application in assignments and reassignments within major commands, in classification for overseas duty and for pin-

pointing physical defects sustained in line of duty. (Not having been devised for these purposes, the system was not sufficiently precise to be of real value in those areas.)

Subsequent to World War II the procedures for profiling of inductees were continued and the system extended in the Army to apply to officers and females. As a result, every member of the active Army has in his records a physical profile serial.

The PULHES system or plan itself with the exception of a few minor changes has remained essentially the same as it was during World War II. Although the requirement for universal profiling within the Army continued after World War II, no further effective use was made of the PULHES system in regard to gross allocation of personnel to the services. Such use was, in effect, unnecessary since in August 1945 the enlistment program was reinstituted permitting competition for manpower between services (chiefly on the basis of mental capacity).

And in 1951 after study and discussion the Department of Defense instituted the system of qualitative distribution of manpower to the services based on mental groups only. Allocation by physical category was no longer considered necessary since equitable distribution by mental group assures also an equitable distribution by physical capacity.

However, as I have already indicated, everyone in the Army had a profile serial in his records. The information was there, it was readily available, and it was inevitable that attempts would be made to put it to some use and only natural that it be applied to techniques of classification and assignment, which at that time were undergoing study within the Army with a view to modernization.

At this point I think it would be apropos to clarify terms. The terms *classification* and *assignment* are almost always used together in the Army since they are closely allied personnel actions. For purposes of thinking, however, particularly in relation to physical profiling, they should be considered as separate and distinct procedures.

When we speak of physical profiling for classification purposes we are referring to physical evaluation in relation to job placement, to the matching of the physical capa-

bilities of the individual to the physical requirements of the military job or specialty, that is, the MOS. Quite obviously an individual may have a minor anatomical defect or physical impairment which would seriously handicap him in training for one military job or MOS but would be of no consequence in developing a skill or performing duty in another MOS.

It might be difficult, for instance, to train as a clerk typist a man who has lost the tips of a couple of fingers but this impairment would in no way interfere with his development as a top-flight gunner, rifleman or tank driver in the combat arms.

This trend within the Army to "put the right man in the right job," although not a new philosophy, began to gain momentum in the period immediately following World War II and into the early 1950's, compatible with a similar trend in civilian industry.

Also, during and since the war there has been a great increase in the requirement for specialists in the service, secondary to the rapid technological advances in weapons and communications systems. New testing techniques have been developed for measuring mental capacities and aptitudes and new machine records systems which would correlate, store, identify and produce information on individuals became available for use in the development of job placement techniques.

A further factor in the refinement of classification procedures is the necessity for maximum utilization of our manpower. In the past our national manpower resources have been sorely strained to meet military requirements and there is no reason to expect that any future war would not create similar problems. Therefore it can be assumed that careful effective use of military manpower will be crucial to the success of our mission should we mobilize for war.

In order to convert the PULHES system to use as a classification tool it was first necessary to determine the physical requirements of each of the 400 odd MOS's in the Army and to establish minimal acceptable grades under each of the PULHES factors to permit matching with the individual profile serial.

As an illustration the MOS (III) of a light weapons infantry man requires a

profile serial of 111121. The presence of a 3 under E or a 2 in any other of the 6 factors in the individual's profile as determined by physical examination indicates that he is not eligible for training in that MOS.

On the other hand, the MOS of 282, radar and TV repair, requires only a physical profile of 323231, indicating that the prospective trainee need not show a high degree of stamina, mobility or distant visual acuity to embark upon a training program leading to the award of this MOS.

It goes without saying, of course, that an individual with a 'higher' profile than established as a minimal requirement also would be physically qualified for training in that MOS. Also parenthetically factors of education, intelligence and previous or existing skills or experience are carefully considered and are often of greater importance in classification for training than the actual physical requirements imposed.

In any event, once the individual is trained in his MOS he retains it so long as his performance in his job is satisfactory. The fact that his profile may be changed over a period of time to the point below that required for original training in that MOS would not require a change in MOS provided he could continue to function satisfactorily within the specialty. In such a situation performance is given the highest priority.

In the event his physical capabilities have deteriorated while in service to the point where he no longer can perform the duties of his MOS, he is first medically evaluated to ascertain whether he is physically fit to be retained in the military service and, if so, to what other MOS he can be assigned or trained with his physical impairment.

This, briefly, is the extent to which the PULHES profile plan has been utilized, converted or applied to classification procedures. Implemented in the late 1950's, this system is still currently in effect in the Army. Its effectiveness as a classification tool and steps being taken to improve the system will be subjects for comment a little later.

Now let us briefly consider the use of the profile plan in assignment or assign-

ment/distribution procedures as differentiated from classification for job placement.

After having met physical standards for entry into service and completed his training the young soldier is considered fit to perform in his MOS in any type unit any place in the world; there are no restrictions upon his assignments.

However, physical capacity or fitness is not a static thing; it can be improved by training, it can deteriorate rapidly from illness or injury and it deteriorates slowly in all of us as a result of the aging process. Eventually in a significant percentage, particularly of career people, the time comes when as a result of some incident of service the individual's functional capacity has changed. He may have received an injury, perhaps he has developed a chronic disease which has to some degree reduced his functional capacity in some specific area and which interferes with the performance of certain military activities. It may have resulted in a reduced capacity to run, jump, crawl, stoop or march, it may require a certain selectivity in his diet, he may no longer be able to perform pull-ups or push-ups, he may have developed a susceptibility to cold injury or frostbite, or as a result of repeated exposure to heavy gun-fire over a period of years he has developed an abnormal susceptibility to acoustic trauma.

Such medical information is very meaningful to the personnel officer who must, at intervals, assign and reassign to specific units or positions the individual who requires assignment limitations. The frostbite case may perform brilliantly in Panama but would be a medical liability in Iceland; the arthritic or low-back case can perform perfectly well in a unit which is not expected to spend long periods in the field. In a word, we attempt to provide the trained soldier with the highly developed usable military skill with assignment considerations commensurate with his restricted medical capability.

To accomplish this with any degree of effectiveness the assignment agency must have certain medical information readily at hand, and again the PULHES profile system has been called upon to fulfill the requirement although it was not designed for this purpose.

In general applicability, a physical profile containing only 1's and 2's indicates no requirement for special assignment considerations. The presence of one or more numerical designations of 3 in the physical profile indicates the existence of a defect which may require an assignment limitation. In such cases a brief statement of the specific limitation in terms of function accompanies the profile serial and is recorded in the individual's personnel record.

In summary, we do have a working system of measurement analysis and recording of individual physical capacities which has been converted or adapted to application in classification and assignment techniques. The natural question is, "How is it working out?"

Unfortunately the answer is not as simple as the question. On the favorable side it can be said that this system or a somewhat similar system of transmitting by means of a code pattern, medical information which is meaningful and significant to classification and assignment agencies has shown itself to be feasible, practical and desirable. It can further be said that the decision to apply the PULHES system to this end was probably a wise and happy

one since the mechanics were already familiar to using agencies and it provided a point of departure from which we could determine with some precision exactly what we want a medical classification system to do and how best to do it.

On the other hand, we have found several weaknesses in the existing profile system which we naturally could expect from one not specifically designed for the purpose to which applied. However, these deficiencies have been identified in detail and steps are being taken to correct them. Certain changes which will streamline assignment techniques have been accepted in principle, are in final staffing, and should be implemented soon. A comprehensive research project is well under way relating to greater precision in matching physical demands of Army jobs with the physical capacities of those who must perform them.

Our goal is the development of a relatively simple mechanism which will function as a gross screening tool applicable to large numbers of personnel, which is also precise enough to permit the accurate placement of the right man to the right job on an individual basis.

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MOTOR TRANSPORT SECTION

NEW DIMENSIONS IN FLEET SAFETY

By MARK ROBESON
Vice Pres., Yellow Transit Freight Lines, Inc., Kansas City, Mo.

I agree wholeheartedly with everything said about the potential influence of the Motor Transport Conference. The objective of the Conference is to mobilize all possible resources we can and focus them on the problems of the motor transport industry. Accident prevention is largely a psychological and social problem because the biggest part of our problem is people and what makes people behave the way they do—what makes people have accidents.

Throughout our history as an industry we have mainly tried to find our own answers to our own problems. We have had some degree of success in this. But we have ignored the fact that other fields, mainly the social sciences have a big contribution to make to the solution of our problems. It will be the objective of the Conference to work in a closer and more direct relationship with these specialized fields of knowledge so that we can get the benefit of what they have learned and apply it to the problem of influencing drivers to drive better and prevent accidents.

The theme of our Congress this year is "New Dimensions in Fleet Safety." Fleet safety, as you know, has many dimensions and you will hear each of them discussed by outstanding experts during the three days we will be together. In each of these dimensions we want to stretch your mind and open your eyes to new ways so that you can operate within each of these dimensions.

If you take away from this Congress just one new idea that can be successfully applied to your own program, your attendance here will have been justified. But from a study of the program, I am sure that you will get not just one new idea, but many.

There is one dimension of your job that I would like to say a few words about this morning. It has not been included on the program itself, but I feel it is the most important dimension and that is represented

by you yourself and your personal psychology or philosophy as a safety director.

Since I became interested in this whole field of accident prevention, I have made it a point to talk to as many individual fleet safety directors as I can about their jobs and their approach to their jobs. As a result of these talks, I have become aware of what you might call an occupational disease or disability which you seem to regard as peculiar to your line of work.

In casting about for a name of this occupational disability, I have coined the term "tired faith." You've heard of "tired blood." I'm not sure myself exactly what "tired blood" is, but it implies to me a general run-down feeling—a general feeling of debility. Well, "tired faith" is a general run-down feeling in the safety director's approach to his job.

I don't know how many of you are suffering from "Tired Faith" now, but I'm sure you have all had attacks of it and will probably be assailed by it from time to time in the year ahead.

It is that "what's the use" feeling that comes over the fleet safety director when he feels that his program is not getting across to drivers, that management no longer appreciates his efforts, that he is not getting the backing he needs, and that his company and his industry are no longer sincerely interested in accident prevention.

I would not presume to discuss this problem were it not for the fact that it seems to come up in your proceedings and discussions with great regularity. In fact it seems to be almost a theme song with some safety directors that I have talked to.

There are only two things that I would like to say about this disease of "tired faith."

First of all, it is not unique to your profession. Other professional people have attacks of "tired faith," too. Preachers sometimes experience it. It afflicts teachers and

college professors, advertising men, salesmen, and members of management. In fact anyone concerned with trying to influence the behavior of other people gives way to this feeling from time to time.

The reason for this is that the human being is the orneryest, most unpredictable and frustrating critter that God ever created. And that holds true whether he is a driver, a dock hand, a supervisor, or a member of management. Just when you think you have him figured out and have adjusted your program to his needs or demands, he will do something exactly the opposite.

Man is the only animal capable of reason. Yet he seldom resorts to it. He does not behave according to reason or logic, but according to his emotions and feelings. These feelings are never out in the open, but are deeply buried in the man's unconscious mind. They are different for each individual and a list of whims, feelings, emotions that can move a man to action would fill a ten-pound dictionary.

That is why he is so unpredictable and that is why anyone concerned with influencing human behavior as you are, is subject to occasional attacks of "tired faith." But, as I said before, this occupational hazard is not unique to your profession, others have it, too.

The second thing about "tired faith" is that the only way to deal with it is to accept it as an inescapable and necessary part of the job. Sure your efforts are not always appreciated—whose are? Sure the industry sometimes seems to lose sight of the importance of accident prevention—industry management has a host of other problems to deal with—financing, taxation, regulation, maintenance, sales, operations, public relations, and a host of others. That's why you were hired—to worry about the

safety problem. As President Harry Truman said, "If you can't take the heat, stay out of the kitchen."

Dealing with human behavior is no profession for a perfectionist. A perfectionist would die of ulcers within a year's time. When you deal with groups of people, you have to deal with averages. You can't bat one thousand, you can only strive for as high a batting average as possible. And to do that you have to have a strong not a "tired faith" in yourself and in the tried and tested techniques of your profession.

For many years I have worked in the field of sales. A salesman deals with people and tries to influence their behavior, too. He has to be a master of practical psychology. He must know how to apply it to turn a prospect into a sale. He doesn't bat a thousand, either. But that doesn't discourage him. He keeps slugging away for as high a batting average as possible. And the most important practical psychology he uses, is the kind he uses on himself.

He has to have faith in himself, in his product, in his market and in his sales approach. He must never allow himself to become defeated or discouraged. He must always be out there on the firing line—doing something more than just going through the motions, more than just putting one foot in front of another (although that's important, too). He must be out there with real enthusiasm, real confidence and real faith in his ability to do the job.

I hope each of you will get something more than new ideas. I hope you acquire a new shot of enthusiasm for accident prevention, a new faith in yourself and your ability to do the job. If you do, I'm sure that you'll be able to deal with those attacks of "tired faith" that will surely come during the year ahead.

Motor Transport Section

THE HUMAN DIMENSION IN SAFETY

By DONALD S. BUCK

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The human dimension is the most important and least understood aspect in traffic safety. It relates to just about "everything in traffic safety," roads and equipment are designed by people, vehicles are operated, controlled, supervised, maintained, and wrecked by people.

The traffic safety effort is primarily—(1) modifying the driving environment to make it safer for humans, and (2) adapting the human to make him safer, despite the environment.

To modify the driving environment, roads are built flatter, wider, and straighter. We thaw ice on roadways, dispel fog, remove snow, fence against animals, and provide illumination. Adjustable seats, power brakes, power steering, seat belts, and energy-absorbing interiors make the environment of the vehicle safer. We separate opposing traffic lanes, provide cloverleaf overpasses, install traffic lights and controls, and employ reflective markings.

We adapt humans to the driving situation by testing, training, warnings, threats, punishment, reward, diet, glasses, hearing aids, coffee breaks, and the countless influences which comprise a traffic safety program.

Some wag said, "People cause accidents—and accidents cause people." There is truth in this adage. People cause accidents and to such degree that thousands assemble in the National Safety Congress annually in quest of means to influence people to cause fewer accidents.

I hasten to admit that, to date, no organized effort has been made by the National Safety Council to address itself to the vexing problem referenced in the other half of the adage—"accidents cause people." However, the adage can be made more applicable: "People cause accidents—and accidents cause people . . . to seek the reasons why."

Every person who drives is guilty of mistakes and oversights while driving. Some drivers commit far more than their fair

share of errors, comparatively; hence they have a propensity for accident involvement, the human penchant for committing driving errors likely never will be entirely eliminated; however, it can be profoundly reduced. The human dimension aspect should be approached with the understanding that perfection behind the wheel is improbable and inhuman. However, it is reasonable to presume that application of certain proven methods will "humanize" humans and improve their driving.

Every accident is evidence of human failure to measure up to the driving situation. Although simply stated, this is difficult to prove and apply. Most persons will agree that their accidents were caused by persons—persons other than themselves! The most difficult aspect of this problem is the earnest conviction by most drivers involved in traffic accidents that they were the victims of providence and other persons concerned.

We must strive to control and improve the behavior of humans so they commit fewer errors of judgment, operating failures, and over-sights.

It is normal for humans to have accidents! Accidents are common-place throughout nature; humans are not excepted. We expect a child to stumble. We quote: ". . . to err is human . . ." but when an adult operator of a vehicle commits an error resulting in an accident, we tend to regard him as criminal or psychotic.

We should admit that freedom from accidents is *unnatural*, hence *abnormal*. To be safe, a driver must put forth unnatural effort and suppress his normal impulses. This self-discipline and regimen results in what we call "safety." It is something above and beyond the normal behavior! The man who avoids accidents should be identified and publicized as *The Exception*! This concept is in contrast to the current practice of trying to label as unusual and exceptional those who have accidents. No one wants to be average—but accidents are the mark of the average person. In other words, "don't be normal or just average, be safe."

Let's examine the contention that accident involvement is "normal circumstance." Will each person here who has never been involved in any kind of traffic accident (e.g., collision, upset, fender scrape, backing into a parked car, denting the fender, running off the road) raise his hand, please? Raise your hand only if your driving record is absolutely free from all accidents, regardless of cause or severity. Now, look about you—those few upraised hands likely belong to persons who are abnormal, lucky, or unlicensed! Most of us, because of our accidents, were unable to raise our hands. This illustrates why I contend—*It is normal to have accidents*. "Safety" is not normal, not average, not typical and not usual in the human society. Safety is abnormal.

Because safe driving is "abnormal," is it out of reach? No! Abnormal performance is within reach of determined men.

In athletic contests, some men run, jump, throw and perform in an abnormal manner. In combat, soldiers override the fear complex to reach heights of abnormal courage and performance. In driving, some men also attain the pinnacle of safety because they have been properly trained and motivated.

Recently our President stated, "Any dangerous spot is tenable if brave men will make it so." To paraphrase this, "Any dangerous spot is safe for traffic if determined men will make it so!"

"The Profile of a Safe Driver" was outlined in a feature article in *Traffic Safety* (November 1960). Based on responses by 3,000 professional drivers to a questionnaire it was found that the safe driver, on the average:

- Is approximately 57 years of age.
- Is married.
- Is of medium size.
- Has driven professionally for 32 years.
- Has worked for the same employer for 30 years.
- Drove 8,000 miles off duty.
- Is easy-going and non-aggressive.
- Drives 20 per cent at night (professionally).
- Signals his intentions.
- Drives a truck.
- Plans his driving well—and is ready for any situation.

Has won an NSC award for at least 23 years.

Has above average knowledge of operation, rules and mechanics.

Has completed 2 years of high school.

Has no military service (too young for WW I; too old for WW II).

Has no traffic violations against him—ever!

Has learned to define and automatically respond to the traffic situation.

Is fairly non-competitive, and generally satisfied with present attainments.

Drove 18,000 miles last year on the job.

Drives cautiously, carefully and courteously.

What does the unsafe driver look like? A glance in a mirror will give us a pretty good idea. The trouble is, our profiles change from day to day, hour-to-hour, minute-to-minute. We may feel decent and cooperative one moment and disposed toward mayhem the next. We can be a decent sort of courteous driver until the chap behind us blasts his horn impatiently to rupture our eardrums. Then, how do we feel? And are we subsequently safe?

However, there are some specific and adverse characteristics which fleet supervisors and foremen should look for in their drivers and regard as stoical warnings of accidents:

1. **Manner**—Tense and troubled. Exhibits anxiety, strain, sadness, pre-occupation or worry.
2. **Behavior**—Excessive and chronic absenteeism and tardiness. Loss of interest in prior pleasures. Loss of appetite. Increased drinking and smoking. Increased near-misses, and minor accidents.
3. **Attitude**—Lessened concern towards work, safety, and near-accidents. Increased grievances, and hostility toward supervision. Withdrawal from "the gang"; aloofness. Increased and unwarranted "griping" about condition of equipment routes. Increased complaints about minor bodily discomforts with repeated "sick calls." Diminished enthusiasm in work, life, and interests.
4. **Emotional Stability**—Irritable, quarrelsome, edgy, restless, impulsive, and

of drinking alcohol in causing traffic accidents. It finds deficiencies in side vision to be more frequent than shortcomings in any other of the visual traits tested. It reports a high percentage of accident-repeaters to have low systolic blood pressure. It comments on many illnesses and diseases that may impair one's ability to drive safely.

Do these findings on personal factors have a familiar sound?

It is significant to note that this study was published 20 years ago! For the 30 long intervening years we have tended to devote ourselves to identifying traits characteristic of accident-prone drivers. We stressed a program of selection, rather than improvement. Those test findings were, and likely are, still valid. But we need to go further and develop and apply positive and effective measures which will change and improve men so they will drive better and safer. We cannot be content with separating sheep from goats; we need to improve them all in driving.

Knowledge and Interests

Knowledge among drivers is derived in different ways:

1. One may learn from his own driving experience. Just ask those involved in accidents, the survivors, the injured, the scared, the arrested! They may have learned a lesson, but this is such a hard way!
2. One may learn from, and watch his interests by, driving experiences of others—this tends to be the majority. They are generally accident-free, wiser, and happier. Here is justification in reporting accidents—it enables the willing to learn from the weak. And here is the reason why you should always set a proper example while driving the family car. Your children tend to pattern their driving attitudes after yours. The family car is the classroom for tomorrow's drivers.

3. Some rugged individualists refuse or are unable to learn from experience, whether their own or someone else's. They are truly accident prone, and they are living fools with a temporary lease on life. They tend to leave a wake of human misery and death, and their disproportionate involvement in accidents is quickly blamed on others. Since they do not learn from hard experience, we are kept busy burying their mistakes.

Personality Traits

This brings us to the dimension of personality and attitude traits. Important breakthroughs are being made in this area.

According to the Association of Casualty Companies, 15 per cent of all accidents come from defects of roadway or vehicular equipment. The balance of 85 per cent result from the human dimension! Human frailties—such as lack of skill, lack of knowledge, wrong attitudes—cause most accidents. The accident investigator may report "passing on a hill" to be the specific cause; however, the real cause is more likely to be found in the attitude or emotions of the chance-taker—his unconcern, his willingness to gamble, his lack of forethought, his impatience, or the lack of general savvy which let him disdain the obvious danger of attempting to pass where he could not safely see a clear distance.

Personal attitudes and traits are increasingly being recognized as the factors which govern driver behavior. Several studies are underway to investigate them, and to determine whether group treatments will improve driving behavior. I am confident that these studies will confirm what common sense tells us: attitudes can be changed and improved by treating the mass population. Adverse driving attitudes are manifested by traits such as, drunken driving, excessive speeds, inattention, discourtesy, and failure to take a rest stop when fatigued.

Anti-social traits, commencing early in childhood, seem to carry through to the adult—emotionally unstable, a feeling of inadequacy, and immature behavior. These kids grow up—physically—to become drivers with immature, childish attitudes. Has it ever occurred to you that our show-off performance on a tricycle or bike, when we were kids, is quite similar to our show-off, chance-taking driving when we have grown to adulthood? We trade the "trike" for a truck; but we don't always trade immaturity for manhood.

In studying the "hot-rod" driver, psychiatrists at the Menninger Clinic found (in a study of 30 cases) that the "usual hot-rod driver, then, is a precocious, physically strong boy. He is aggressive of temperament, and early history shows evidence of emotional deprivation. His relationship with his mother is usually a very ambivalent

one ("Yuh gotta have mothers, but I can't stand 'em. They're bossy.") . . . interest in sports which employ interaction (team-work) was lacking in these adolescents." How obvious the implication of this human dimension with regard to traffic safety!

We find that faulty attitudes may be either temporary or permanent (mood or neurosis). At some time or other most of us have driven excessively fast, and for various reasons. But some of us may be inclined to repeatedly and continuously drive excessively fast. When we subscribe to the popular idea of "getting those speeders off the highways," we mean, of course, those others who seem to be the chronic speeders.

The same analogy holds for the drinking driver. We agree the drinking driver should be denied all driving privileges, but don't enforce this concept right after the next lodge meeting or the next cocktail party!

Our safety effort should be more strongly directed towards self-improvement! We need a do-it-yourself kit to help reduce the times when all of us demonstrate faulty attitudes. We devote much fine effort to identifying the relatively few psychoses who drive. All of us, on occasion, however infrequent, are to be counted among the "nutty" (unsafe) driver. Few of us can survive it on a full-time basis.

Two aspects of age take their toll: immaturity and old age. There is an exceptionally high accident rate among male drivers below 20 years of age. Those over 65 also show a rate well above average. "They're either too young or too old!"

If we could clearly categorize driver attitudes on a continuing basis, the problem would be simple to control. We'd bar from driving all the stupid jerks who have faulty attitudes. But each driver's attitude is chameleon! Enroute to work in the morning, rested, in no hurry, under no stress, a driver may be a paragon of emotional stability behind the wheel. But after a day of stress and frustrating effort, he crawls into a steaming hot vehicle to fight his way home in congested traffic.

He will be tired and perhaps in a hurry because of some extra-curricular activity. Now, "little things" may inflame him. Emotion displaces reason. Combativeness replaces cooperativeness. He is not a different

man, but he surely acts and feels differently. Pooped drivers drive poorly!

Our responses to the driving situation (our emotional stability) can be markedly changed by stress, fatigue, anxiety, sleepiness, hurry, tension, anger, distraction, or romance.

Individually we may have many different moods—some good and some bad. If we, personally and individually, can find means to help prevent or temper bad moods of drivers, we will contribute to accident prevention. Bad moods are caused—they can result from bellyaches, bawling-outs, blaring horns, break-downs,—and a billion other factors. Good moods are also caused; by providing the driver a reasonable and understanding environment, by helping him understand himself, and by removing needless irritations.

If it were possible, we should dispatch drivers on the basis of their current feelings (instead of their abilities). We desperately need a "Feel-O-Meter"—a gadget which will "blow the horn" on the driver when his blood pressure goes up, or his attention goes down!

Treating faulty attitudes (adverse personality traits) is a new conceptual approach. In the June 1961 issue of *Traffic Safety Research Review*, a paper entitled, "Emotions and Traffic Accidents," by Samuel S. Dubin, identifies two categories of problem drivers whose attitudes require careful attention:

1. The habitual violator.
2. The youthful driver.

A new attitude test has been developed which successfully predicts whether the male aged 16 to 25 is likely to be a safe driver. This test, developed for the Farmers Mutual Reinsurance Company by psychologist Charles F. Haner, of Grinnell College, Iowa, is purely psychological. Using test results, lower insurance premiums are granted to the under-25 male drivers who score well on the test.

In two year's experience with 4,000 young male drivers, the test has predicted well: putting 40 per cent into the higher risk group, they responded with 60 per cent of the accidents. More serious accidents, and more than their share of accidents caused. This 40 per cent further distin-

guished itself in several unsavory ways. It claimed 87.5 per cent of the licenses revoked or suspended.

Insurance-wise, it caused insurance losses three and one-third times group one. The bottom 10 per cent submitted 25 per cent of all insurance claims. On the other hand, those having top scores turned in half as many culpable accident claims as might have been expected. These results corroborate the realization that proper attitude is the key to safe driving.

The question facing us is: What can be done to these human dimensions to gain safer performance?

1. *Improve Self.* I suggest we start by improving ourselves. We should exemplify in word, deed, and driving the attitudes which we desire of our operators. What is right and safe for us to do while driving will seem more so to them—after all they are the professional drivers. If we consider it safe to hit the road after a short snort, why not them? They know more than we do about the practical side of driving. If we feel conscious-free at burning up the road, why not them? They drive so much more than we do that they should be privileged to at least emulate our amateur privileges. Above all, set a good example.

2. *Test.* Since this subject is being covered by another speaker, I will restrict my remarks to urging that all drivers be tested initially, and re-tested at least once every 3 years. Include in the test procedure an evaluation of emotional stability, personality, maladjustment, attitude, judgment, and ability to act in emergencies. Acquaint each driver with the deficiencies detected in his testing.

3. *Train.* Next, we need to teach them all the know-how possible. This includes not only operating techniques, but the who, what, why, when and how of accidents. They should know the impact of accidents on operating costs—(how many extra jars of nickles must the company sell to offset a single accident?) Help the driver to appreciate the importance of proper attitudes. Then train drivers as to the effective ways for coping with the practical problems of driving. For example, it is not uncommon for drivers to get sleepy.

Fatigue (or sleepiness) merits attention as to ways to prevent and offset it. Many

accidents ascribed to inattention may have actually resulted from drowsiness. Drowsiness besets me while driving after lunch, especially on a warm afternoon. I cannot will myself into a state of alertness. It does no good to admonish me to keep awake! I do carry a thermos of ice water so I can sponge my face and neck with an icy cloth. This really rouses me! It is somewhat like a cold shower. I shudder to think what sort of driver I would be, if I did not have my thermos of ice water to wake me up, when my eyes grow heavy. Conjecture as to how many oncoming drivers similarly are sleepy, but lack means to rouse themselves also helps to produce wakefulness.

I am convinced that many accidents could be prevented by instructing drivers how to effectively offset drowsiness while driving. Coffee breaks help. Some men munch on popcorn or peanuts to offset drowsiness. Dismounting and exercising vigorously stimulates circulation and sweeps away the cobwebs. Some drivers thrust a toothpick between their front teeth, to preclude sleep. A "catnap" along the road (in a properly parked vehicle) does wonders. The point is: we should instruct our drivers on practical ways to keep awake.

For simple, effective training, I recommend use of the National Safety Council's materials, such as "Five Minute Safety Talks for Driver Supervisors." These books apply to drivers in large and small fleets and to drivers of all types of vehicles.

4. *Motivate Drivers.* Give men a reason to want to drive above average. What is it for them? Improve their morals (as a group) and their job satisfaction (as an individual). Men need incentive to try harder—to put out more effort. Re-inforce the ego and security of drivers—remove their uncertainties. Of particular help in understanding the relationships between human behavior and accidents is a series of booklets entitled "Men and Motives in Safety Supervision," recently published by National Safety Council. These comprise an excellent short course in human relations, and each booklet presents a different aspect of the relationship between human behavior and accidents. Their universal themes are most applicable to the traffic situation:

- (1) People Cause Accidents.
- (2) Believing in Safety.

- (3) Job Instruction.
- (4) Big Little Difference.
- (5) Runaway Feelings.
- (6) Saying it Right for Safety.

5. *Change Attitudes.* It is possible to change human behavior. And, this is necessary if we want drivers to conform to the desired pattern. Establish our traffic safety clinics to deal with accident repeaters and habitual violators.

In considering human dimensions in traffic safety, the most heartening aspect is that men can be motivated to change their performance. Improved driving can be obtained, even from a mediocre operator.

To improve driving behavior, the driver must:

- (1) Acquire a new behavior pattern, and/or,
- (2) Discard the undesirable practice.

There are several courses of action whereby driving behavior may be influenced:

- (1) Change the driving environment (a different route, territory, vehicle, or assignment).

(2) Change attitude towards current environment. (This is not easy. Drivers have fixed ways of feeling and acting, which become habits. They resist change, per se, and tend to defend their way of thinking and feeling to be correct. Emphasize the more socially acceptable position of safe driving. Stress the distinction which attends the really safe driver. The driver is apt to effect the desired change if he is given opportunity to relate and consider his experience as well as his own thinking and feelings. Drivers tend to drive as they feel—and it is their adverse feeling which should become the targets of our safety effort).

(3) Change attitude toward the trivial accident, and the accident cause. Get at the latter by including in each report of accident, an account of the history of events prior to the accident. Collect information on violators and accident repeaters in a central agency or file—and let the driver's realize the value of a good record.

The concept of "strategic driving" (which I helped Driver Safety Services, New York City to develop) favorably impresses me. Strategic driving is planned driving. The

plan for coping with the enemy is not left to guesswork nor to deciding on a course of action after a hazard presents itself. It is logic on wheels, plan in motion, hazards contained before they become a serious threat. This concept arms the driver with the big guns from the arsenal of safety: *know-how, will-do and be-ready.*

The term "strategy" is commonly used in speaking of situations (e.g., war, economics, politics, chess or stud poker) which:

1. Present a complex sequence of events.
2. Involve two or more people in some kind of give and take.
3. Involve important stakes.

Thus, it seems apropos that the spirit and concept of strategic action be employed in vehicle operation. Warfare and traffic accidents are each national struggles—and the campaign against each is most effectively accomplished by vigorous application of sound strategy and tactics. Strategic driving sounds like a direct way to go at the problem, rather than wait passively until the hazard presents itself. It is safety in action.

This concept intrigues me because it positively emphasizes *what-to-do's* of driving rather than the time-worn *what-not's*. It goes far beyond the traditional emphasis on courtesy, slowness, sportsmanship, carefulness and compliance (since these tend to be the end—not the means—of safe driving). It seeks not only to develop the skills of good driving but proper *attitudes* as well. The strategic driver learns to take the offensive against hazards, rather than persons, and he employs a plan of action to reduce needless risks.

1. One aspect of strategy—and of strategic driving—is *plans and preparation*. This means get ready before departure, and be ready for any eventualities.

2. Strategy also calls for *anticipation*, upon which the driver makes decisions for action; the basic tactic emphasized is *communication*. The strategic driver expects surprise maneuvers from others; he learns to read early warning signs concerning other-drivers' plans, and he learns to let others know unmistakably and as soon as possible, of his intended action.

3. Another important element of the strategic driving concept is the strategy of *mer-*

gency. This means planning an "out" for every possible situation, knowing what to do in the emergency, and practicing against emergencies.

Strategic driving is a new and advanced approach to vehicle operation. Its concept is borrowed from the military whose aim in war is to overcome the various forces of the enemy. Applied to the driving situation, it encourages the driver to become a leader, strong, certain, alert, and to have a solution "in his pocket" for every conceivable problem. His tactics will include plan, check, timely departure, application of proper procedures, and constant diligence. The concept of strategic driving boils down to this: anyone can drive—so long as things are normal—but a strategic driver can be expected to drive safely, come what may. Some of your drivers instinctively apply this concept; many others might be trained to respond to its logic and challenge.

6. *Provide Safe Equipment.* Drivers are no safer than their equipment. Pot-flares which are empty or inoperative are built-in hazards. Comparatively simple improvements could be adopted in defogging and defogging equipment, arrangement of vehicle lighting for more positive identification of the presence and actions of other vehicles and drivers, and the positioning of instruments and foot controls to serve more nearly the functional demands of safe driving.

The vehicle of tomorrow may feature capsule chairs, protection from rear-end collisions, seat belts, flexible or telescoping steering shafts, protection for head from whip-lash, rectangular steering wheel to safeguard knees, smaller wheel for better visibility, improved maneuverability, unitized energy-absorbing bodies, automatic fire extinguishers, power and safety brakes, roll-over protection, penetration-resistant windshields which also screen out ultraviolet rays and heat, reflective licence plates for darkness, and supports for each of the driver's arms. These improvements are feasible; however, I wonder if we are willing to pay for protection against crashes?

In the October issue of *Saga*, Representative Kenneth A. Roberts (Chairman, House Subcommittee on Health and Safety) stated:

"If you and I can persuade Detroit . . . to make use of inventions already proven, already available, but almost totally ignored,

then the cars Detroit turns out next year and the years after will be even more remarkable. For these cars will be just as handsome, just as convenient—and they will be almost immune to accidents. An achievement greatly to be desired.

"A miracle of chemistry (Enso-lite), a marvel of engineering ingenuity (Professor Ryans "magic" bumper), a commonplace device borrowed from the aircraft industry (the seat belt) and some simple changes like dashboard-redesigning can make the accidents of next year end with people driving away in their cars, instead of being carried away on stretchers."

We can go a long way towards providing safer vehicles if we regularly inspect vehicles. Why wait until a police check catches us with our safety equipment down. We can prevent arrests, fines, and accidents by beating the police to the punch!

7. *Accept Responsibility.* The most significant aspect of this problem is the universal unwillingness of individuals, communities, and organizations to accept some degree of responsibility for the general mess that we all call accident causation. Everyone conveniently disclaims responsibility and conscientiously transfers the "blame" elsewhere. This is true of fleet owners and fleet drivers; management and labor; vehicle maintenance men and highway maintenance men; federal government and state governments; legislatures and laymen; professional drivers and amateurs; young and old; rich and poor; male and female; experienced and inexperienced; home folk and strangers; parents and children; teacher and pupil; manufacturer and customer; pedestrian and rider; speeders and slow drivers; and all others who have some part in this problem.

We are a nation of finger-pointers when it comes to facing up to accident causation. No real progress in safety can be expected until there is an upsurge of moral character, a public confessional on the sins of accident causation, and a cooperative joining of all forces and individuals in a common endeavor to identify ourselves, individually and collectively, with accident causes so that the mass effort and feeling will overcome the problem.

In summary, the human dimension is the most important aspect in safety. People cause accidents. Safe driving is "abnor-

mal," but attainable. New yardsticks for measuring human dimensions have been developed. There are tests available which evaluate, with decreasing accuracy, physical characteristics, abilities and skills, knowledge and interests, and (importantly) personality traits. We recognize need for psychophysical testing but disagree on the standards. Human engineering in vehicle design shows promise. Safer vehicles can be built, but are people willing to pay the price? Drivers get sleepy and need instruction on keeping awake. Tests of abilities and skills should lead to improvement measures.

Strategic driving is a promising concept which emphasizes what-to-do instead of what-not-to-do. Driving behavior can be changed by changing attitudes. Personality traits can be tested to predict performance. Some may learn from their own experience, some from

experience of others, and some never learn. We considered the attitudes are chameleonic. The publication, "Men and Motives in Safety Supervision" provides guidance in understanding attitude relationships.

We advocated: Safety clinics for violations, personality traits tests, periodic re-examinations, emphasis on importance of attitude, centralized accident data, investigation of events prior to accident, research on attitude and prevention measures, incentives, emphasis on minor accidents, and a good example in driving. The human dimension is the essence of the safety problem.

Just as dimensions are considered important in assessing the physical attractiveness of a lady, it is high time we accord to human dimensions the same degree of importance in safety.

THE MORAL DEPTH OF SAFETY

By ARTHUR B. LANGLIE

Pres., The McCall Corp., New York City; Chairman, National Committee of Religious Leaders for Safety, N.S.C.

My subject is "The Moral Depth of Safety" and I am talking to professionals in the business of operating transportation vehicles.

We have professionals today in almost every area. We are in an age of specialization and as a result of that we all do the best we can within the framework of the law and the environment in which we find ourselves, and sometimes stretch the law, sometimes stretch the environment, because in a competitive society we want to make a living and get ahead.

This is the basis upon which we've been operating and I must say that, at this time, we are challenged to take a look at ourselves by an ideology that says we don't really believe what we stand for, or what we say.

We have made some progress but the real guts of our problem still haven't been touched. That's in the individual, his motivations, his moral stamina and character that implement all that we learn and hear and know about these things.

Our society today is recognized as being a little careless in some of the things that we stand for, as far as our spirit and idealism is concerned, and it is in this area that the National Safety Council has tried to reach out and set up a special committee that works in the field of religious activities, trying to encourage religious leaders to become more interested in safety in order to communicate to the people down below.

Norman Cousins wrote a book about our revolutionary forefathers entitled *In God We Trust* and in this book he gave a rather brief description but a succinct one of these men and their general attributes. He said that they believed that the end of government was to transform freedom into creative growth. They believed deeply in the ability of the human being to learn and to take part in self-government. They believed in the capacity of people to make sense of their lives if given reasonable conditions in society itself. They believed in the responsive power of men when exposed to

great ideas, and in people's ability to stand upright spiritually without ornate or complicated props.

We are not without hope in this day because we are being challenged by an ideology that is really crowding us hard. They are saying we don't really believe in our ideals, and they're forcing us to take a good look at ourselves. All over the country men are beginning to look at the moral responsibilities of the individual, to think in terms of the other fellow, and to do something about building the right kind of ideals and strength in America.

Just last week the National Foreman's Institute wrote to me as chairman of the board of my company and said:

At the request of the United States Navy, the National Foreman's Institute has created a new publication under the moral responsibility leadership program, for their services to civilian supervisory personnel. The decline of integrity and rise of moral turpitude over the last decade were brought before the public view during the Korean episode, and also by several widely publicized incidents in the business world.

This new monthly publication is being called to your attention, since the program involving moral responsibility must start from the top executive level and work downward through all supervisory personnel in order to be effective. Moral responsibility is an integral part of supervisory development. This publication should be utilized as a vehicle of discussion, each month at every level of supervision, on the basic tenets of moral responsibility.

Well, what do the space scientists think about this kind of business? I am encouraged that a man like Werner Von Braun will say this about immortality.

Today more than ever before, our survival, yours, mine and our children's, depends on our adherence to ethical principles. Ethics alone will decide whether atomic energy will be an earthly blessing or the source of mankind's utter destruction.

Where is the desire for ethical action to come from? What makes us want to be ethical? I believe there are two forces which move us. One is belief in the last judgment, when every one of us has to account for what we did with God's great gift of life on the earth; the other is belief in an immortal soul. A soul which will cherish the award or suffer the penalty decreed in the final judgment.

Belief in God and in immortality give us the moral strength and the ethical guidance we need for virtually every action in our daily lives. In our modern world, many people seem to feel that science has somehow made such religious ideas untimely or old fashioned, but I think science has a real surprise for the skeptics. Science, for instance, tells us this, nothing in nature not even the tiniest particle can disappear without a trace.

Think about that for a moment: once you do, your thoughts about life will never be

the same. Science has found that nothing can disappear without a trace. Nature does not know extinction. All it knows is transformation.

Now if God applies this fundamental principle to the most minute and insignificant parts of his universe, doesn't it make sense to assume that he applies it also to the masterpiece of his creation, the human soul? I think it does, and everything science has taught me, and continues to teach me, strengthens my belief in the continuity of our spiritual experience after death.

Nothing disappears without a trace. While we have this freedom, and we feel that we enjoy it, we think it's the greatest system in the world—it has given us the highest standard of living, it's made us feel happy and successful as a people—but it isn't something that we can just exploit.

The real definition of freedom is, that atmosphere in which the spirit of men and women, boys and girls can grow. Now what has this to do with safety? Well I think it's the greatest reservoir of safety action there is left to us.

I know what these other things can do. We did it in the state of Washington. We used education, we used engineering, we used enforcement like no other state in the union. We took police officers, put them in plain clothes, in unmarked cars with out-of-state license plates. We used radar, airplanes and helicopters to spot law violators and enforce the law, and in two years we saved 200 lives. For every life that was saved there were 25 or 30 injuries that did not happen. We cut our insurance rates, we made a wonderful showing.

It was talked about all over the country, but we still killed more than 400 people on the highways of our state in one year. More people than we lost from the state of Washington in three years of the Korean War.

Now I know this is ridiculous, and why is it? It's because people will not take to themselves the moral courage to do the things that they should do if they're really Americans. Now frankly I don't know a better way to be a good American than really to take to heart all we know about operating vehicles on our highways, all we know about the engineering of highways, all our relationships in churches and other places, and doing something because we really believe in it.

If we do that, the impact on this whole program will be so far in excess of any

thing that we have seen that it will be the most rewarding thing we have ever done, and it will begin to teach us the kind of responsibility to apply in every area of our lives as American citizens, whether it's in religion, or in politics, or in business, whether it's in the professions, or in our social life. We must begin to live like responsible, free, citizens and give this country the greatest shot of vitality it's had since the Continental Congress and the Declaration of Independence. This is the kind of a frontier we must face. We can no longer take on every hand, play the game safely as we go along, and let the other fellow take care of himself.

I know of no area where we can demonstrate so clearly what a good American can do as in traffic, because it is so great a part of the American way of life.

Fifty young men completely changed the government of the city of Seattle. That city used to be the worst run in the whole United States. It was run by the police department, and the only thing we ever settled in Seattle for years as we elected a mayor every two years was which fourth of the police department would go down on skid row and collect the graft and which fourth would go out in the sticks and start working the campaign for the next election.

The city was in debt, the streets were run down, its transportation system was a mess, its parks were terrible, its purchasing practices were awful. It was a beautiful city but in an awful state, and 50 young people with ideals got together and said, "We're going to find some candidates, we're going to ask them not to take more than

\$25 in campaign funds from anybody, we're going to go out and support them with our work, door to door, and see if we can't get some honest officials who are motivated right and who will serve their government rather than try to take from it."

To the amazement of everybody they finally squeaked one young fellow into the city council. He in turn, through courageous battling, brought in three others. They finally elected a mayor, and in two and a half years the city turned completely around and has been one of the better governed cities of the country since.

We go to church to get ministers interested in safety. This is fine, it's the trickle-down theory and it's good. You've got to start someplace, the image at the top has to be good, but when people who are living with these problems conscientiously throw themselves into a crusade to do something about it, you get real action. And this is what, of course, we really need.

We as Americans must quit thinking about what we can get out of things and do as our President suggested in his inaugural address, "Think not what you can take from your government, but what you can give to it." And believe me, when we do that we'll find out that we're investing in a resource that doubles every time we put something out. This is the area where we need action. This is the greatest reservoir of safety left. This is where the profits are. It takes a little faith.

Do we really believe that safety pays? Do we really think there is something morally sound about it? Do we think it's in the interest of our fellow men?

MOTIVATION — THE ART OF LETTING PEOPLE HAVE IT YOUR WAY

By EARLE S. HANNAPFORD, PH.D.
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and Vice President for Industry, National Safety Council

Stripped and shorn of all its high-sounding descriptive phrases and plumage of words, motivation is just what our title says: "The art of letting people have it

your way." And that seems to be the popular conception of it also.

In an age when we are literally up to our ears in motivation—product motiva-

ring to buy cereals, soaps, compact automobiles, and to actively support national and local movements of all kinds—folks are justified in being skeptical and at times obstinate if they suspect they are being motivated against their own will and interests. And all the recent talk of subliminal motivation on an unconscious level tends to make people even more skeptical and suspicious.

So before we go into the interesting and absorbing story of how motivation works, let's make sure just what we mean by motivation—what it is and what it is not. After that we shall talk about how to motivate people successfully and then complete our discussion by talking about how we can check to see if motivation is working.

There is one thing to keep in mind at all times. What we shall talk about is fundamental and true of all motivation, even though our applications of it and our illustrations will be in the field of safety.

What We Mean By Motivation

Current misconceptions and fallacies about motivation demand that we clear up some of them even before we settle upon our basic definitions. First let's mention some of the things that *motivation is not*. It is not some subtle potion brewed of words, ideas, hypnosis and thought control that enables us to manipulate people to our own advantage against their will.

Motivation, as we are going to talk about it, is based upon *not* disabling or eliminating our American democratic freedom to think for ourselves, but using it. It does not violate the God-given right to make up our own minds and to choose for ourselves.

It is true—only too true—that perversion and distortion of what we shall talk about has given birth to the maniacal, ruthless devil's brood of propaganda, thought control and brain washing. All of these reduce man to mere automation or robot, a slave of the will, spirit and emotions of another—a much worse form of slavery than forced physical servitude.

In safety as in all motivation for sane, rewarding living, we seek to motivate for the good of the ones motivated. This calls for arousing the voluntary persistence and perseverance of a person from within himself, from the free spirit itself. Yes, without any doubt, in discussing the compellingly interesting subject of human motivation we

are dealing with powerful forces, forces which improperly used are just as disastrous, and probably even more so, than the nuclear weapons which cause us so much anxiety today. Pause a moment if you doubt this, and reflect on Nazism and Communism and the physical slaughter of millions which was compounded out of the horrible obsession and motivations from which they sprang.

True motivation of a positive nature operates without using the negative controls of fear and anxiety. Furthermore, it does not destroy the individual's perceptive and ethical values, nor does it seek to produce negative motivation through depression of physical, mental or emotional responses and reactions.

Note that we said positive motivation does not use the negative controls of fear and anxiety as such. This is based upon one of the key axioms of all learning—and motivation is directed learning. Dr. Lester Sontag states it this way: "The basis of all learning (positive motivation) is the striving by the individual to *lessen anxiety by mastering problems as they arise*." Keep this in mind, for we shall use it later.

Having oriented ourselves with respect to what motivation is, and what it is not, we can define it with confidence that it will not be misinterpreted. I am going to use what I like to call a "sequential form of definition." Actually it's simply this. First I will define motivation and then the key concepts composing it as follows:

Motivation—Sequential Definition

1. *Motivation* is supplying the *incentives* which impel an individual to achieve a pre-selected goal.
2. An *incentive* is anything which an individual feels will satisfy a *drive* or a *motive*.
3. A *drive* is a persistent stimulated condition usually arising out of body-tissue needs and which demands immediate satisfaction.
4. A *motive* is any condition, usually emotional, that arouses, sustains and directs an individual's activity to a preselected goal.

Obviously from our definitions it would seem that motivating people for safety would center primarily about providing *incentives* which satisfy a *motive*, since safety is not

a "one shot" thing but calls for sustained, persistent, directed activity on a continuing day-after-day basis. Moreover, it has a high emotional content.

Drives, Motives and Incentives

Before we make any more conclusions and comparisons with respect to *drives*, *motives* and *incentives*, let's list the basic *drives* and some *motives*.

All of us are, no doubt, familiar with the natural, instinctive drives which I have shown in their order of dominance: thirst, hunger, sex, exploratory, and a recent addition, mastery.

Actually, *mastery* probably lies between *drives* and *motives*, but many recent research developments place it nearer to tissue-need *drives* than *motives*. This is a natural deduction because there is new evidence that our *motives* have their roots in the natural *drives*.

The really important thing to remember is that *drives* have an order of *dominance*, or in other words a precedence which operates so that the strongest one in that order of precedence gets attention before the others. With *motives* it's a different story. *Motives* being emotional do not have a natural, fixed order of dominance, but can vary in strength, depending upon the appeal to the emotions. Since many *motives* can be and usually are competing for our attention at the same time, the one that appears to offer the most reduction in anxiety, fear and tension usually wins out over the others.

A *motive* must withstand repeated competition with other *motives*, repeated diversions and assaults over a period of time. *Drives* with their tissue-need origins and order of dominance and precedence do not have to face such competition. In fact, it is obvious that when thirst and/or hunger are extreme they usually override all else. *Motives* are overridden, but once the thirst and hunger are allayed, *motives* can be revived and with the proper *incentives* resume their striving for the goal.

Thus we see that a particular *motive* can have several fates; it can:

1. Be successful in the competition with other *motives*.
2. Be only partially successful.
3. Be replaced with another; i.e., give way to a substitute.

4. Be completely blocked or inhibited.

From this we see why *motives* must be pretty strong rugged fellows. In this struggle, the survival of the fittest rule certainly applies. And from experience we all know safety has strong competition. So it behooves us to know the facts and be able to use them realistically and effectively.

Let's list some of the *motives* we've been talking about: Social approval, conformity, security, achievement, belonging, attitude, self-expression, interests—likes and dislikes, and prestige.

Probably you are wondering why I haven't included many familiar terms such as praise, reproof and rewards. That's just my point. Before we can arrive at the secret of *motivation* we must be sure of just what we mean by *drives*, *motives* and *incentives*, for there is a great deal of confusion as to just what each is and its functions. All too often *incentives* and *motives* are used interchangeably in talking about them, and this is wrong. It leads to poor, conflicting, and confused efforts to motivate.

The underlying truth is this. *Drives* and *motives* are the same for everyone. They are broad concepts. *Incentives* vary with the individual, for they are the intermediate achievements which impel the person to achieve the goal.

Remember our definition of motivation?

Motivation is supplying the *incentives* which impel an individual to achieve a pre-selected goal. And an

incentive is anything which an individual feels will satisfy a *drive* or a *motive*.

Such things as praise, reproof, rewards, rivalry, participation, etc., are *incentives*; and it's the *incentives* we must supply, not the *motives*. The *motives* are universal, human conditions which are the same for everyone in just the same way as *drives*.

Remember in our definition of *motive* we said it is any condition, usually emotional, that arouses, sustains and directs an individual's activity to a pre-selected goal. Note we said a *motive* is a "condition."

We also said a *drive* is a condition, but of a different kind. A *drive* is a persistent stimulated condition usually arising out of body-tissue needs and which demands immediate satisfaction.

Here's the important, vital concept that distinguishes *drives* and *motives* from *incentives* — *drives* and *motives* are *conditions*. A *condition* is something that necessarily precedes and sets up the climate for an action and its result, but which does not of itself produce the result. It is the *incentives* which produce the result; i.e., an achievement of the goal, if and when the *drives* and/or *motives* provide the necessary conditions under which the *incentives* can function effectively.

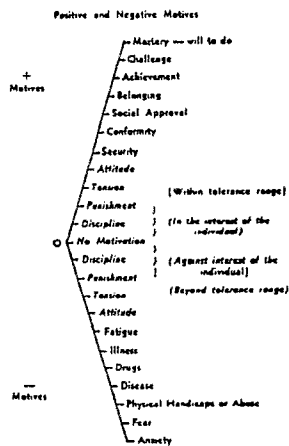
Before we sum up and list the key facts about *drives*, *motives* and *incentives* so we can use some actual accident situations and cases as illustrations, there is one more very interesting and also pivotal concept. I call it "pivotal" because it is the point of departure which determines whether we are going to motivate in the true sense we described earlier or pervert and divert into the "devil's brood" of thought control, brain washing and propaganda.

The "pivotal concept" is simply this: There are two kinds of *motives* — *positive motives* and *negative motives*. In the partial list of *motives* we looked at a few moments ago only *positive motives* were shown. All too often discussions deal exclusively with *positive motives* alone because, mistakenly, it is thought only the things that give pleasure reduce tension. But that gives a distorted, one-sided picture.

The following diagram shows the relationship between *positive* and *negative motives*.

As we can see from our diagram, there are some four motives which can be either positive or negative. They appear on both sides of the "pivotal point" which is shown as 0 (zero), the point of no motivation. These four motives: discipline, punishment, tension and attitude are what psychologists call ambivalent. They combine two possible impulses which are as opposite in nature as love and hate.

Let's take discipline as an example, for it is very important from an on-the-job captive group standpoint—it's their climate. Understanding discipline in the interests of the persons being motivated is positive, while discipline solely in the interest of the motivator, and particularly when not in the interest of the motivated, is negative. And the same is true of punishment. When both are



negative they have a close kinship with fear and anxiety, two highly and solely negative motives which can disable our perceptions and in their extremes cause panic.

When they are positive they are among our strongest motives. It is unfortunate that these two motives are so often viewed only from their negative standpoint. The same is true of tension. However, people see attitude a little differently. Most folks agree it can be either good or bad. As we can see, it is further out from the pivotal point.

Now here's a very vital and interesting thing about these ambivalent motives. Something that recent research has given new meaning. An ambivalent motive has an unconscious added impact on an individual, and when he senses the intent behind it, its effect is intensified and amplified. This can be and is true even when the person is "gripping" about it.

Why? Because these ambivalent motives are those associated with and ascribed to

authority figures." And when we have confidence in and respect for the "authority figure" we get a relief from tension by his assuming the responsibility.

The emotional content, impact and positive or negative nature of these highly powerful ambivalent motives are wholly dependent upon the use made of them by the motivating authority figure.

The solely positive motives are obviously effective motivators and the solely negative ones are often barriers to goal seeking and attainment. Even so, negative motives, fear and anxiety, can at times be strong motivators. Here's an interesting example of their use in a field that requires strong motivation — that of collecting debts as done by collection agencies. Dr. E. H. Barnes, psychologist for the National Accounts System says, "The basic approach in the collection of debts is creation of fear and anxiety in the debtor, which he can only dispel by paying the debt. You can't get away from the use of fear and anxiety as motives and the collector has to make sure that a certain amount of anxiety is present." Obviously, the creation of fear and anxiety are not the preferred motives in accident prevention because of the ease with which they can develop into panic, even when closely controlled.

Now here are some facts that will put things into focus, for Dr. E. B. Hurlock's work with the effects of three carefully chosen incentives of the discipline motive are really startling.

He used four groups:

A control group which was given no incentives.

A group which received high praise.

A group which was given severe reproof in their own interest, and

A group which was ignored, but heard the praise and reproof given the others, since only the control group was separate.

Here are the results in terms of their performance, using the control group as 100.

Group	Performance
Control	100
Ignored	144
Reproved	158
Praised	180

The use of reproof as an incentive of the discipline motive for their benefit resulted in 58 per cent improvement over the control group. The ignored group which heard both the other incentives being used improved its performance by 44 per cent over the control group.

Discipline of a positive nature is a motive which is inherent in all captive groups — it's a condition, a climate of such groups — and it is effective when properly used even on someone else.

Note, though the praised group increased its performance by 80 per cent over the control group. This is direct and clear testimony as to the solely positive social approval motive's effectiveness when praise is used as an incentive.

However, we must keep in mind that the praise was given to a captive group operating under a general overall state of discipline and the praise was warranted. Actually this incentive (praise) can be associated with both the discipline and social approval motives. In this case it was closer to the discipline motive.

Please understand why I have dealt somewhat at length with these ambivalent motives, particularly discipline. It is not because I am ranking them above the solely positive. It is because of their key position and impact and also because their nature and use has been so misunderstood. Furthermore, all on-the-job safety motivation takes place in a setting where discipline and controlled operation exists as the way of life — not "free choice," as off-the-job.

Returning to the main stream or central core of our discussion, I want to re-cap this way.

When we *motivate* we select a goal, decide upon what *motives* are most carefully related to the goal and then provide the *incentives* which will appeal to the individual or group as satisfying that *motive* or *motives*. Obviously, because of the possible mortality or "fall out" of *motives* it is best to use several and choose your *incentives* accordingly.

We don't supply or provide *motives*, as people often say. We supply *incentives* which satisfy *motives* which already exist for all of us.

Illustrations of Goals, Drives, Motives and Incentives

Let's use a few simplified illustrations to sum up.

Goal—Survival. **Drive**—Thirst. **Possible incentives**:

1. Tissue-need stomach pain
2. Seeing someone else drinking
3. Advertisement for soft drink

Goal—Save a life by rescue breathing. **Possible Motives**—Achievement is +. **Possible Incentives**:

1. Desire to help
2. Knowing what to do
3. Praise, awards, etc.
4. Fear is —

Goal—No eye injuries. **Possible Motives**—Security. **Possible Incentives**:

1. Publicizing loss of sight cases
2. Publicizing cases of eyes saved by safety glasses
3. Provide safety glasses cost-free
4. Taking personal responsibility
- + Discipline

1. Enforcement of rule requiring use of safety glasses at all times on the job

Note that these three simple illustrations included the competition of motives in the "rescue breathing case" and multiple possible motives in the "no eye injury case." Apropos of previous comments on positive discipline as a motive, when we tried to get full use of safety glasses by paying for them and the prescriptions and using several motives, we got about 70 per cent reduction in eye injuries. But when we made it mandatory to wear safety glasses at all times on the job and enforced it, eye injuries were practically eliminated in the outside construction and maintenance forces concerned.

How to Motivate People for Safety Successfully

In talking about "how to motivate people for safety successfully," we must be realistic. To do this I am going to use four actual cases. Two will concern group motivation and the two others will deal with the motivation of individuals. Please keep them in mind.

Case I—Large group, 17,000 women. Frequency rate 1955 was 0.93. Placed last in 19 competing companies.

Frequency rate 1957 was 0.21. Placed third in 19 competing companies.

Case II—300 men in outside construction work.

Frequency rate 28 under normal working conditions.

Frequency rate 0 under disaster service restoration—abnormal hazardous working conditions.

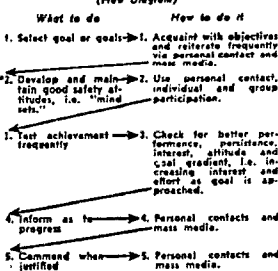
Case III—Individual employee (male). Individual bus driver with poor accident record given planned motivation resulting in five year accident-free performance to date.

Case IV—Individual employee (male). Individual craftsman with five year accident-free record suffers loss of finger—neurotic paradox of motivation and the forced choice.

Since we took the time to explore just what motivation is and is not and also developed and discussed basic definitions, we can cash in on it now. All we have to do is put the "pattern of successful motivation" in "flow diagram form" and use it as a guide in discussing our four cases.

The only term we've introduced in talking about our motivation pattern is "goal gradient." It is simply this: If the motivation

The Pattern of Successful Motivation (Flow Diagram)



is working, the nearer we get to a goal the stronger the motivation. It also applies when we divide a continuing, long-term goal into intermediate successive goals.

If we analyzed and discussed each of our four cases in detail, it would take hours. So I'm going to describe briefly what was done and then just mention some of the factors involved.

Case I—Large group—17,000 women.

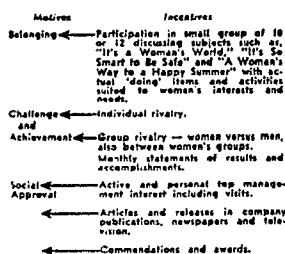
Frequency rate 1955 was 0.93. Placed last in 19 competing companies.

Frequency rate 1957 was 0.21. Placed third in 19 competing companies.

A careful and detailed field study showed that safety programs and activities were basically oriented to men's needs, objectives and thinking.

A women's committee on safety was organized. It developed objectives, programs, materials and activities in terms of women's motives, needs, incentives, interests and thinking. The program activities were given to the women by women supervisors. As stated, in two years the women's frequency rate decreased from 0.93 to 0.21, and they moved from 19th and last place to 3rd and also bettered the men's performance.

Here are some of the motives and incentives used. (In each of the four cases I'll try to comment on different ones, i.e., motives and incentives.)



Actually there were more motives and dozens of incentives used. All of these items were designed to follow the "pattern of

successful motivation" and there was ample evidence that they did.

Remember our second case?

Case II—Departmental Group—300 men in outside construction work.

Frequency rate—28 under normal working conditions.

Frequency rate—0 under disaster service restoration—abnormal hazardous working conditions.

This case differs from the preceding group motivation. It has "situational motivating factors" which Case I did not have.

When hurricanes strike and telephone lines are down, towns and even cities can be isolated. Construction crews and their equipment are rushed to the disaster area from all parts of the country. They work day and night under the most hazardous conditions to restore service, for lives are at stake.

And yet there are far fewer injuries than under usual working conditions. The case quoted above shows that.

Looking at our "pattern for successful motivation" we can see that the goal is sharply and starkly defined; the previously developed safety attitudes, habits and training all are brought into focus through urgency for serving others. Without question, achievement is constantly before them as is information as to progress, and warranted commendation and praise are quickly given by everyone, including the public at large.

Added incentives arising out of the situational motives operate to strengthen the whole pattern of motivation. The incentives? They are multitude—for some the desire to help in time of dire need, for some the rewards of overtime, the group effort, and individual rivalry within gangs—all come into play.

The critical thing about "situational motivation" centers about this one fact. Unless the situational impact has been preceded by good sound safety attitude development, training and habit formation, it has nothing to build on and may well increase injuries instead of preventing them.

Case III—Individual Employee (male). Individual bus driver with poor accident record given planned motivation resulting in five year accident-free performance to date.

In both this case and the following one I'm going to limit our discussion to their unique aspects rather than reiterate principles we've already covered.

This case concerns a bus driver who had a very poor accident record, but whose physical and mental qualifications were satisfactory.

The company psychologist and safety engineer developed this plan. The incentives were group and individual rivalry, financial rewards and participation with the motives of achievement, conformity and identification doing the conditioning. Here's how it was done. The poor performer was put in a group with three drivers with very good records and these rules made:

Each driver would get a \$50 bonus at the end of an accident-free year.

If all four drivers had an accident-free year, all four would receive an additional \$100 each, making a total of \$150. Naturally the three good drivers assisted and "worked on" the poor one. He tried to conform and identify with the good ones. It worked so well that all drivers in that company now are competing on the "group of four" plan.

Probably most folks would say "sure it worked—they gave them some money." Actually money was not the key. The same plan worked when the reward incentive was not money and moreover even when there wasn't a material reward. It was the rivalry that turned the trick.

Notice how well this ties in with the following research results on the value of rivalry as an incentive where no rewards were used.

Dr. V. M. Sims used three groups:

1. A control group in which there was no special motivation.
2. A group in which only group rivalry and participation was used.
3. A group in which only individual rivalry and participation was used.

Here are the relative results, assigning the score of 100 as a starting base.

Group	Score	Per Cent Gain
Control	108	8
Group rivalry	115	15
Individual rivalry	153	53

The "group of four plan" combined the motivating values of both the group and individual rivalry incentives in a most effective manner, and these figures show why it worked so well.

Case IV—Individual Employee (male). Individual craftsmen with 5 year accident-free record suffers loss of finger—neurotic paradox of motivation and the forced choice.

This case illustrates the competition and clash of motives and their implementing incentives. Briefly, here's the story of the accident.

A craftsman with five years accident-free service had to make some changes in equipment panels located 10 feet above the floor. Another employee was using the ladder on the other side of the office. Instead of waiting a few minutes and walking across the office to get the ladder, the employee secured a small table 30 inches high and stood on it to make the adjustment. His supervisor saw him do it but did not stop him.

After making the adjustment the employee, who was six feet four inches tall, elected to descend in one step to the floor. As he did so his wedding ring caught on an equipment detail eight feet above the floor. His body and full weight being in motion he couldn't stop and the ring severed his finger at the first joint. The remainder of the finger had to be amputated later.

Without going into detail it's pretty clear that the clash between motives ended with the motivation for safety, which had been working for five years, losing the battle. It failed. Also notice the absence of the discipline motive when it was needed to re-enforce the ones that weren't functioning. Understanding discipline is like the "safety man" in football—it can save the day if the individual carrying the ball fumbles.

The Neurotic Paradox of Safety Motivation

I chose this fourth case for another reason besides its aptness for illustrating the conflict of motives. It also depicts the underlying basic problem of all safety motivation, "The Neurotic Paradox." In his significant contribution to the new concepts on motivation, Dr. O. H. Mowrer, research professor of psychology, University of Illinois,

states it this way. "Why does a person sometimes persist in unrewarding and self-defeating injurious behaviour when he knows he should not and is familiar with the safe rewarding behaviour?"

In our fourth case the employee knew and had practiced the safe procedure for five years. Recent research indicates we have not been fully conscious of the very high motivating element in a forced choice between opposites. Opposition, from sources outside ourselves, to our choice reinforces our unconscious drive to do things we are told not to do, and we have what is the commonest of all emotional blocks—pressure to resist anything that may be felt to be coercion. This is the core of the motivation problem since, as we said in our introduction, we do not use the perverted motivation of propaganda, thought control and brain washing which destroy the free spirit and creative initiative.

In our fourth case the discipline motive and incentives of direction and enforcement would have saved the day. The general procedures are incorporated in our flow diagram. More particularly, though, incentives must personalize for the individual and work through the properly selected motives, i.e. conditions which give the emotional kick to put and keep the person in the safety orbit. The more strongly the desired goal is perceived and reiterated the stronger the motivation, particularly when the development of the proper attitudes, i.e. "mind sets," puts the desired goal in favored position.

How to Tell Whether Motivation Is Working

There are four simple checks we can make to see if our motivation is working.

1. The effectiveness and efficiency of the desired learning is increased (other things being equal).
2. The individual or group efforts to achieve the goal are persistent.
3. The goal gradient effect is clearly evident.
4. The individual or group voluntarily expresses interest, satisfaction and desire to achieve the goal.

In the first three of our four illustrative cases it is obvious from what I have said that these four tests were satisfactorily met and would be observable to anyone making the check. In the fourth case, when the motivation failed it was and should have been evident to the supervisor that these four tests were not being met and that there was need for immediate action, as is shown in our previously discussed "motivation flow diagram."

Conclusion

It may be difficult for some to believe that what we have discussed here, motivation, is the key element in our lives. But its effective use spells the difference between success and failure in all we do. It determines also whether happiness or misery will prevail. Moreover, it holds the solution to emotional adjustment in lieu of maladjustment for, mark you, what we have discussed contains the key to self-motivation as well as the motivation of others.

There can be no continuing safety without motivation. And in a broader scope even our conquest of outer space and solution of the problems of nuclear energy will be hollow, meaningless and, yes, disastrous Pyrrhic victories if we fail in solving the problems of our own behaviour.

COMMERCIAL VEHICLE SECTION

AUTO DRIVING FITNESS AND THE PHYSICAL EQUATION

By ABRAHAM J. MIRKEN, M.D.

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American Medical Association, Cumberland, Md.

The topic assigned was "the physical equation." I choose to broaden it a little bit and talk about "auto driving fitness," because I think it encompasses more of what we as physicians are interested in. When a disease kills almost 40,000 people a year and affects them physically to the extent of four and one-half or five million more a year, it certainly is not unnatural for physicians to be interested in it.

Automobile accidents last year did just that. For quite a few years physicians have been interested in the problem, but primarily from the point of view of treatment of casualties, and rehabilitation. It's only in the last 11 or 12 years possibly that physicians began to look upon this as a preventive disease; it should certainly fall into the province of general medicine and not just the surgeon, the orthopedist, the physical rehabilitation specialist, and so forth.

The American Medical Association has for some years felt its responsibility and has had a committee interested in this. Until this year, the committee was called Medical Aspects of Automobile Injuries and Deaths, but in the last two months was changed to Medical Aspects of Automobile Safety.

As Mr. Fine has stated, expert drivers, with 20 years of experience, or better, in driving safely, did not measure up to what we as physicians felt should be ideal standards for selecting drivers. They were all older—they probably didn't coordinate as well, their reflex timing was not as good as for younger people—and they certainly did not see as well at age 59 as they did at 18 or 20. They probably didn't hear as well—their fields of vision might have been somewhat impaired.

We know for a fact that their ability to

see at dusk and at dawn was definitely impaired. At 60 or 65, one becomes less capable of seeing in the hours when there's not quite enough daylight.

There's no substitute for the judgment that maturity brings. When a fellow is stable enough to stay on the job for 33 or 34 years and to respect the customs and the opinions of his community, he's one who should be a good driver even though on a testing machine or device he may not check out so well.

The physician is interested in preventing accidents by trying to determine the individual's ability to drive, and also the particular things that impair the ability to drive. His sole concern, I believe, is with the driver's physical make-up—how tall, how short, how obese, how old and so forth—and his physiology—is he able to move all his extremities, turn his neck, see over a wide enough range when looking straight ahead, or perceive that he has just enough time to get by in changing lanes and passing?

These things are very difficult to measure, but they can be impaired by certain diseases and by taking medication, drugs and alcohol. The physician also tries to sort out the people mentally or emotionally unfit to drive. The moron, or individual with an IQ of less than 70, should not be driving any vehicle, especially a commercial one, or one that transports passengers.

Emotionally disturbed individuals whether psychotic or severely neurotic, or just upset by a bout with boss or wife, are not as good drivers as the normal individual.

Last we come to the effect of specific diseases on the body, the effect of drugs and medications on the ability of the individual to work, see or judge, and the effect of alcohol. One doesn't have to be

a chronic alcoholic or abject drunkard to be a bad driver. We are concerned with the fellow who has one or two cocktails and then proceeds to drive home thirty minutes after the last one. It's been determined time and again that even one beer or 1½ ounces of whiskey in the blood stream will be sufficient to impair physical ability.

The figures of 1957 still hold true in 1960. There were 39,000 killed last year and the 1½ million mentioned as being injured are those who missed a day or more from work. Actually there were 4,700,000 reportable injuries, and the prediction that one person in every ten will be injured or killed in a motor vehicle accident in the next 15 years still holds.

Obviously there are three facets that are involved in an automobile accident. One is highways. We are going to have dream highways where cars will be locked on electronically, and the driver may take his hand off the controls and not touch them until he gets off the highway, but that's in the future.

Second is the motor vehicle. This has become faster moving, more maneuverable, and truly has fewer mechanical failures causing accidents. One thing that I'd like to emphasize is that the automobile can be vastly improved as a means of packaging the driver and other occupants.

Statistics show that human failure is the most important factor in the causation of accidents. The human mechanism has to be not only physically fit but also able to function and unmodified by drugs or alcohol.

Drivers having repeated accidents or a high accident rate are usually of lower intelligence, youthful, or have certain emotional problems, such as egocentricity, resistance, or social irresponsibility. However, most accidents involving personal injury take place between drivers who have never been involved in a personal injury accident before, or been injured themselves. That's a little surprising in the light of the three factors compiled above.

How can we determine safe driving ability? There is no law that I know of in any state which compels a physician to report to a motor administrator the physical, emotional or mental disabilities which in his opinion may result in the impairment of his

patient's driving ability. The only possible exception is epilepsy which some 22 states have designated by law as a reportable disease.

The individual who suffers fatigue while driving may be more likely to have an accident. And he will usually have that accident in the first two or three hours after he starts driving. I think that statistics have borne this out. Usually his fatigue comes from some activity he engaged in prior to driving. The physician and the safety engineer should both be on the lookout for the fellow who has not slept properly the night before, or who has engaged in some physical activity, such as golf, tennis, or week-end camping trip. He should be warned about his ability to drive.

The individual likely to faint or become confused, whether due to disease or because he has been taking tranquilizers, must be watched. Temporary impairment may be induced by certain drugs like marijuana, cocaine, morphine or their derivatives, and from the use of alcohol. There is no single opinion about what constitutes the best vision, but certainly if everybody had 20/20 vision we would have better drivers. It's the feeling among most practitioners that at least one eye should be correctable to 20/40, and the other to not worse than 20/70.

The value of good hearing is something else again. We know that many drivers don't hear well, and that a man who is driving a tractor-trailer or a large bus, and who is hard of hearing, can't do as well with a hearing aid as without one. Also, drivers who know that they are hard of hearing can compensate for it by using their other senses to greater advantage. Sometimes these men are quite competent drivers.

It goes without saying that a person should be able to operate the controls of his car. He should be able to use his arms, should have enough strength in his legs and thighs to use brakes and clutch pedals, and should be able to rotate his neck in both directions so that he can see over both shoulders. The individual who has a cast or a splint on one arm and is otherwise well should not drive an automobile, particularly a commercial vehicle.

A physician can only advise a patient but certainly his responsibility is great to advise that patient not to drive with a

Commercial Vehicle Section

cast, or a patch over one eye. The individual who is blind in one eye and drives over a period of 10-12 years learns to compensate for the loss of that eye, although tests reveal inadequate depth perception in car handling; but an individual temporarily blinded in one eye has depended for so long on both eyes for binocular vision that he is temporarily incapable of doing a good job in depth perception. Such an individual should be warned by a physician or a safety man that he must not drive until his eye is healed.

Emotional instability cannot be measured. There's no test which, in 5 to 30 minutes, can rule out the emotionally unfit as drivers. Long interviews are necessary, and even then, as we learn from racing experience, they don't work. Many a man is a competent driver on a practice course—a sober, stable individual when you talk to him in a physical interview—yet when he gets into competition he becomes terribly aggressive and abusive, and dares to disregard not only his own welfare but also that of those around him. Such an individual has to be taken off the course immediately.

There are certain endocrine glands—organs of internal secretion, such as the pancreas, the pituitary, the ovaries, the testicles and the thyroid—which affect our emotions, our behavior, our physiology, our ability to work; and there are certain diseases and certain drugs which affect these glands. Some of the diseases cause a motor weakness in which an individual cannot temporarily do simple things with his arms, legs, or back muscles which he could do before. Such an individual shouldn't drive.

There are some diseases in which one particular muscle is weakened, as from a cerebral stroke in which paralysis on one side results in a loss of an arm or leg. No one would disagree that such a man cannot drive. There are certain diseases of the endocrine system which produce spasms and convulsive movements, not due to loss of consciousness, but due to an overpowering, uncontrollable muscle contraction. Such a disease is hypoparathyroidism, which fortunately is not too common.

Sudden episodes of vertigo, or dizziness, appear in certain diseases. Individuals who have them should not be permitted to drive, and it goes without question that anyone

who suffers loss of consciousness, whether it be due to blocking of a cerebral blood vessel, epilepsy, or any of the convulsive disorders, must not drive.

How can we discover the individual who has these? If he seeks medical advice, his physician, if he is competent and zealous in his work, can make a pretty accurate diagnosis. But the physician's hands are tied as far as doing anything more than advising that individual not to drive is concerned.

When it comes to commercial drivers, there is a controlling organization with its own medical department, but we all know there are individuals under the care of private physicians who have certain diseases which would preclude their driving a commercial vehicle. Yet, the organization medical department does not know about it because the individual has never been in trouble in the plant. When discovered, he must be prevented from further driving.

The problem of diabetes and dropsy is rather serious and complex. There are a tremendous number of diabetics in this country, and an untold number who have never been diagnosed, or have no idea themselves that they are diabetics. The medical profession feels that if the diabetes is mild enough so that only diet is necessary to control a man's blood sugar, then he may drive all vehicles. If diet and one of the oral antidiabetic drugs control his blood sugar, he may drive all vehicles. If insulin is needed in addition to diet control, he may drive a private car but he should not drive a commercial vehicle or a passenger transportation vehicle.

People are going to differ about that. If the individual is seriously diabetic, so that dry insulin alone does not always control his diabetes, he should not be permitted to drive any vehicle. The reason is that, if his blood sugar suddenly goes up too high, he may become unconscious or semi-conscious. This can sneak up on him without much warning.

On the other hand, if he's taking insulin, and for some reason didn't eat his meal or didn't eat as much as he should have, he may go into insulin shock, an abrupt drop in blood sugar resulting in loss of consciousness and even convulsions. Such an individual should not be behind the wheel

of any vehicle. The feeling of the American Medical Association is, if the individual is taking insulin, whether his diabetes be controlled by it or not, he should not drive a commercial vehicle or a passenger transportation vehicle.

A person should not be allowed to drive when he is under influence of drugs which impair sensory, mental or physical functions. As we know, there are many drugs that cause drowsiness, lack of coordination, etc. Today, people are taking tranquilizers, sedatives, hypnotics, even small doses of narcotics, if they have chronic muscular disorders.

Drugs are being used more and more today to control high blood pressure and, surprisingly enough, in many individuals, cause a certain amount of drowsiness and slowing-down of reflex time. Furthermore, the individual usually has to take this kind of preparation every day. Antihistamines, considered not long ago as a cure-all for the symptoms of colds, cause tremendous amounts of drowsiness.

Tranquilizers also cause drowsiness, or dull one's mind; there are some drugs which relax one's mind, make one feel that everything is fine when it isn't. Both these kinds of drugs are harmful to the driver.

We know that drowsy drivers are capable of losing attention, their reaction count has slowed down, their ability to see is definitely impaired, and they are dangerous. They should stop and rest; if possible, they shouldn't work that day. In general, fatigue affects the mind, the eye, and the whole body. It is recommended that no one drive more than eight hours and that an individual stop every two hours. I might mention that these are recommendations made for the average passenger car driver, and not necessarily the commercial vehicle driver.

One of the best drugs we have to keep you from falling asleep is caffeine, from coffee, colas, or the caffeine tablets. We don't recommend that drivers take benzadrine tablets before making a trip. Heart and blood vessel diseases are dangerous only if they cause a sudden loss of consciousness. High blood pressure itself is not a complication to driving either a passenger car or a commercial vehicle. The effect of high blood pressure on an individual—on his brain, kidneys, etc.—should be evaluated

from the point of view whether there has been damage to renal vessels or whether kidneys are failing and the driver is likely to go into a coma. I return to consideration of the visual acuity necessary for safe driving. Double vision should not keep an individual from driving. Color blindness is not a significant hindrance at all. Dark adaptation and glare are problems in themselves. An individual hitting 60 or 65 does not adapt very easily to the change from daylight to dark, or from dark to daylight, at dawn.

It has been shown that an individual who smokes three cigarettes will impair his dark adaptation to the same extent as if he went up 7,300 feet in altitude in an airplane. The higher you go without an oxygen mask, the less oxygen you get, and the poorer you see in dark and twilight.

An individual who has an artificial opening in his wind pipe through which he breathes, as a result of tracheotomy, should not be allowed to drive a commercial vehicle, because he may be easily choked by breathing in foreign matter.

The person suffering from convulsions, such as epilepsy produces, or any disease causing faintness, weakness, or like disorders, should be avoided in selecting drivers. There are no two states in the union having epilepsy laws that agree, but most of them feel that an epileptic may drive safely on no medication if he has had no attacks in two years; others allow medication. There are certain things that will induce an attack in an epileptic person—undue fatigue, alcohol, and emotional tension or stress.

Any individual who gets emotionally upset can have his driving impaired in three different ways. He may be so absorbed in his own problems that he is inattentive or indifferent to driving. He may be so depressed that he is unable to work. He may have such violent antagonism to the world or to people around him, that he becomes repulsive, aggressive, loses his good judgment and his sense of caution.

Every individual who is neurotic should be carefully evaluated by his physician and safety engineer. He should also have evaluated the effect of any drugs he is taking to control his neurosis before he is permitted to drive.

A psychiatric patient who has been hos-

italized should not drive. A patient being treated by a psychiatrist with drugs or by shock therapy should not drive, and anyone whose psychiatric status slows his behavior and reflexes should not be permitted to drive.

Thirty-five milligrams of alcohol per hundred milliliters of blood impairs ability to function physically. With 50 milligrams, or 0.05 per cent, there is definite measurable impairment. The third drink can get you

into trouble with the police. In many states there is an arbitrary limit of either 0.10 or 0.15 mg./ml., above which you are considered drunk. Some states do not have an arbitrary limit, but the blood alcohol determination is easy to make and, if you have alcohol in your blood, and it can be shown that you did not operate your vehicle with the same judgment and skill that you would have had you taken in no alcohol, then you may be prosecuted.

SLIDE RULE TO SAFETY

By JEROME L. FINE

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The dictionary defines a slide rule as "a device for rapid calculation." Unfortunately, this sort of device does not presently exist in the field of traffic safety. After several decades of experience and research we are still attempting to select, evaluate and understand the automobile driver and his behavior on the road by using any number of methods, from the simplest interview to the most complicated battery of tests. These methods, however, have at least one thing in common—each is grossly imperfect. We simply do not possess accurate, rapid devices for driver assessment, and due to the complexities of the traffic situation none seem forthcoming in the foreseeable future.

This, of course, makes the title of my address somewhat of a misnomer. As far as can be determined there is no "slide rule to safety." There are no shortcuts to understanding the actions, feelings and thoughts of a complicated machine, the human being, operating in a complex situation. Recognizing this state of affairs, the Safety Research and Education Project at Teachers College, Columbia University, came into being just four years ago. Its main purpose was to investigate the causes of accidents, primarily traffic accidents.

After carefully studying the many possible causes we decided to focus on the driver since he appears to be the most significant among these. Under the able leadership of Dr. J. L. Malferi, the project activities have grown to encompass three general areas:

1. Determining the characteristics of safe and unsafe drivers and translating these into tests which might be used by licensing authorities, fleet operators, insurance underwriters and others.

2. Improving driver behavior through education.

3. Studying automatic devices to take over for the driver when he fails.

While seemingly unrelated there was a logical progression from one area to another. First, we wanted to find out something about automobile drivers. Then we wanted to use that knowledge to develop ways of choosing those individuals who are liable to become accident statistics before they are able to damage themselves or others. Once the unsafe or potentially unsafe driver has been identified, not allowing him to have a license or refusing him insurance did not seem to be enough.

Some positive action was indicated like rehabilitation or education in the essentials of safe driving practices which includes training in attitudes, skills and knowledge. But this kind of training is at best a slow process and even individuals who are generally safe drivers may at times break down and become unsafe, sometimes due to circumstances beyond their control, such as cardiac seizure. Hence, our interest in electronic or automatic devices that function to supply the lost control and direct or stop the vehicle in a safe manner.

While the project's framework and long-range objectives concern the reduction of accidents, urgency has led to a concentration on applied research in areas where immediate action may be taken. One investigation, for example, involved working with the Driver Improvement Clinic of the Automobile Club of Cleveland. We studied the psychological differences between teenage traffic violators and non-violators ultimately developing a battery of tests to predict violators. In summary, we found that the violator does not think things through and see the consequences of his acts. He may see from A to M—but not to Z. More about this extremely important point later. He doesn't get along with people, including those closest to him. While loving freedom and himself, he feels held in check and is rebellious. His over-sensitivity, lack of self-confidence and feelings of unworthiness make him one of the "angry young men" who may resort to erratic and ill-considered actions, using the automobile as a weapon.

Also of great interest, was that his parents displayed similar anti-social tendencies. They are not very civic-minded and stay pretty much to themselves. They feel little responsibility toward the rest of society. This philosophy of "Every man for himself; just take care of Number One," has evidently rubbed off on Junior in his automobile. One relevant though poignant example occurred recently in California. A young man speeding excessively was killed but the police could not find his father; he was in court paying a fine for reckless driving and speeding.

There are two reasons for my reporting these findings about teen-age violators and their families. On the one hand, it documents dramatically the importance of enunciation or example in the formation of driving attitudes which begins at quite an early stage of development. It is not infrequent for the child learning to count and read to ask his father why the sign on the road says "45" and the arrow on the speedometer points to "60."

On the other hand, this study typifies along at least one dimension the kind of research presently being conducted. It concerns the "pathological" driver, the one whose record reveals him as dangerous when behind the wheel of an automobile.

Through the years research has produced an ever-growing list of traits, attitudes and actions which are significantly related to "bad" driving. In contrast, there is little information and even less conceptual clarity about the nature of "good" driving. In terms of our culture, this is not particularly strange. I wonder if you realize how many of our standards are based on the characteristics of marginal or totally maladjusted individuals. As a psychologist, I have frequently attempted to measure neurotic potential and character disorder. But there are no scales for measuring *healthy* potential or character *order*. Traffic safety is no exception. Violation point systems, for example, are arranged so that 0 is the best score.

Equally important is the fact that "good" driving is not just the obverse of "bad" driving. In an older study, we collected over 2,000 incidents typifying "good" and "bad" driver behavior. Although the results are not yet complete, the analysis definitely indicates that certain actions ascribed to good drivers cannot be classified on the bad side of the ledger. The individual who interrupts his journey to clear a dangerous obstacle from the roadway has no "bad" counterpart. Isn't it about time we started to model our standards after people who did things well. It certainly seems we can learn at least as much from good drivers as we can from poor drivers.

It was in this atmosphere that we especially welcomed the opportunity to work with a group of proven safe drivers. It was frankly refreshing to work with people who were normal or better-than-normal. Collaborating with the National Safety Council, the DuPont Co., Remington-Rand, Univac Div., Dodge Corp. and many helpful individuals, we examined the characteristics of over 2,000 drivers who had received the National Safety Council Safe Driver Award for 20 years or more.

Incidentally, the opportunity to test a large group of individuals for whom orderly, accurate records over a long period of time were available is rare in itself, and to a considerable degree serves to offset some of the more serious limitations concerning doubtful driver classification due to inaccurate or inadequate records imposed on many studies in this field.

For the first phase, we prepared a questionnaire which was distributed to the drivers by the National Safety Council. The questionnaire contained 22 items relating to biographical and driving records. Some of the results may be of interest to you. The profile of the 20-year award winner reflects social stability and conformity. He is 39 years old, married and has two children. He has been driving professionally for 33 years, has worked for the same employer for 32 years and has had, on the average, only one previous employer. In fact, like most of his fellow winners, he has been with the same company for his entire working life.

He has never had a single traffic violation during his personal and professional driving career, has had only one preventable and one non-preventable accident during his vocational driving career and no preventable accidents otherwise. In 1959, he drove about 17,000 on-the-job miles and added another 8,000 in personal driving.

With the help of Remington's high-speed computer, Univac, we ran these characteristics through and selected six drivers largely on the basis of an accident-exposure index. The process took twelve hours on the machine. According to Dr. Mahoney, it was reminiscent of winning in the hospital lobby for one's first baby to be born. Being a bachelor, I must confess to feeling a little "inadequate" but feeling after several hours my anxiety complex turned to sheer excitement. After being told the information at 6 p.m., Univac's digestive process took until 11 a.m. the following morning before it punched out twelve names and last pilot selected received its selected plates.

Six of our twelve highest ranking drivers were available for the tests on which intensive, depth testing had been scheduled. One week end, here in Chicago, the "chosen few" were assembled and subjected to twelve solid hours of tests divided as follows:

Medical	2 hours
Driving performance	2 hours
Psychological	4 hours
Knowledge	4 hours

The tests were administered by specialists in each of these areas. Specific items were selected according to the specialist's concept of what the ideal characteristics of the safe driver should be or established operating

standards for drivers such as those found in licensing and fleet driver examination. Because only six individuals were involved, some results of the highly personal tests cannot be released, but I am sure you will find the results that can be made public most provocative.

Items on the medical examination ranged over several areas which include, among others, five different visual tests, a neurological and cardiovascular examination and eight different psychomotor tests. The results indicated that the subjects were average and below average in terms of suggested standards for medical fitness to drive and in terms of some of the physical standards currently used in licensing. They were no better physically than the average man in their age bracket.

In most cases, however, they knew their physical deficiencies and had compensated for these in the driving task. More specifically, suppose the ability to see signals and other vehicles was impaired or simple reaction time was slow, they would then look harder for signals and other vehicles, and when they saw these they would know instantly what to do. Their concentration, caution, ability to anticipate and make quick decisions, evidently more than made up for whatever physical deficiencies they might have.

The psychological battery included the Rorschach "ink-blot" test, other projective tests, an intelligence test and a personal interview. The results indicated that all subjects operate in at least the average range of intelligence. In general, they are non-aggressive individuals with a high level of impulse control. They are loyal, dependable, sober, saving, cautious husbands and fathers as well as dependable, loyal, hard-working employees. A high degree of vocational and social security seems more important to them than competitive, aggressive strivings.

These characteristics are reflected further in their tendency to plan conservatively and well for financial commitments, retirements and other phases of their own and their family's future. In doing so, they invest in safety and security to the exclusion of other potential gratifications. In addition, all share a strong preference for an outdoor job—that is, one which does not require a formal, long-term and close relationship with others.

As a group, they are highly sensitive to the opinions of others and to the mores of society. While quick to recognize a threat to their well-being, they try to avoid, deflect and deny such threats before they evoke retaliatory feelings. This is particularly true of threats which normally arouse anger so that, for example, they do not seem irritated by the bad manners and poor driving skill of others. Impulsivity or rebelliousness are totally foreign to their patterns of adjustment and their behavior seems modeled after a parent who is easy-going and non-aggressive. In the light of these factors, their social behavior is probably very stable even though the evidence suggests that a high percentage of these men underwent extremely stressful childhood experiences.

The performance test consisted of driving over a pre-set course in a specially equipped car. The course was selected to meet the requirements of containing 24 major driving incidents which included 136 separate items. In addition, seven general driving practices were assessed. The results—all six subjects did better than average. In fact, all rank in either the "excellent" or "good" classification. Not a single one ranked as low as "average driver." Five positive characteristics, common to all subjects, stood out on the performance test. These were:

- (1) Signaling intentions when slowing down, stopping, turning or changing lanes;
- (2) Correct use of the eyes in traffic, at intersections and in the open road;
- (3) Courtesy towards pedestrians and other drivers;
- (4) Perfect timing when passing and changing lanes;
- (5) A manner of driving that caused passengers to rest at ease at all times.

In the knowledge area, each driver was given several standard tests totaling almost 200 questions. The subjects included mechanics, law and regulations, vehicle operation and first aid. The results—five of the six drivers scored average to poor, one scored good.

It is evident that the information gathered

in each of the areas tested raises some serious questions. In general, we compared our drivers to the ideal safe driver and on the whole they did not make the grade. But we tested the "genuine article" and ideals are, at best, good guesses. Should we not consider re-evaluating our concept of the ideal driver in order to make it more realistic? Stated in a positive manner, we should take a long, hard, look at theoretical licensing and selection standards which are not validated pragmatically.

Admittedly, this is not an easy task. Results to date suggest that if driver behavior is divided into three stages—input, organization and output—then the mature, safe driver excels in organization or the ability to make a correct decision and to adjust his behavior so that it is in accordance with his ability. Compare this profile to that of the teen-age violator whose visual input and reflexive output are probably at their respective peaks, but whose organization or decision-making machinery has not been fully developed. Organization, however, is probably the most complex, difficult variable to isolate and study.

The fact must be kept in mind, the results of our study, no matter how interesting or disturbing, are based on the records of only six men. More definitive information is needed before any change based on these findings can even be contemplated. With this purpose in mind, and with the cooperation of the National Safety Council, we have proposed a larger study which seeks to test comprehensively in much the same manner as the pilot study, some 1,000 proven safe drivers throughout the United States.

The concentration of public attention on the safe driver in itself should serve as a quiet step in the reduction of traffic accidents. We also believe that the knowledge to be learned from the nation's safest drivers will be an invaluable aid towards the total understanding of our traffic problems. We are, of course, still vitally interested in the characteristics of all drivers; but perhaps now is the time to quietly rehabilitate the bad drivers and publicly applaud the good drivers.

duction employees, an endeavor to determine whether a special driver index could be developed through the ARII was undertaken. Sufficient data for this study became available only late this summer. Now to do a job like that you need large samples, because you are very likely otherwise to capitalize on chance.

A preliminary driver index has been developed now from other data and applied to the southern trucking firm to try it out. When the truck drivers of this middle southern firm were scored with the new key, the results were highly satisfactory. Correlation between the new safety index and accident data was .75—an extremely significant relationship.

This result strongly suggests the desirability of utilizing samples in the refinement of this driver index for general use.

At this point I wish to emphasize an important difference between the accident problems of over the road drivers and stop and go drivers. That is, in addition to accidents involving collisions either with vehicles or pedestrians, the stop and go urban bus driver seems to be charged with the responsibility for injuries to passengers for which he is not primarily responsible. For instance, when stopping, a standing passenger may fall and sprain his ankle. Who is responsible?

This strongly suggests that accidents in this field should be classified not only for levels of negligence in colliding with vehicles and jaywalkers, but also be broken down into three categories as follows: collisions with vehicles, collisions with pedestrians, injury to passengers on a bus not involved in a collision.

Our investigations to date reveal the extreme importance in recording detailed information about each accident if you're going to do a study like ours. This is important in order to clarify and assess the nature of the accident risk which an applicant for a driver's job may present. I have already referred to the importance of determining level of negligence on the part of the drivers. It is just as important to factory workers, but it is sometimes very hard to obtain. That is one of the difficulties I had in the production field. The level of negligence is not enough. We also need to know the length of service with the

firm, so that the accident record can be properly weighted for length of employment. Now a few concrete examples will reveal the need for this.

For instance, one firm presented accident records for 17 months. During this time one driver had a serious accident involving gross negligence. Yet management classified him as their best driver. Another company tested a group of drivers whom they considered as accident repeats. Yet the records over a three year period showed, and that's only if we had the records for a three year period, showed that 7 of these drivers rated as unsafe had had no accident during this three year interval.

Well what can you do with data like that? Examples like these reveal the prime importance in obtaining accident data over the entire period of employment. A man may have a serious accident involving gross negligence in 17 months, yet management may base its opinion of the driver on a record of a twenty year period of employment. Let's have all the facts.

Test users sometimes develop the habit of depending entirely upon test results—very sad if they did. As you know, this would be a great mistake. In hiring, a wise employer takes into account all the data at hand, such as interviewing, and previous job history.

Test results are never perfect. The same could be said for many medical discoveries. The Salk vaccine for instance has decreased the incidence of polio, but it has not eliminated it entirely. It would be difficult to find anyone, however, who would say that this lack of perfection was a good reason for giving up the use of the Salk vaccine.

Primary concern for the tester, however, is to refine these tests as much as possible with industry's cooperation to achieve two purposes. To see reduced to a minimum the probability of eliminating a good risk, while increasing to a maximum the probability of identifying a poor one. Eliminating the poor risk is most likely to effect reduction in the cost of accidents. Moreover it might be helpful to direct special attention to re-training the driver who has had his first serious accident.

In closing this report, we can make a few suggestions. We already know that the driver index can be a useful aid in select-

ing the over the road drivers who are least likely to become involved in accidents. But it is also important to learn how the driver index applies to other driver operations. To

carry out such studies it is essential that accurate records of accident levels with degree of negligence for the entire period of employment be presented.

SECOND DIMENSION OF FLEET SAFETY

(a) DRIVER PERFORMANCE—A TRUE MEASURE OF MOTIVATION

By ROBERT PERLOFF

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I should like to begin my remarks by warning you that I come here this morning not as a prophet of psychology, nor as a sage in safety, for I am neither, but rather as one whose modest contribution to your deliberations this week may, at most, be characterized by whatever merit there be in the impetuosity of naivete. I am naive. That is, my ignorance in the field of safety may help you, through your depth and knowledge of the problem, through your untimely with accidents, and through your compassion with the human operator of vehicles and the multitude of pressures that never leave him—obtain a fresh start or at least a different view of this enigma of highway accidents which you have been wrestling for decades.

At the outset, let me set the record straight by advising you that, notwithstanding the original notions of the program committee as well as my own vague ideas when the subject of participation in this symposium was broached last spring, I will be concerned neither with motivation research nor with measurement techniques as explicit topics. Let me tell you why.

Motivation research, as many of you know, seeks to probe, oftentimes beneath the level of the individual's conscious awareness, for underlying or basic motives responsible for the individual's behavior. Typically, motivation research studies have been conducted in the context of consumer research in marketing, advertising, and selling. To illustrate, the conventional motivation research activity might reveal that "Milady's" soap is preferred (by your lady,

and mine) not especially for its cleansing qualities, but rather because of the way it caresses the skin, tenderly and lovingly. Motives or reasons such as these are scarcely capable of being revealed unless considerable probing is used by skillful and professionally trained interviewers.

While the clinical techniques employed in motivation research, projective tests for example, are indeed appropriate for and have been used in safety research, I am now convinced, having sweat through some of your voluminous safety research literature, that the time has passed when we can afford to view the individual as an entity divorced from other factors with which he interacts in committing traffic violations or accidents. To be sure, a small piece of the explanation of accidents may be brought to light through motivation research, but so far as I am concerned there are other approaches that appear to be more promising, at least at our current level of knowledge of driving behavior. But more about this later.

Permit me to illustrate but briefly the type of frustration one faces in reviewing the psychological literature bearing on driver safety. An excellent summary of behavioral research in this field was published recently by the Driver Behavior Research Project of George Washington University (Goldstein, 1961). An examination of this objectively oriented statistical digest revealed a multitude of depressingly meager relationships (either correlational or in terms of significance tests) between personality measures (the nuclei of motivation

research) and actual driving performance. If these objective studies, embracing personality measures of all descriptions and inferred from thousands of cases, are incapable of unmasking the riddle of driver safety or of differentiating between safe and unsafe drivers, then what chance is there for motivation research, along with its handful of clinical interviews and its probes in depth and its assortment of projective devices, to do hardly more than provide a few clues, not definitive answers, in our search for truth?

Hence I decided not to try your patience by speaking about motivation research and driving behavior. Alford you, I am not saying that motivation research does not have a legitimate role in psychological research, but rather that in my judgment it is not a primary tool of inquiry appropriate for use at a time like this, in 1961, conspicuous for its shapeless understanding of the parameters of driver behavior.

Moreover, a review of your literature documented my intuition that there is no famine of research or statistical talent in the ranks of the psychologists engaged in driver behavior studies. Hence it would be prodigal to pontificate on measurement problems in safety research.

To help you understand better, or at least sympathize with, the position I shall espouse, I would like to recount for your suzerainty the disappointments I endured by discovering, one by one, piece by piece, in study after study, the reasons why safety research has germinated, not the towering Redwood tree or the defiant excavator, but dwarfish shrubs or diminutive motor scooters, healthy little shrubs and peppy little scooters, mind you, but still, alas, only shrubs and scooters, not Redwoods and excavators. The list of reasons why driver safety research has languished includes, but is not necessarily restricted to, the following items:

1. The statistics of violations and accidents are horribly muddled, unreliable, lacking in uniformity so that data can not be combined meaningfully and interpreted sensibly.
2. The nearly unimaginable variations among traffic laws, or at least certain in the subjective nature characterizing the traffic officer's interpretation of violations.
3. The fact that variations within drivers are oftentimes greater than variations among drivers, one of the sorriest and most pessimistic observations that one encounters in this area.

4. Because driver attitudes are easier to measure than actual driving behavior, considerable work has been done in this area. However, there is incongruity between attitudes and behavior, viz., between what a person says he believes or says he will do and what he actually believes or actually does.

5. The operation of chance, and hence unpredictable, factors in the accident complex.

6. It has been disappointing to find that no test, or even test battery, appears to be clearly outstanding accidents, despite the fact that numerous predictor tests have been studied, including those that seek to assay individual differences in the realm of man's sensory, motor, intellectual, and personality qualities. (Reference here is not meant to include extreme cases such as drinking, fatigue, emotional disturbance, youth, inexperience.)

7. The generally poor relationships between indices of performance in driver training courses and later accident records. "Grades in driver training courses apparently have no validity for predicting who will receive traffic citations or have accidents. Socioeconomic and geographic variables also failed to show any important relationships to traffic citations or accidents. The dark coloring factor failed to have any loading for the accident or citation variables tending to suggest that Mexican and Negro groups are not markedly different from other groups in these respects." (Comrey, 1958, pp. 220-23)

The foregoing list of reasons, and more, are documented liberally in the psychological literature (Comrey, 1958; Goldstein, 1961; Stewart, 1954; Thorndike, 1951).

Several facts and hypotheses are readily inferred from the studies from which the above state of affairs are derived. To begin with, it seems that most approaches to the problem have been explorations of single factors or systems of variables, rather than of interactions among factors. These interactions suggested to me a crude model out of which the nature of accidents might be teased or glimpsed. Let us assume that accidents are some function of the driver, the vehicle, and the environment. This function might consist of some weighted combination of driver characteristics, vehicular characteristics, and environmental characteristics, plus driver-vehicle interaction, driver-environment interaction, and vehicle-environment interaction, plus, finally, driver-vehicle-environment interaction. Simple as it is, when such a model appears in front of one, on paper, some possibly interesting clues of accident etiology are exposed. Let us see what these clues are.

It is apparent that if our model is correct we will get nowhere by studying the individual, the vehicle, and the environment, each, in turn, as a discrete entity. True,

from this restricted kind of study, we will learn something about accidents, but never much, I fear.

What about the next level, the double interactions? These will open the curtain a bit wider, to be sure, than was possible through an examination of discrete entities exclusively, suggested in the preceding paragraph, but the stage revealed by the partially opened curtain will disclose a few of the principals but not the entire cast of factors, without whom the drama and the tragedy of highway accidents will never be fully understood. These double interactions, while not the full story, are significant, and include such interactions as these:

1. The driver-vehicle interaction, relating the individual's physical and sensory dimensions with the design of the vehicle.
2. The driver-environment interaction, telling us that certain kinds of visual defects will be a distinct handicap for night driving, and
3. The vehicle-environment interaction, advising us that time and wet roads provide an ideal condition for slippage.

There are doubtless numerous interactions of the driver-vehicle, driver-environment, and vehicle-environment varieties that have not been uncovered in the studies conducted thus far. However, it is with another order of interaction that we might be concerned, which for want of a more definitive map of driver behavior I should like to "house" under the triple-order, or driver-environment-vehicle interaction. Let me suggest three of these generic kinds of interactions, each of which is capable, I believe, in producing through systematic, programmatic research an abundance of specific, measurable interactions:

1. There has been some, but I suspect entirely too superficial, effort to determine what happened to the driver before the accident, i.e., where he was coming from, both physically and psychologically, and where he was heading, again both physically and psychologically. Reference is made not only to the driver who left the loading dock in a rage over some basset or another, or to the driver with fits of anxiety regarding someone he is planning to visit. Rather, the reference is to something considerably more subtle than the foregoing illustrations. It is, in a word, to the intricate, over-burdening social milieu in which we live. In this milieu, for instance, the breadwinner, whether he operates a passenger automobile or a commercial vehicle is irrelevant, is a father, a son, a husband, a member of the PTA finance committee, a tankard with power tools and maybe even a member of his local "great books" discussion group. But wait! He is also a suburb

dwellers, spending more time taking more members of his family to more places, and is concerned, too, with zoning problems, school reorganization plans, and the pros and cons of municipal annexation. So here we observe a man, a vehicle operator being but one of dozens of roles he must play, interacting with a powerful engine in night environments or on secondary roads environments, or both, a man whose multitude of responsibilities and preoccupations are perhaps pushing precariously the bounds of man's capacity to attend adequately to whatever task is at hand. Perhaps this task, call it driving, is punctured by the numerous other tasks to which the individual is addressed psychologically. I am not proposing that drivers have fewer activities, which is clearly not my business, but rather that this complex business of the extensive tasks or activities that most of us hope to manage may, indeed, be the focus of some of the explanations underlying the riddle of driver safety. Specifically, if we could study the individual driver as part of a system of events, including where he was and where he was going when "crash" the accident occurred, then we might be able to isolate a number of factors that seem to interact with each other in such a way as to discriminate between individuals who have accidents (one or more) and those who do not.

2. There are, regrettably, a number of things that people can not or will not regard with concern or with that degree of motivation needed to modify their behavior. I refer, illustratively, to:

- a. Smoking—people continue to smoke despite strong statistical studies linking smoking with cancer.
- b. Fatigue absters—people by and large do not have them, yet they may, feel are aware of the consequences of being without a shelter in the event of a nuclear attack.
- c. Exercise—one hardly does enough, though the relationship between lack of exercise and certain cardiovascular diseases is publicized constantly.
- d. Diet—excessive calories, foods with high cholesterol content, and other dietary defects are purported, again, to be associated with diseases, with reduced longevity, a fact which is apparently disregarded by thousands upon thousands of people who would never admit that they seek illness and shortened lives.
- e. Voting—the failure to cast a ballot on election day is associated with an indifference leading to inefficient government, waste, injustices, but still millions of eligible voters fail to exercise this responsibility.

3. Driving—we are told not to follow behind the car in front less than a prescribed distance under different conditions of speed and other factors, lest we seek collisions, injuries or possibly death, and unplanned expenses, but we still hug the back bumper of the fellow in front. Why? Why? Why?

Quite possibly a kind of triple interaction of person with vehicle with environment is at work in which the individual may simply disbelieve that his operation of the vehicle in a certain way in a particular environment is capable of involving an accident. How can we understand this lack of belief, this ostensibly incredible but unqualified faith the individual has in his skills or in the protective qualities of fate or the environment? Under what conditions are these incongruities entertained? How can such incongruous behavior be remedied? A suggestion will be advanced in a few minutes.

2. It is extremely probable that when an individual learned to drive an automobile this learning took place under an entirely different set of conditions which characterize driving once the skill has been allegedly mastered. Specifically a number of things occur in practice that do not occur during the learning situation. Of course, you are far more conversant with these divergencies than I am, but I should like to mention just one of these, merely to make sure that I have communicated fully the concept I am now seeking to suggest. Let us take speed, as an illustration. While learning to drive, you were rarely if ever in haste, but this is a state of affairs clearly different from those in which we operate from day to day as so-called experienced drivers. And haste, or speed, brings on excessive risk taking, driving too far in too short a period of time, leading in turn to fatigue and an overstraining of already limited sensory capacities. Certainly I am not suggesting that the learner be encouraged to speed while learning to drive, or that he be deliberately placed in a state of fatigue. But I am suggesting that he be over-trained, that he over-learns, so that his knowledge of the fundamentals is so complete that his reactions in dangerous situations are nearly automatic. How can this over-learning, or more efficient learning, occur? How may the entire process of driver training be improved by some significant increment? A suggestion along these lines will be made a bit further along the pike.

The question now arises, what can be done? Granted that the three kinds of interactions mentioned above are capable of giving us more insights into the nature and causes of accidents, how can we introduce this salutary state of affairs?

You will recall that the three generic interactions to which reference was made, are (1) the social milieu in which people, including drivers, are possibly best, provoking for certain people and under certain conditions a set of factors favoring accidents; (2) the incongruity between idealized driving behavior and actual driving behavior; and (3) driver training, or learning.

Here, then, for each of the three hypothesized interactions are some simple recommendations for better understanding the structure of these interactions and for applying this understanding to the process of remediation:

1. A study of the social milieu encompassing the individual is no mere academic search for understanding better the human condition, but rather is capable of teaching us more about the antecedents of poor driving habits leading to accidents. The closest suggestion I have seen for the kind of thing I have in mind here is discussed in a Conference on Traffic Behavior: a summary of the conclusions of a meeting called by the President's Committee on Traffic Safety at Williamsburg, Va. (1959). The Committee's recommendations include:

A. A systems approach to traffic flow and driver behavior.

B. A study of the psychology of driver behavior.

C. An examination of the social content of the automobile.

This last point suggests that consideration be given to the "place of the automobile in American life and in different subcultures that make up America." In order to discover how the automobile is linked with our total pattern of life, "historical, political, legal, economic, recreational, technological, familial." This is patently sensible and a recommendation I am confident each of you would endorse, but is still somewhat short of what I mean by this "social milieu interaction." It is my suggestion that we seek not only to relate the automobile to other facets of life in America, but also to relate the individual as a driver to other facets of his life and then to hunt for those clusters of relationships that distinguish among critical driving behaviors linked with accidents, on the one hand, and with safety, on the other. Putting it differently, I am saying that we need to know not only how the automobile is in harmony or in conflict with facets of our total life pattern, but also to know how the individual as individual fits in with or moves about in this life pattern. The automobile *qua* automobile is a rather sterile object, but the individual's interaction with this automobile in this life pattern—that is another matter. While I recognize that it is not the responsibility of the driver behavior researcher to chart life patterns, but rather that of the psychologist, sociologist, and perhaps the social philosopher as well, I believe that it is the responsibility of the driver behavior researcher to look for driving behavior in the total life pattern, and to be satisfied not with a glimpse of the automobile *qua* driver in this life pattern. Putting it plainly, if accidents arise to some significant degree out of the complexity of modern living, then let us stick our noses into this complexity and see if it can steer us closer to man's misuse and abuse of the automobile.

Another way of getting across to you the concept I am seeking to develop is by considering the predictions that are made for accidents during holiday week-ends, viz., Labor Day, Memorial Day, Christmas, New Year's Day, and Independence Day. Now we cannot quarrel with the fact that each of these national holidays is a chunk of the social milieu comprising the total life pattern in the United States. The "holiday spirit" induces excessive drinking, excessive anxiety to be with loved ones and hence excessive speed, or other excesses or distractions which nibble away at the attention that needs to be given to the task at hand, the driver's interaction with 250 horses or so, a muddy track. However, besides these holidays and the excesses and anxieties they engender, there are other elements in our social environment, things like the groups or associations to which we belong and the thousands of other items filling our heads. These, I submit, are just as capable of pulling us away from the job of attending to driving, as are revelry and fatigue, and in addition these are the kinds of factors that operate 365 days of the year, not only on holidays.

Identify these social elements, compare them one with the other, give them their proper weights, and we might reduce accidents appreciably.

2. The second interaction, dealing with the incongruity between idealized driving behavior and actual driving behavior, suggests incidental to my major thesis that a conspicuous void in safety research, at least with the psychological parts of this research is that to the best of my knowledge there has been no real effort to view driving behavior systematically in the framework of some accepted theoretical position purporting to offer a model for explaining behavior. Theory is suggested, not because it is elegant or fashionable to do so, but rather because it is impractical and wasteful not to seek to view one's data or interpret one's findings in the light of some reasonable theoretical position. Theory gives direction. Theory helps us make sense out of what would otherwise appear to be isolated phenomena. Hence talking in one's sleep is no unexplained mystery if it is viewed as part of some Freudian type of theory seeking to link behavioral responses to subconscious states.

Accordingly, the driver's responses are probably more capable of being understood, forecast, and controlled if these responses are viewed not as isolated bits of behavior flitting with us here and popping in on us there, but rather as part of some reasonable or promising theoretical framework embracing man's behavior.

There are several theoretical positions one might discuss I will select one described by Leon Festinger (1957). He calls it a "theory of cognitive dissonance." This theory maintains that an effective motivating state for impelling the individual to action is the joint appearance, existence, or occurrence of two dissonant, or disagreeable, or incompatible cognitions or bits of behavior. To illustrate, a situation of dissonance is upon the individual who, on the one hand, smokes a couple of packs of cigarettes daily and, on the other, is bombarded with threats of premature death stemming from excessive smoking. Rational individuals are motivated to action when confronted by a situation of dissonance. They seek to bring harmony or consonance to the situation. This can be done either by (1) modifying the individual's behavior or (2) rejecting the cognition which appears to be in opposition to, or antagonistic with, his behavior. In the smoking illustration, dissonance is removable by modifying the individual's behavior: he stops smoking, or by rejecting the cognition: he does not believe that smoking will shorten his life.

Do you see how this begins to make sense in the driving situation? Essentially, poor driving habits, combined with the driver's knowledge of the consequences of these habits, if a situation saturated with dissonance. Unfortunately, the dissonance is removed usually, not by modifying the driver's behavior, but rather by rejecting the validity of the consequences to him (it will happen to the next fellow, not him) of this faulty driving behavior. He says that "I can stop faster than they say," can "therefore," my driving so closely behind the fellow in front isn't such a dangerous practice, or at least for me it's not." What he should do, of course, is remove the dissonance by modifying his behavior: by maintaining a safe or wider distance between him and the fellow in front. But this he does not do? Why? Perhaps his self-image as a driver is too favorable, too unrealistic. If he had better information about his limitations, he too might have such a strong view of his driving capabilities and would hence be more inclined to change his driving behavior in a situation

of dissonance than to reject the facts of what will happen if his behavior is not changed. Another possible reason is that the facts of the case are simply not believable to him. That is, he cannot see that following too closely is an invitation to a collision. Perhaps certain key situations like this could be simulated, or even under careful supervision mildly engaged in, during the learning stage of a driver's interaction with vehicle, road, and other vehicles. Then, whenever stories of the consequences of faulty driving practices are disseminated, he would be reminded of his experiences during the learning situation and hence his belief in the reality of these consequences would be genuine, deep and reinforced. Perhaps then it would be easier for him to achieve consonance by modifying his driving behavior.

Another insight into this matter of credibility may be inferred from research in social psychology (Hovland, Janis, and Kelley, 1953; Janis, and Fishbach, 1953), indicating that "a strong threat may be less effective than a mild threat in inducing the desired opinion change" (Abelson, 1953, p. 16). The studies by Hovland, Janis, and Kelley, and by Janis, and Fishbach, are summarized by Abelson (1959, p. 16):

Three fifteen-minute illustrated lectures were prepared on the topic of dental hygiene. All of them contained information on the causes of tooth decay, and all of them suggested proper ways of caring for the teeth and gums. Each of the lectures differed in the description of what might happen if the teeth and gums were not properly cared for. The strongly threatening lecture included the possibility of cancer among the many consequences of poor oral hygiene habits. The mildly threatening lecture condemned people who neglected their mouths to poisoning worse than a few cavities. The third form of the lecture was intermediate in its degree of threat.

Three groups of students from a high school freshman class were used as subjects. One group for each form of the lecture. A fourth group of freshmen were used as controls. A week before and a week after the lecture, the students filled out a short questionnaire designed to find out about their dental hygiene practices. Right after the lecture, the students filled out a questionnaire which asked them how worried they were about the condition of their teeth.

Findings. The more threatening the lecture, the more the worry that was expressed immediately after it about the condition of the teeth. But when the students were asked a week later how well they were actually conforming to the recommendations of the lecture, the group who had been subjected to the least amount of threat were found to have conformed the most. Those who had heard the most threatening lecture conformed the least. In fact, there were no differences in amount of conforming between this most threatened group and the control group that did not hear any form of the lecture.

The suggestion, "A strong threat may be less effective than a mild threat in inducing the desired opinion change," implies that in the driving situation perhaps one should not "play up" death, or show pictures of twisted steel or mangled bodies resulting from automobile accidents. The principle suggests, possibly, that the mild accident

should be presented, allowing the driver to form a mental picture of the little, everyday inconveniences that can happen and, indeed, may have happened to him or an acquaintance. Stress injuries, not death, dented bumpers, not automobile front-ends resembling a squeezed accordion.

Or at least these are reasonable hypotheses deserving of some hard-headed research brains and dollars.

3. Finally, with regard to the process of learning, driver training, and over-learning, I should like to submit for your consideration the concept of *programmed learning*, about which you may have heard in the context of teaching machines.

To understand what is meant by programmed learning, one must first consider the process of learning. What is learning? We say that a person has learned when some aspect of his behavior has been changed as a result of experience, practice, or training. One outcome of learning is the driver's depression of the brake pedal as he approaches a red traffic signal.

The learning process has been studied by philosophers from Socrates to William James, by educational psychologists like S. L. Pressey, and more recently by experimental psychologists like B. F. Skinner. These men have codified for us the conditions under which learning may occur, endure, and be extinguished. One of these conditions, and there are many others, is the rewarding, or more technically the reinforcing, of particular responses associated with the behavior one is seeking to shape. Hence, in our context we would seek to shape the behavior of maintaining a minimum though safe distance from the car in front. The question then arises if this is the response we are anxious to shape, how may that response be appropriately rewarded or reinforced, in order to assure its recurrence again and again and again? Since the reinforcement of a particular response increases the probability that that identical response will occur again, it then behooves us to search for the conditions, including adequate reinforcement objects and schedules of reinforcement, under which any one of a multitude of driving responses may be repeated.

Now what is programmed learning? Learning material broken up into tiny sequenced bits or frames, more or less approximating chunks that are intellectually digestible by the learner, and organized logically, in deference to certain principles of learning, is called programmed learning. A highly readable book has been recently published (*Programmed Learning, Working Principles and Industrial Applications*, 1961) which summarizes ably, clearly, and sometimes even entertainingly those fundamentals and applications of programmed learning which should be of special interest to you people. (A digest of this book, along with one or two comments of appraisal, appears in a book review prepared by Perloff, 1961.)

In brief, I am commending for your consideration the examination of the concept of programmed learning, with or without the teaching machines which in many cases facilitate this learning, in teaching certain phases of driving as well as for refreshing

courses for experienced drivers. Programmed learning, or I should say, good learning programs, should go a long way in accomplishing better learning, less forgetting, and perhaps more automatic behavior, in situations where responses must be immediate . . . and correct.

In conclusion, while I am not certain whether I have given you men and women anything worthwhile to contemplate, I am sure of at least one benefit: as a result of preparing my remarks I have become a strong safety partisan. If my own behavior and that of those I am able to influence results in an increment of additional safety, then perhaps this presentation will have been worth the while.

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(b) THE WIDE ANGLE VIEW

By HAROLD L. SMITH
Harold L. Smith & Associates, Los Angeles, Calif.

In carefully screening our drivers we have to give them physical and visual examinations. We have to teach them how to handle our complex truck equipment, and we have to impress on them the necessity of understanding and adhering to the rules and regulations.

After all that has been done, we're still not satisfied with our accident frequencies, we still have too many preventable accidents. The answer to further improvement lies, in our opinion, in the direction of better driver seeing habits. And in order to get into perspective so that we fully realize the magnitude of the job we face, I'd like to start with some statistics.

The latest *Accident Facts* reveals that, at the end of 1960, we had accumulated 87,000,000 licensed drivers. The population now is 180,000,000; it would seem that almost everyone who is of legal age or in other ways qualified has a license to drive.

In 1960, these 87,000,000 people rolled up a fantastic toll of 10,500,000 accidents.

Who are the people having these accidents? We read a lot of articles. The people that we read most about have a certain amount of drama—the tire peeler, the ninety-mile-an-hour maniac going through the city streets, the guy on the wrong side of the highway on a toll-road, trying to kill people in head-on collisions.

We definitely have people that shouldn't be on the highways, but they only amount to one per cent of all drivers; they are a problem because they account for 15 per cent of the total accidents. It is obvious that our police and courts have a job to do.

We have a small percentage of drivers who are experts. These are the people who, by their habits of driving, can go a lifetime without contributing to the accident toll in any way; but they're only three per cent. Think of this for a moment: we have had the automobile for some 60 years, during which were accumulated 87,000,000 drivers whose collective years of experience would amount to hundreds of millions, and we have only been able to produce

out of all these years three per cent of the driving population in the category of the Mickey Mantle or Sam Snead.

Obviously, experience is not the best teacher. That phrase does not fit the business of driving. People should be made aware of the skill and knowledge that they need to join the ranks of these expert drivers.

The rest of this problem is simple arithmetic. Ninety-six per cent of the people who drive can be called average. For the most part, they're good people with good intentions, that just don't know how to avoid accidents. By their subconscious habits of seeing and reading the traffic signals, every time they get into a vehicle they're practicing for an accident without knowing it.

Most accidents these days involve good driving. What we mean is that most accidents involve good people, not safe driving. Deliberate traffic violations that lead to an accident are rare. Most drivers violate, but few drivers deliberately violate traffic regulations.

According to *Accident Facts*, 9,000,000 of those 10,000,000 accidents that happened last year and the year before happened at speeds below 40 miles per hour. And yet the public in its reading of traffic articles is led to believe that high speed is the big problem. We need more policemen, more radar, more crack-down.

I saw, and I'm sure many of you did also, the CBS report on the 1960 Labor Day weekend accident toll. After I saw it I was sad because I knew that the public, not knowing how to interpret these things, could only conclude after the program that, "That's just what I believed all the time—a teenager, a couple of drunks, a wild, reckless so-and-so and that's the accident problem today."

Unfortunately, this is the impression that kind of reporting leads to with the general public. We're trying to reach people with an intelligent approach to get their cooperation, and make them sit up and listen, and then we give them a distorted picture of the entire situation.

jects in clear detail. You have another set of seeing equipment with which you can look straight ahead at a given point, and, standing with your arms extended from your sides, wiggle your thumbs and see motion.

You are able to move your eyes quite freely because seeing takes place so rapidly—one one hundredth of a second. This enables you, with tiny eye movements, to see a picture broader than a five foot circle at one hundred feet. Perhaps you know that your vision narrows as your speed rises, and your vision disappears completely when you are giving all your attention to one detail.

Let me elaborate. I always have people who can't believe the cone bit; it just doesn't seem possible to them. I suggest that you just pick a word out of the middle of a sentence, fix your eyes and your mind on that word, concentrate real hard, and I'll give you a hundred dollars if you can identify, while you are concentrating on that word the second word to the left or right.

Now that should prove to you that your central vision is only a tiny cone. This doesn't mean that you can't read a whole sentence or a whole paragraph, and people who are trained in journalism can read a whole page in a matter of seconds. This is known as the scanning process. The similarity of driving a motor vehicle is that you must scan as long as your wheels are turning, since the picture is changing every second or split second, and as long as the picture keeps changing you have to be right with it. Those who get into trouble with the motor vehicle let their vision stop while the wheels are still moving.

There's a lot to be learned about the use of seeing equipment. First of all, I assume that all fleet owners are giving their drivers some kind of physical eye test to find out if they have the equipment with which to see. If they need it, get professional help to bring their sight up to the highest possible standard; and then explain to them the equipment they have, and how it is to be used in driving.

We see by fixing our attention on a small part of what we look at. Attention normally shifts from one detail to another causing an automatic eye shift, but when you have a fixed stare it's because some-

thing is holding your attention. A blank stare occurs when your eyes stay longer than two seconds on some detail of no importance.

I believe that the blank stare is the first stage of highway hypnosis. I have nothing to confirm this belief other than observation; it is being researched right now in many areas.

The correct seeing habits will help prevent you from being victims of either the fixed or the blank stare. For example, most people that have driven for any length of time have at one time or another unintentionally gone through a red light. We don't deliberately go through traffic lights without recognizing that this can be a dangerous habit. Usually, when a driver goes through one, if he's caught, or if he's aware of what he did and isn't caught, he makes the excuse, "I didn't see it."

If asked why he thinks he didn't see it, his usual comment is, "I had something else on my mind." Well, that's logical, we've been telling them all these years that these distractions are the causes of accidents, so he thinks it was because he had something else on his mind.

Well, I'll tell you what I think in this particular case. A driver, going down the center of a four-lane street in light traffic, with cars parked on both sides, finds himself half a block from an intersection—where the traffic light is green. Another driver who for some time had remained a block ahead of him at a constant speed now pulls up and stops.

He quickly analyzes the situation and says, "If that fellow decides to back into the parking place ahead of which he stopped, it will throw the front end of his vehicle into my lane and affect his and my safety."

"Or if he's just going to leave his car there and run in someplace, when he opens the door it's going to come over into my lane and affect our safety. Or he could be preparing to make a U-turn, and that would affect our safety."

He's looking at that fellow with that cone of central vision; he has his eyes and his mind on him and his car. He has just covered 220 feet with nobody watching the store. He never uses his horn. I know that.

Well, his buddy didn't do any of those three things—he just sat there.

Our driver got up alongside him, still looking at him, took one final look to congratulate himself on how well he handled that situation, and WHAM, he was in the middle of the intersection on a red light.

All he had to do was tap the horn to let his buddy know that his mind had left the street, shift to him the responsibility, then get those eyes back up to see what color the light was. He spent too much time looking at one thing—his eyes had stopped but his wheels had not.

That cone of sight too often comes to a halt on the vehicle ahead or on the road ahead. Expert drivers almost never let it, average drivers let it occasionally, and poor drivers let it consistently. It's the frequency of that error that either makes you an expert driver, an average driver or a poor driver.

Expert drivers protect themselves by recognizing consciously or subconsciously that there are two basic requirements for operating a motor vehicle. First of all, you have to have a place to put it, so space is essential; and secondly, you have to have visibility. This is basic.

There is a driver right this minute following a truck down one of Chicago's main streets. For fourteen blocks he's been in that spot looking at the brake lights on the truck and making no effort to get out.

Now we can't say that this driver doesn't have space and visibility, because we know he has, but we know he can hardly shave it any thinner. His eyes are leading the front of his vehicle physically by one second. He must keep his eyes on the brake light every second he's in motion.

If he drove that way all the time, he would get about a 20 per cent seeing-quotient, he'd be expected to have about three accidents a year, and he would either kill himself, or the state would come along and take away his license.

The expert driver, on the other hand, is a fellow that can manage for himself in the traffic stream, in any town at any hour, so long as traffic is in motion. In a comparatively few seconds, this fellow places himself in the stream all alone. He doesn't have any fixations that are robbing him of his ability to see, he's free to lift his sights up to horizon and take a time lead of 8 to 12 seconds.

He is looking up and down, back and forth, checking his mirrors—he's on top of the situation all the time. In the next block, he sees a salesman come out of an establishment with a briefcase, walk around, open the door, get into a car and start the engine. He knows exactly where he is going to be about the time that fellow has his engine running, his wheels cut, ready to leave the curb. If we can reduce the frequency of a driver's surprises, we're bringing him up to the threshold of accident-free driving for the rest of his life.

This is what expert drivers do—they keep a stopping and swerving space open as much as possible. By consciously watching other people they learn how to predict the actions of those people who could cause a conflict.

Accidents follow a consistently simple pattern and anything that has such a simple pattern as a driver accident must have a simple solution. We think we have the simplest program in the world, but still it takes a lot of pick and shovel work, and a lot of sweat and tears, to get out and get the job done.

There is no short cut to teaching people how to drive better. You've got to get out on the streets in the vehicle to do the job, but otherwise the program is very simple.

Five simple rules follow. The first is aim high in steering. Correct steering requires use of a high-aim steering formula. This calls for repeated glances well ahead at the center of the intended driving lane. The vehicle will then follow in the middle of this path. The same rule applies when turning a corner.

Use of high-aim steering at night is also essential. When no other cars are in the immediate vicinity at night, check beyond your own headlight ray for dark shapes or outlines. With oncoming cars check lane position while they are still a long distance away.

Low-aim steering is often the reason why the driver has difficulty in holding his position in the center of his lane. Here are some earmarks of the driver using low-aim steering: (1) hogs left side of lane, (2) reels too far left to avoid object on right, (3) swings to right in turns, (4) at night, apt to use upper beams in overtaking, (5) sits

on edge of seat peering at front of bumper. (5) fails to reduce speed under conditions of poor visibility.

Rule two is how to get the big picture. This involves being able to see all the roadway scene and consider the objects immediately ahead as only a small part of it. The eye should sweep over the scene for a full city block, or for a half-mile on rural roads. The sharp central vision is not permitted to fix on anything for more than an instant.

To help drivers get the big picture, a new formula has been developed which includes three basic procedures: sweeping the eye over the scene, keeping proper space between vehicles, and getting into the broad viewing habit.

The first procedure, sweeping eyes over the scene, pausing only for an instant on any one object, results in the driver's being able to (a) observe problems facing other drivers in time to avoid being forced into abrupt changes in speed and direction, (b) make a better check at intersections, using repeated glances, and (c) pick a safe time to look away from the road.

The driver who doesn't sweep his eyes over the scene, but limits himself to one small part of the traffic picture is guilty of small-picture viewing. The penalty for this poor seeing habit is practically certain to be a serious accident. Clues to small-picture errors should be learned, as they are a tip-off to the incorrect seeing habits that cause accidents.

Important clues are: close following of other vehicles, hard stops or turns, traffic delays due to poor positioning or timing of moves, delayed response in reactions to signals of other drivers or in observing traffic situations.

The second procedure in the big-picture viewing formula requires proper spacing between vehicles. The rule is to allow more than one car length for each ten miles per hour. This rule must be observed in order to give other seeing rules a chance. As a result, drivers (a) are able to see the big-picture, because the scene ahead is not blocked out by a vehicle immediately in front on which attention must be concentrated, (b) have time for making proper responses, because space is provided in which to move safely while observing and adjust-

ing speed or action, (c) allow adequate braking distance as would be necessary if there should be an emergency ahead.

The third big-picture procedure is to build the ground-viewing habit. Glancing at the ground beside the front wheel of other vehicles before overtaking to pass or before meeting on-coming cars is a valuable habit. Any right or left swing of the wheels tells you instantly that the vehicle is about to veer. At the same time, relate the position of the other vehicle to adjacent fixed objects, to aid in judging its speed.

Rule three is to keep your eyes moving. Several key points must be observed. First, build a habit of shifting the eyes every two seconds. Keep glancing near and far, and to each side. Constant eye movement prevents the loss of fringe vision, which occurs when the central vision fixes on an object. Second, keeping your eyes moving calls for you to dispose of eye-holding problems quickly by adjusting speed, changing lanes or signalling, or all three if needed.

Dispose of the problem of conflict—don't romance a potential hazard. A real one may exist elsewhere in your path. The habit of disposing your eye-moving problems promptly has these results: (a) it forces an adjustment of speed to visibility along the driving path, (b) it prevents overconcentration on one part of the scene while moving blindly into an accident-producing situation, (c) it prevents the over-relaxing that invites sleep or highway hypnosis and provides the slight tension necessary to clear vision.

Third, keeping your eyes moving permits a check of mirrors at least every five seconds. The instant a conflict is indicated ahead, double check the rear for clearance before applying brakes or changing lanes. The habit of frequently checking in the rear-view mirror pays off because the driver (a) is aware of other vehicles and can judge speed and position of traffic behind him more efficiently, (b) can more quickly determine his clearance on swerves, etc., (c) knows when to signal drivers behind in order to alert them.

Rule four is continuously leave yourself an out. There are three major guideposts you use to accomplish this: First, strive for better spacing by moving forward or dropping back, pick a lane when a choice

of lanes is legal, with the best view of traffic and with the least chance of conflict from the front, rear or side. Allow extra space ahead when boxed-in with no swerving space on either side, on slippery or irregular road surface. Avoid a very restricted type of view that obscures the path ahead, or presence of a vehicle close behind.

The second principal in leaving yourself an out is to adjust speed to visibility. Reduce speed when rounding curves, topping hills and when darkness or other hazards lower your visibility; also at blind or unmarked intersections when no other vehicle will yield right of way to you. Speed must be appropriate to visibility.

The third principal is leaving yourself an out in doubtful situations by reducing speed and touching brakes. Children, animals and absent-minded pedestrians are common causes of doubtful situations for the alert driver. Other examples of doubtful situations: (a) traffic light is still green, ready to change; be able to stop the instant the yellow shows; (b) drive watchfully when near any fixed hazards; (c) cautiously pass a parked car with a driver at the wheel, who could pull suddenly into the traffic lane; (d) watch out for on-coming vehicles that may turn left in front of your vehicle, and (e) for drivers approaching too fast at an intersection.

Rule five is to "make sure they see you." This means that you must be certain that any pedestrian or other drivers who might cause a conflict have seen your vehicle. Proper communication with them is essential to safe driving. The experts signal others of his intentions early, while he still has the time and space in which to avoid them if they do not respond.

There are three situations in which other drivers or pedestrians are most apt to become a hazard to you.

(1) They are in the path ahead and could cause a conflict. Signal immediately if they do not recognize your right-of-way. Signal with a tap on the horn, or a flick of the

lights, or both. Make certain they stabilize in response to the signal.

(2) A driver might cause a conflict from his position behind your vehicle. If a sudden slow-down is unavoidable, warn the driver in back immediately. Get your brake light on early to warn the drivers behind you. If turning, get in the proper lane early, signal well ahead of the maneuver.

(3) A conflict is always possible when meeting or passing another vehicle. Check the big picture. Is there anything that might cause its driver to change plans? Signal before passing if there is any doubt that the driver may hold a steady position. Once he stabilizes, get your eyes up in the center of the road ahead and pass briskly.

The conflicts occurring in the daytime are most frequently one of the following types:

(1) Slow down or stop and being hit from the rear.

(2) Start up, and being struck from the side or the rear.

(3) Crowding or blocking other vehicles when changing lanes.

The common conflicts at night that result in accidents are usually:

(1) Striking an object in a forward path.

(2) Swerving from the driving path into the other lane or off the road.

Here's the acid test of an expert driver—drives five to ten years without even a tire skid or a violent swerve to escape an accident. The experts do it, you can too. If you practice this system of expert seeing, you can acquire the skills necessary to pass the acid test. Accompanying these skills must be a full understanding of your physical limitations—of the rules and the control of the vehicle.

Finally, the determination to drive as well as possible is mandatory—if your skill, understanding and experience are to make you an expert driver. The art of expert seeing can be summed up in the five seeing steps. Use them as the framework on which your expert seeing habits are built.

THE STRAIGHT LINE OF COMMUNICATION

By HIDEYA KUMATA

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Last year, I suggested that the problems of attitude change hinged around a firm understanding of communication as a process. We pointed out some of the important elements in this process and their relation to safety messages. I'd like to amplify those remarks today by concentrating upon some of the common faults committed by people engaged in trying to change other people's behavior.

1. *We take a very short run view of our efforts in trying to change safety attitudes and behavior.* We know that there must be preparation for change and that change is apt to be a long and tedious process where those who must change do not see immediate benefits. Even in those instances where the outcomes seem clearly advantageous to the people adopting change, adoption and system may be slow in coming. Hybrid corn, something farmers now take for granted, took almost 13 years for farmers to adopt. This in spite of extensive work by agricultural extension workers.

The point here is that those of us who want change may take a very short run view of our efforts. We perhaps need a different time perspective in talking about attitude change efforts. This is especially true for campaigns which are not seen by the people as particularly crucial.

2. *We need to understand the communication process involved in adoption of new practices or change of ideas.* We plan campaigns based on what we think are the needs of those who are to be affected. We assume that if we get through with information, the sheer weight of evidence will be enough to persuade. Thus we concentrate on ways of getting people exposed to appeals. That this may be a grossly oversimplified view of the world has been demonstrated more than once.

People do not simply absorb statements of fact. They consider who has made them, they define the situation in a particular way, they interpret facts. This interpretation is made to fit existing beliefs of the individual.

If the person needs help in interpretation, he will turn to others like him for discussion, not to an outsider such as persons conducting the campaign.

People who have studied change programs tell us that a person goes through the following stages before adopting the new idea: he becomes aware of the problem and interested, he tries out the recommendation in one way or another, he evaluates the results in his own way and then finally makes his decision. Different styles of communication accompany these phases.

Awareness and interest is often accomplished through mass media campaigns and through the efforts of experts and workers for the campaign. Evaluation and adoption is accomplished mainly through face-to-face discussions with friends and neighbors. The convincing, the persuading is most often carried out by insiders, not outsiders.

3. *We do not take informal leaders into account in planning campaigns.* It is natural, I suppose, that we define leaders in a certain way. These are people of public prominence or high status people who are influential in a formal way. Most certainly these people are needed to give legitimacy to any action program. However, if it is true that the core of the problem of having people make up their minds lies in the intimate friendly discussion sessions which people have, then attention should be focused also on leaders of such discussions. These may not be people in the public eye and they may not have positions of formal leadership.

4. *We communicate with the wrong people to carry our message.* Organizations which push safety campaigns recruit membership from certain segments of the organization or the community. These people are the active well-informed, the better educated. Volunteers for the campaigns come from these people. The credibility of these people may not be as high as one might hope among those groups which have to be convinced in order to make campaigns successful.

5. *We do not train our communicators.* Well intentioned people often fail. This is not because their motives were awry or that they lacked enthusiasm, but that they have not been prepared adequately. For example, some notions of basics in persuasion—one sided versus two sided arguments, the efficiency of participation, the effect of source credibility, emotional versus rational appeals, the effect of varying strength of appeals, the notion of perceived rewards—might be included in some training sessions.

Mobilization of resources means more than getting enthusiastic endorsement by people willing to help out. It means careful preparation of campaign strategy and tactics which include training.

6. *We overlook prevailing values and attitudes some of which we have helped to establish.* Our safety campaign is but one item in the communication atmosphere. How do we fit our message into this mass of messages? We meet ourselves in some of our campaigns. What is vexing is that when we do meet ourselves, we find that some of our campaigns of the past are back to frustrate us. We have molded some of the attitudes which must be changed in order for the new campaign to succeed.

7. *People make up their minds on their perceptions of the situation, not necessarily on reality.* The impact of our educational system is to teach disciplined rationality. The products of our educational system often fail to show such training. However, we plan in terms of a rational approach. Then we wonder why people do not become convinced. Let me repeat—statements of fact are not in and of themselves persuasive. Conclusion drawing by people does not necessarily follow established formal rules of logic. If we, then, can get some forewarning of the perceptions of people, then we can plan more efficiently.

8. *We find it easy to talk to those who are already favorable.* A false sense of elation is easily obtainable in campaigns. Our circle of discussion usually is with like-minded persons. Those who are already for the point of view do not need more convincing. It is those who are opposed, or more important, those who are apathetic who need to be taken into account. In terms of energy expenditure, it is uneconomical to concentrate upon those who are firmly opposed. Attitude change campaigns

seldom convert firm opposers. The apathetic, the passive, the mildly interested provide the greatest opportunity.

However, the apathetic and the passive are not reached through mass media campaigns. The mass media attract those who are already interested and support the issue and do not attract others. It is direct face-to-face campaigns which have maximum effect with these people. But, if we have a tendency to talk longer, to talk more easily with those who are sympathetic to us, then we will slight our attempts with those who have little interest.

9. *We evaluate campaigns in faulty ways.* If we are to learn from experience, we must ask the right kinds of questions of the right kinds of people. Evaluation of either successful or unsuccessful campaigns often is done by talking to people like ourselves. We pool our ignorance and guess at why particular segments did not support the issue. We seldom go to these segments to get some feedback. Experience is a good teacher only if we get the right kind of experience.

10. *We overlook the importance of the competition.* The people directly opposed to us are easy to spot. We can pass them off as crackpots or the lunatic fringe, but their efficiency means that we ought to give more study to what they are doing. In addition to the direct opposition, we might at some time take a look at the demands of the individuals made by other organizations and agencies. These are competitors in that we are both vying for attention and time.

11. *Verbal support is not the same as action support.* To take a person from verbal agreement with your position to some action is a difficult task. We often end our efforts with verbal agreement. When the time comes for action, we are disappointed. Some means of commitment to action is necessary beyond verbal agreement. In our training sessions, some attention should be paid to this aspect of moving people to change.

These are but some of the factors one could mention in connection with safety campaigns. In the final analysis, the success of any program depends upon our ability to take the recipient's point of view keeping in mind that all of us view the world through our perceptions of what it ought to be rather than what it really is.

TRANSIT SECTION

PROBLEM OPERATOR CLINIC

Moderator—ELMER R. SCHUEMANN, Supt. of Transportation & Safety, United Motor Coach Co., Des Plaines, Illinois.

Clinical Experts: G. WRAY THOMAS, General Supt., Surface Depot Operations, Philadelphia Transportation Co., Philadelphia, Pa.;

GEORGE A. RILEY, Asst. Supt., Operating Stations, Chicago Transit Authority, Chicago, Ill.;

THOMAS L. WARD, Supt. of Training, Milwaukee & Suburban Transport Corp., Milwaukee, Wis.;

D. L. WILLIAMSON, Supervisor, Training & Accident Prevention, Cleveland Transit System, Cleveland, Ohio.

Case History . . . Driver, 51, with the company 16 years had compiled a satisfactory record. He developed a drinking problem which seemed to be off the job, but later alcohol on his breath was noticed while he was working. He was discharged.

Comments . . . Mr. Ward commented that his company had had relatively little experience with the drinking problem, but that they had found rehabilitation to be unsuccessful. Mr. Williamson felt the drinking driver should be given a second chance. Mr. Riley thought that few drinking drivers could be rehabilitated, but that they could be placed in non-driving jobs. Mr. Thomas was opposed to any kind of rehabilitation program. He said his company fires drivers who are found drinking or drunk on the job.

Case History . . . Operator with 17 years of experience had a below par accident record. There were occasional complaints of recklessness filed against him. It was discovered he was using paragon. He was warned and given a second chance, but he failed and was discharged.

Comments . . . Mr. Williamson agreed that the man should have been fired or given a non-driving job. Mr. Ward questioned the effect on the other employees of the driver being given a second chance. Mr. Riley felt that the man should have been discharged on the first offense.

Case History . . . The 60-year-old operator of a one-man streetcar had a series of

rear-end collisions. He had had 28 years experience on his particular job and a satisfactory accident experience.

Comments . . . Mr. Thomas said he would give some consideration to the man's experience, and would suspend him for from 5 to 7 days for negligence. Mr. Riley would consider the man's service and the pension fund he had built up. He would give the man a medical exam. If it revealed nothing the instruction department would follow-up with a refresher course. Mr. Ward thought his performance should have been checked on before a series of accidents developed. Mr. Riley suggested that once-a-year physical exam would be a good thing for older drivers. Mr. Schuemann stated that tests showed that the man's reflexes had slowed down and that he had a serious heart condition.

Case History . . . Operator with 22 years of service as a streetcar and bus motorman (He had proved unsatisfactory in a supervisory role) had a series of accidents spaced over a six-year period. There was no recklessness involved. It seemed to be a matter of poor judgment on the driver's part. Driver did have a mild heart condition, but there appeared to be no connection between this and the accidents.

Comments . . . Mr. Riley suggested retraining. Mr. Williamson also suggested retraining to correct the driver's bad habits. If this didn't work out, discharge should follow. Mr. Thomas agreed that retraining

should be given, but if trouble continued and the man's health was okay, he should be fired. Mr. Schuemann then explained that the man suffered from a mild form of epilepsy. When this was discovered he was transferred to a non-driving job.

Case History . . . Operator with 36 years of experience and an overall good record had a slight accident. Investigation showed he never had gone as long as three years without an accident. They were never serious and there was no pattern.

Comments . . . Mr. Williamson said this situation should not have been allowed to go for so long. The operator should have been given retraining and had a vision check. Mr. Thomas thought the driver had earned some consideration for the 36 years and should have been urged to retire. Cited from the floor was similar case. The driver

had been so well-liked by passengers that he was distracted by conversations.

What to do with drivers who have heart conditions serious enough to prohibit their continuing to drive was a problem considered by the panel. The panelists agreed that every effort should be made to place them in non-driving jobs within their company. But this is not always possible, and sometimes they must be discharged.

It was suggested that driving record reports be sent to the operator's home, where his family could get a look and possibly influence him to do a better job. One case cited was where an operator's father had been a bus driver with an excellent record. The father helped the son (who did not have a good record) and improved his driving greatly.

WHAT OPERATORS THINK ABOUT ACCIDENTS

By BURNS M. FRANKLIN

Dir. of Training, St. Louis Public Service Co., St. Louis, Mo.

The employee-employer (or supervisor) relationship in industry has gone through three definite psychological stages. These might be designated as the "or else" era, the "powder puff" era and the "sandwich" era.

In the "or else" era the corrective procedures for failure of employee to meet standard of job performance were simple. The boss or supervisor who was not satisfied with the employee's job performance or behavior simply told the employee he must do a better job "or else." This approach was based upon the threat of job security. It was an effective means until jobs became more plentiful, then the erring employee simply beat the boss to the punch by leaving.

Then came the "powder puff" approach. This suggests that the supervisor "condition" criticism with praise. By praising the worker, said the psychologist, "you create a receptive attitude, that will make your criticism more effective." This was an improvement over the "or else" negative ap-

proach based upon the fear of insecurity. But it wasn't long, however, until the employee expected criticism to follow every praise. In fact, the effectiveness of any bona fide attempt by the supervisor to praise an employee was defeated by the mental block created in the employee's mind as he attempted to anticipate what the "old man was leading up to." Such conditioning destroyed the effectiveness of constructive corrective measures and reduced the value of sincere praise.

So the psychologists then recommended the "sandwich" technique. First you praise—then criticize—then praise. This is a softer approach than the others but the interviewee continued to build up defenses to meet the corrective suggestions. When they do not come out, the employee does not accept the praise wholeheartedly and misses the point of any corrective suggestions.

There exists a false opinion that the sole reason for an effort towards self-development is the desire for recognition. It is true that every person appreciates

recognition of a job well done. This is an outgrowth of the inner force, found in each organism, to express all its capacities. But all too few are willing to work up a sweat to get recognition.

There are forces at work that condition this desire for recognition. Such things as lack of a feeling of belonging, safety, respect, love, self-esteem, and many other needs. Unless these are satisfied they have a tendency to overpower any desire for recognition.

Most of us have believed for a long time that we Americans have the desire and the capacity to overcome our weaknesses. Recent surveys have indicated that we just don't understand Americans. Some report that three-fourths of the workers in industry today have small capacity, much less a desire for genuine self improvement or self direction. An alarming number don't want to improve themselves if it requires effort. Few want jobs that require responsibility. Employees it appears want a safe place to work, job security and some one to do their thinking. They wait for someone to tell them what to do. They avoid any decision-making.

When appraising an employee's job performance we must recognize these factors. We must not approach the interview as a means of warning him that he must do better, or to prepare him for a better job, or to change his personality. Our objective is to get the employee to improve his present job performance by recognizing his weak points and realizing what he must do to attain this improvement. Our approach on a recent safety project was to get him to talk about his job performance so he would ultimately recognize his operating faults. We wanted him to take a good look at himself. The counselor was not to give advice or make any other comments unless it was requested.

Even when the operator requested help the counselor was advised to try to get the operator to think his problem through by using the retort technique and ask questions, such as—"What do you think you should do?"—"What is your idea?" The interviewer must attempt to get the operator to make his own decisions. Once a person understands his own wants and needs, his own reaction to work, his own reaction to authority, his own moods and habits, his

own abilities and disabilities—the more openly and clearly he can look at his faults and the more likely he will come up with effective corrective measures.

In January of this year we experienced a sudden increase in accidents due to collisions between company vehicles, collisions with fixed objects, and run-away buses caused by faulty parking. When the increase continued through February we began a campaign to correct the trend.

We assigned an instructor to each division, with instructions to talk with each operator about this increase in accidents. The object was to get the operator to give his opinion of the cases for his accidents and to offer explanations for accidents caused by other operators.

The interviews were to be scheduled at a time convenient to the operator, on his own time, and in a private place. Every precaution was made to secure clear, accurate and unbiased statements from the operator.

The instructor was cautioned to keep his ideas and judgments out of the interview. His job was to listen, with an open mind, and to concentrate on understanding the operator's statements, ideas and attitudes. The instructor was to remain in the background and be extremely careful to avoid doing anything that might influence the operator's statements.

This is a difficult assignment because every person has a tendency to want to control the discussion, offer suggestions, especially when the ideas expressed do not conform to the observer's opinions.

The instructor made it clear to each operator that anything said or discussed would be kept strictly confidential and would not be placed on his record or brought to the attention of any other person. It was emphasized that personalities would remain anonymous in so far as these interviews were concerned. The instructor, of course, knew each operator he interviewed. He was familiar with his record and knew something about his behavior pattern. He was instructed to ask questions only when necessary to stimulate discussion. He was to ask questions only about the way the operator handled the incident and the results. He was never to question the operator's intentions nor compare him with other operators.

Each instructor was cautioned to avoid any tendency to "play God" by assuming himself capable of analyzing each statement and incident with psychological perfection. He was also cautioned to avoid giving a "halo effect" to his report by letting his personal feelings or friendship with the operator influence his observations.

During the interview the interviewer was instructed to make mental notes of specific items the operator mentioned. Immediately following the discussion he made a written report of his observations and a personality rating for each operator.

The reports made by two instructors indicated they had done a thorough and objective job of interviewing. We selected at random 244 reports made by these two instructors as a study sampling.

Thirty-seven of the operators in the sample group had three or more accidents in 1960 and they were arbitrarily placed in a "poor" category. The remaining 207 operators were considered as "good" operators. The reports were then reviewed, the personality ratings tabulated and instructor observations recorded.

A comparison of the personality rating of the two groups indicates there isn't a significant difference between the personalities of the "good" and "poor" operators. A higher rating in mentality was given to the "good" record men. The good operators were credited with better ability to express themselves when talking. However, in factors which we usually agree as having a major influence on behavior, such as aggressiveness, poise and maturity, judgment, and job enthusiasm the ratings placed them about equal. This however should not be cause for alarm or used as a basis for forming judgments. We must remember that all of these men were subjected to selective procedures when employed and this would tend to eliminate extreme variability.

Actually, about the only thing gained from those personality ratings was an indication that the interviewer making the rating did a fairly accurate evaluation of each operator.

The operators' most frequently mentioned comments were grouped according to their relationship with operational practices. Some that were mentioned only a few times were recorded because the lack of operator's concern seemed to add to their significance.

The impact of these comments becomes impressive if we remember that they are voluntary statements—made without suggestion, direction or force.

One rather startling revelation came from these interviews. We had, we thought, made every operator conscious of the increase in the number of rear end collisions, collisions with fixed objects and run-away buses. However, the interviewers were startled by the number of operators, estimated to be as much as 20 per cent, who knew that there had been greater number of accidents at their division but they did not know that these three types were the ones that caused the increase.

An encouraging observation was the reaction of the men when they discovered accidents of these classifications were prevalent. The operators were unanimous in their opinion that they were inexcusable. Even operators who had had accidents of this type stated they just "goofed." They, quite humanly, at first offered alibis and excuses but eventually concluded that if they had been more alert the accident could have been avoided.

Any one who has had contact with mass transit operators will be aware of their concern for more running time and longer layovers. Any discussion with them about accidents, sooner or later, brings up these two items. However it seems from these observations that their "off guard" statements indicate that they do not really believe these are the causes. The operators with poor records gave less credit for these factors as contributing to their accidents as did the good operators.

The men indicated some concern for the heavy traffic on the streets, and especially the increase in the legal speed limits. We now have different specified speed limits in St. Louis. We operate on some streets that have speed limits of 15 mph, some 25 mph, some 30 mph, some 35 mph, and some 40 mph, and on expressways 55 mph. A street may have a district of ten or twelve blocks where the legal speed is 35 mph, then drops to a speed of 25 mph. This has caused them some concern because motorists, at present time are not familiar with the break points in the districts and travel at speeds that do not conform with the legal rate.

4. Annual age examinations. 5. Special examinations.

The pre-employment examination is one of, if not the most important type of medical screening we have. The examination of the applicant is just as important as that done on the employee. Let me make it clear here that employment of the handicapped is very important and necessary, in general. However, in public transportation companies where the safe operation of vehicles is paramount there is very little opportunity to place these people.

Our aim is to select the most nearly perfectly physically and mentally fit individual. This is done by taking a careful medical history and doing a detailed physical examination, including a urinalysis test.

The additional examinations which we found helpful in selecting a healthy applicant are X-rays of the chest, and electrocardiogram, plus additional laboratory work which may be indicated in certain cases. Also a very important part of the pre-employment appraisal is the record of the individual's military service medical record. This is of great help in evaluating the applicant's ability and physical status. Sometimes applicants misrepresent their medical history by deliberately falsifying their record, especially in cases where the medical condition is not detectable by routine physical examination. The following illustrates the point:

We request a military service medical record. Our pre-employment medical record shows a "No" answer to a question "Did you ever receive or apply for any disability pension or compensation for any injuries or diseases?" but a report from military service shows applicant is receiving disability.

Examination of the employee who is presently on the sick list gives the doctor the opportunity to make as many examinations as may be necessary. This type of examination is very important because sometimes unsuspected conditions unrelated to the original illnesses are discovered. For example, an employee may sign off with pneumonia and then report to the medical department several weeks later for a return to duty examination. On examination it is revealed that the employee has diabetes or high blood pressure. Unless these conditions can be corrected, the whistle is blown and

the employee is transferred from an operating job to a non-operating job.

Compensation caves—all of the employees, no matter what the injury is, providing they have been off more than seven days are given a thorough examination. Any previously unknown disease found by this method is treated in the same way as described above.

The annual or periodic examination is very important and different from the preceding types of examinations. This is true because the examinations are made on employees who are working daily. They are not on the sick list nor have they been injured. Yet surprisingly enough we find certain conditions which are disqualifying for operators. In these instances the employee may be temporarily disapproved, placed on the sick list and under the care of his own family doctor. He is also checked in the medical department at regular intervals to determine his fitness to continue working.

There are several possibilities in all these cases under discussion. First, medical treatment may bring improvement so the employee may safely resume work; or secondly, it may be necessary to transfer him to a non-operating job if good recovery is not obtained; and finally, there is the employee who becomes progressively worse and is unable to do any type of work. In such instances the employee is placed on the total and permanent disability list.

Some of the more common disabling conditions discovered on the medical bus examinations are hypertension, heart cases of all kinds, particularly coronary, diabetes, psychiatric cases and defective vision.

Special examinations—may be requested by the department head whenever there is anything unusual about the employee's ability to continue working. For example, when an employee has frequent accidents or complaints of blurring of vision, or has a blackout on the job, he is sent to the medical department for an examination. The medical department will sometimes discover in these cases any one of the defects mentioned above.

In conclusion, we find that frequent periodic physical examinations are important and necessary to disclose physical defects. It should be emphasized that these exami-

nations are not done primarily to disqualify the employee. On the contrary, they are done to improve the general health and thereby keep the employee at work longer. We feel very strongly that early diagnosis and prompt efficient treatment of the dis-

eases or defects represent the basic principles of our program. This plan benefits the employee and the employer. The final analysis and evaluation of these examinations tells the medical department "when to blow the whistle."

Front Section

INCREASING THE OCTANE RATING OF YOUR SAFETY MEETING

By FRANK BURROWS
Field Service Dir., Citizens Traffic Board, Chicago

I want to create an enthusiasm within you so that you will increase the octane rating of your safety meeting by using what I call "advertising gimmicks." May I refer to them here as enjoyable, methods of improving your "raising up." This richer mixture will add more miles per gallon to your safety message.

I hope to impart to you a variety of ideas to advertise good safety tips. This collection of ideas first began to accumulate when I was asked to lecture at Northwestern University Traffic Institute. Since a large part of my work consists of lecturing before all kinds of groups, old and young, large and small, a need to do something other than just talk safety arose. I discovered, and I am sure that you have, too, because it has happened to you, that a large part of the audience does not receive the safety message, so I began to incorporate little attention getters to hold interest. In other words, I enriched the mixture and the audience received the message more strongly.

To understand how an idea, or gimmick, should be used, one must keep in mind three definitions which when used through all your safety planning will enable you to attain the maximum results. The three definitions are:

Safety—Doing the "job" the right way. Job is anything a person undertakes to do—standing, sitting in a chair, driving a car, running a machine, peeling potatoes, improving your safety record.

Safety Education—The art of making a man want to do what he ought to do.

Safety Program—To create an appetite in people who are not hungry.

Keep these definitions in mind. Observe the next ten minutes of my lecture. I am going to demonstrate how I tell safety . . . (here the audience viewed a short part of a traffic safety lecture in which several visual aids, gimmicks, magic and humorous stories were used as an example of what adding a touch of glamour to a safety message means) . . . and that is the way I attempt to present the safety message to the people here in our area.

You know, sometimes those of us who have a safety message to sell overlook the obvious. Sometimes we create our own illusions. Our own most trying problems are often the result of self-deception. And are often the result of self-deception. And too many people selling an intangible safety message are prone to assume that the doors are locked against them when the difficulty is actually a mental block. Remember Harry Houdini? He was an ingenious entertainer.

Behind Houdini's skill as an illusionist was a profoundly scientific mind and a keen grasp of the application of modern mechanics to intricate physical problems. He matched wits with locksmiths and prison wardens, and never failed to escape within the time limit. But he almost failed on one occasion by overlooking the obvious.

The warden who nearly outwitted Houdini used a simple artifice. He placed Houdini in an "escape-proof" cell and closed the door. Houdini tried all his ingenuity on the lock but could get no action from the mechanism. A few minutes before the deadline, in desperation, he tried the knob of

the ponderous door. Presto! It opened. It hadn't been locked in the first place.

Use gimmicks, humor, or anything else you can think of to enrich the mixture and add more gallons to your safety mile.

Let me encourage you to use some of these ideas. You will enjoy it more, and you will be creating an appetite in people who are not hungry by making them want to do what they ought to do—that is, to do every job the right way.

Look at some of the ideas I have here. You could build a whole routine around these gimmick types of glasses. "Goo-goo" glasses—funny to look at aren't they. Goggle glasses—make me look sick, don't they. Open and shut glasses, and what about this pair here that makes me look as if I'm pop-eyed. When I'm wearing these I could tell you that I want to see what's actually causing accidents. See what you're doing, you're laughing at what I'm doing and how I look while I have these glasses on. But think, while you're laughing you're listening to my message. This is what you have to do with your safety program. People will enjoy it more, and they will receive more from it.

How about these articles here. I have a little police badge, a little boy's police cap, his gun, his whistle and his handcuffs. Anyone of these items can be tied into a safety message. You can tell the audience while twisting the handcuffs that with their cooperation you can "handcuff" a certain cause of accidents. With the gun you could pretend that you are out "gunning" for crime and that is the thing that causes accidents in a specific field. Blowing your whistle can be tied in with blowing the whistle to stop accidents, and so forth. You could build a whole safety message around dollar bills that come in many shapes and sizes—large comic dollar bills, little dollar bills, rubber dollar bills. With a little bit of imagination you could tie in the cause of accidents or stretching your money, stretching money through the prevention of accidents. See what I mean, ladies and gentlemen. Such "gassing up" will enrich the mixture and give your safety program extra mileage.

Earlier I was able to plant a piece of corn in everyone's pocket or purse. I have developed a little SAFETY SIX PACK in

order to help you plant a safety message in everyone's mind. This six pack contains six items which have retention value and are very inexpensive. The six items are:

1. A piece of string—"string along with our message of safety."

2. A kernel of corn—a pocket or change purse reminder of the need for cooperation of the individual in the safety program.

3. A safety pin—to be pinned on one's clothing as a reminder to keep one's guard up against accidents and be safe at all times.

4. A band-aid—to be placed on the back of the hand or dashboard of a car as a reminder that traffic laws or good safety rules practiced will hardly ever result in an injury serious enough to need more than a band-aid for repair.

5. A rubber-band—"you must stretch your efforts for safety."

6. A lollipop—"don't let accidents make a 'sucker' out of you. Work hard to 'lick' the problem of accidents."

Let me give you an idea of how to think about sparking up your safety message. I have here what's called a "Hypo-Phony." This looks like a regular doctor's syringe, and, as you can see, it looks as if I am drawing blood right out of the air. I saw this article in a drug store. It costs a buck and a half. I felt I could use it in a safety message, so I purchased it. Shortly thereafter, I received a telephone call asking me what the title of my lecture to be presented before the Woman's Auxiliary to the American Medical Association would be. I looked at this toy on my desk and told the caller that the title would be "You Can Get Blood Out of a Turnip."

I made the turnip resemble their impossible task of selling safety. I then proceeded to tell them how to use good programming to sell safety, and I concluded my speech by saying that if you use the right tools, the right safety programs, etc. you can do the impossible. Of course, the right tool for extracting blood is a doctor's syringe. See, I inject my syringe into this bloodless turnip and extract blood. This is the only time in my life that I ever received a standing ovation for a lecture and it cost me a buck and a half.

If you are interested in enriching your

mixture, if you want some additional ideas, please drop me a card or telephone me. Use one or all of the ideas, enough so that the audience will receive your safety message. Remember, the purpose of these ideas is to add color, humor and enjoyment to your safety talk. So often, selling safety is a thankless part of your program because the recipient knows it all and he mentally tunes you out.

The ideas expressed here and the ones I'd be happy to send you are audience tested. If used as suggested or as you see

fit, they will make your safety lecture a little unusual. This alone will create an interest in the audience. Some of these ideas, by nature, will bring a chuckle or smile to the faces of those who observe them. This laughter tells you that they are listening. It is not directed at you but at the "gimmick" which emphasizes your point.

See for yourself how an audience's attention will improve when you improve your mixture. Remember, increased attention will mean increased mileage toward your safety goal.

SCHOOL TRANSPORTATION

DRIVER SELECTION IS IMPORTANT

By JOHN B. MURRAY
Specialist, Pupil Transportation, Office of Education,
U. S. Dept. of Health, Education, and Welfare, Washington, D. C.

Each and every morning during this school year, approximately 13 million children across the Nation will be driven to school by one of the more than 160,000 school bus drivers currently employed by our local school districts throughout the country.

Sometime between 7:00 and 8:30 tomorrow morning thousands of yellow school buses from Texas to Minnesota and from Rhode Island to Alaska will begin their daily runs with a school bus driver behind the wheel.

Recognizing the vital role that these 160,000 school bus drivers are to play in delivering their precious cargoes safely to school, it is fair to pose the question—How were these drivers selected for their jobs?

1. Were they selected primarily because they were able to underbid others in the community for the position?
2. Were they selected solely because they may have had important connections with the influential elements in their community, and thus their jobs represent "political plums"?

3. Were they selected primarily as a result of the practice that we hear some communities follow of giving these positions to persons with "strong backs and weak minds" or what is probably worse, people with both "weak backs and weak minds" because the community felt that there was no other type of work they were capable of doing and that the job of driving a school bus would at least give them a steady although meager income and keep them busy?

Yes, to be perfectly frank, probably this fall some drivers in some localities were selected on one of these bases or some similar basis equally as deplorable and not necessarily on their overall qualifications. On the other hand, in all fairness we would also have to concede that the number of

drivers selected solely on such a basis and not on their overall qualifications would represent a relatively small minority, and that driver selection of this type is fast disappearing as states and local districts tighten their policies and standards in regard to school bus driver selection.

Realizing that the lives of children are in jeopardy whenever a careless or incompetent driver gets behind the wheel of a school bus, we can take comfort from the fact that the vast majority of our school bus drivers are selected with reasonable care and in accordance with sound and defensible standards.

After all, our school bus drivers across the nation have established a remarkable safety record over the years and although it is generally conceded that school bus transportation does have an enviable safety record, this fact in and of itself is no guarantee that we can maintain this record without constant vigilance and progress. It is in this sense, then, and in no way critical, that my following remarks on the selection of school bus drivers are directed.

Driving a school bus is more often than not a low paying part-time job requiring only a few hours of work each day. In the majority of the cases it represents a side job; and as a result school bus drivers are usually recruited from a variety of local sources: farmers or ranchers, garage mechanics, gasoline station operators, store clerks, truck drivers, school teachers, barbers, housewives, ministers, and in some states high school students, represent in many cases, the local groups from which many of our school bus drivers are recruited. Usually the individuals secured from these sources possess only those basic qualifications which, in all too many cases, those in positions of authority feel are in themselves sufficient to drive a school bus, (1) sound moral character, and (2) an under-

standing of the elementary rudiments of driving a motor vehicle.

Even today we have those school officials, I am sorry to say, who do not accept the fact that selecting a school bus driver should demand relatively as much time and attention as the selection of any other member of the school staff including the classroom teacher. It would be incomprehensible to most school officials to think of hiring the first person who walked into their office and asked to be hired as a teacher without first checking his credentials, previous experience, and qualifications.

In hiring a school bus driver, however, we are too often guilty of hiring the first available applicant in spite of the fact that we realize no school bus is safe in the hands of a driver who is physically and emotionally unfit, or who fails to follow sound driving practices; and, as a result, school bus drivers are in many cases ill-suited for their responsibility.

There appear to be two major aspects to the problem, apart from the continuing and competent supervision, of providing the best possible school bus drivers, (1) the recruitment and selection of qualified people; and (2) providing adequate training programs specifically designed to prepare these people for the job to be done. Although recruitment, selection, supervision, and training are in a sense inseparable, I will attempt in as far as possible to confine myself to school bus driver selection in as much as other speakers on the program are scheduled to speak to us on recruitment and school bus driver training programs.

Securing responsible and qualified drivers is not necessarily a new problem in the field of school transportation. Even before the advent of motorized transportation in this country when horse-drawn carriages and wagons were the conveyances commonly used to transport pupils to school, both the personal qualities of the driver and his control of the pupils being transported as well as his skill in handling his team were matters of concern and as such received attention in certain localities.

You will recognize, I am sure, this concern and also agree that the following comments taken from a report by O. J. Kern, superintendent of Winnebago County, Illinois, schools at the turn of the century

has a certain familiar ring. In this report Mr. Kern describes his visit to several newly centralized schools in North Eastern, Ohio.

"So we drove on to North Madison, in Madison Township, where three wagons are used. On our way there we saw the first wagon. We stopped at the farmhouse and talked with the driver. He carried all the children from one district, about twenty in number. His route was five miles long. That is to say, starting at the first home to pick up a child until he arrived at the central school was five miles. Then he drove back home after delivering the children, thus covering ten miles in the morning. Of course he traveled the same ground after school, thus making 20 miles in all. He got \$1.50 a day for his work. We asked him if he made any money at it. He said he did, as he was all the time and labor of himself and team. We asked him if he had any trouble with the children and replied none. He said he was employed by the township board of education, who put him under bond to be careful with the children; to have a safe team; to provide a suitable wagon, covered and provided with curtains, and containing soap-stones and lap robes for the severest weather. We asked what objections the parents along the route had to the new plan. His reply was that the only objection was on the part of two or three at the beginning of the route, as they had to get their children ready somewhat earlier than they used to when they went to the district school. Of course the children had to be ready when the wagon came. He aimed to start at 7:30 and arrive at the building not later than 8:15. Thus there were no children tardy; none came with wet feet or clothing; the attendance was greatly increased and much more regular. The driver believed the movement had come to stay; that the people would not consent to go back to the old way."

Kern goes on to describe school transportation during that period at another school district he visited on this trip:

"The wagons are provided with curtains, lap robes, soapstones etc. for severe weather. The board of education exercises as much care in the selection of drivers as they do in teachers. The contract for each route is let out to the lowest responsible bidder, who is under bond to fulfill his obligations. The drivers are required to have children on the school grounds at 8:15 a.m., which does away with tardiness, and to leave for home at 3:15 p.m. The wagons call at every farmhouse where there are school children. The children thus stepping into the wagons at the roadside find no tramping through snow and mud and the attendance is much increased and far more regular. With the children under the control of a responsible driver, there is no opportunity for vicious conversation or the terroring of the little ones by some bully as they trudge homeward through the snow and mud from the district school."

This account of pupil transportation in Ohio at the turn of the century would indicate that many of our current problems in school transportation such as securing

well-qualified drivers are by no means new ones, but rather in one form or another have been with us for over 70 years.

The seriousness of the problem of securing well-qualified school bus drivers has been compounded in recent years, however, as a result of two developments. (1) The rapid growth of school transportation in this country (for example, in 1923 approximately 800,000 pupils were transported in the United States as against about 7 million in 1950 and more than 13 million this year with an estimated 15 million by 1965), and (2) the increased complexity of our transportation technology today, along with the side effects of this technological development in terms of the complexity of the vehicle itself, increased speeds, and our innumerable and varied traffic and highway problems.

There is no doubt about it—the job of driving a school bus today calls for physical, mental, and emotional capabilities of the very highest order. In order to secure qualified school bus drivers possessing these capabilities, it is necessary as an initial step to (1) establish adequate standards that all drivers are required to meet prior to employment, and (2) rigidly adhere to these standards.

The major responsibility for selecting drivers rests, of course, as it should upon the local school authorities. It is conceded, however, that the states have a major responsibility in exercising a reasonable degree of leadership, authority, and control in this area, and that adequate general standards and regulations must be promulgated by the states, preferably through the state education agency, to guide local school boards in this important function. It is recognized, of course, that local initiative should be constantly encouraged to exceed state requirements whenever possible.

The fact that school bus drivers in all of the states are now required to meet at least some standards indicates that the states do recognize this responsibility. Although there are wide variations between the states, both as to the specific items covered and the extent these items are covered in state standards, there does appear to be a definite trend to require that drivers meet more rigid standards.

The following excerpt taken from a recent

report by the Georgia State Department of Education points out the immediate result this has had in one state.

"In 1959, the State Board of Education tightened up its policies regarding physical examinations. The Board ruled that drivers over 65 could not be employed; nor could a driver with a physical handicap. These newer and more stringent regulations were adopted in order to insure greater safety for the 428,079 Georgia children who get on 1,927 school buses each day to ride to school and home again. When the new regulations were put into effect and more rigid tests required, 322 previously employed drivers failed because of such physical defects as missing limbs, eye or ear handicaps, heart ailments or other disabilities. As a result of the rigid new requirements, school bus accidents in Georgia involving the drivers' judgment were reduced from 28 per cent to 18 per cent."

Generally speaking the standards for school bus drivers in a majority of the states include the following elements: age, physical condition, experience, and character, among others.

Age Requirements

Minimum Age. In 1960, 16 states¹ required their school bus drivers to be at least 21. One state, Rhode Island, required drivers to be at least 25, while in South Dakota, a 15 year old could legally drive a school bus.

In 10 states,² 16 year olds could legally drive a school bus, 5 states³ allowed 17 year olds to drive school buses, and 15 states⁴ allowed 18 year olds to be employed as drivers. One state⁵ required school bus drivers to be at least 19, while Hawaii required all school bus drivers to be at least 20.

Maximum Age. In regard to maximum age requirements, the 1960 survey indicated that 39 states have no specific maximum age limit for school bus drivers. One state⁶

1. Arizona, Delaware, Illinois, Indiana, Maryland, Massachusetts, Michigan, Missouri, New Jersey, New York, Ohio, Pennsylvania, Tennessee, Utah, West Virginia, and Wisconsin.
2. Alabama, Iowa, Kansas, Maine, Nebraska, Nevada, North Carolina, Oklahoma, South Carolina, and Virginia.
3. Arkansas, Colorado, Florida, Mississippi, and Texas.
4. Alaska, California, Connecticut, Georgia, Idaho, Kentucky, Louisiana, Minnesota, New Hampshire, New Mexico, North Dakota, Oregon, Vermont, Washington, and Wyoming.
5. Montana.
6. Delaware.

sets the maximum age limit for drivers at 70, 4⁷ at 65, and 3⁸ at 60.

For all new drivers, Tennessee has an age limit of 55. Virginia requires annual physical and licensing examinations for all drivers over 65 and West Virginia requires a semiannual physical examination for all drivers over 50, also persons who have reached their 51st birthday and have not previously driven a school bus may not be employed in West Virginia.

As we all know, this problem of realistically fixing age limits for school bus drivers is a most difficult one indeed. There are two opposing points of view in regard to the minimum age requirement. There are those on the one hand that support the view that every driver should be at least 21 and some would say 25. While according to others, the employment of minors as bus drivers is fully justified on the basis that pupil drivers, if carefully selected and trained are fully as capable as the average adult driver. The safety records established by pupil drivers in such states as North Carolina tend to give support to this point of view.

On the other hand those who advocate that every school bus driver should be at least 21 contend that: (1) adult drivers are more likely to maintain higher standards of pupil behavior, and (2) driving a school bus requires a "sense of responsibility or degree of maturity" which is seldom possessed by pupil drivers.

Setting definite maximum age limits also presents a problem. It is known, of course, that with advancing years (1) driving skills can decline, (2) sight and hearing can deteriorate, (3) reaction time can decrease, while (4) coordination, general health, and physical stamina are more likely to decline.

Apparently the important question is not always how old a particular driver may be, but rather how safe and reliable he may be. Safety and reliability, however, do not necessarily correlate with age, and it is generally agreed that the periodic physical examinations should be required more often of the older driver.

In spite of the conflicting opinions which

7. Iowa, Louisiana, Maryland, and New Mexico.
8. North Carolina, North Dakota, and Wisconsin.

exist in regard to minimum and maximum age limits for school bus drivers, it appears that two conclusions can be advanced: (1) state minimum and maximum age limits for school bus drivers are essential; and (2) in those states not bound by statutory provisions in this area, state departments of education should exert leadership in setting up reasonable requirements.

I would like to say, at this point, that I am not at all sure that it is wise for the states to attempt to set forth by statute a comprehensive detailed set of standards for school bus drivers. It may be a far sounder policy for the states to enact broad general statutory provisions which in turn place upon the state education agency the responsibility for developing rules and regulations asserting that these rules and regulations will, in fact, have force and effect of law governing all phases of school transportation including the qualifications for school bus drivers.

I hope you will keep this distinction in mind as I discuss various requirements for school bus drivers and the possibility of strengthening these requirements in certain areas.

Physical Requirement

A majority of the states at the present time require school bus drivers to meet specific physical standards and to undergo a physical examination in order to operate a school bus. As would be expected, however, there are wider variations among the various states in regard to the kind and extent of these physical requirements.

In a number of states the physical qualifications are written in very general terms, while in others the physical requirements may be limited to a single item such as requiring all drivers to submit to a tuberculosis test or an eye examination. States desiring to strengthen their physical requirements for school bus drivers would do well to consider at least the following physical requirements as an absolute minimum for all school bus drivers.

A complete annual physical examination by a physician approved by the local school authorities on the basis of a standardized state form, developed by the state education agency with the advice of state medical authorities, and in cooperation with other appropriate state agencies.

This annual physical examination for school bus drivers should be based on adequate minimum state standards and should at least include such items as: (1) an acceptable degree of sight and hearing, (2) the physical strength necessary to handle a school bus with ease, (3) possession and the full and normal use of both hands, both arms, both feet, and both legs, (4) freedom from any communicable disease, and (5) freedom from mental, nervous, organic, or functional disease likely to interfere with safe driving, such as epilepsy, tuberculosis, paralysis, insanity, diabetes, abnormal blood pressure, and heart ailments.

In addition to this compulsory annual physical examination, the local school authorities may wish, and should be encouraged, to require additional examinations during the year as the need may arise.

Character

Most of the states, either by statute or by regulation, appear to support the premise that since transported pupils will spend considerable time each day under the jurisdiction of a bus driver, his character and personal habits should be carefully assessed prior to employment.

Generally speaking, state requirements specify that individuals employed as school bus drivers are (1) to be of good moral character and reputation, and (2) to abstain from the use of profanity, narcotics, and alcoholic beverages. I am not sure a general requirement of this type in itself, without a prescribed procedure that local school officials may follow in determining whether an applicant's character measures up to the state requirement, is sufficient.

The recommendations of the 1959 National School Transportation Conference on the selection, instruction, and supervision of school bus drivers support this point of view. The Conference recommended that "states should require that prospective school bus drivers be selected on the basis of a specific character standard," and local school authorities should apply this standard in employing school bus drivers.

Among the elements that should be considered in setting a character standard are: (1) reliability and dependability, (2) initiative, self-reliance, and leadership, (3) ability to get along with others, (4) freedom from use of undesirable language, (5) personal

habits of cleanliness, (6) moral conduct above reproach, (7) honesty, (8) freedom from addiction to narcotics or habit-forming drugs, and (9) freedom from addiction to alcoholic beverages or liquors.

The Conference also suggested that valuable information about a prospective school bus driver may be obtained by checking court records, personal references, credit bureaus, and state and federal fingerprinting records.

In regard to driver selection at the local level, I believe the point should be continually stressed that:

(1) A properly developed application form can serve as a valuable tool in the selection process.

(2) Personal references or other information of this type which can provide clues to the applicant's personal habits and past work record can be of considerable help as a first step in driver selection.

(3) A thorough investigation of drivers before they are hired is not only extremely important—it is essential.

(4) Finally, a personal interview can prove to be extremely helpful in crystallizing the accuracy and validity of the data collected on a particular applicant and in evaluating his overall desirability as an employee.

Experience

There are also wide variations among the states in regard to experience requirements for school bus drivers. A number of the states simply specify that drivers must file evidence of experience, must hold an operator's or chauffeur's license, or have a satisfactory driving record. Often the state indicates a specific number of years of satisfactory driving experience which may be necessary in order to qualify. A few states have no specific experience requirements at all.

One might question, of course, whether or not the mere experience of driving an automobile, in and of itself, qualifies an individual to drive a school bus. There appears to be considerable merit in the procedure followed by a number of states of specifying that prior to employment (1) new drivers be given a performance test in a school bus, and (2) the applicant's driving record be free of serious traffic violations

and accidents due to negligence. If we firmly believe driving a school bus requires special skills and information, then the answer is, of course, on-the-job experience and training for new drivers prior to assignment.

I would like to touch very briefly on only two of a number of other important considerations in school bus driver selection.

(1) Few school employees are in as unique a position as the school bus driver to influence the community's confidence and respect in its school system. A school bus driver's personal conduct and daily performance as observed by the pupils, parents, and the taxpayers of the community can have a serious impact one way or another on the school's public relations in the community.

(2) A school bus driver can have either a positive or negative influence on the young minds which are under his charge for a considerable portion of the school day: his attitude toward promptness, the manner in which he drives his bus, his respect for laws and regulations during the daily run, the manner in which he handles discipline, his personal habits of speech and dress, his self-control and emotional stability, all can have considerable, immediate, and perhaps even a lasting influence on the attitudes and behavior patterns in this particular age group.

As Walter M. Gordon, head of one of the nation's largest school bus operations with 42,000 riders, Baltimore County, Maryland, so aptly and humorously put it:

"What we are looking for in a school bus driver is a paragon, a diplomat, a public relations man, a nursemaid, a Prussian general for discipline. He must be able to keep both eyes on the road, watch for traffic situations with considerably more care than the average motorist, and at the same time control 30 or more squirming, yelling, energetic, hell-bent kids who are behind his back."

And I might add, we want his services for only a few hours per day at a salary often in no way commensurate with his responsibility.

A report by G. I. Fletcher, an agent for the Massachusetts State Board of Education in 1906, on the quality of the drivers in that state in 1898 might well be used, with certain modification, to sum up the situation as it exists today in regard to the quality of our school bus drivers across the Nation.

"Nearly all of the drivers are reported to be trustworthy. Some are said to be as good as let one get. Some are of doubtful qualifications. All committees and superintendents regard trustworthiness and fitness as the driver as of the highest importance. One committee says: 'Only such persons should be employed as we would trust with the care of our own children.' A few committees say that they have to watch drivers of conveyances and hold them in strict account. Some complain that children are not under proper control in the vehicles; but, upon the whole, there seems to be a good degree of satisfaction with such vehicles and drivers as have been employed."

A HYPOTHESIS ON LICENSING THE SCHOOL BUS DRIVER

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From its beginnings in 1840 in one school district in Massachusetts, transportation for students to and from school has grown into the massive enterprise of today. A 1960 publication reports that although only one in every four students relies upon school sponsored transportation, there are nearly 11 million young people riding school buses each day.

Elaboration on the need for safety in school bus programs is certainly unnecessary. There is no question but that the prevention of accidents should be a high priority goal. However, it would appear that adequate measures are not being taken toward this end. As clear evidence of this, national statistics with only 42 states reporting in 1960, concerning school bus accidents,

show more than 2000 injured and 177 killed in a total of 8900 accidents. In Illinois for example, the average accident rate per vehicle in 1958 was greater for school buses than for all other commercial vehicles!

Recognizing the extensiveness of school bus programs throughout the country, and with the evidence of a great number of accidents and injuries occurring, it is clear there is a need for a concerted effort toward maximizing safety within these programs. However, it would appear that in most instances, greater attention is paid to the mechanical condition of the vehicle than to the driving skills of the operator. Federal and state laws exist pertaining to the physical characteristics of the vehicle. Only limited regulations exist concerning the adequacy of the driver.

The annual cost in 1959 of operating the many school bus systems in the nation was over 400 million dollars. The separate school bus systems, functioning within the unit of the school district, are, in most cases, maintained and financed by the local board of education in cooperation with various state agencies. In fulfilling their responsibility of adequately maintaining these programs, several states have established screening, training, and refresher programs for their drivers. There is a noticeable lack of any such preventive measures in the majority of states, however.

Corrective or punitive measures taken against drivers after the occurrence of accidents do serve as a form of preventive action against future accidents. However, it is the thesis of this paper that the more positive approach of taking preventive measures prior to any traffic offenses or accidents represents a far superior method. Thus, the general hypothesis is that a strict and comprehensive licensing examination will reduce school bus accidents.

Hiring and Screening

As was true in the case of national statistics on the number and severity of accidents in which school buses were involved, information concerning the screening and training procedures for school bus drivers, as they exist in the various states, is quite difficult to obtain. Those states which now have, or which are presently establishing extensive programs in this area do report on their efforts and findings. However, the majority

of states in which programs of wide scope do not exist, report limited data concerning the procedures they employ.

The hours for school bus drivers are typically not those of the usual nine to five working day. They are shorter and are divided over the day according to the arrival and dismissal time of the schools. The salaries paid to these drivers must be expected to be concomitant with these limited hours. It is safe to assume that few adults could support themselves and their families on school bus driver salaries. To supplement the salary, the driver may either be employed in some additional capacity by the school district, or he may hold another part-time job. In any case, due to the nature of the job and its obvious disadvantages, a large proportion of school bus driver applicants tend to be retired persons, students, housewives, or persons seeking only short-term employment. These applicants are not likely to be the best safety risks.

One problem which is highlighted by these conditions is that a good many of the older persons who have been retired from full-time employment and who now serve as school bus drivers are no longer in their physical prime. Unfortunately, attention becomes focused upon this issue only on the occasions when tragedy occurs as a result of the sudden physical incapacitation of the driver. While the question of physical fitness is especially pertinent with reference to the older driver, it is also of serious importance for all drivers. Illinois, for instance, requires not only a doctor's confirmation of the applicant's physical fitness but also yearly examination during the term of employment.

Part of the screening procedures in both New York and Oregon include careful physical examinations. Of course these examinations are usually designed only to detect gross physical deficiencies such as a serious heart condition which would make the individual a risk on the road. Such check-ups in all probability, seldom determine those psychophysical capacities of a driver (reaction time, depth perception, and field of vision) which are equally important to the safety of the vehicle and its passengers.

As one way of meeting this salient problem of the lack of qualified and physically fit drivers, North Carolina has inaugurated a program of hiring and training students

as drivers. At present, over 90 per cent of the school bus drivers in the state are high school students. The training program for the prospective drivers include 12 hours of classroom work as well as a minimum of six hours of actual road training. This instruction is beyond the ten hours of training required for all driver education students in the state. Such a program as this has obvious benefits in providing the opportunity for close supervision of drivers, quick availability of substitute drivers, and greater selectivity in the hiring of personnel.

Initiated by a safety specialist for a local General Electric plant transportation system, another program involving student participation rather than student drivers, was instituted in the school districts in at least one county in Indiana. Two or more students on each bus are trained to provide assistance to the driver in emergencies. This precaution is, of course, taken to avert the disasters which can occur when the driver is unable to handle or maintain discipline with all of his passengers, or to maintain control of this vehicle in a critical situation or when he becomes physically incapacitated.

West Virginia focuses upon the technical ability of the driver and submits each of its applicants to a six hour training program. This is followed by a written examination and an on-the-road test of the applicant's skill in handling the bus. All training and examinations are supervised by the state police force.

In-Service Training and Testing

In Michigan, the in-service training program consists of a 12-hour intensive instruction program held for all school bus drivers in the state. Small subsistence money are paid to those drivers in attendance for the two day program. The instructors for the training sessions, each of whom have been trained in highway safety measures, are brought in from several of the colleges and universities in the state.

A somewhat similar program has been established in New Mexico. It is reported that each year 700 to 800 drivers attend the Annual School Bus Drivers' Institute for training in safety techniques. Refresher courses of the same nature are also carried on during the year in areas where accidents or violations are reported.

A program in Oregon was instituted by the State Department of Education in cooperation with the Division of Motor Vehicles. The essentials of this program are similar to the elements noted above. Oregon requires special school bus driver license. A team of trained inspectors review safe methods of school bus operation and traffic laws and regulations with the drivers. Satisfactory fulfillment of the training sessions as well as certification of physical fitness are required before the license is granted by the state.

As evidence of the efficiency of a screening program, after all school bus drivers in Georgia were tested, the rate of accidents due to errors on the part of the driver were reported to be "cut in half." Furthermore a total of 252 drivers were disqualified from operating school buses as a result of the tests.

There have been numerous reports in the past several years which contain recommendations for national and/or local school bus driver screening, training, and supervision programs. Most of these include mandatory yearly physical examinations as well as some form of training for the driver in safety precautions to be taken on the road. A recent report recommends, beyond the physical qualifications, requirements for high standards of moral character, emotional stability, knowledge of traffic laws and regulations, skill requirements in the handling of the school bus, and experience in driving. Although such a program would indeed be of great value, careful research must precede its establishment. New Jersey, continually active in the general field of accident prevention, is now in the process of doing such research and establishing such a program.

New Jersey Program

In building a comprehensive program in highway safety, the state of New Jersey recognized the need for rehabilitative (corrective and preventive) supplements to its punitive (law enforcement) measures. In 1952, the first Accident Prevention Clinic was established with Drivers Safety Service acting as technical consultants. Since then, the program has grown to comprise eight clinics located throughout the state. The multiple purposes of these clinics include determining those psychophysical and psy-

chological characteristics of the driver which tend to be related to accident involvement, informing the driver of whatever psychophysical deficiencies exist, advising him of how to compensate for or correct limitations, and imparting to him through counseling, more positive attitudes toward law enforcement, traffic regulations, and safety precautions.

In general, drivers who had more than two reportable accidents or who have accumulated a given number of violation points, or who have been convicted of driving while intoxicated, are required by the state to participate in the program. Each subject is given a thorough psychophysical examination, including tests of visual acuity, field of vision, reaction time, depth perception, night vision, color vision, and glare recovery.

Two psychological examinations are also administered to each subject, although at present, the results of these tests are used for research purposes only. Based upon a comparison between the subjects' scores on each of the psychophysical tests and minimum standards which have been established as the basic requirements for safe driving, recommendations are made to each driver as to what he should do to compensate for whatever deficiencies may exist. This processing, including an initial interview and a final counseling session, usually takes about two hours. In cases of extreme psychophysical inadequacies, the driver is referred back to one of the state licensing centers for re-examination and possible action on suspension of his license unless corrective steps can be taken.

Of the 28,834 drivers processed by the Accident Prevention Clinics from September 1952 through June 30, 1959, only 2,469 have continued to reoffend; that is, be involved in either accidents or violations. This represents reoffenses for only 8.5 per cent of the total group of subjects. As a further check on the efficiency of the Accident Prevention Clinics, research is currently underway to determine the reoffense rate of a control group of drivers, who, though "eligible" for action, were not exposed to Accident Prevention Clinic processing.

New Jersey has had a limited examination program for school bus drivers for some years. Until November, 1960, the following procedure was used in school bus

driver licensing in New Jersey: Together with the initial application form, the subject submitted a medical report stating that his physical condition was satisfactory. He also had to satisfactorily complete a test measuring his knowledge of traffic laws. Visual acuity and other psychophysical tests were then administered to the applicant (Porto-Clinic). The final step was a road test on which the driver had to demonstrate his skill in operating a school bus.

In November 1960, however, Drivers Safety Service was asked to cooperate in setting up a new testing program for school bus drivers. At present therefore, applicants are required to go through the complete Accident Prevention Clinic processing. Any subject who falls below the established minimum standards on any three psychophysical examinations is unlikely to be granted a license.

One of the basic problems in establishing a research program within such a practical setting is meeting the needs of the various agencies connected with the program. The Division of Motor Vehicles and the Department of Education, both agreed on the need for psychophysical test minimums as part of the criteria for school bus drivers. However, although comprehensive recommendations have been prepared by Drivers Safety Service, no standard has, as yet, been set on the psychological or emotional qualifications of these applicants. There is now, in progress, a psychological test program as part of the school bus driver screening.

The tests currently used in the program were originally developed by Drivers Safety Service for use in a rehabilitation program which is supported, in part, by a Public Health Grant [RG-6296 (R1)]. The program concerns itself with the rehabilitation of that 8.5 per cent who continued to reoffend following their Accident Prevention Clinic processing. The results of these test administrations to school bus drivers will be used initially for research purposes. As indicated, no applicant is currently denied a license on the basis of these psychological tests.

Table I indicates the extent of yearly accidents, injuries, and death in school buses since 1953. The information has been assembled in such a manner that individual bits of information can become meaningful. For example, Column Three (number of ac-

School Transportation Section

Year	No. of States Reporting	No. of Accidents	Per Cent of Increase	No. of Injuries	Per Cent of Increase	No. Killed	Per Cent of Increase
1953	30	2,941		701		4	
1954	34	4,316	47.77	983	40.22	8	100
1955	36	5,144	18.36	1,304	32.87	18	125
1956	38	5,809	12.95	1,295	0.81	5	-72.22
1957	37	5,953	2.47	1,171	9.07	7	40.0
1958	40	7,186	20.71	1,580	34.92	29	314.28
1959	39	7,152	-1.47	2,039	29.64	13	82.73
1960	42	8,906	24.55	2,067	1.32	19	-64.15

idents) shows a steady climb in accidents—1960 has almost three times the number of reported accidents as 1953. The number of injuries has also increased at the same rate for this period.

Although it is obvious from the above table that the number of accidents and injuries has increased, the number of people killed each year has fluctuated, so that no pattern is discernable. This is hardly any consolation to those families affected by this tragedy.

We note from this table that:

1. There are still no uniform or complete statistics available on school bus accidents.

2. The number of deaths and injuries incurred in school bus accidents does not follow any pattern other than a steady increase—thus suggesting that more intensive research efforts are needed with an emphasis on the vehicle operator.

The following table compares accident and injuries of New Jersey and national statistics. No tabular presentation is needed for the number killed during this period since school bus deaths in New Jersey for this same period totaled only three. What is particularly interesting in this table is that the number of school bus accidents and injuries have increased at approximately the same rate as the national figures.

TABLE II
A Comparison of National and New Jersey School Bus Accidents and Injuries

Year	No. in N. J.	ACCIDENTS		No. in N. J.	INJURIES	
		Per Cent of Increase	National		Per Cent of Increase	National
1963	44	2.22		23	53.08	
1954	54	21.72	47.77	23	0	40.22
1955	54	3.57	18.36	33	43.47	34.61
1956	56	77.77	12.92	41	84.84	0.81
1957	73	23.55	2.47	58	45.90	9.07
1958	101	38.33	20.71	69	22.47	54.55
1959	78	22.77	0.47	34	50.72	28.64
1960	129	65.38	24.55	103	202.94	1.32

In terms of percents, it would seem that New Jersey statistics are even more erratic than the national figures. The above comparison will only become meaningful when the licensees under the new program have had sufficient driving exposure to allow for meaningful statistics. Since the new licensing program has gone into effect, the school bus drivers who were processed under this system have had a total of four school bus accidents and only one private car accident, while at the same time, these same drivers have been ticketed for only five moving violations, with none of these

on a school bus. Thus, it seems likely that some aspect of clinic processing is having the desired effect. It would also appear the bulk of the school bus accidents are being contributed to by the drivers who received school bus licenses before the new procedure was put into effect.

One cannot yet draw any final conclusions since sufficient time has not elapsed for these newly licensed drivers to have had sufficient exposure. However, we hope that they will follow a pattern similar to other Accident Prevention Clinic processed subjects.

TABLE III
An Age Comparison of the Accidents and Violations of Three Groups of Drivers

Age	Per Cent of Sample			Per Cent of Violations			Per Cent of Accidents		
	New Jersey	Accid. Prev. Clinic	School Bus Drivers	New Jersey	Accid. Prev. Clinic	School Bus Drivers	New Jersey	Accid. Prev. Clinic	School Bus Drivers
17	1.8	0	0	3.7	0	0	2.9	0	0
18	1.8	2.2	0	2.2	0.7	0	4.8	1.7	0
19	1.8	4.8	0	2.8	2.2	0	4.8	4.2	0
20-24	8.7	17.0	13.7	13.0	15.2	18.97	18.2	25.9	36.09
25-34	23.3	34.6	32.4	26.9	43.4	43.97	27.6	34.7	36.15
35-44	28.1	32.2	30.2	23.0	28	21.12	30.9	22.9	36
45-54	19.4	10.1	17.1	15.2	6.8	12.14	12.9	5.9	11.34
55-64	11.4	6.3	6.0	8.7	2.9	2.64	6.2	3.9	2.4
65 plus	6.1	1.8	1.6	2.5	1.2	1.4	2.0	.8	.4

Table III is designed to show the accident and violation behavior, in terms of age, of three groups of New Jersey drivers. Columns two, five and eight represent a sample of 503,144 drivers selected randomly from the total population of two and one-half million licensed drivers in New Jersey. Columns three, six and nine represent 1,304 drivers—a sample of the 30,000 Accident Prevention Clinic processed subjects. Columns four, seven and ten deal with the total number of new school bus drivers processed up to October of this year.

No results are recorded for the "under 20" age group—the minimum age for a school bus license in New Jersey is age 21. It is interesting to note that the age range 20-34 of school bus drivers has more accidents and violations than either Accident Prevention Clinic subjects or a sample of all New Jersey Drivers. These facts suggest that:

1. Drivers between the ages of 20-34 ought to be excluded from operating school buses, or

2. More detailed attention should be paid to the past accident and violation history of all applicants, especially 20-34 year olds.

It should be noted that the records recorded for the school bus driver population are for their pre-processing behavior—that is before they received a school bus driver's permit.

The next table presents the pre-licensing records of the newly processed school bus drivers and their post-processing behavior. Table IV indicates, with limitations, a decrease in both accidents and violations. However, we should not be misled by these re-

sults. The time interval between their processing date and the search of their records for post-processing behavior has not been long enough to draw any positive conclusions.

TABLE IV
The Accident and Violation Records of School Bus Drivers, Pre- and Post-Processing
N = 322

ACCIDENTS		Post-Processing	
Pre-Processing	46	Post-Processing	8
VIOLATIONS		Post-Processing	
Pre-Processing	144	Post-Processing	15

The following four tables compare by per cent of failure, three groups of drivers, on various psychophysical tests. In Tables V (A, B, C, and D) the New Jersey or control group were accident and violation free for a period of three years, before being processed. The Accident Prevention Clinic subjects are a sample of those usually processed for accident involvement. The school bus driver group represents the total number processed, to date.

Each table may be read in the same manner. For example, in Table V A, for subjects aged 58 plus, the controls and school bus drivers had no visual acuity failures, whereas ten per cent of the Accident Prevention Clinic subjects failed on left eye acuity.

The four tables provide some interesting data concerning New Jersey school bus drivers. In terms of visual acuity, field of vision and complex reaction time, the school bus drivers have fewer failures than either of the other two groups. Day depth perception is the one area they fall below the controls and "accident repeaters."

TABLE V A
A Comparison, by Per Cent of Failure, on Visual Acuity, of Three Driver Groups

Age	LEFT EYE			RIGHT EYE		
	Controls	Accident Prevention Clinic	School Bus Driver	Controls	Accident Prevention Clinic	School Bus Driver
18-25	0	0	0	0	0	0
26-34	0	3.12	0	0	3.12	0
35-44	0	1.58	1.25	1.58	3.17	2.5
45-54	0	3.03	0	1.51	4.54	1.44
55-64	0	3.22	2.43	3.22	4.06	0
58 plus	0	10	0	0	2.33	0

TABLE V B
A Comparison, by Per Cent of Failure, of the Field of Vision of Three Driver Groups

Age	LEFT EYE			RIGHT EYE		
	Controls	Accident Prevention Clinic	School Bus Driver	Controls	Accident Prevention Clinic	School Bus Driver
18-25	0	0	0	0	0	0
26-34	1.56	1.56	0	1.56	3.12	0
35-44	.79	1.19	0	1.58	4.24	0
45-54	1.51	4.92	0	1.51	6.43	0
55-64	0	15.22	0	0	18.39	0
58 plus	3.22	12.66	9.09	3.22	11.66	0

TABLE V C
A Comparison, by Per Cent of Failure, of the Complex Reaction Time of Three Driver Groups

Age	LEFT EYE			RIGHT EYE		
	Controls	Accident Prevention Clinic	School Bus Driver	Controls	Accident Prevention Clinic	School Bus Driver
18-25	0	0	0	0	0	0
26-34	4.6	10.15	2.56	4.6	10.15	2.56
35-44	7.92	12.30	0	7.92	12.30	0
45-54	9.09	16.66	1.44	9.09	16.66	1.44
55-64	17.74	24.19	0	17.74	24.19	0
58 plus	42.33	46.66	16.66	42.33	46.66	16.66

TABLE V D
A Comparison, by Per Cent of Failure, of the Day Depth Perception of Three Driver Groups

Age	LEFT EYE			RIGHT EYE		
	Controls	Accident Prevention Clinic	School Bus Driver	Controls	Accident Prevention Clinic	School Bus Driver
18-25	0	37.5	36.28	0	37.5	36.28
26-34	3.12	34.5	44.87	3.12	34.5	44.87
35-44	7.9	43.65	51.25	7.9	43.65	51.25
45-54	9.09	43.18	42.30	9.09	43.18	42.30
55-64	29.02	38.70	53.17	29.02	38.70	53.17
58 plus	13.33	66.66	54.55	13.33	66.66	54.55

What we may be able to say, if the school bus driver offenses at an expected rate, is that their psychophysical characteristics, excluding depth perception, are not necessarily related to their driving behavior. So far, of the over 320 school bus drivers tested and screened, only one has been denied the license on the basis of his failure to meet minimum psychophysical requirements. Therefore, it may be that criteria are either

too low or that only basic psychophysical capabilities are, in fact, necessary.

However, it is more likely a matter of previous screening. Under the new procedure, an applicant has had at least two screenings before receiving his clinic processing. All applicants must first have gone through the usual driver licensing screening and received an operators license. When he or she applies for a school bus driver

permut, he is given a second screening and receives a provisional license for one month; only then does he get the full Accident Prevention Clinic processing.

Conclusions and Hypotheses for Continued Research

It has been generally accepted that there is need for more stringent licensing procedures for school bus drivers. Obviously, if we can prevent applicants who are the greatest risks from operating school buses our accident, injury and death figures should improve. It is also obvious that, in many cases, psychophysical test results give useful information concerning this group of drivers. The need for a high degree of physical fitness is certainly needed. What makes this all the more meaningful, however, is that even with limited pre-licensing counseling, violations and accidents tend to decrease. Thus, we have some basis or logic for *Hypothesis Number One*:

driver who learns about his psychophysical capabilities and is counseled on the compensatory behavior for any defect tends to have fewer accidents and violations.

As indicated earlier, a start in psychological testing in this area has been made. As yet the number of applicants who have taken these tests is too small for any, even preliminary, analysis. Yet, there is considerable evidence from other studies, that measurement of the psychological and emotional components of a driver provide the best hope for identifying "safety risks." In addition, those applicants who are emotionally disturbed should be screened out since they are operating in an extremely sensitive area. Therefore, *Hypothesis Number Two*:

The inclusion of standardized or custom-built psychological instruments in a school bus licensing program has merit, in terms of identifying accident "risks," as well as emotionally unstable applicants.

Although these two hypotheses may seem rather general, their testing holds the key toward reducing school bus accidents.

While the New Jersey research is still in its early stages, it is hoped that studies can be soon initiated to test the above hypotheses and resolve a variety of problems complicated to deal with in this preliminary paper.

A STRAIGHT LINE ON SAFE DRIVER AWARDS AND INCENTIVES

By E. J. SLINGERLAND
Safety Director, Seattle Transit System, Seattle, Wash.

I think it is safe to assume that every one of us works because he gets paid for it—and no one who works for wages is likely to admit to any other reason. It might seem contradictory, then, to talk about safe driver awards as an incentive for employees when we have already admitted that it is money that talks. Those of you who have tried to sell your management on a driver award program will undoubtedly have met with this argument. What I have been asked to do is discuss some of the criticisms of incentive awards, to see if they are really valid.

When we first suggested a program of driver awards for our operators, we were

met almost instantly with the question "Why should we give a driver a medal for doing the job we hired him to do in the first place?" That may sound like a fairly reasonable argument, but I don't think it will stand much scrutiny. While it is true that when we hire a driver, we make every effort to hire one who will be safe, very few companies can boast that all their drivers are perfect. The latest edition of *Accident Facts* verifies this imperfection by recording over 2,000,000 accidents in 1960 involving commercial vehicles.

So I think that we all recognize that while we might have had high hopes, some of our drivers turn out less than perfect, and will

be involved in accidents. We also know that Tom, the driver who has one or two minor accidents each year, costs us more money, yet draws the same wages as George, who has a perfect record. Is there any reason why we shouldn't publicly recognize George's excellent performance, and at the same time provide an incentive for Tom to improve his record? Though we are all working for money, there are none of us who don't appreciate recognition of a job well done. In the motor transport industry, I believe there is no better recognition than that provided by a safe driver award.

Other critics of our program said "What good is a safe driver award? Only the good drivers will get them, and they won't have any effect on the driver who has the accidents and really needs the help." I wonder if this same critic would refuse to buy fire insurance because when the salesman called, his house wasn't on fire? The insurance is the same. Actually, one of the recommendations of a program such as the Council provides is the fact that the benefits reach every driver, good or not so good.

Even the good drivers need a reminder now and then that they are good because they put forth the necessary effort, and not because of luck. Each month we send a letter and booklet or other material to the driver's home, where not only he, but his family as well, reads it. I'm sure that in many cases, the driver's wife has just as much influence on his driving as his company supervisors. One driver told me that after he read the driver-letter, he forwarded it to his son at college, where it was posted on the fraternity bulletin board.

There is another way that the benefits of our program reach nearly every driver. With very few exceptions, the man who has a permanent place on our payroll takes a certain amount of pride in being a good driver. No matter what we're doing, there's a certain competitive spirit that makes us want to be a little bit better than the fellow next to us. If that fellow happens to be wearing a safe driver pin or a shoulder patch, and I'm not, I'm likely to try a little bit harder to get one too. It's possible that I'd never admit it to anyone, but the competition is still there.

This brings up another criticism of incentive awards. Many opponents insist that

incentives for safe driving records, whether they may be in the form of additional pay, merchandise, or a lapel pin, will increase the number of "blind" or "no-report" accidents. I agree that there could be a tendency toward this, but it has been no particular problem to us. Our operators are well aware that while we can possibly excuse an accident, failure to report one is a serious offense which will result in disciplinary action. Last year less than two per cent of our traffic accidents were blind reports.

Some people have told me that an incentive award program requires too much in the way of records—that all I'm doing is making more work for myself. But there is another way of looking at it. No matter what your safety program is, to be effective, it must be based on complete and accurate records. Whether you certify a driver for an award makes very little difference in the amount of work involved; and for any extra work there might be, you are repaid by having available a complete record of each driver's performance. This is essential for any program that produces results in accident prevention.

Of course, the \$64 question, (if such a term can be used) is the one asked by the boss: "How much will it cost?" Unless we are prepared to show that we can save more than the program will cost, we don't stand much chance of selling it. It's easy to calculate the direct expenses, and not much more difficult to add up the indirect costs. There will be the cost per driver in purchasing the material, whether we are giving prizes or shoulder patches. There is the mailing expense if you enter a program that includes such material for the operator.

Some companies pay their drivers for attendance at safety meetings, so these direct expenses would vary according to individual plans, and can usually be figured quite accurately. It is a little more difficult to calculate the money that is saved by such a program. Who can accurately determine the cost of an accident that didn't happen? The best that can be done here is an educated guess, based on your own previous record and the experience of others who have gone into an incentive program. Possibly a few of the facts concerning our own experience in Seattle might be appropriate.

Before we decided to try an award program, we had what we thought was a pretty fair record. Our traffic accident rate was a little better than the national average for comparable properties, and our ratio of claims expense to total revenue had been quite favorable. Our accident frequency rate was more or less stationary, but the cost of accidents was rising rapidly, due to the inflation of claims. In one year alone we had to set aside over \$425,000 for injuries and damages. We felt that if we could reduce our accident costs by as little as one per cent we would save money, as the incentive program that we were considering would cost only about half that amount.

I wish that I could report that immediately after signing up for the Council's driver award program that our accident rate started down, but unfortunately it didn't happen quite that way. It took some time for the program to show effects, and even some of our operators didn't like it at first. However, it wasn't long until even those drivers were showing more enthusiasm for the plan, which they indicated in several ways. More drivers came in to check their records, and ask when their next award was due. Management also took a closer look at these driving records, and we were able to give more attention to the drivers who really needed it. The operators also began to show more concern over their accidents, coming in more frequently to discuss those that were charged preventable. We were always ready to go over these reports with them, using the opportunity to point out the reasons they were considered preventable.

In this way we found the driver award program gave us an excellent opportunity to talk about defensive driving and it seemed

to go over better than when we had to ask the driver to come in.

The driver awards are, of course, only one part of our safety program. We continue to put a great deal of emphasis on training and re-checking. When an operator seems to require it, he is given an additional training period in an effort to help him eliminate any poor driving techniques he may have developed. It is not possible, nor would it be accurate, to say that the incentive awards are solely responsible for the fact that last year we enjoyed the lowest traffic accident rate in the history of our company. Certainly a good portion of the credit for this record, and for the resulting reduction in accident costs is due to this program. It would be hard to find anyone in authority in our company who would not agree that our annual cost of less than \$2000 for the incentive program has not been saved many times over.

In 1960, our cost for injuries and damage was only 40 per cent as high as in 1957, and over the four-year period, the savings were in the neighborhood of half a million dollars. We are not alone in our experience, either. A local trucking concern which introduced an incentive award program reported a 25 per cent reduction in accidents by the second year, and a number of other commercial vehicle operators have made similar reports to our local safety council.

Certainly no one contends that a safe driver award program is a gimmick that will do away with accidents forever, but you will find an increasing number of people who believe that it should be made a part of any well rounded safety program.

NEW DIMENSIONS IN SCHOOL BUS FLEET SAFETY

By SGT. P. A. ZEISSE

Fleet Coordinator, Texas Dept. of Public Safety, Austin, Tex.

An Index on School Bus Patrols

What are the advantages of a school bus patrol?

1. Student training in leadership.
2. Welfare of students on the bus.
3. Assistance to driver in maintaining schedule.
4. Assistance to driver during emergencies.
5. Aid to driver in controlling students at loading stops to prevent accidents.

We are concerned here with advantage (3), which is related directly to our major topic, fleet safety. We shall not evaluate the other advantages.

How is advantage (3) related to the precautions involved at a loading stop?

1. Bus driver seeing distance from point of loading stop.
2. Other driver seeing distance to point of loading stop.
3. Loading stop flashing signal given over 300 feet from point of slowing for a stop.
4. Stop light signal and turn indicators at least 300 feet from point of stop.
5. Stopping bus at least four feet off the pavement or main-traveled portion of roadway.
6. Bus driver sets parking brakes.
7. Bus doors are opened only after bus comes to a complete stop.
8. Driver checks traffic in both directions. (Patrol aid.)
9. Driver signals for students to cross roadway from either direction. (Patrol aid.)
10. Students enter roadway only after receiving signal from driver. (Patrol aid.)
11. Students cross roadway at a brisk walk in a path at right angles to and near the bus. (Patrol aid.)
12. After all students have crossed and bus door is closed, driver turns off loading stop flashing signal and uses turn indicators to aid in entering traffic again.

A study of Texas school bus accident reports 1960 indicates a need of several of the preceding precautions.

We shall look at data related to

1. Students crossing roadway at loading stops.
2. Buses stopping in roadway and on shoulder.
3. Accidents a bus patrol can help prevent.

Note that we are being guided exclusively by what we find in accident reports. This review is an illustration of how schools should proceed in their fleet safety program.

Texas School Bus Fleet Accidents—1960
255 total accidents involving school bus operation.

182 accidents involving school bus loading stops in some way (71 per cent of total).

143 accidents involving school bus stopped (79 per cent of the 182 accidents and 56 per cent of the total).

41 accidents involving school bus stopped on shoulder (29 per cent of the 143 accidents). 17 injury accidents, including six injuries to students crossing roadway (36 per cent of 47 injury accidents involving bus at loading stop).

24/41 non-injury accidents.
86 accidents involving school bus stopped partially or completely in roadway (60 per cent of the 143 accidents).

30 injury accidents (12 injuries, including two deaths, to students crossing roadway) (64 per cent of the 47 injury accidents involving bus at loading stop).

56/86 non-injury accidents.

16/143 accidents not known whether bus on shoulder or roadway (11 per cent of the 143 accidents).

39/182 accidents involving stops where bus was not stopped.

73/255 accidents involving all other bus operations (29 per cent of total).

time, in light of the four general objectives of safety, adequacy, efficiency, and economy; (2) to determine the needs of the district regarding routing of pupil transportation, being guided by the previously mentioned objectives; and (3) to propose a definite routing plan for pupil transportation that would contribute to the safe, efficient, and economical organization of the school district.

The data for these surveys are drawn from such sources as: the office of the county board of education, county highway department, files of the superintendent or local executive head, building principals, and bus drivers. These data are collected by the superintendent, or the local executive head or their designated assistant, and each district is responsible for the accuracy of its own data.

The information collected and procedure for these surveys involve securing detailed maps of the school district, trip sheets or bus time schedules of the present system, definition of attendance areas, equipment inventory, and school board policy for transportation, if any exists. The existing bus routes are plotted on the map, the school sites are located, boundaries are defined, and students are located along the routes by use of colored map pins, coded to the vertical organization of the school system.

The services of our department are given to the route reorganization process, which involves inspection of roads, route construction, mileage measurement, location of pick-up points, shake-down runs, and driver and/or board of education conferences.

After the survey has been completed, a very detailed report is filed with the local board of education, the county superintendent and one copy is retained by our department. This report contains a complete analysis of the routes of the system in use and those of the plan proposed as a result of the survey. The report also contains a comparison of these two routing plans, plus conclusions drawn from the survey and recommendations for improvement.

Since September, 1960, we have completed some twenty odd surveys in Ohio schools. Most of these have been in districts that have had recent consolidations of rural territory. Although, the local board of education is not obligated to follow the recom-

mendations of our surveys, we have been quite well pleased with the number of districts that have indicated their intention to adopt our proposals this school year. A follow-up of these districts should give some indication of the success of our efforts next year and aid in evaluation of our methods.

You may be interested in the results of these surveys, and I will now present the most numerous conclusions consistently drawn from our studies.

1. The complete lack of board of education policy on school bus routing contributes to the inefficient and uneconomical organization of the present transportation system. This lack of policy also makes the administration of the system difficult and inadequate to meet the needs of the future.

2. The number of buses used in many districts at the present is excessive, and due to the reorganization of the school district, it should be possible to reduce the number by several methods that will be mentioned later.

3. The amount of backtracking on school bus routes can be reduced by proper routing at a considerable savings to the board of education.

4. The number of side spurs to the main bus routes should be reduced in order to save travel time and cost. This would extend the range of the bus and contribute to the safety of all pupils by eliminating some turn-arounds and pick-up stops.

5. The number of pick-up stops should be reduced. This would decrease travel time, extend the range of the bus, and reduce operational cost of fuel and maintenance.

6. Single-trip routing should be eliminated, and double or multi-trip routing used wherever possible to decrease operational cost of drivers and equipment. This would increase the efficiency of equipment used and decrease the number of buses needed.

7. The exclusive use of loop routes limits the range of the buses. They can only pick up pupils within an area limited by one-half the travel time of the route, since they must pick up pupils during the whole travel time. A shunting route does not pick up on the way out, therefore, it saves travel time and can range farther from school. Not all situations lend themselves to both types of

routes mentioned, and it should be remembered that the loop route can reduce dead-head mileage and should be used wherever possible.

8. Unsafe turn-arounds and stops should be eliminated.

9. The length of routes should be equalized as much as possible to properly utilize drivers and equipment. This may also eliminate some routes altogether, thereby, reducing the number of buses needed.

10. Overloading and underloading could be prevented by constant route revision.

11. Proper assignment of pupils to school and bus route can prevent overloading and underloading, and help equalize length of routes.

12. Small-capacity buses necessitate short routes that are expensive because the number of buses needed increases. When purchasing new buses, larger buses should be considered.

13. When planning routes, dead-head mileage should be eliminated except in cases where shoestring routes are needed to extend the range of the bus for scheduling purposes.

14. Travel time on the bus should be equalized for all routes as much as possible. This time should not exceed over one hour for high school pupils and forty-five minutes for elementary students.

15. The long elementary school day caused by transporting the high school and elementary pupils on the same bus should be eliminated. When transporting high school pupils in a different building than the elementary site, dual routing should be used. This decreases the number of buses and drivers needed, and increases the efficiency of equipment.

16. The traditional routing practices and restrictions of the old system should be ignored. New route planning should consider the school district as a whole, and routes and pupil assignment should be made for efficiency of operation.

17. Route revision should be made constantly, and administrator-bus driver conferences should be held periodically.

18. Express routes should be used where possible, especially for high school students. This would decrease travel time, eliminate

pick-up stops, and extend the range of the bus.

19. Feeder cars should be used in areas where the regular route would be too long or an extra route would be underloaded. The feeder car could eliminate unsafe turn-arounds, and long side spurs. The feeder car would also be an aid in scheduling.

20. The average number of pupils transported by a bus in a day should be increased to reduce per pupil cost.

21. Average trips per bus per day should be increased to eliminate the low average mentioned above.

22. Average one-way trip should be lengthened by eliminating excessive stops, side spurs, and turn-arounds.

23. Travel time should be decreased for elementary students and increased for high school students in some cases.

24. Average daily mileage of the buses should be increased to give a lower per mile cost and per pupil cost because of the use of less buses.

25. The extreme range in the composition of the bus load, travel time, and pick-up stops contributes to discipline problems for the drivers and principals and safety hazards for the students.

26. The extreme range in the bus load, stops, and daily mileage contributes to the inefficient use of equipment and driver's time.

27. The use of more buses than needed requires more capital outlay for new bus purchase during the depreciation period of the fleet.

28. The use of more drivers than necessary requires more supervision and salary outlay each year.

29. Maintenance costs should be spread over the smallest fleet necessary.

We do not intend to generalize upon these conclusions at this time, but we believe that another year of such investigation will point the way in which school bus routing should move in the future.

It may be interesting to you to know that in every survey conducted to date, our cost estimates have indicated that a decrease in either the per pupil cost or the per mile cost or both may be expected, as a result of route reorganization. Coupled with this

reduced operational estimate, is another cost reduction in capital outlay for bus purchase because of a reduction in fleet size. The estimated savings in annual operating cost have been as high as \$20,000 in one instance, and the capital outlay savings in this case was estimated at \$50,000.

More important than cost have been the indications of improvement in safety such as reduction in stops for a given age group, trip, or bus. A reduction in side spurs and turn-a-rounds improves safety, as does the separation of age groups, decreased travel time, and elimination of waiting periods in many cases.

The administrative changes made possible in many cases indicate a better organization of the school day, the curriculum and staff time.

If, after such limited study of the routing situation in only one state, I were asked to state the most urgent needs of school bus routing today, I would suggest the following areas as most important:

Boards of education should consider, write and adopt policy to guide the administration of pupil transportation. This policy should at least be concerned with the following basic questions:

1. The maximum travel time for high school and elementary pupils on school buses.
2. The maximum speed at which buses will be permitted to operate.
3. The maximum time that transported pupils arrive at school before it opens or wait for a bus after school is dismissed.
4. How far normal pupils must live from school in order to be entitled to transportation.
5. The type of physically handicapped pupils entitled to transportation.

6. How far pupils are required to walk to the main bus line from side roads.

7. Whether the bus will stop in front of each pupil's home on the main route, or only at spaced stops, limited in number by a required minimum distance between stops. It is not suggested that the policies are all-inclusive or that they meet all the needs of all districts. They are presented as essential statements for providing safe, economical, and adequate service.

Boards of education should provide for supervision of pupil transportation in the person of someone other than the head administrator. The problems of pupil transportation today require more time than the head administrator can devote to the job.

Boards of education should adopt the dual routing system for pupil transportation. The high school pupils are transported on separate routes from the elementary pupils. This procedure will free the elementary school from the restrictions of the high school schedule. Dual routing also will reduce the number of buses needed because some of them can be used for more than one route. This is a simple matter of scheduling the start of the high school first in the morning and elementary school last; this is a matter of board policy.

Boards of education should provide for a public information program to show the need for change in the transportation system. This program should be started long before the actual change is put into effect to avoid public opposition to quick change.

In the final analysis, let us not lose sight of the fact that the purpose of safety, efficiency, and economy in transportation is to make available the better educational program which, after all, is the basis of our existence.

AN OLD AXIOM — SCHOOL BUS ACCIDENT SUMMARY — 1960

By DOUGLAS M. FERGUSSON
Superintendent of Safety—Personal Lines,
Nationwide Mutual Insurance Co., Columbus, Ohio

I'm happy to appear here before you again. It's always a pleasure to talk to the leaders in the field of school transportation safety—even when I have to discuss the statistics of our business.

Statistics is never a popular subject—unless they refer to something "vital" and especially interesting, like 38-24-36.

Sir Thomas Browne, an English author of the 17th century, must have had something "vital" in mind when he wrote: "I have often admired . . . the secret magic of numbers."

More to the majority viewpoint, I think, was one of Sir Thomas's compatriots—a bloke named Shakespeare—who noted in his play, "Much Ado About Nothing," that "comparisons are odorous."

The statistics I'm going to review here today may not be as interesting as 38-24-36, but they're every bit as "vital." They pertain to the safe transportation of our "most important cargo"—our school children.

To get into my subject, I cite an excerpt from a report of the 99th Annual Convention of the National Education Association last June. Meeting in Atlantic City, 10,000 N.E.A. members adopted a resolution on the protection of children. That resolution said:

Safety of school children is among the prime concerns of all educators. Yet, despite continuing efforts of school and community groups to prevent accidents and fires, adequate safety remains a serious problem. The National Education Association urges all members of the education profession to continue to use and to expand the day-to-day opportunities for teaching the principles and practices of safe living which are pertinent to their fields of instruction. The N.E.A. calls upon school boards, teaching staffs, and administrators to intensify their efforts to provide physical settings which protect children, to give meaning to the principles of safety, and to enhance the development of safe behavior.

N.E.A. convention resolutions supplement the N.E.A. platform in two ways: (1) by directing the Association's officers and staff

to take specific actions, and (2) by stating the position of the N.E.A. rank-and-file on matters which are educational in nature, national in scope, and of current importance to the teaching profession.

Two things about this particular N.E.A. policy statement are apparent: (1) its scope is greater than the interest of this group here today, and (2) the need for safely transporting an increasing number of children to and from school is the herculean task challenged by the resolution.

Many people, it seems, no longer believe that they can influence actions in their sections of the world. This apathy—this tendency to "let George do it"—may be due to the great international power struggle and the war threats it involves; it may be due to the mighty scientific advances which are announced almost daily; or it may be caused by the world's population explosion and a feeling that one or two people don't count for much anymore.

But whatever the reason for this lack of "go-power," it's up to us—we in this room—to fight it, overcome it, and to pursue the problems of safe transportation with renewed faith and conviction.

We are the leaders—and the manner and methods by which we lead will largely determine the strength and character of those who will follow us, of how many will follow us, and of how good a job we'll all eventually do.

So it's up to us—you and me—to make school transportation safer.

But as I mentioned in this same setting one year ago, we'll see more darkness before we see daylight. With families migrating en masse to suburban homes and with the resulting increase in consolidated school districts, the problems inherent in school transportation have assumed gigantic proportions—and these problems will continue to get worse, instead of better, unless the trends of recent years are reversed.

This is the challenge I throw to you now.

Never before have America's school transportation facilities so badly needed the active support and guidance that you can provide. Your demonstrated leadership and experience are absolutely necessary, if the success we all hope for is ever to be realized. That's why I challenge each and everyone of you—in harmony with our colleagues who are absent today—to assume active roles in promoting a safe school transportation system.

Now accident statistics, by themselves, aren't worth much. They're sometimes nice to know, and they may even be nice to look at—but they do not become meaningful unless they are related to a common denominator or inter-related to themselves. For my purposes today, I'm going to inter-relate some statistics through successive years. By doing this, I think I can chart a trend—a trend that should alarm you as much as it has alarmed me.

First, let's look at the progress that's been made in recent years in securing annual school bus statistics from the various states in the U.S.A. In 1953, such data was furnished by 30 states; last year, 48 reported. That's an encouraging increase . . . but before we become sore from mutual back-slapping, allow me to insert a somber note.

Forty-eight states reported last year. That's a fact. But a number of them still do not separate their school bus accidents from the total reported for all bus accidents. In other words, any accident or fatality involving a passenger-carrying vehicle is recorded in some states. Thus, we safety people don't get all of the information we should to help us plan our attack against accidents. So (if you haven't already done it), I suggest that you acquaint yourself with your state's reporting format and—if it does not conform to procedures recommended by the National Safety Council—I urge you to launch a campaign to bring about adoption of the Safety Council's recommended reporting in your state.

Now, to more accurately measure the size of our school bus safety problems, let's use the reports from the individual states and see how much of an increase there's been in the number of school buses in operation. In 1953, 30 states had 80,000

school buses running. Last year, the number in 50 states was 176,471. I think you'll agree from this comparison that the size of our school bus operation is challenging enough for anyone.

Looking at another angle of our problems, how is the migration to suburbia proceeding? Well, in 1953 five million pupils were transported to and from schools daily. And by 1960—only eight years later—the number had skyrocketed to nearly 12½ million.

Turning to a third area to get the pulse of a rising tide of urgency, let's examine the accident involvement rate of school buses. The figure stood at 2,941 in 1953—and at 8,908 in 1960.

At this point, some of you may be thinking that these advances in numbers transported and accident involvements are not too bad when compared with the increase in school bus usage.

I ask you, though, to please withhold judgment until I make some additional analyses. Because again—this time in the area of school bus accident involvement—some states do not delineate between school buses and public carriers in their annual safety reports. And I don't mean to minimize the tragedy of commercial bus accidents when I indict those states which fail to attach sufficient importance to school bus mishaps to warrant separate accident-reporting data.

When we have accidents, of course, we can anticipate personal injuries. That's as sure as summer and winter, day and night, or flies at a picnic. Statistically, 701 students were hurt in school bus accidents in 1953, and the number had almost tripled by 1960, when 2,067 pupils were injured.

I admit that we might be inclined to look favorably upon these injury figures as they relate to previous data, but again I warn you that such a conclusion will be premature and possibly erroneous.

As long as we have an increasing number of school buses in operation, an increasing number of school children-riders, and an increasing number of injury-producing accidents, we must also expect more fatalities. In 1953, 13 boys and girls were killed while engaged in activities incidental to riding on school buses. In 1960, the number of dead was 50—or approximately four times what it was eight years previously.

My research indicates that previous speakers have given separate treatment to student fatalities which occur on buses and to those which take place while students are going to or from school buses. This separation of information has led to an idea that injuries and deaths occurring while pupils are boarding or dismounting somehow differ from those which take place while the loaded bus is actually moving and transporting its young charges.

I, personally, cannot agree—either with the arbitrary separation of reports of accidents on and accidents off our school buses or with the conclusion that such separation seems to support.

For reasons beyond the intended limits of my presentation, I submit that injuries and fatalities occurring both on and off school buses should be reported together as part of the buses' total operation. I strongly believe this—and I'm exercising the prerogatives of that belief in presenting this accident summary material to you today.

If we now draw the component parts of our problems into one picture, we see what I believe to be a significant, shocking truth. In the period between 1952 and 1961, inclusive, the number of states submitting school bus statistics (but still with some discrepancy), has increased 60 per cent; the number of pupils transported has increased 150 per cent; the number of buses operated has increased 119 per cent; the

number of school bus accidents has increased 203 per cent, and the number of pupils killed has increased 285 per cent.

Now, to those people who have lost confidence in their ability to influence actions in their parts of the world, I ask—what would this school bus safety problem have looked like if every school board could have prevented only one accident or only one injury? How would it look if every state had been able to prevent only one fatality? You know the answers to those questions. But you have to get the questions and the answers to others—and then take them and help us act to solve all of the problems.

Since my assignment is to review the reported school bus statistics for 1960, I can't conclude without going through some more figures. But since you have the same state-by-state data as I (and if you don't, you can get it from the National Safety Council), I'll spare you the agony of a more lengthy report.

Guided by the ancient adage that "die mind can absorb only what the seat can endure," I'm cutting short my part of the program with a tabulation of school bus facts by region. I hope these figures—when compared with the statistics of your state and your neighboring states—will be of interest and value.

In making my tabulation, I have divided the United States into 8 regions.

Region	Number of Buses	Number of Accidents	Number of Pupils Transported Daily	Number of Injuries	Number of Fatalities
NEW ENGLAND (Me., N.H., Vt., Mass., R.I., Conn.)	8,351	162	642,543	67	0
MIDDLE ATLANTIC (N.Y., Pa., N.J.)	22,659	1,049	1,871,182	276	7
EAST NORTH CENTRAL (Ohio, Ind., Mich., Ill., Wis.)	32,422	1,079	2,303,890	145	6
WEST NORTH CENTRAL (N.D., S.D., Neb., Kan., Minn., Ia., Mo.)	23,544	1,076	1,941,235	358	2
SOUTH ATLANTIC (Del., Md., W.Va., Va., N.C.)	30,768	2,635	2,452,917	592	14
EAST SOUTH CENTRAL (Ky., Tenn., Miss., Ark.)	18,096	740	1,350,254	160	16
WEST SOUTH CENTRAL (Okla., Tex., Ark., La.)	19,882	414	1,131,316	126	4
MOUNTAIN (Mont., Idaho, Wyo., Nev., Utah, Colo., Ariz., N.M.)	8,808	247	427,948	93	0
PACIFIC (Ore., Wash., Calif.)	12,650	1,186	1,178,190	148	1
CONTINENTAL U.S.	176,471	8,908	12,280,474	2,067	50

In closing, let me say that the picture I've tried to present here today is not a pretty one. I deliberately refrained from using "honey-coated" words or phrases in my presentation with the hope that my words would arouse you—and that you, in turn, would arouse your neighbors and the people of your communities—and that finally all of the citizens and officials of our nation would be awakened—before it is too late.

Active leadership is needed now! Progress is not automatic. The world grows better—not because people wish that it can—but because they know that it can and pitch in and take steps so it can be made better. And we've all got to push and shove and make it better if we're ever going to have the safest transportation possible for school children—"our most priceless cargo."

PUTTING THE RIGHT ANGLE INTO DRIVER SAFETY MEETINGS

By HOWARD R. CHEEK

Supvr. of Transportation, Board of Education of Harford County, Bel Air, Md.

Good safety meetings do not just happen. As a matter of fact, there are far too many school districts in the United States where safety meetings for bus drivers are nonexistent. There are far too many school districts which do not have an organized safety program of any kind in the area of pupil transportation. This is true, not because the administrators in these districts are not concerned about the safe transportation of their pupils, but because this problem gets lost in the multiplicity of problems which cross their desks daily. It is true because they are understaffed and overworked. It is a situation which will continue to exist until the problem is put in its proper perspective and corrective action is taken.

The prevention of accidents is primary among safety considerations and it is my hope that it will not take a series of tragic bus accidents across the nation to impress the people that proper supervision of the bus operation is a vital necessity.

This is exactly what happened in the state in which I live, Maryland. The schools in Maryland are organized on a county system. Since there are 23 counties and Baltimore City, which is a separate political subdivision, in the state, there are only 24 school systems. Up until two years ago, some of the county Boards of Education had appointed supervisors of transportation

and some had not. No state aid was made available to help toward the payment of the salary of such a person, and many counties felt that they could not afford such a "luxury."

This situation existed for a number of years, until one morning a train hit a school bus which had stalled on the tracks. Seven high school pupils were killed. Several committees investigated the circumstances surrounding this accident, one of which was appointed by the Governor.

As a result, the Attorney General ruled that expenditures for adequate supervision of school transportation was a legitimate expenditure of state funds. The state Department of Education recommended that each county Board of Education appoint a full-time supervisor of transportation, and one assistant supervisor for each 100 buses in use in the particular county. A full-time state supervisor of transportation was appointed.

A full summer session, yielding six semester hours of credit in the field of pupil transportation, was offered last summer by the University of Maryland. Mr. Wesley Pickle of Tennessee and Mr. Mike Haggerty of Minnesota were obtained as instructors for the two courses offered. I feel that a giant step forward has been taken to assure the safest possible transportation of the school children of Maryland. I deeply

regret, however, that this step was not taken five years ago, and that it had to be purchased with the lives of seven children.

A great deal of time must be spent by someone in planning, organizing, and conducting training programs and safety meetings for bus drivers in school districts from one end of our country to the other. It is just as necessary in Oregon as it is in Virginia. The lives of the pupils in small school districts are just as precious as the lives of pupils in large districts. The first step that must be taken in many school districts is the delegation of the responsibility for pupil transportation to a specific person. The person to whom the responsibility is assigned must have a realistic amount of time to devote to this area.

In my opinion, safety meetings cannot be considered except as a part of the overall safety program for bus drivers. The person whose responsibility this program is must clearly understand what his objectives are and what part the safety meeting plays in meeting these objectives.

Let us consider a total safety program for a few moments. What are our concerns? What do we hope to accomplish? How are we going to go about achieving our objectives?

We are concerned, of course, with the safe transportation of pupils to and from school. That is our objective. We are told by the people who investigate accidents and compile statistics that over 90 per cent of all accidents are the result of driver error. We are, therefore, concerned with the elimination of driving errors by our bus drivers.

I think it axiomatic that the person responsible for the transportation of pupils must select bus drivers with great care. You do not hire someone to drive a school bus whose driving record is loaded with traffic violations.

After the driver is hired, he must be impressed with his responsibility and the urgent need for safe driving at all times. After the first impression, he must be constantly reminded. He must be made "safety conscious." We must change the "it can't happen to me" attitude which all drivers have. The driver must realize that, unless proper precautions are constantly observed, it can happen to him. He must also realize

that whatever happens to him also happens to everyone that is on his bus and who is dependent upon his driving. In essence, we must develop and constantly re-enforce a desirable safety attitude.

The safety meeting is one means of developing and enforcing this attitude. It is not the only means. There are many other things which can be done which will help to achieve this objective.

A safety meeting, however, should not be planned and conducted to develop this desirable attitude. The attitude of which I speak will be developed as a result of the total safety program, which should have a cumulative effect upon the driver.

Safety meetings should be specific in nature, and should treat one topic in detail. It is essential that drivers understand the need for the presentation of the particular topic covered in the meeting. The driver must be properly motivated if he is going to derive any lasting benefit from the meeting.

For instance, suppose a review of your accident reports indicates that several accidents involving school buses have occurred at intersections. Here is a specific problem, which presently exists in your school district, which can effectively be made the topic of a good safety meeting. A presentation of the problem, indicating that 15 per cent, or 20 per cent, or whatever the percentage actually is, of the accidents involving school buses so far this year have occurred at intersections should convince drivers that intersections are dangerous places.

Once the driver has accepted the fact that a dangerous situation does actually exist, he is ready to pay close attention to learning some techniques which will help him to stay out of trouble at intersections. Do not attempt to cover "tail gating" or adjusting to changing weather conditions at the same meeting. These are appropriate subjects for safety meetings on their own. Stick to the one topic which has been selected for presentation and do a good job on that topic.

A poor presentation on the selected topic, or the presentation of a topic which bus drivers do not consider important, can be detrimental to your entire safety program. Bus drivers who attend safety meetings

are attending at a time when they would ordinarily be doing something else. Housewives would be home taking care of their domestic obligations. Service station attendants would be working at their primary job. If they regard safety meetings as important, informative, and helpful they will willingly attend. If they do not, they will not. A poorly organized and conducted safety meeting can be worse than no safety meeting at all.

In organizing safety meetings, careful consideration should be given to the physical arrangements. The time and the place of the meeting should be carefully selected, as these factors will, in part, determine how many of your drivers will be able to attend. Some school districts obtain excellent results by having safety meetings in the evening. I find that, in my own situation, it is best to schedule safety meetings immediately after the morning bus runs, and to schedule them at schools where the majority of the drivers finish their morning runs.

This means that a good number of the drivers scheduled to attend this particular meeting are automatically at the meeting place at the appointed time. It requires less effort for them to stay and attend than it would if they had to make a special trip from their homes at some other time. There is also the advantage of having the educational facilities of the school, such as film projectors, motion picture machines, tape recorders, etc., immediately available for use in the meeting. The environment is an educational one and will have some impact upon the drivers.

Careful consideration should be given to which drivers and how many of them attend any given meeting. The meeting will be much more effective if drivers freely participate in an expression of views and/or an exchange of ideas. This will not occur if the number of drivers at the meeting is too large, or if the drivers do not know each other.

In systems which require a large number of drivers, it will be necessary to hold the same meeting a number of times. These meetings should be held in different geographical areas of the system, and should be planned to include not more than about 30 drivers. From the discussions which oc-

cur during the meeting, the conductor of the meeting can often spot misconceptions which drivers have. This will sometimes indicate the need for a meeting devoted specifically to correcting an expressed misconception!

One of the major problems which must be faced in the establishment of a series of safety meetings is that of driver attendance. Bus drivers are just like any other kind of driver, in that they consider themselves considerably better than the average. Many of them have been driving school buses for some period of time, and will not have been involved in an accident of any kind. They consider themselves to be safe drivers, and there is a certain amount of resentment generated when they are asked to attend a safety meeting. The "what can they teach me about driving" attitude must be faced and overcome if safety meetings are going to play an important part in the total safety program.

How do we attack the problem of driver attendance? One way is to make it compulsory. I am sure that this is not the best way. The old adage that "you can drive a horse to water but you can't make him drink" applies to this situation. I think that compulsory in-service training may have some benefits, but I think they are very limited.

Drivers must see that the safety meetings are going to be of some benefit to them if they are to attend willingly. Your job is to make them want to come.

One method of applying gentle pressure in this direction is establishing attendance at safety meetings as one of the requirements for obtaining safe driver awards. This means that drivers who attend safety meetings are recognized on a higher level than those who do not. Drivers like to receive safe driving pins in recognition of the good job they have done. This technique will help to get them to the meetings originally. Whether they return or not depends upon their impression of the actual meetings. If they are helpful, interesting, and informative, they will come back.

The supervisor of transportation in one of the counties of Maryland recently informed me that he had solved the problem of driver attendance. I was rather skeptical, until he explained his problem

and solution. He had been interested in having all bus drivers trained in rudimentary first aid. He was able to obtain a qualified instructor from the regular teaching staff of the county. She was 22 years old, red headed, and had very complimentary measurements. The meetings were held in the evening, and he reported that, not only did the drivers show up, but he sometimes had considerable difficulty getting them to leave. I think his first step in organizing a safety meeting now is to train the red head so that she can be the instructor.

In planning safety meetings, please do not overlook the wealth of expert assistance which is immediately available to you. Be sure, however, that the person that you ask to help you is really qualified in the area in which you need help.

I have never been refused help from people who are knowledgeable in areas which I wish to cover in safety meetings. People throughout the country are concerned with safety on school buses, and will contribute whatever they can toward furthering it if they are asked to do so.

Insurance companies have field safety engineers who are experts in the field. They are more than willing to help, not only from a humanitarian viewpoint, but also because reduced accidents means better business for their employers.

State police are available everywhere and are anxious to help. The American Red Cross welcomes the opportunity to work with drivers in the area of first aid. Safety engineers employed by the government and by private industry have much to offer and are willing to help.

These human resources exist in nearly all communities throughout the country. Not to make use of their talents is a great waste.

Care should be exercised by the person who is responsible for safe transportation, however, that personal contact with bus drivers is not lost. Even when the problem to which the meeting is devoted is being discussed and treated by an appropriate resource person, the supervisor of transportation, if that be his title, should be in attendance at the meeting to introduce the resource person. He should remain throughout the meeting and help to get the discussion and exchange of ideas started.

He should be available after the meeting to talk with the one or two drivers who always have some question which they wish to direct to the supervisor. His presence indicates that the entire school system endorses and approves of the meeting and the concept of an organized safety program. Just as it is hard to visualize an effective faculty meeting without the principal, or an effective board meeting without the president of the board, it is hard to visualize an effective safety meeting without the person responsible for safe transportation in attendance.

There are two cautions to be observed in conducting safety meetings. The person conducting the meeting must realize that he is presenting the topic to a very heterogeneous group. In the group he will have housewives, farmers, retired army officers, service station attendants, and men who work the night shift at a local industrial firm. He will be confronted with educational levels ranging from completion of the third or fourth grade through graduation from college. The members of the group will have vastly different backgrounds. All of these factors must be recognized, and the material must be presented in such a way that it is understandable to everyone. It is always good to use visual aids as much as possible. Such aids might include motion pictures, film strips, overhead projector, and the use of flannel boards or magnetic boards. The last two are particularly valuable for setting up actual and hypothetical traffic situations. Remember that you are after understanding. More understanding will result if the presentation is on a level which is easily understandable by those making up the group. It is not necessary to impress them with our scholarship.

The second caution to be observed concerns the length of the meeting. When the objective of the meeting has been accomplished, stop! Just because the meeting is scheduled to last one hour is not sufficient reason to drag it out. When the appropriate understandings have been developed, everything else is superfluous. Interest will wane quickly, and drivers, when they are finally dismissed, will leave with a bad taste in their mouths. There is nothing sacred about one hour. A good 40-minute meeting is more to be desired than a half dozen poor one-hour ones. As I have stated before, drivers

will not willingly return to be subjected to poorly planned and conducted meetings.

In brief summary, the following must receive careful consideration in organizing and conducting effective safety meetings:

1. Some one person must be delegated the responsibility for school bus safety. This person must have sufficient time to devote to doing this job.
2. Time and place should be selected carefully so that it is easy for drivers to attend.
3. Number of drivers attending each meeting should be controlled so that meetings are not too large.
4. The safety meeting must be specific in nature. The objectives must be clearly defined.
5. The drivers who attend the meeting must be convinced that the topic of the meeting is an important one—one in which they are interested.
6. The presentation must be informative,

interesting, and geared to a level that is readily understood by the members of the group. Human resources in the community should be utilized.

7. Visual and auditory aids should be employed wherever possible.

8. The meeting should be adjourned when the objectives of the meeting have been accomplished.

9. Drivers who regularly attend safety meetings should be rewarded on a higher level than those who do not.

I would again urge that school districts across the nation take the necessary steps to improve the safe operation of their transportation system. I do not mean to imply that travel by school bus is presently extremely hazardous. It is far from it. I do think, however, that increased safety and increased economy can be realized if qualified, trained personnel are appointed to administer this phase of the school program. Do not wait until the horse has been stolen. The time to act is now.

ENCOMPASSING CONTRACT BUS OPERATORS IN THE TRAINING PROGRAM

By BENJAMIN W. NELSON

Supvr. of Transportation, Board of Education of Worcester County, Snow Hill, Md.

In the technological age in which we are living much attention has been focused upon the school system and imploring eyes are watching all of the supporting services which are linked to the total program.

Since transportation is one of the supporting services and we are involved in this endeavor, it is essential that the major purpose of pupil transportation services be defined:

1. To provide educational opportunities for all children regardless of the distance they may live from an appropriate school center of the proper grade level.

2. To provide educational experiences for children above that which might be obtained in a classroom situation.

With the listing of purpose, one needs to add the objectives that have been proven

necessary in the development of any satisfactory program of pupil transportation service. They are as follows:

1. Safety

The first objective is to provide maximum safety for all pupils to be transported and in so doing, the following items should be observed by the Board of Education:

- a. Provide adequate and safe bus equipment.
- b. Select drivers who are capable of operating large vehicles.
- c. Make a thorough study of transportation routes in order to eliminate unnecessary hazards in operation.
- d. Provide for the adequate supervision of drivers and the maintenance of equipment.

2. Economy

The second objective is to provide transportation services at a low cost. In order to maintain a program of pupil transportation within the available funds, it is necessary for a school system to make constant studies and revisions in order to achieve the best service from the funds available for this purpose.

3. Adequacy

The third objective in the operation of a pupil transportation program is based on adequacy of service. In an effort to provide adequate services for all eligible children within a school system, board of education should consider the following items:

- a. A sufficient number of buses to provide transportation services on a system-wide basis for all children within a reasonable time limit.
- b. Provide express type transportation services for children living in remote areas. This arrangement for services should be made to eliminate the necessity of children being required to remain on a school bus beyond the limit of one and one-half hours.

4. Efficiency

A fourth objective requires efficiency in operation. Since the efficient operation of a transportation program depends upon the placement of responsibility, it is necessary that the following factors be given careful attention prior to and during the school term by all responsible persons connected with the program:

- a. Observance of time schedules on a pre-planned basis in order to eliminate inconveniences to those students meeting or waiting for school buses.
- b. Selection of appropriate bus stops so as to minimize the danger of accidents on heavily traveled highways.
- c. Provide a sufficient number of buses to prevent overcrowding and lengthy routes.
- d. Employ capable drivers within the communities to be served.
- e. Maintain adequate maintenance facilities to insure minimum expense and maximum safety in operation.

In order to insure that the philosophy and goals of a transportation program may be realized, it is essential that clearly defined policies be passed by the Board of Education.

It is felt by many that the following should be covered:

1. The general philosophy of the transportation program should be stated.

2. A detailed spelling out of operating procedures is required.

3. Consideration must be given to the type and capacity of the buses to be used.

4. There should be plans for routing and scheduling buses.

5. A specific declaration relating to pupil privileges and responsibilities is necessary.

6. Duties of various personnel must be defined.

7. A realistic system is needed for replacing buses in service.

8. A program of maintenance and repair is needed to keep buses in satisfactory operating condition.

9. Outline procedures for the transportation of pupils for field trips and extra curricular functions are required.

10. Proper training of contract drivers is necessary.

Recognizing the importance of the driver in the total transportation program and the objectives previously stated, our Board of Education put into effect a Pre-Service Driver Training Program.

At the present time the Board of Education will not employ any individual to operate a school bus unless he has successfully completed the program consisting of fifty hours of work.

The course consists of actual classroom work, with tests, plus supervised driver training and then the final check out, by the State Police in a bus over a pre-determined route, taking into account the skills learned in the training program.

Enclosed is an outline of the material covered in the course.

Pre-Service Course for Bus Drivers, 1960-61

I. Content of course

A. Transportation

1. Importance of training program
2. Importance of transportation in school system

B. Responsibilities and regulations of school bus operation

1. State and county responsibilities for transportation

2. Contractor
3. Driver
4. School bus law
5. School Board regulations
- C. The school bus
 1. Bus care and maintenance
 - a. Driver's daily checks
 - b. Emergency equipment
 2. Bus housekeeping
 - D. School bus operation—policies and procedures
 1. Schedule
 2. Loading and unloading
 3. Railroad crossings
 4. Stops and blinkers
 5. Pupil discipline
 - a. Types of bus problems
 - b. The Principal and bus discipline
 - c. Discipline on the bus
 - d. School bus rules
 - e. The Supervisor and bus discipline
 6. Bus drills
 - a. Front door
 - b. Back door
 - c. Two door
 - E. Public relations
 1. What and why
 2. Who and how
 - F. Fire prevention
 1. Causes of vehicle fire
 2. Use of extinguisher
 - G. Driving skills
 1. Individual alertness test
 - a. Person rides in another bus and observes correct and incorrect skills displayed.
 - b. Behind wheel test for each person over a prescribed route checking skills of performance
 2. Written tests
 - A. Traffic and driving knowledge
 - B. Psycho-physical tests
 - C. Essay test on materials covered
- H. Accidents and how to prevent them
 - a. Types of accidents
 - b. What to do in case an accident happens
- I. First aid
 - a. The first aid kit
 - b. What first aid should a driver use in his situation

A HEXAGONAL PROBLEM — SCHOOL BUS SELECTION

By M. R. LIECHTY

Engineering Consultant, International Harvester Co., Chicago

The selection of school bus vehicles is truly a six-sided problem. And even more than a hexagon, we might call it a revolving hexagon. As the six sides of this hexagon, we have selected (1) vehicle life and dependability, (2) vehicle repairs and replacement, (3) maintenance and operating expense, (4) spare units, (5) purchase price, and (6) vehicle application. And when we say that it is a revolving hexagon, you will notice that as your application of vehicles to the intended service is improved, your operating expense will be reduced. You will find that as the dependability of your vehicles rises you will re-

quire fewer spare units. You will find that as you spend more money on the original purchase price for better equipment, you will usually spend less money on repairs and breakdowns. Let's look at each of these items a little bit closer.

1. Safety

As a representative of the School Bus Chassis Committee of the Automobile Manufacturers Association, I can tell you with confidence that the chassis industry feels that we have come a long way up the safety curve, insofar as new vehicles are concerned. There are always things which

can be done. We constantly strive in the direction of added safety and some of the suggestions which we can make at the present time are these:

(a) *Power.* For many years school buses were built with barely enough power to drag the vehicle from its loading source to the school and back home. While other vehicles have been increasing in the power and performance areas, school buses have long been inadequately powered to keep in step with traffic. The new power formula, which was adopted by the national minimum standards for school buses in Lawrence, Kansas, in 1959, is now coming into full play.

It is a good formula for a minimum power standard. Vehicles which meet these standards will have better acceleration than older buses and, in turn, will tend to help keep traffic moving, especially in congested areas and on high-speed highways. This power standard is a good minimum, but it does not preclude the chance that there are applications which need even more power for proper ability to accelerate and maneuver in traffic.

(b) *The driver's position.* We in the chassis industry feel that the driver's position, visibility, and driving attitude, has a tremendous impact on the safety of the school bus operation. We are not satisfied with the driver's physical position in the present day conventional school bus. Too often, while the driver can see well enough to operate the bus satisfactorily, he does not have the superb vision which he should have if we are to achieve maximum safety.

We, the chassis people, and our school bus technical committee are actively exchanging ideas with the engineers of the body manufacturers through their association, in order to improve on and eliminate this particular problem. We have already offered and are actively engaged in selling transit type units with the driver mounted in the front part of the bus where he has an excellent view, not only of the road ahead, but also of the pupils who are entering the bus itself.

(c) *Brakes.* It would be improper to talk about vehicle safety and not mention brakes, but it is our opinion that the single largest improvement in brakes is in the area of maintenance rather than with new equip-

ment. There are new things being offered, such as the parking brake, which is spring applied and air released and actuates the rear truck brakes when the air is lost on an air brake equipped vehicle, but the majority of school buses are still using hydraulic brakes.

There is a new split-system on hydraulic brakes which will be offered in the near future by various manufacturers to enable the operator to bring the vehicle to a stop on those occasions where a failure with the present system might cause a complete loss of braking. But the best safety factor in any brake system is still good maintenance—preventative maintenance, prior to failure.

(d) *Weight distribution.* When you select a new bus you should consider weight distribution, which is an important factor in achieving good vehicle balance and stability, but normally we in the industry do this for you by offering only those wheelbases on only those passenger sizes which result in satisfactory distribution.

(e) *Seating capacity.* We are sure you will agree, that in making new vehicle purchases, it is necessary to plan a seat for each youngster and at least 10 per cent more if it is economically possible. Natural population growth often forces some routes to pick up more pupils than can be properly seated, but in making any plans for new vehicle selection you will most certainly want to provide enough seats to accommodate all of the pupils and a few extras.

And, one more thing on accidents—we have attempted, for years and years, to avoid school bus accidents by stopping all traffic. In reality, traffic in this day and age on high-speed highways is safest while it is moving uninterrupted. It is our belief that the eventual long range goal in school bus safety must include a program where the school bus does not interrupt high-speed traffic. This may necessitate pull-off areas on congested routes and other new ways of loading and unloading which will allow traffic to move uninterrupted in both ways.

We think it is imperative that plans be started now to keep the school children completely off high-speed multi-lane highways. The very act of stopping traffic, in many instances, directly contributes to the accident. Today's school bus is much like

the Sunday driver—not a menace of himself, but breeding congestion, ill will, and discontent, all of which are safety menaces.

Now, what are the six sides of this problem?

Vehicle Life and Dependability

Certainly if you have any pride in your transportation organization you must have an excellent degree of dependability. Your buses must maintain accurate time schedules to allow a high degree of conformity on the route and thereby enable Mammy to have Johnny on the corner without making it necessary to wait for long periods of time in adverse weather. It is wonderful, for our purpose, that when we select a unit adequate to do the job in a dependable manner, that we normally also get longer life as an added bonus. There is no better bargain in school transportation than an extra year of dependable service built into a school bus.

Spare Units

Across our rotating hexagon, as life and dependability of the selected vehicles go up, the number of spare units you need to maintain rigid schedules will go down. This is a natural reaction.

Application

But dependability is also very closely related to the application of the vehicle in the intended service. Buses have been getting bigger and bigger for good reason. The population of the various areas has been increasing so as to enable the average school bus route to fill a larger bus in the same time. It is rarely practical to buy a school bus which cannot be loaded in one hour. Consequently, we expect that for many years stabilized communities will cause a sizable demand for 48 and 54 passenger units, but the areas where the population is increasing most rapidly are areas of dense population. In these fast growing densely populated areas, it is natural that we should lean more toward the 60 and 66 passenger units.

Using today's methods, the 66 passenger unit is the longest bus which we can build in a conventional type unit and still stay within the overall length limit of 35 feet. Since this bus will be operated in congested areas, and since it requires 256 inches of

wheelbase to properly distribute the load, it is too cumbersome to maneuver properly in congested areas. Further, in congested areas we can fill a bus of even larger size in a short time and this is where we recommend the transit type unit which can accommodate another row of seats. The transit type unit with the engine in the front, and capable of hauling 72 seated pupils, has only a 208-inch wheelbase of the conventional 66 passenger unit. This shorter wheelbase results in much better maneuverability and the driver is "up front" where he can see.

With the engine mounted in the front, the transit type bus needs a beefed-up front axle and front suspension system to carry the extra load, which is suspended ahead of the front axle. The aisle entrance way is less than ideal because of the engine cover which uses up a large portion of the floor area in the front of the chassis. The forward control unit does retain an innate identity with normal truck parts. The engine, transmission, radiator, and shift controls are all in positions similar to normal truck operation, allowing a high degree of standardization with other parts and a reasonable purchase price.

To gain the ultimate in application for congested areas, we suggest the pusher bus with the engine mounted in the rear; this bus includes the advantages of short wheelbase, ideal driver location, flat front floor with unlimited aisle room, and ideal load distribution with the 1/3-2/3 front to back load distribution ratio, which allows each tire to carry its proportionate part of the load.

The price goes up a bit because it is designed as a bus instead of a truck, but the application is ideal. In visiting with school bus people over the years, we have often been faced with the question of compromises between a truck chassis and a bus chassis and have been asked to build a vehicle specifically for bus service. The pusher bus unit is such a unit and is designed from the ground up to haul young people.

Other applications, which we must recognize in order to complete the job of getting the pupils to school, are cases which transport the physically handicapped, requiring special driver attention, and many areas are hauling small loads over long distances.

In still other applications, it is ideal to use small vehicles for feeder buses to congregate more pupils in pick-up areas where the larger units can pick them up fast and then make multiple trips to the school. For such an application, a small vehicle, such as the *Treefall*, is gaining popularity and serves a very important purpose. Directly across our hexagon is maintenance and operating expense.

Maintenance and Operating Expense

When it is possible through good application to use five large units instead of six smaller units, then you can save one driver, the housing and greasing expense, and the driver's supervision that goes along with each separate unit. If the six units should be 60 passenger units and the five units should be 72 passenger units, it would result in exactly the same seating area. It is easy to see that when our application is improved, maintenance and operating expenses will go down. But when we talk about the proper application reducing maintenance expense, let us not talk about shoddy maintenance. We sincerely believe in preventative maintenance in school buses, to tear down and inspect, repair and replace all parts before they have a chance to fail in operation.

Other things enter heavily into the particular application and should be considered when making the school bus selection. Such things as cold climate where additional heater capacity is needed. And even time zones such as an area which uses daylight saving time, might use headlights, clearance lights and other lamps sufficiently to warrant buying larger generators. So the selection of the proper equipment to fit the particular application is directly related to the maintenance and operating expense. And what else must be remembered? Repairs and vehicle replacement.

Repairs and Vehicle Replacement

Maintenance and operating expenses are very closely related to repair expenses. For instance, in making recommendations for the national minimum standards, it was the consensus of that group, that a 12-volt 35-amp low-speed cut-in generator was a satisfactory minimum to be used on school buses nationally. The statement has often been made and we repeat it here, that so

often the minimum becomes the maximum. People who select school bus chassis are too often inclined to select components without sufficient analysis, especially on technical capacity of items such as generators.

This can result in a vehicle with inadequate electrical capacity to replace the current drawn from the battery. When this happens, it can only mean trouble. A battery is exactly like a checking account—you cannot draw out more than you put into it. In order to avoid dead batteries, many states are now setting a minimum of 12-volt 30-amp low-speed cut-in generators, and even this size is not adequate for all applications. Always compare your generator capacity with the expected current draw.

The wide-spread use of heavier axles, bigger brakes, larger and more powerful engines, in the same application, will reduce the expense of costly repairs and substantially lengthen the vehicle life.

Purchase Price

And to get back to our hexagon—it is not surprising to see that when you take the definite steps to buy adequate components, reduce repairs, and lengthen vehicle life, then the purchase price goes up. Now the purchase price is very important in the vehicle selection and often is the one outstanding factor which is used in determining what the final selection of vehicle should be. We all know that the purchase price is important, but I contend that the price does not warrant the attention which it receives in making a school bus selection because the best is often cheapest in the long run. But price has been over-emphasized to an extent where our hexagon is out of balance. Prices go too low, repairs go up too high and vehicles are replaced more frequently than necessary.

The transportation industry has concentrated its last ten years in large part to the problems centering on economy of operation—cost per mile of units hauled. In coping with this problem, many facets are involved but I would like to make it appear simple by comparing two typical truck users.

The individual, who owns and drives his own vehicle, often faces his biggest obstacle in purchasing new equipment. He must keep the price low because of the money required to finance the deal and

makes his payments out of proceeds earned by the vehicle. Price is important to him, so he buys a highly stressed vehicle and squeezes out every drop of revenue it can produce. It puts him in business but he is not getting a low cost per mile.

The larger operator or company which has better access to capital funds needed to finance the purchase of ideal equipment, is buying more expensive, low stressed equipment. These operators are rewarded with more dependability, longer life per vehicle, less repair expense, and lower cost per mile of units hauled.

Most school buses have long been in the category of high stressed equipment with short vehicle life because of the emphasis on purchase price. I am happy to see bus users taking a good look at the over-all expense of operation and, therefore, leaning farther over to the side of low-stressed long life equipment as an ideal long range way of reducing the cost per mile per pupil hauled.

So there you have it—a six-sided problem of selecting a school bus, but all revolving around safety and written bid specifications; we must never compromise on safety, and we will always have written bid specifications because most buses are owned by public schools—in fact, our last accurate figures indicated that 64 per cent of all school buses are owned by public schools, 10 per cent by private schools, with the remaining 25 per cent by contract haulers.

I am sure that the 25 per cent of the buses which are owned by contract haulers are selected with all the factors which we have discussed here, carefully considered in the vehicle selection. I am confident that the 10 per cent owned by the private schools are carefully selected, based on all six-sides of the hexagon, but very often the 64 per cent which are selected by the public schools, are selected with the purchase price as the prime factor. When the purchase price is the prime factor in school bus selection, an age-old proverb comes into play; namely, that nothing is so bad but that someone else can make it a little worse and sell it a little cheaper.

I am sure that the transportation officials who buy all of their buses on written bid specifications and low bid realize this and

consequently spend almost 100 per cent of their time, which should be devoted to the vehicle selection, to writing bid specifications. It is, consequently, important that we give it some consideration when we talk about selecting a school bus.

On the one side of the ledger we have the people who actually make their vehicle selection based on good and bad experience, and then write their bid specifications so that the vehicle which they have selected will comply and other vehicles will not comply. This gets the job done in a sense, but we could not, in all fairness, contend that this is free and open competition.

Other people tend to set their own arbitrary standards of brake lining area, engine cubic inches and other physical dimensions, which enable the user to select vehicles with components which have previously been found necessary to satisfy his requirements. This also gets the job done in a sense, but this method has some bad side effects which we in the industry do not like. We know that a larger brake will last longer in a school bus operation, but if you buy brakes on their size alone then you destroy the initiative of the engineer who is constantly striving to build a longer life brake in the same size.

We know that an engine with a larger cubic displacement will last longer, but when you start buying engines on size alone, then you destroy the initiative of the industry to build more efficient engines and to build more engine life into engines which are of adequate size and power to do the job. When you specify clutches by diameter because you desire longer clutch life, then you give no credit to the countless number of people who are working on better linings in the same diameter and tremendous strides are being made in this area.

But, generally, when you buy school bus vehicles on price alone, then you are assuming that all of the vehicles offered are exactly equal and you destroy the incentive of individual companies to build more quality and longer life into their specific bus. You must recognize the differences if quality is to be an incentive to the manufacturer.

So it is the recommendation of the chassis industry that written specifications be based

on performance standards rather than physical dimensions. Tell us what you want this vehicle to do and how you want it to react so that we can take the resources which we possess, our efficient staffs of engineers and testing personnel, to build you the vehicle to do the job which you want it to do. Tell us what you expect by way of vehicle performance and vehicle life. Tell us what problems you are encountering which need to be solved and let us help you with them.

When you write bid specifications, take the time to investigate your specific needs

and write specifications which will result in the quality of merchandise that is required in your application. And when you make your selection from those offered, pick the units that are most economical in the long run, buses that will add to the dependability of your time tables and add to your vehicle life, that will reduce repairs, cut down your operating expenses and eliminate accidents.

Let the local chassis people help you with written bid specifications so that this six-sided figure will become balanced and revolve the way it should—around safety.

THE APEX IN SCHOOL BUS MAINTENANCE

By JOHN M. PARSONS

Supervisor of Transportation, Ohio Dept. of Education, Columbus, Ohio

Pupil transportation in the U. S. today is a big business. It is big in size, big in cost, and a big operation to administer. In many schools across the Nation, pupil transportation is the big problem of school boards and school administrators, and—this problem is still growing.

A few short years ago pupil transportation was a small auxiliary service to be tacked onto the school budget and to be administered easily by spending a few hours with several bus drivers. Today the cost of pupil transportation is a major item in the school budget, and administrators spend many hours struggling with the problems that accompany this growth.

Pupil transportation is no longer an auxiliary service, but a necessary and important part of the total education program. Transportation is essential for the operation of most school systems today. The school bus has also become an extension of the classroom in many school systems. The use of school buses for educational trips such as field trips, county and state testing programs, county vocational schools, etc., is increasing.

School transportation is being used not only to transport pupils to and from school, but to extend the educational horizon, to help attain the American ideal that every

child, regardless of where he lives, or his physical handicaps, has the right to an adequate educational opportunity.

School transportation can be expensive, and it is becoming more so in an increasing amount annually. Many factors are helping to increase the cost of pupil transportation today. School district reorganization and consolidation have expanded this service to a vast number of students who now attend schools in areas far from their homes. The migration of large masses of city people to the suburbs has increased the number of students to be transported.

Mechanization of the farm has reduced farm population resulting in more sparsely populated farm areas. This, in turn, has caused an increase in the size of rural school attendance areas. The steady increase in our population, coupled with the fact that students attend school more years than in the past has added to the burden of pupil transportation.

School districts in the past have been typically small in area and population, because school districts were small the need for pupil transportation did not create any urgent fiscal consideration by school boards.

School boards were able to operate their pupil transportation program with a small fleet involving very little capital or opera-

total outlay. These small fleets were usually maintained by local garages and since most schools had small fleets their yearly maintenance cost would be very minor in comparison to other component parts of the school budget.

For instance one district in Ohio ten years ago had a fleet of two school buses. The total operational expenses for the two buses for an average year was \$2,400. Today this district by consolidation inherited 30 additional school buses. The average operational cost ten years ago per bus was \$1,200. Considering the present average operational cost in Ohio for each individual bus at \$2,100 the total operational cost for this district with 22 buses would be \$46,200, not a small item anymore for school boards to consider.

Also, to be considered by school boards is the capital outlay needed to transport all eligible students. Replacing 22 buses at one time would cost a school board approximately \$132,000. Therefore, it is of the utmost importance, due to increasing operational cost and capital outlay, for a district to establish a safe, efficient and economical maintenance program that will insure maximum longevity for their school bus fleet.

I. Developing a Summer Maintenance Program

It is of the utmost importance for school districts to establish a maintenance program, not only for economy and efficiency but also for the safety of our students transported. A maintenance staff dedicated and responsible for a safe operation is the apex of a safe, economical, and efficient maintenance program. We in Ohio feel that during the summer months is the critical period and at this time a maintenance foundation for school buses needs to be established.

In other words, this is the time when mechanics can do a superb preventative maintenance analysis and have the necessary time to make proper repairs. If this foundation is not built strong enough during the summer months, then a maintenance problem is created for the coming school year.

In Ohio our summer issue of the *Pupil Transportation News Letter* is devoted entirely to maintenance. The following are some of the helpful hints and preventative maintenance tips we call "trouble shooting"

that are used to guide mechanics in their preventative maintenance program.

Low Oil Pressure can indicate clogged oil pump, worn main bearings, worn rings or loose lines—small leaks are not too difficult to spot, and it has been estimated that an oil leak of one drop every 30 ft. will account for a gallon of oil in about 400 miles of driving.

Valves which do not seat properly, or do not have clearances adjusted properly can often be detected by sound, and of course, can always be detected by the compression test.

Cylinder Head and Block: A defective head gasket or a warped head or block will result in loss of compression. Cracks in the head or block may be indicated by water on the spark plugs or in the oil pan, and may result in loss of compression, water in the fuel mixture or improper lubrication.

Engine Mountings: Visual inspection can be made to see if they are very loose. If the mountings are not kept tight, damage can be done to the clutch and/or drive line parts.

Clutch: In those buses equipped with a conventional transmission, power is transmitted through a clutch. Improper adjustment, i.e., no pedal free travel, will cause a slipping clutch which, of course, can be quite expensive. Improper driving habits, such as driving with the foot on the clutch, can lead to the same result. A dragging clutch is most likely caused by too much pedal free travel and natural wear must be compensated for by adjustment of pedal linkage.

Transmission Noise: Noise which seems to come from the transmission, may be caused by another assembly such as the axle, propeller shaft, universal joint, or clutch. Transmission noise may also result from the use of improper or insufficient lubrication, or from poor driving practices. Of course, if the gears are worn or broken, or the bearings on the shafts are bad, replacement is required. This is expensive.

Propeller Shafts and Universal Joints: Excessive noise or vibration can be caused by lack of lubrication; also if propeller shafts are not assembled with universal joints in the same plane, vibration will result. Worn universal joint bearings or journals or a sprung propeller shaft will cause vibration and noise.

Axles: An unusual noise is usually the first indication of improper functioning of axle driving parts. Noises which seem to come from the axles may be caused by the transmission or tires. If there is a continuous axle noise, drive the vehicle on soft ground. If the noise ceases, it has been caused by the tires and not the axle. If the noise continues on soft ground, it is caused by worn or improperly adjusted wheel bearings, worn or improperly adjusted differential gears and bearings, or insufficient lubrication in the differential. If the axle noise is heard in drive only, or in coast only, this is an indication that the differential pinion and ring gear are out of adjustment or excessively worn.

Wheels, Hubs and Tires: 1. Excessive or unequal tire wear—unequal tire pressure may be responsible. Inflate all tires to the recommended correct pressure. 2. Front wheel misalignment will cause unequal tire wear. Check and correct. 3. Bent wheels or damaged wheel bearings will cause uneven tire wear. Replace if necessary. Hard steering may be caused by under-inflated tires, steering gear in need of adjustment, or lubricant, front wheels out of alignment or wheel bearings in need of adjustment.

Steering System: Proper operation of the steering system is closely related to other units in the vehicle. Steering difficulties may involve such factors as front axle alignment, front spring suspension, tire inflation, wheel and tire mounting, wheel bearing adjustments, frame alignment and brake adjustment.

Springs: Break of spring leaves is usually the result of overloading the vehicle or driving at excessive speeds over rough routes. The bus carries a plate giving the manufacturer's recommended gross vehicle weight. This recommendation should be followed, or if this is not possible, allowances should be made when driving the vehicle. Loose or missing rebound clips, or loose U-bolts can also cause spring failure. Frozen shackles, due to lack of lubrication, will also cause spring failure, and also cause springs to break.

Shock Absorbers: Where furnished, are an important part of the suspension system with the springs. They should be checked and filled or replaced when they do not serve their function of damping out rebound.

Brakes: Today's modern buses subject their brakes to terrific stresses. Therefore, it is imperative that brakes be kept in adjustment. If linings are allowed to wear too long, or if shoe contact is not true on the face of the brake drums, wear will be far more rapid and brake drums can become egg-shaped or out-of-round. To correct this wearing is far more expensive than the routine inspection. Tightening of connections, slack adjusters and the like and relining—should be part of your standard preventative maintenance program.

Body Maintenance: During the summer all school bus bodies should be checked for rust spots, deteriorating flooring and seats, emergency door operation, replacement of glass, body attachment to chassis frame, first aid kit, all warning devices and lights, fire extinguishers, flares, pots, etc.

Summer months are an ideal time for mechanics to touch up all rust spots or repaint portions of body. Older buses should be repainted. This will add longer life for the body, and will eliminate need to replace a school bus because of body deterioration.

A preventative maintenance summer inspection check sheet should be available for the mechanics and all buses should be checked thoroughly during the summer. We mail a check sheet to all schools early in the spring as a reminder to the maintenance staff that a preventative maintenance program should be a complete and thorough analysis and repair of the school bus chassis and body.

II. Developing a Preventative Maintenance Program

Preventative maintenance is the necessary apex for a successful and economical school bus operation. An efficient and effective preventative maintenance program is the key for dependability; in fact, it is essential that school bus fleets maintain a dependable service. School administrators depend upon the pupil transportation staff for an operation that will deliver the students to school daily and on schedule.

Commercial bus fleets are adequately maintained, not only because road failures must be kept to an irreducible minimum, but because preventative maintenance is the cheapest way to maintain a bus fleet. Railways and airlines practice rigid preventative

maintenance to avoid mechanical failures during scheduled operation and to reduce total operating expenses. School buses must also be maintained properly if reliable and low operation costs are to be achieved. Safety of bus equipment is almost wholly dependent on preventative maintenance because even the finest bus becomes unsafe if proper inspections and preventative services are not provided.

Preventative maintenance differs from regular repair or replacement maintenance. In comparison, a preventative maintenance analysis or inspection is similar to an annual physical examination. Doctors evaluate and analyze the working parts of the human body to ascertain the need for a preventative medicinal program before the body has a serious major breakdown. This preventative program for human beings tends to extend the length of our life expectancy.

It is imperative to have a staff trained in proper methods and procedures for diagnosing trouble. Just as a doctor is trained for diagnosing human sickness so should the maintenance staff be trained in diagnosing mechanical sickness. A superb preventative maintenance program will extend the longevity, prevent major breakdown, and provide a safe, efficient and economical school bus fleet.

Developing and administering a good program of preventative maintenance for school buses is a cooperative undertaking that begins with the top level policy-forming officials and runs throughout the entire organization. Failure to place maintenance on a policy-forming level is a mistake that often results in inadequate care for school buses. A good maintenance program must be planned and executed at the level of organization responsible for the transportation system.

III. Developing a Dedicated Maintenance Staff.

Developing a basic fundamental attitude and dedication toward preventative maintenance is one of the most difficult things to

accomplish. The development of a proper attitude by the maintenance staff is one of the basic goals that needs to be achieved if a good program of preventative maintenance is to be established. The maintenance staff should constantly be looking for new methods of improvement and dedicate themselves to perfection.

This is often difficult to develop since looking for work to do and its perfection is a concept not always easily acceptable.

The men who drive and service buses must fully believe that every bolt and screw has a definite function to perform, and unless each is in its place, the bus is not complete. Maintenance cannot effectively function where drivers and servicemen do not value the little things that do not immediately impair bus functions. A driver who is genuinely concerned when he knows that the slightest thing is wrong with a bus has a good maintenance attitude. He simply cannot let minor ailments go without attention.

A maintenance staff dedicated to an efficient and safe program of preventative maintenance needs to have many qualifications, but basically they should be dedicated to the following fundamental requirements:

1. Knowledge of all parts of a school bus, and especially the correct function and location of each part.

2. A pride or satisfaction in good workmanship. A good maintenance attitude can be satisfied only by doing things the right way all the time.

This kind of attitude toward preventative maintenance can be developed only through long and careful training. The need for careful attention to small details and the need for exact workmanship must be emphasized by school administrators, training and supervisory personnel, and by everyone having anything to do with school bus operations. Without this emphasis, it is impossible to develop a preventative maintenance program sufficient to insure long, dependable service, and economical operation.

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PSYCHOLOGICAL ACCIDENTS — THE INDUSTRIAL PHYSICIAN'S VIEWPOINT

By D. J. KILLIAN, M.D.
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Throughout the years that I have treated occupational injuries it has become increasingly apparent that the vast majority of the accidents were not due to mechanical failure of equipment, or faulty protective devices, but due to the human failure of not doing the proper thing at the proper time. When I was a neophyte in this field, I logically assumed that such was due to day dreaming or perhaps just a chance, but as my appreciation of the human psychological mechanism became more acute I began to realize that there was something far deeper and more basic in many of these accidents. This human understanding has progressed until at the present time I am firmly convinced that a significant number of our occupational injuries are due to basic psychological mechanisms, the patterns of which are just as real as the mechanical equipment that we use.

It is time that the folks who work in the field of safety develop an increased awareness of this and, also, realize that many of these psychological mechanisms must have their protective devices just as certain machinery has to have its protective devices. Today through the presentations on this panel I hope that you will develop this increased awareness of the necessity to understand people and recognize certain emotional danger signals if you expect to make a real impact in the field of safety.

I do not intend to bombard you with a barrage of psychological gobbledegook, but I would like to point out to you some fundamental facts about everyone's personality and illustrate how certain psychological mechanisms may have a bearing upon certain accidents. In all of our minds we have certain areas which we must understand before we can begin to comprehend this problem of the psychological influence of the human mind on industrial accidents. It is a well recognized fact that the human mind can be divided into three

parts: the conscious, the preconscious and the unconscious mind.

The conscious portion is the part that does our everyday thinking. It is the part that I am using at this time in presenting this speech to you.

The preconscious is the area of the mind which we do not ordinarily use, but from which facts can be brought up to the conscious mind rather easily.

On the other hand the unconscious mind is the deeper, inner reserves, which is composed of material not immediately available to our conscious thinking, but is composed of stored experiences and conflicts that have occurred throughout our whole lives. The influence of each of these areas is extremely important to the man on the job, but the thing that should be extremely enlightening to all of you is that fundamentally our lives are governed, moulded and influenced by our unconscious thought processes.

Let me illustrate it in this manner. When one learns to drive a car he consciously thinks about taking his foot from the accelerator and applying the brakes during this training period. After awhile this becomes automatic and now when one approaches the stop sign this particular act does not enter one's conscious mind at all. It is in the preconscious area where it can be easily recalled if one puts his mind to it.

If the brain did not function in this manner, our lives would be completely occupied by all sorts of irrelevant thought processes everytime we did something. These things must function at a lower level and on an automatic basis in order that we may devote our conscious thinking to the important things. The unconscious mind, deep within the inner recesses of our thought processes and can only be brought out by certain psychiatric techniques that we cannot concern ourselves with today.

There is one fact that I feel is extremely important, that I have discovered from experience. It is that people who work in safety, as well as members of supervision, have a difficult time accepting the concept that the unconscious mind can really influence an individual's actions to the extent that it will produce serious accidents and disabling injuries.

When one mentions psychological causes of accidents most of the people think in terms of the man who is consciously trying to hurt himself to gain a certain advantage, or that a man is preoccupied by his emotional problems and he does not realize that danger is creeping upon him. If one just considers these aspects of psychologically motivated accidents he is indeed missing the boat on the vast majority of cases. Let us take a few examples to try to drive across the point.

Case number one. This case involved a man who was working on an extruder press in which the equipment was well guarded in a manner that made it virtually impossible for the man to get his hand in the extrusion mechanism and throw the switch at the same time. However, early on Monday morning this happened and the man was brought to the medical department with a seriously crushed hand. During his anguish and state of semi-shock he confided in the industrial physician that he really did not much care what happened to him since he had been having marital difficulty and his wife had run away two days before with another man. At no time after this revelation would he again discuss this situation. The wife was located, however, and within a short time she was at the bedside of the victim crying and feeling a great deal of remorse towards the injury.

Now what did this accident accomplish for this man? Obviously it served the purpose of getting his wife back (at least temporarily), and I think one should really ask himself the question, "Was this really a mechanical accident of a psychologically-induced accident?" When the accident reviewing committee made a study of this particular situation they reported with their analytical, conscious, thinking that they could not understand how this individual could override the guarding mechanism and have this happen.

The question that all of you are probably wondering about is, "Did this man do this deliberately?" To this I would like to add my unqualified "no" he did not! Preservation of life and avoidance of pain and injury is a powerful instinct, and this man's unconscious mind was fundamentally driving him to this solution of his problem. How many times we see highway accidents where there is no logical explanation of why it occurred and it is a matter of statistics that mechanical failure of the equipment plays a minor role in the overall problem. The problem is people and most of these problems involve psychological mechanisms which cannot be understood by the conscious portions of our mind.

Now, let us look at another case and perhaps we can more clearly bring out some other of these unconscious underlying factors that are so important. This man was working in an area where they were temporarily short handed, and his foreman asked him to roll a 400 pound drum out of the aisle. This normally was not the employee's job and he conveniently forgot the order for several hours. Later the foreman again reminded him that the drum in this area was a safety hazard and should be moved. Again the individual chose to ignore this command, and a short while later the foreman became rather disgusted with this turn of events and sternly commanded that the man had better get the drum moved, or else! The employee then went out, seized the drum, and with a tremendous strain which was conceived in anger and executed with hate, moved the drum out of the aisle and, in the process, produced a severe lumbosacral strain in his lower back.

The man was disabled over a year and intensive investigation revealed no evidence of a ruptured disc or any physical disability which would account for the prolonged loss of time from the job. Many months after the original injury, I got into the act as his physician and found out that at one time he and his foreman had been hourly employees, vying for the same job as foreman and that the other fellow eventually got. In my discussion with him he literally exploded resentment towards this man when given the opportunity.

This incident that I pointed out to you reminded me of a little child who deliberately threw himself down and tried to sustain an injury and thereby punish his parents who were the symbols of authority to him. This man's back pain (which I am convinced was a simple muscular strain) became a symbol of the festering resentment that he had towards this figure of authority. The eventual outcome was that the more his back could bother and disable him the more he could blame his foreman for what had happened.

This type of thing is happening all the time in industry. Many times the industrial physicians are not treating an organic injury, but are treating a serious interpersonal relationship between a worker and the chain of authority above him. We have to recognize this and do our best to deal with it effectively. I also feel very strongly that you who deal with safety should likewise recognize it and do your best to deal with it effectively.

I have presented this approach of the consideration of the psychologically motivated aspect of occupational injury to many people in management and invariably I have received the same reaction, which I think is a very healthy one, and I am sure all of you in the audience will be asking the same question. "So there are underlying psychological reasons which truly can be on an unconscious basis for many of these things, but just what good is your talk doing? It is one thing to tell us why something happens, but it is a horse of a different color to say what you are going to do about it. After all, we cannot all be psychologists, or psychiatrists, or physicians, and how can we as supervisors and safety people hope to prevent psychologically-motivated accidents?"

My answer to this is, first of all, there needs to be an awareness all the way up and down the line of management that this business of the psychologically-moti-

vated accident is a very real thing. Secondly, there needs to be training so that these people understand how certain emotional conflicts can express themselves in various physical ways of having accidents. With this should come skill in recognition and assigning people to sublimate many of these emotional conflicts into constructive channels.

Let me give you an example. Each of us has the very primitive emotion of aggression and the skillful supervisor should direct the individual who manifests signs of over-aggression into some form of activity which will be useful in allowing that man to work off his aggression. For example, if he is an outside worker he might be given an ax to clear shrubbery from the edge of a road so that he can work off his aggression by wielding the ax against the trees and shrubbery. This will go a long way towards preventing him from wielding a venomous tongue against his fellow employees or his supervision. It may prevent him from an unsafe act, because his hostility may seek expression in mentally unhealthy channels to punish his boss.

Do not lost time accidents really do a very effective job of punishing the boss? People must be taught that everyone in supervision should be an emotional first aid station and allow the employee to ventilate his problems, and to recognize that when this becomes insufficient he should refer the man on to those who have the special training to deal with these problem cases. The days of the old hard nosed sergeant are over and experience has shown that management gets more productivity, fewer accidents and a healthier and happier worker, when he is dealt with in an environment of understanding, sympathy and genuine concern for the employee. People in safety work can help a great deal by promoting this philosophy and pointing out to management the important factors that we have discussed here.

THE OCCUPATIONAL NURSE'S ROLE IN THE DIRECTION AND REFERRAL OF EMOTIONAL PROBLEMS

By ANNE KLOIBER, R.N.
Supervising Nurse, Pabst Brewing Co., Milwaukee, Wis.

How many times have you heard said, "don't pay any attention to him—he hasn't got all his marbles?" Or, how many times have you discussed an occupational injury or disease with the foreman or supervisor only to have him inject in the conversation—somewhere, "that guy's nuts—he doesn't keep his mind on his work—something's bothering him."

Yes, that is precisely the point! SOMETHING is bothering him! And, it's up to us, as occupational nurses, to steer him in the right direction so that he receives proper help.

We nurses in industry, of course, shouldn't have to wait until an injury occurs or until the man's apparent emotional problem is brought to light by the foreman or supervisor. We should, because of our personal knowledge of people at work, be able to detect certain signs and signals which should alert us to action. For this reason, it is vitally important that the nurse maintain a professional, yet warm, relationship with all employees so that they will come to her willingly with their ailments and injuries. Through her adequate medical records, the nurse will then be able to see patterns of behavior which perhaps even medical people outside of the plant could not detect.

It might be well at this time to add that these people with problems—these people who are "different"—not only call attention to themselves in the Medical Department. They are known to Personnel, the Credit Union, and in other areas of the plant as being in one jam after another. It seems almost as if they're enveloped in trouble.

One can't help but wonder if these situations—these difficulties they create, aren't actually S.O.S.—signals for help. What a pity then if, we, who are in a position, at least to, give them some guidance, close our eyes and ears to these situations—perhaps give them something for their nerves, or offer them another job or a few rationed words of reassurance—just to satisfy our conscience.

This problem, as you are all aware, is not confined to industry alone. All one needs is to look about him—be it in a super market, church, school, or what have you. Emotional outbursts of all kinds are visible almost daily in society at large.

Dr. Gerald Gordon of the DuPont Co., in his paper on "Industry's Problem Children," states:

"People are not either sane or insane in the same sense that a woman is or is not pregnant. Whereas it is impossible to be a little bit pregnant, it is quite commonplace to be a little bit crazy. Some degree of mental illness is present in all of us, normal people, inasmuch as we all suffer from it, we find it difficult to see in others, and all but impossible to see in ourselves.

"The diagnosis of mental illness may be made early from apparently trivial and unrelated signs and symptoms if we are willing to be realistic and objective, even about ourselves. Dr. Dersheimer once wrote that 'industry constitutes one of the most realistic situations existing in our modern world. As such, it is the testing ground on which the strength and weaknesses developed by the early training of individuals become clearly apparent.'

"It is, therefore, in industry where many of the earliest signs of failure or mental illness may be seen. This situation gives management and supervision an opportunity, found almost nowhere else, to do a real job of mental hygiene which will benefit the employee no less than industry."

In keeping with the fast pace we have set for ourselves today, with the result, of course, that there is really never enough time for everything we would like to do, I suppose we feel justified in effecting a job transfer for someone who can't get along in a certain department or where a specific problem exists. But we cannot keep shrugging off these responsibilities in this manner—we must face these issues squarely and give them the time that they truly deserve.

Let me tell you of a problem which existed in our plant recently. This problem, I am happy to say, was resolved with the patient coming out as the victor—one of those "happy-ending stories." This young man has no vision in one eye as the result of a childhood injury. Needless to say, he protects his remaining good eye more than one would do normally. Because of his low seniority, he is occasionally placed in a transfer pool to areas where caustic solutions are used for cleaning. Protective equipment is issued this man, as is to all employees. However, when this transfer arrangement first started, this man would be in the Medical Department constantly with one caustic burn after another—his self-diagnosed caustic burns. Actually, most of the time they weren't burns at all.

During every visit he would beg us for a transfer to another department where this hazard was not present, but the doctor and I both felt that we would try to help him face the problem and not run away from it. We knew that if we gave in to him this one time, we would set off a chain of transfer requests. At any rate, the course was slow and at times quite stormy. There were two or three times when the foreman called us and shouted, "get this guy out of my department—he's getting everyone jumpy."

But we hung on a while longer and were victorious. We tried to educate him as to the proper equipment to wear. We tried to instill in him a respect not only for caustic soda, but for all harmful chemicals. We spelled out to him the proper first-aid measures in the event he did come in contact with them in spite of his caution.

Recently, he came in to see us, and thanked us for making a man out of him. His foreman has told us that he has become a more industrious and safe worker. Not only are we thankful that he's not running to the Medical Department three or four times a day with apparent chemical burns, but more important, we are glad that he faced up to the problem and did something about it.

Happy endings such as this are not always possible. We shall continue to have the overly fearful worker or, conversely, the careless worker—the guy who says, "I can take a bath in the stuff," but who continues

to be a threat because of his deep ulcerations from strong solutions. We shall have to realize that lack of attention to the inanimate things about us often involves us in accidents and that this lack of attention is usually conditioned by our mood or preoccupation with other things at that time.

We shall have to stop using that expression, "he's just accident prone," and, instead, learn to appreciate that accidents to a large extent are the result of the person being unable to cope with the situation in which he is placed. We shall have to realize that our physiological well-being can go up or down like a thermometer, that everyone has regular periods of exhilaration and depression—that it's just not women with "estrogen imbalance."

It is suggested that the nurse include in her history, following an occupational injury, the mood the person was in prior to the incident. She might even go a step farther by asking this same question of the foreman or supervisor. At least it might alert him to the fact that maybe this business of emotions isn't just something you read in a book.

In going back over our more serious and disabling injuries of the past year or so, we came up with the following moods or things employees were thinking about just prior to the time of the accident:

One man, who sustained very serious caustic soda burns to 30 per cent of his body, including his eyes, admitted to the doctor that he and his wife were having marital difficulties—that on the morning of the accident, they had an unpleasant scene which was witnessed by their youngest child, who apparently was the apple of his eye. He admitted to the doctor that this argument had left him nervous and jumpy—and that he just wasn't thinking when he dumped the water into the powder instead of vice-versa.

Another man who sustained a traumatic thumb amputation said afterward that he found he was in an ornery mood from the time he got up in the morning—you know, one of those days when everything goes wrong! Still another man claimed the foreman was nagging him constantly on the morning of the accident.

Is there little wonder then that these people become highly vulnerable to accident

prone? An industrial nurse recognizes the fact that tension and conflict among workers, or between workers and foremen, often causes a rise in accident frequency. Her knowledge of industrial health counseling in such instances can be used most effectively.

While we're touching on the subject of counseling, let me say here that industrial nurses can make themselves responsible to a certain degree for teaching health to the employees. Nothing can replace an intelligently administered health program. Work habits of the employees are influenced by their mental processes and by the help or hindrance offered to them, be it in their homes or at work. It is helpful to the nurse to observe not only how the employee behaves under unusual circumstances but to observe his customary everyday behavior.

Management, of course, also must share in this responsibility. Management should know the physical capacities of the worker, his home situation and his personality traits. Pre-placement physical examinations are a must, as well as routine annual re-examinations. Matching up the job requirements with the individual so that a happy medium is reached is another of management's responsibilities.

A NEW CONCEPT OF ACCIDENTS

By SANFORD G. ROGG, M.D.

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There can be no questioning of the fact that, as long as we remain human beings, we will become involved in accidents. Obviously the more we understand the multiple factors involved in accidents, the better prepared we will be to prevent the avoidable ones.

There has been an increasing awareness regarding the fact that our continuing nationally high accident rate is a reflection of personal rather than machine failure. Certainly the engineers who design machinery and in particular, those whose task it is to pay attention to safety features

I would also like to stress the importance of confidentiality of medical information. While it is generally accepted that management must know of existing physical capacities and limitations so that proper job placement can be effected, there is no special reason why all the details have to be spelled out. If the examining physician interprets his findings into a physical capacities appraisal and sends this to management, this should be sufficient. One of the most tested attributes of the industrial nurse is her ability to maintain confidences. If she is to do well as a counselor, this must continue to be of prime importance.

In summation, then, I would like to offer that nurses, because of their personal knowledge of people at work, because of their background fortified with courses in psychology and counseling, and because of their thorough medical records, are able to see patterns of behavior and emotional problems which can then be referred to the proper people for care.

Having the psychiatrist in mind, did you hear about the two psychiatrists who met on the street? One said, "Hello, there! And how are you today?" After which they parted and the other one said, "Hm, I wonder what he meant by that."

and operational control, have all done an extremely competent job.

As a matter of fact, they have done their work so well, that the continuing high accident rates we see quoted yearly throughout our country, can in no sense be called a responsibility of poor design features. At the same time, it would be foolish to inter by any means that continuing effort on the part of design engineers would be unrewarding. The fact to be emphasized is that even if we designed to theoretical perfection, we undoubtedly would still have well over 80 per cent of our accidents occurring.

TABLE I
Leading Causes of Death by Age Groups
U. S. Dept. Health, Education & Welfare

AGE	Accidents	Heart Disease	Cancer
1-4	Accidents		
5-14	Accidents		
15-24	Accidents		
25-34	Accidents	Heart Disease	Cancer
35-44	Accidents	Heart Disease	Cancer
45-54	Accidents	Heart Disease	Cancer

Table I, while contributing no new knowledge on the subject, does emphasize the place that accidents hold as a cause of death in our country.

Without becoming too involved in figures, the National Safety Council's statistics list approximately 40,000 people killed in automobile accidents, 14,000 in industrial accidents, 27,000 in home accidents, and 10,000 public deaths. We can define public deaths to include train accidents, airplane accidents, public fires, etc. or whatever else might happen to a person in a public situation. To this, add an untold number of injuries, possibly running as high as 24 million of the type that brings itself to the attention of a physician or limits a person's activities for at least one day.

Perhaps the question arises as to why the medical profession is becoming so concerned about safety. Certainly any condition that kills about 97,000 people a year and leaves over 400,000 with permanent residual injuries, varying from the minor to the most severe type, should of necessity command the attention of the profession that has the responsibility of caring for these people.

In my opinion, most of the problem is to be found in the emotional status or even in its broader aspects, the personality of people who become involved in accidents. And to digress for a moment, we can define personality in the sense that it is being used here by labeling it as consisting of the habitual patterns of temperament, intelligence, desires and behavior that distinguish us as individuals. We can readily appreciate the problem, in that it is difficult to delve into and obtain an understanding of these factors. This can be easily understood if we realize that we are dealing with personal motivations and conflicts of thought, wishes and desires of people, combined with all the frustrating situations with which they are confronted.

It should be emphasized that there is no

desire to leave the reader with the implication that the problem of accidents is a narrow concept, a psychiatric one, in that mentally ill people who require treatment are the ones who become involved in accidents. It would be much better and more easily understood, if all of us were to acknowledge that we are liable to accident situations at various times throughout our lives.

What is overlooked in a good deal of the work that is being done, is the fundamental factor that looms as most important in all of our dealings with people. This is, that although we like to think of man as an intelligent, rational, coherently reasoning and consistently logical individual, man in reality is predominantly guided by motives and feelings of which he is most often unaware. These logical powers only serve as a means of allowing the individual to reach goals that are created by more deeply placed emotions. This in turn could lead us to realize how we must look at, and deal with, these feelings if we are to be successful in our safety endeavors.

We must realize that becoming involved in an accident is basically the same as any other condition about which people become involved in difficulties. These individuals could just as well solve their problems by developing stomach ulcers, severe headaches, spastic colitis or the numerous other entities that are diagnosed as psychogenic illnesses. The accident-involved person is, in a very unsuitable, and from the viewpoint of our society, in a totally unsatisfactory way, solving the emotional problem by becoming involved in an accident situation.

It appears suitable and advisable to go a little further at the present time and state that the emotions we are discussing arise from the whole life of the individual, the twenty-four hours of each day that he lives, and by no means only the eight hours that he spends in gainful employment.

We have all heard the expression many times over, that so and so tends to take his work home with him. Well, we can reverse this and state that everybody tends to take his home to work with him.

My interest in the factors producing accidents was aroused while discussing one with a safety engineer. He was describ-

ing an accident that had just occurred and in the course of the conversation said "I just don't know what happened. This man has been doing the job for years and knows it perfectly well. As a matter of fact, in the usual course of events, we checked over everything, the switch controlling the machine, and the machine itself, and they were in perfect operating condition; still, the man became involved in an accident that resulted in the amputation of his finger."

After this discussion my thinking went along the lines of what could have involved the man in this accident, and broadening things a bit began to wonder what could be going on in the mind of a person just prior to his having an accident.

By accident, we are referring of course to the common garden variety where the individual alone is responsible. Technically we could call this a "personal accident" with the primary cause to be found in the individual in contrast to the "impersonal accident" with the primary cause in the environment. It is possible to be even more precise here and state that this study was not directed towards an exploration of the basic personalities of these individuals, many such studies have been done and the literature is replete with articles describing the personalities of people who become involved in accidents. Attention was focused on the thinking occurring in a person's mind prior to becoming involved in an accident and by prior is meant half an hour, a minute, or even moments before the event happened.

After becoming interested, it was considered advisable to have reference to what had been written by others on this subject and the literature was searched. This led to the conclusion that very little had previously been done where a trained person sat down with someone involved in an accident and tried to find out what thought processes were going on in the mind of this person just prior to the occurrence of the accident. This was somewhat surprising and indicates a field that has been badly neglected. One thing learned however, was the increasing awareness that we are neglecting a very important phase of accident prevention by omitting the study of the influence of human behavior and moods in causing accidents.

To investigate this matter, a procedure was set up whereby the men who were working in a large plant and had been involved in an accident would be seen by me. The sampling was a non-directed one, the men being picked on a consecutive basis by the receptionist. The attitudes of the men were mainly cooperative. They spoke freely and at times gave more information than was being looked for.

It was felt that to interview someone whose accident had occurred more than three days past would be a useless procedure in that many things would start fading from the individual's mind. Human nature being what it is, when things start to fade from one's mind, the person then tends to supply facts that he actually thinks would fit the situation. It is not meant by this to imply that the individual would deliberately construct misinformation. It is a matter of knowledge that as our memory fades and we are asked to recall an incident that has occurred in the past, a good deal of the information that we bring to recall in information of a type that we ourselves have formulated. The technical term for this would be retrospective falsification.

An excellent article, "Accident Statistics and The Concept of Accident-Prone," by Arbous and Kerrick,¹ states that it is conceivable that with our present instruments of analysis, we may yet succeed in pinning down the personal factor in accident-causation in terms of some strict definition, but this may involve so many restrictions in a mathematical sense that the concept will bear little relation to the real factors in everyday industrial life. The above comments do not constitute a denial of the usefulness of statistical procedures in investigations of this type, nor is it suggested that the research worker can ever dispense with them altogether. The conclusions indicate rather the limitations of these techniques and emphasize the fact that statistics can never do your thinking for you.

The above considerations may well lead one into a state of despondency and frustrated resignation, were it not for the fact that a different approach to the problem seems possible. This approach may not enable us to analyze accident liability in terms of universal principles, laws of dis-

tribution, etc. with reference to human behavior in general, but it may well enable us to reduce the incidence of accidents in our community by enhancing our knowledge of the mechanisms at work causing individuals to have accidents. And surely this is the ultimate objective of all this work.

Before getting into the actual cases seen, it appears pertinent to mention the work of Vinales,² who emphasizes the fact that another limitation of the statistical viewpoint in accident prevention is the emphasis upon isolated aspects of the individual personality, in contrast with the concern, in the clinical approach, for the total relationship. The clinical approach recognizes that there are many different causes of accidents and that they may combine in different patterns in different individuals.

Several things became apparent after the procedure of interviewing was started and led to the realization that my thinking was not in agreement with much that had been previously written about accidents.

The first concept with which there was disagreement was that of a man being "an accident-prone individual." The initial studies on which this was formulated were done in England in 1919.³ The term itself (i.e., accident-prone) was coined in 1939 by Farmer & Chambers.⁴ For various reasons, one of which undoubtedly was the fact that the concept of "accident-proneness" relieved or lifted the burden of responsibility from where it belonged, this idea immediately attracted attention. Other workers in this field, then began to formulate lists of traits that could be found in these "accident-prone" people. Somehow it was presumed, that armed with such a list of traits, one could then more suitably place or even avoid hiring a person falling into this category.

The obvious fallacy of this type of reasoning is that all of us have accidents, whether at home, at the office, at the plant, on the road, or anywhere, and throughout our lives probably will have many times more than one accident. It seems that there are times when all of us are in a state of increased susceptibility to having an accident without it necessarily being a life-long pattern of behavior. Therefore, the type of personality of the accident involved in-

dividual, as wide as the range of our entire population.

Of the people seen, only those with sub-major injuries were considered. It was found that the employees having accidents were mainly experienced men. It seems that the younger plant population is helped by the elasticity of youth in dealing with their problems. They also are more attentive to work hazards and still have "open-ears" at safety meetings. Since no control groups on considerations of hazard exposure could be statistically validated, it would be foolish to attempt to read too much into this.

TABLE II
Comparisons Between Injury Group and Plant as a Whole

	Injury Group	Plant
Average Age	45	44
Average Length of Service	18	17
Average No. Dispensary Visits per Year (Excluding Injuries)	14	2.3
No. Minor Injuries per 100 Person-Years	67	25
No. Previous Major and Sub-Major Injuries per 100 Person-Years	1.6	0.9

From a review of Table II one might be tempted to hypothesize regarding the number of minor injuries in the injury group as compared to the whole plant. Arbous & Kerrick,¹ in their admirable statistical study, strongly conclude that "minor accidents do not enable us to make any prediction with relation to major accidents."

Many people feel that once the accident train is set in motion, there is no real difference between a major and a minor accident and that the resulting injury was the one chance element in the situation. A mathematical example might demonstrate some of the hazards involved in the deductions obtained from collected statistics.

For example, in studying accidents that result in sub-major injuries (a sub-major can be defined as a type of resultant injury that renders the person unable to continue his regular type of work, and a major injury is one that results in loss of time from one's work) it would seem that there are two liabilities to be considered: (a) the liability of the individual to have an accident, and (b) the liability of this event to cause subsequent injury—resulting in its being recorded. It is conceivable that if the injury were not chance determined, the following results may be obtained as illustrated in Table III.

TABLE III
—Represents unplanned events without injury.
(a) —Represents unplanned events with sub-major or major injury.
In the case of two individuals, the results will might be:
Individual X had a, a, a, (a) a, a, a, a = 1 reported sub-major or major accident.
Individual Y had - (a), (a), (a) = 3 reported sub-major or major accidents.

In the records Y would obviously be considered more accident prone than X, but this would not be a reflection of his proneness to unplanned events (near accidents) since Y has only 4, whereas X has 8. It would rather be a reflection of the liability of such events as he had, to result in injury. This may well be determined by factors beyond his control and the study of (e)'s would give little indication of the individual's susceptibility to (e)'s.

Another deterrent factor bearing on Table III is the inability to equate exposure hazards between the injured group and the plant as a whole.

Returning back to Table II it can be seen that there is a valid statistically significant difference between the average number of dispensary visits per year for the injury group and the rest of the plant. Possibly the people having injuries are settling their emotional problems via this route while the plant group is discharging its emotional problems via psychogenic symptomatology.

TABLE IV
Accidents with Demonstrable Psychological Factors of Recent Origin

Psychological problem of recent origin	Number	Per Cent
No evidence of emotional disturbance	12	44.4
Subtotal	27	100.0
Non-assignable, multi-party responsibility	8	
Not cooperative	2	
Total	35	

Roughly 70 per cent of the psychologically disturbing factors were job-connected, 30 per cent non-job connected.

Table IV might on a clinical basis substantiate my hypothesis. It is, however, a fundamental piece of knowledge that it is never possible in any science to prove a hypothesis.

It may be informative and interesting to transcribe the notes made after interviewing three people who had been involved in accidents.

Case No. 1 a male employee age 21 with two years of employment as a driver for a parcel delivery concern. He sustained a severe twisting injury of his right ankle that required the use of crutches and kept him from regular work for five weeks. The safety bulletin listed the following description.

"This injury was sustained during normal operating conditions. The weather was clear and cold. The concrete surface was level and dry and free of any foreign body. The truck running board was clean and dry, with all door attachments in excellent condition. The injured stated that he looked before stepping down and noticed nothing out of the ordinary." This man in talking to me said that he realized as he was getting off the truck he was headed to go around the front of it. Realizing this, it then became necessary for him to turn so that he would be facing towards the rear and be able to walk around the back of the truck. The sudden shutting of his body after it had already established the direction in which it was going resulted in the accident.

He went on to talk very freely and stated that he was hit by a truck as a child at about nine years of age and ever since that time he has been afraid to walk in front of any vehicle even to the present moment. Even now if a car or truck is parked at the curb with no one in it, he still will not walk in front of this vehicle but will walk an extra fifty feet if necessary, in order to go behind it. He says at any time he absolutely cannot avoid walking in front of a truck or car, the picture of his being hit by the heavy truck when he was a youngster still comes to mind. "Several times a year," he continued, "I still have nightmares where I wake up screaming and soaked with sweat, dreaming that the truck was coming down the street and about to run over me again. All that I know is that I still can't get over the fear of walking in front of any car or truck."

Case No. 2. This case that I am going to describe, is I feel, an interesting one although it did not actually result in an accident in which somebody was hurt, but very nearly did and would have created an extremely serious situation had the accident itself actually occurred. The man in question was sent to the plant medical building because of an acutely upset condition following the incident. His job is to put an alloy

into a chemical process. He has been doing this for two years and is a first-class operator. In the past four weeks he has had a new helper. This helper and he evidently were extremely incompatible. He feels that this man was negligent and had a careless attitude towards his work. The operator had spoken with his foreman twice asking for a new helper, giving the above reasons for his request. He told his foreman that sooner or later such carelessness would lead to an accident.

No action had been taken up until the day in question. The morning of the incident, he was particularly annoyed by his helper. In violation of all operating rules he dropped his charge of pellets into an agitator following routine procedure except for the very serious omission of not checking to make sure that the agitator was cleared of its previous charge. Fortunately (and in no way could the man know this) the agitator happened to be clear at that time. If not, a violent explosion would have occurred. When the man realized what he had done, he began to suffer an acute panic reaction and his foreman sent him to the medical building. The man was able to pinpoint his thinking when talking to me—"I was so mad with the helper, I knew something would go wrong. I tried to get rid of him but they wouldn't transfer him. I guess the strain was too much for me waiting for him to do something wrong so I went ahead and did it myself."

Case No. 3, a 36 year old man with sixteen years of service fractured a finger while working on a machine. This was the man's first recorded accident in all of his years on the plant. He had worked a double shift the previous day. He said he was asked to do this a few hours before quitting time. He and his wife had made arrangements to go out that evening, this of course entailed the usual difficulties of baby sitters, etc. Although he very much wanted to say "No" to supervision's request, he has always been too compliant an individual to be able to voice his own feelings and therefore, said he would do the extra work. As far as supervision was concerned, their request was routine with this man, since he was usually asked first when there was some extra work available. The next day the man was thinking about the previous evening and was pretty much "burnt up inside" about what

had happened. In addition to his normal resentment he had experienced a difficult situation with his wife when he explained to her that they were not going out. As a matter of fact, he stated his wife was "as boiling mad as he had ever seen her." While dealing with these feelings of extreme resentment, the man suffered an injury.

One of the things that can be seen here is that in the cases quoted we have a fairly clear idea of what was going on in an individual's mind just prior to his becoming involved in an accident. As to how this might be of any benefit in helping us to prevent accidents in the future, several implications can be drawn. First, we should learn all that we possibly can about the fact that such motivations exist in an individual. By this I do not wish to imply that all safety engineers should become amateur psychologists but they must at least have some basic idea of the facts of how human behavior and emotions at times may influence our susceptibility to accidents.

To this end safety educational material could perhaps be reviewed, to emphasize this fact. The advertising industry in the past ten or so years has been doing a good job in some respects with what is called motivation research. Perhaps orienting our safety education somewhat in that direction might be fruitful. In our study of accidents we should try to find out from the people involved how they felt about the accident at that particular time, so that we may learn something about the problems and distractions that have diverted the individual's attention from the safety hazard. By doing this, we may also get some hints about what things distract and disturb people and also some idea of how we may be alert to similar problems in others. Perhaps with a better understanding of the human factors involved in accidents, we can make safety education even more effective.

After a recent talk which I gave to a group of safety men and supervisors, someone in the audience asked me a question—"What would you do with a man who continually and knowingly violates established safety procedures? He insists that he will do the job in the way that he desires." I gave the question back to the audience for an answer and several members stated—"I would fire him." The man who originally raised the question sadly said—"I can't, we both work for the Government."

Another interesting facet of human behavior here is that the employee himself, the individual who stands most to lose through an accident, is the last one to accept the fact that safety is as much a part of doing his job as any other area of performance. Of course, a safe worker will aid management, but openly and directly the safe employee will primarily benefit himself. Be that as it may, and this cannot be too strongly emphasized, we can certainly see that there has been a tendency to be tolerant towards the continued irresponsible actions of people involved in accidents.

We also must realize that stronger demands for an adult standard of behavior will be necessary. Our society as a whole must insist on adherence to effective lines of behavior in regards to safety. Certainly it does not make sense to lightly gloss over the irresponsible, the immature, the careless and negligent individuals who cause accidents. It is a rather grim prospect that the irresponsible actions of people who refuse to follow our rules are yearly causing increases in our national statistics of people who are killed and injured. It appears that the least we should do is to learn more about the factors leading to people becoming involved in accidents, so that we can be in a position to work out ways for lowering the frequency of accidents that can be avoided.

My feeling is that the medical profession must assume more responsibilities in developing these effective ways to help in accident prevention. Since I am firmly convinced and feel that most of us who deal with safety agree that the emotional factors are the cause of the greater part of accidents, our approach must become more meaningful and must consider the emotional life of the people concerned in order to effect any changes.

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CLINICAL OBSERVATIONS ON THE CUTANEOUS EFFECTS ASSOCIATED WITH CURING EPOXY RESINS

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Occupational dermatitis occurring from the manufacture of plastics was observed shortly after the industry began. Phenol, urea, formaldehyde, and hexamethylenetetramine were among the chemicals first used in making synthetic resins, and they became well-known dermatitis producers. Later, almost every new plastic, such as styrene, alkyd, melamine, acrylic, and polyvinyl, became associated with outbreaks of dermatoses in the respective industries.

About six years ago, the epoxy or epoxide resins were introduced to American industry, and since that time we have had an opportunity to observe many cases of contact dermatitis due to the handling of these resins and their amine hardeners. This is a problem not only in our industry, but one which has been similarly noted in Great Britain, the Netherlands, and Switzerland, where much of the epoxy development took place.

The epoxies have become commonplace in a large cross section of United States manufacturing because of their excellent strength, adhesion, chemical resistance, and dielectric properties. They are widely used in electrical equipment manufacture for enclosing transformers, condensers, and other components; in automobile plants for tool and die castings; in painting for surface coatings; in aircraft and other plants for adhesive purposes. Their versatility points to even greater application.

Some epoxy resins are irritants, or sensitizers, or both, but the major problem in handling these materials occurs from the di- or triamine curing agents which are, for the most part, irritants and sensitizers. The workman contacts the epoxy resin and the hardener while mixing the weighed or recommended amounts of these basic ingredients. In small plants, several workmen may mix their own batch of resins and hardeners, and thus it becomes difficult to control contact with the basic ingredients.

After the resin and hardener have been mixed, the material can be cast into a mold or it can be brushed onto a form. Sometimes the mixture is successively alternated with layers of Fiberglas cloth to construct the mold or form. Molding is generally done with rollers, brushes, or similar tools, but on occasion it is done by hand. As a rule, the resin becomes deposited on the tools which are subsequently dipped into acetone or other ketone solvents for cleaning purposes. At the same time, the workman frequently uses the solvent to remove the resin from his skin. Finally, after the molding or casting has been done, the laminates are tooled. The epoxy-Fiberglas structure may be sanded, drilled, sawed, and painted.

In these successive operations, several hazards occur, namely:

1. Mixing the resin with the hardener, wherein contact may be made with the basic components or their vapors.
2. Molding: Some workers mold the material while wearing gloves; others use no protection whatsoever. Rarely are the face and neck protected.
3. Solvents: Cleansing the tools in solvents and at the same time removing the resin from the gloves or the skin constitutes a distinct hazard. The resin tends to concentrate in the solvent container, and a workman washing resin from his skin in this fashion unwittingly deposits a film of resin upon the skin.
4. Tooling: Grinding, drilling, or sanding the cast or molded laminates creates a hazard of contact with minute spicules of Fiberglas. A mechanical dermatitis can occur when slugs of glass become imbedded in the exposed surfaces of the skin. This is not an allergic dermatitis; it is simply a foreign-body reaction giving rise to irritation, itching, scratching, and, frequently, secondary infection. In Great Britain, it has been sug-

gested that the tooling operations may also depolymerize the resin, in which instance, the workmen would be contacting resin decomposition products largely of unknown composition.

Many of the uncured epoxy resins can be handled without ill effect, but those of the lower molecular weights have irritant properties. On the other hand, almost all of the amines are irritants and sometimes sensitizers. Their high pH (13-14) damages the keratin or at least severely weakens this protective layer of the skin. At the same time, surface lipid is readily removed. Further insult occurs from contact with the ketenes. The additional alkaline effect of most industrial cleansers, along with the amines and solvents, leads to marked redness and dryness of the skin. A dermatosis of varying degree usually results. There have been complaints that contact with the fumes has caused not only a dermatitis of the face, eyelids, and neck, but also asthmatic symptoms from breathing the amine-contaminated air. Several years ago, Dornel reported this problem among men working with amines.

From the case histories collected during numerous surveys involving these operations and from reviewing the experience of others in Europe, it is evident that the major cutaneous effects are produced by contact with the liquid stage of the low molecular weight resins, or the hardener, or with a mixture of these before polymerization or curing is complete. As a general rule, the completely polymerized product is inert upon the skin.

The onset of dermatitis generally occurs within three weeks from the beginning of employment, but it may be seen earlier in workmen already sensitized or among those who are careless in handling the mixtures. Most of the workmen continue to work by using protective devices, but some who have become highly allergic must change employment.

We have concluded that the best method of controlling dermatitis from epoxy resins is to introduce the best preventive practices possible. Outbreaks of dermatitis can be averted by following a few basic rules: (a) thorough education of management, supervisors, and workmen about the hazards; (b) adequate ventilation to control the Fiberglass particulates and the epoxy dusts and vapors;

(c) personal cleanliness through appropriate industrial cleansers, protective clothing, and, where needed, protective creams. To elaborate further, the following recommendations have been found to be reasonably effective:

1. All supervisors and workmen should be instructed thoroughly about the hazards of these operations and the importance of avoiding contact.
2. The mixing, molding, curing, and tooling of the resins should be done in an isolated area of the plant, to avoid contamination of other areas and employees.
3. Batch mixing of the resin and hardener should be done under a ventilated hood to control the escape of vapors. Only a few workers should be permitted to do the batch mixing.
4. During molding operations, skin contact can be avoided by wearing protective sleeves and cotton-lined rubber gloves. Clean uniforms should be furnished and changed each day if necessary.
5. Acetone or related solvents are not to be used to cleanse the skin.
6. Tables, machinery, tools, floors, walls, and windows must be kept free of the Fiberglass spicules and resinous dusts. The tables can be kept clean by using disposable heavy paper.
7. Clean-up rags should be replaced by disposable paper towels.
8. Grinding, sawing, drilling, or polishing the molded laminates should be done under ventilated hoods which remove all dusts from the breathing area and minimize the problem of skin contact.
9. Accidental spills of the resin or catalyst should be washed from the sites contacted as soon as possible by using mild soaps in warm water dispensed at conveniently located wash stations.
10. Neutral or acid soaps should be used in preference to alkaline, powdered, or abrasive cleansing agents.
11. Water-soluble skin-protective gels which are neutral in their pH provide some help in protecting against the action of the solvents.

To summarize, after the introduction of epoxy resins into American industry, a large number of cases of contact dermatitis have occurred. Many of the basic epoxy resins

can be handled without offending the skin, but most of the amines used as hardeners have an irritant or sensitizing effect. It is possible to avert contact dermatitis while working with epoxy resins by educating management, supervisory personnel, and the

workmen about the hazards associated with these materials; by introducing vapor and dust control measures, and by employing personal protective devices, notably protective gloves and adequate washing facilities and cleansing agents.

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ENGINEERING CONTROL OF PLASTIC MATERIALS

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Plastics, in one form or another, now have become an integral part of our way of living, from the plastic-cased clock which wakes us up in the morning to the plastic tooth brush we use when we go to bed. The growth of the plastic industry has been phenomenal; so much so, in fact, that virtually every industry has been affected by the unique properties of these man-made materials, and the future appears limitless. New machines and materials are being developed every day by our engineers and scientists. At the June, 1961, plastic show it was commented that if the industry continues to increase over the next 2½ years as it has in the 2½ years since the last show, it will be possible to look forward to countless new products and new uses for plastics which are not even dreamed of today.

A great deal of time and effort has been given to some of the relatively new plas-

tics such as toluene diisocyanates, epoxies, polystyrene-fiberglass, and dextrin. The new materials, however, are not receiving all of the attention. New uses of the long developed plastics such as phenol and urea-formaldehyde, furfuryl and polyvinyl chloride attach new significance to these materials. Both the new and old compounds have important uses and are of importance to industrial health in terms of health hazards.

Numerous papers have been written about the ability of plastic materials to produce dermatitis along with recommended methods of alleviating the problem, therefore this discussion will cover the other potentially hazardous characteristics of plastics. When the term plastic or a given plastic is mentioned the engineering control measures for stabilizers, catalysts, fillers, hardeners, parting materials and similar compounds are also taken into consideration.

Toxicology of Synthetic Resins

No discussion of these properties is complete without reference to the excellent compilations by Wilson and McCormick.¹ The following summary is provided for convenience and is quoted from the above reference. The original text should be consulted for complete details.

Acrylic Resins. Methyl methacrylate vapors have some systemic effects on the brain cortex and on the blood pressure, resulting in lowering. The acrylic resins themselves appear to be substances which can be used successfully as bone replacements, artificial eyes, and other prosthetic appliances. When placed in certain regions of the human body, however, they should be kept under observation because tumor formation, tissue reaction, and sepsis have been reported.

Alkyd Resins. The alkyd resins are capable of causing occasional mild cases of dermatitis.

Amino (Urea and Melamine) Resins. The amino resins (urea and melamine) can in certain combinations, particularly melamine formaldehyde compound, pyrolyze into hydrogen cyanide and carbon monoxide. Urea-formaldehyde-ethylene glycol resins can safely be used as food-wrapping material. The aminoplasts may be very toxic. Dermatitis has resulted in workers handling these resins.

Cellulose Plastic Materials. Cellulose plastics can be used safely externally; they only rarely produce dermatitis. Internal use may be hazardous. There is some occupational risk in the manufacture of cellulose acetate.

Coumarone-Indene Resins. A relatively non-toxic variety of resins. The hypersensitive person can acquire a dermatitis from handling these materials.

Epoxyes. The epoxy resins are relatively inert chemically and are resistant to heat. Severe skin irritation can occur in their manufacture and use. They must be handled with care. The curing agents with these resins appear to be the primary cause of the skin irritant effects.

Fluorocarbons. The fluorocarbons are extremely resistant to corrosive agents and solvents. The end-products are inert and non-toxic, but toxic decomposition products may be produced. Inhalation of Teflon dust may cause an effect resembling "metal-fume fever." Irritation of the mucous membrane and pulmonary edema can occur from inhaling the decomposition products.

Nylon. Nylon is a perfectly safe material. The fashionable women of the world have proved this by wearing nylon hose. In spite of its widespread use, only occasional cases of proved contact dermatitis have been reported. Nylon can be implanted in the human body with little or no tissue reaction.

Phenolic Resins. The phenolics as finished laminates are inert and non-toxic. They can be used safely as external prosthetic appliances. Many workers exposed to these resins during manufacturing processes have developed severe dermatoses.

Polyethylene. Polyethylene is a perfectly safe, non-toxic, inert material. It can be used as a surgical repair material, both in and out of the body. Occasional tissue reaction can occur, probably only in the sensitive person.

Polyester Resins. The polyester resins are relatively inert, non-toxic materials. Virtually no one appears to be allergic to them.

Silicones. The silicones are practically physiologically inert and non-toxic. They may cause a transitory conjunctival irritation when introduced into the eye but no corneal damage. Silicones are non-sensitizing and non-irritating.

Polystyrene. Polystyrene presents no health hazard from oral ingestion or in contact, being inert and non-toxic. In its manufacture some hazards are encountered, especially from ethylbenzene. Dermatitis can occur.

Vinyl Resins. The vinyl resins are used for a variety of purposes. Polyvinyl pyrrolidone (PVP) is non-toxic and can be used in the human body. Polyvinyl chloride (PVC) has been stored with little reaction in the chest cavity. Some slight skin irritations have been observed in workers manufacturing PVC.

Polyurethanes. The polyurethanes are a relatively new class of polymers. The finished polymers are inert chemically and present no toxic hazards. During manufacture severe industrial health hazards occur because of the use of isocyanates. These compounds can be lethal and in small amounts are very irritating to mucous membranes, producing an asthmatic type effect. Great care must be taken in their use. Close medical supervision of workers is desirable.

Case Histories

Epoxy resins are truly wonder materials and an answer to the plastic technologists' and product designers' dreams because of their excellent range of properties and applications. Epoxy fabrication procedures including resin application by brush or spray, compounding and finishing, all require ventilation control. Any attempt to make a complete list of the applications of this versatile resin is futile because of new uses listed almost daily. However, a few are mentioned here to show its wide range and point out some problem areas.

One of its major uses is in conjunction with fiberglass. The fiberglass can be used as a cloth or mat, or in specially designed spray guns that shred or chop the glass filaments and apply the resin simultaneously. In either of these applications good ventilation is required to control the solvent vapor and irritating effect of the fiberglass. Control measures are required at the mixing of the resin, and at the spraying, brush or roller application to reduce the amount of contaminant in the worker's breathing zone.

Upon curing of the product certain secondary operations of sawing, milling, grinding, and sanding may be required. Since these operations generate heat it is believed that vapor can be regenerated and set up

new exposures. Similarly, these operations produce dust. The literature indicates that fiberglass dust upon inhalation, has little if any effect. However, some of the fillers such as silica flour or lead can produce disabling effects and therefore require ventilation.

An example of regeneration and dust is cited by Joyner² who reports an episode in which six laborers developed upper respiratory irritation from inhaling emanated dust and/or vapor during destructive removal of epoxy resin-concrete. Secondary infection occurred in three of the patients. A mild nephrotoxic action was thought to be observed in all six patients. The offending agent was not conclusively identified but is thought to have been xylene, amine salts, or other unknown resin decomposition products.

Other uses of epoxy are in paints and require the conventional ventilation provided for any spray painting operation; an additive for tile and terrazzo flooring requires general ventilation for solvent vapor control; solvent vapor control is also needed at operations of encapsulation of electrical and electronic components in the resin, and in automobile body repair shops. In an instance where adequate ventilation is not or cannot be easily provided, personnel protective equipment approved by the U. S. Bureau of Mines for solvent vapor or dust should be provided.

The polyester resin utilizes styrene to dissolve the resin and facilitate mixing and application. Many of the problems and controls mentioned for epoxy resins are equally applicable to this resin and vice versa. Application of the resin to fiberglass cloth requires ventilation.

In some instances the scope and extent of these operations may present problems with respect to providing local exhaust ventilation. In these cases dilution ventilation should be considered. The following example is of design value when the observed conditions are considered.

In a process of room curing at 76° F. and curing time of one hour, the solvent loss of styrene is five grams per square foot of surface area per hour, (5 gr/sq.ft./hr). When these factors are taken into consideration, the calculation of the amount of solvent liberated and exhaust air required

to reduce the styrene concentration to a safe limit is easily made.

In both the epoxy and polyester resins the mixing, handling and storage of the catalyst should be done with care to avoid fire and explosions. An example is methyl ethyl ketone peroxide which is a strong oxidizing agent, and therefore should be stored carefully to guard against spontaneous combustion when this material comes in contact with organic substances. The mixing of benzoyl peroxide and tricresyl phosphate with a wooden paddle resulted in an explosion that severely burned an employee about the face and arms. Since this operation was previously carried out many times in the same manner without dire consequences, it was felt that the paddle was contaminated by some such material as cobalt naphenate.

Polyurethanes, at the present time, are finding the widest use in the form of foam. Foams are made by metering and mixing the correct amount of toluene diisocyanate (TDI) and other required ingredients. The mixture is deposited in a mold, allowed to foam, jell and partially cure. The foam may be stripped from the mold within a short time and then is allowed to cure fully at room temperature or at elevated temperatures in an oven. Toluene diisocyanate can be given off during the mixing, foaming and curing procedure or at any stage before being consumed by the chemical reaction. During these steps the TDI liberated can be irritating to the skin, eyes, and respiratory tract which can cause, in some people, an asthmatic reaction. This contaminant can be controlled by providing ventilation at the various steps involved.

Adequate facilities should be provided for decontamination of work areas in case of accidental spills of TDI. These should include adequate floor drainage, hoses, mops, and buckets. An adequate supply of decontaminants consisting of aqueous 5 per cent ammonia containing 10 per cent isopropyl alcohol or a water solution of sodium carbonate should be kept on hand. An oil absorbent can be used since it is helpful in drying up the spill. The contaminated absorbent then must be removed quickly to a ventilated location and/or treated with one of the decontaminating solutions.

Polyvinyl chloride mixed with powdered lead creates a serious health hazard. Con-

tral for this is achieved by providing exhaust ventilation at the blender and providing the operator with an air supplied helmet. Good housekeeping was also instituted to remove accumulated dust deposits.

Delrin acetal resin liberates decomposition products largely consisting of formaldehyde when above normal operating temperatures are encountered in injection molding and extrusion work. Should excessive temperatures be encountered the heat should be turned off, injection pressure reduced, and the overheated melt allowed to drop in a bucket of water. This procedure cools the cylinder and reduces the amount of fume. The area should be cleared until some means of ventilation has removed the contaminants.

Phenol and urea-formaldehydes have been the stand-bys of the plastic industry. New formulations and uses are continually being introduced. Plastic problems are generally not encountered in foundries; however, these materials are now integral parts of foundry operations.

Sand is mixed with 3-6 per cent of an alcohol solution of phenol formaldehyde in a muller. Heated air is passed into the muller to drive off the alcohol and deposit the resin on the sand particle. This results in a serious explosion hazard. The application of exhaust ventilation, 4-5 times over normal requirements, reduces this hazard. The resin coated sand is transferred to the molding machine and here irritating amounts of phenol, ammonia, and aldehydes are liberated. Ventilation controls these irritating gases. During pouring of these molds significant amounts of carbon monoxide and the above-mentioned irritating gases are given off. Ventilation is required to control these gases.

Urea-formaldehyde modified with furfuryl alcohol is used as a new core binder. The mixing and molding operations release formaldehyde and require ventilation.

Plastic coating of metal parts is a relatively new development. The metal part is heated to the required temperature and dipped into a tank of plastic powder which fuses to the heated metal part. Almost any pure resin or mixture of resin, plasticizers and stabilizers are involved. The literature is fragmentary on the health problems of

plastic dust. A case is cited of irritation to the upper respiratory system from polymerized polyvinyl chloride dust.

Ventilation is provided for the plastic coating operation to recover the fine powder because of its high cost and to improve housekeeping. This also aids in alleviating the dust explosion problem which is common to many fine plastic powders.

Thermal Decomposition of Plastics

Fears are frequently expressed that plastics involved in fires will yield combustion products which are more toxic than those usually occurring with wood or other common combustible materials.

Some of these fears are based on cases reported as follows: Upon exposing "teflon" to temperatures over 450° F. the decomposition products cause a temporary flu-like condition referred to as "polymer fume fever". A fire at a plant handling epoxy resins resulted in two employees being hospitalized for two weeks. It was theorized that the disability may have been due to decomposition products of epoxy resins. It has been previously mentioned that exposure to epoxy concrete dust has produced ill effects. A report from England indicates some of the decomposition products may include depolymerized resin, free amines, and other intermediates.

A review of the published literature shows that, in a majority of fires, the principal toxic combustion product is carbon monoxide, and although other lethal gases might also be present, the volume of carbon monoxide would be so much greater that it would constitute the major hazard.

A hazard certainly exists when plastics are involved in fires and fears of additional gases involved must not be minimized nor obscure the realization of the hazards of carbon monoxide. It also points to the real conclusion of the need for further study of pyrolysis and/or combustion products to determine the effect of specific contaminants, combination of decomposition products, and brief exposure to high concentrations.

Flammable Liquids

The use of flammable liquids in plastic processing and fabrication plants has rapidly increased in recent years and constitutes one of the major health and fire hazards

in plastic plants. The commonplace use of many flammable liquids has caused some operators to discard the health and safety aspects of the problem and to become complacent. This has resulted in an ever-increasing number of harmful solvent exposures and fires with consequent loss of life and property.

Not all flammable liquids vaporize at the same rate nor is the same proportion of air required for ignition and burning of the vapor-air mixture. These characteristics and others are used to determine the degree of hazard of flammable liquids. Some of the more important factors which are taken into consideration include flash point, ignition temperature, explosion range, vapor density, solubility in water, toxicity, specific gravity and diffusion.

Flash Point. The lowest temperature at which a flammable liquid gives off vapors in sufficient quantity to form a flammable mixture of vapor and air immediately above the liquid surface is termed a "flash point."

Explosive Range. Vapors of flammable liquids burn or explode when the proportions of vapors and air are within certain limits. There is a lower and an upper explosive limit for each liquid. The vapor-air mixtures that lie between these two limits is called the explosive range.

Ignition Temperature. Ignition temperature is the minimum temperature required to initiate or cause sustained combustion.

Vapor Density. Vapors of almost all solvents are heavier than air and they may flow long distances along the ground to a point of ignition and then flash back. The relative weight of a vapor as compared to that of an equivalent volume of air is termed vapor density. The heavier vapors tend to resist dispersion and remain in the low spots.

Solubility in Water. The water solubility of a flammable liquid is an important factor in selecting a good fire extinguishing system. Certain foam extinguishing agents are effective on petroleum fires, but ineffective against alcohols and water soluble solvents. Special alcohol resistant foams are available for these materials.

Toxicity. The vapors of most flammable liquids are harmful if breathed in quantity for an extended time. Certain of these materials break down in fires to form toxic

and irritating products of combustion which impede the work of firemen and make extinguishment more difficult.

Specific Gravity. The specific gravity of a liquid is a ratio of the weight of a given volume of the material to the weight of an equal volume of water. Most flammable liquids are lighter than water and will float if not soluble in the water. If burning, a fire will spread.

Diffusion. The vapors of flammable liquids tend to diffuse in air in the same way that a drop of ink in a glass of water diffuses through the water so that it all becomes colored. The lighter vapors will diffuse faster than the heavier.

Control Measures

1. **Engineering.** The substances used in the formulation, mixing, lay-up, and curing of resin fabrications present serious hazards to health and plant operation. The locations for these operations should be ventilated to exhaust dangerous vapors from the working atmosphere and discharge them far enough away from the building of origin to prevent their contaminating the fresh air intake.

Because of the dermatitis possibilities, every precaution must be taken to prevent spills and drips. Disposable paper, replaced as needed, should be used to cover bench and floor surfaces likely to become contaminated.

Meticulous plant care and constant employee supervision should be maintained to guard against the two chief dangers in plant operations:

1. Skin contact with the reactants.
 2. Exposure to their vapors and dust.
- B. **Personal Protective Equipment.** To prevent personal contact, the following items should be used by employees for the exposures indicated:
1. **Full face shields,** or preferably, gas-tight chemical safety goggles and organic fume and vapor respirators, to protect the eyes and face. These are especially necessary for employees working with caustic amine curing agents that are toxic and volatile, such as triethylene tetramine.
 2. **Gloves** (rubber or plastic) — to be worn whenever skin contact with the resins or their fabricating or curing agents is

likely. When soiled, the gloves should be discarded, or washed in acetone or methyl ethyl ketone (toxic, volatile and flammable) followed by soap and water. They should never be removed from their place of use without being cleaned, or placed where unauthorized people may handle them.

3. **Protective clothing**—coveralls and plastic aprons and sleeves, to protect employees repeatedly or continuously working in contaminated areas. Coveralls should be changed at least twice weekly, or whenever so contaminated that irritating substances are likely to contact a worker's skin.

4. **Protective creams**—of a suitable type, to be used by those subject to occasional and unpredictable contamination.

5. **Placement of Workers.** Toxic substances affect some individuals more than others. Susceptible workers are often injured by concentrations easily tolerated by the average person. As the hypersensitive cannot be identified until symptoms develop, all employees should follow the safety precautions outlined. The dermatitis resulting from the uncured resins and their modifiers may sensitize the individual, making him more susceptible to dermatitis. Such employees should be removed from the exposure until they have completely recovered from this condition. Subsequent contact with the causative substance should be limited to what can be tolerated without a recurrence. Hypersensitive individuals should be removed from the exposure.

6. **Training and Education of Workers.** Much of the success of protecting workers engaged in resin formulation depends on their knowledge and understanding of the hazards involved. The following points should be especially emphasized:

1. A continuous flow of fresh air should be maintained in work rooms.

2. Workers should keep themselves and their equipment clean.

3. Mild soap, or a skin detergent, and water should be used for washing. Organic solvents, such as acetone or other ketones, alcohols, benzene, gasoline, kerosene, and toluene, should be avoided, as they are more or less toxic, and may increase susceptibility to dermatitis by removing skin fats and moisture. If they have been used previously for cleaning equipment and

thus contain dissolved epoxy resins or their curing agents, there is even greater danger of dermatitis and sensitivity toward it due to the fine film of resin which such contaminated solvents spread over the skin area.

4. Skin roughness and dryness should be corrected by the use of satisfactory ointments.

5. Open cuts, abrasions, or skin areas already irritated (as from fiber-glass "mechanical itch") should be kept from contacting any of the materials already mentioned as likely to cause irritation.

6. Fingernails should be kept short and clean.

7. Hands, especially if contaminated with the irritating substances referred to, should be kept away from the face and other parts of the body.

8. Suitable rubber or plastic gloves should be used.

9. Irritating substances should be washed off gloves while they are still on the hands, the wash water being kept from touching the hands.

10. Talcum powder or, for those allergic thereto, baby or cornstarch powder, should be used on the hands to facilitate putting on and taking off the gloves, and to alleviate the irritation of excessive perspiration under the gloves. People allergic to the gloves can wear light cotton gloves underneath.

11. Powder and gloves should be kept on clean paper, changed at least once every shift to prevent contamination.

12. A minimum of protective clothing, such as coveralls and plastic aprons and sleeves, should be worn to prevent heat rash while nevertheless providing adequate protection.

13. Showers should be taken before changing to street clothing.

14. Any sanding or grinding operations producing resin dust should be well exhausted.

All employees should understand that anyone can develop dermatitis and that everyone should follow these precautions. Each should understand that once he develops a skin rash, he is more likely to get it again. Each operator should take special care to prevent others from developing

dermatitis because of contact with plant equipment, hand rails, door knobs, valves and switches that he has been too careless to keep clean.

Personal cleanliness is a prime requisite for all employed in the curing and fabrication of resins. They should make every effort to:

1. Avoid direct contact with the uncured resins or their curing agents.

2. Remove them as quickly as possible from any skin or body part contacted.

3. Leave no possible sources of contamination for others.

4. **Storage.** The solvents and curing agents are volatile, flammable liquids and should be handled with the following precautions:

1. They should be stored and handled in safety cans, approved by Underwriters' Laboratories.

2. The area where they are used should be cool, well ventilated, and isolated from open flames, oxidizing agents, and other fire hazards.

3. A flammable-gas indicator or explosimeter should be employed for checking questionable air concentrations.

4. A sign reading: "DANGER—FIRE HAZARD, FLAMMABLE SOLVENTS" should be prominently displayed.

5. Approved fire extinguishers should be readily available to fight fires.

6. **First Aid.** Facilities for immediate care of any accidental skin or eye contact should be readily available. The following measures are suggested:

1. Eye contamination—The eye should be immediately washed with copious quantities of clean water for ten minutes. All cases should be referred to a physician immediately.

2. Skin contact—Affected areas should be cleaned thoroughly with soap and water. Fresh acetone or methyl ethyl ketone may be used only if necessary, and then in small amounts, as these are toxic and flammable, as noted under Personal Protective Equipment. Solvents used previously to clean

tools or equipment should not be applied to the skin. Clothing wetted from spilled solvents or curing agents should be replaced immediately. If the affected person is not sensitive to ethyl alcohol, a light application of it may give relief.

7. **Waste Disposal.** Every care should be taken to keep all contaminated gloves and clothing, waste paper, rags, etc. in special isolated plant areas reserved for that purpose, with every previously indicated precaution being taken for storage and handling.

Contaminated clothing, equipment or waste should not be permitted to come into contact with such items as handrails, door knobs, valves and switches that employees are likely to touch with the bare hands. All materials contaminated with uncured resins or their curing or processing agents, that are to be discarded, should be disposed of as quickly as possible.

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THE MAN MOST LIKELY . . .

By MAX E. STANSBURY

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Every once in a while I am forced to give up time when I might be shooting pool to attend a meeting and listen to a so-called "message" from some speaker or other. When I make that sacrifice, I like to think that the speaker knows what he is talking about.

On the assumption that you would feel the same way about it, when I was asked to talk to you, I started casting about for a subject on which I could appear qualified to speak. A quick review of my personal history gave me the answer.

I used to be in the land department of my company and lasted only about five years. Then I was in the legal department for about three years. Currently, I'm having my troubles in the industrial relations department. Having thus been tried and found wanting in three high fields of endeavor, I feel that I can qualify as an expert on the subject of how to be a failure. I am even willing to put my neck out a little bit and attempt to tell you how to be an outstanding failure as distinguished from the ordinary or run-of-the-mill failure.

The reason there are so few truly colossal failures is that many of the persons striving toward the goal lack concentration and direction. They are like the famous Leacock character who leaped into the saddle and galloped off in all directions. The man who succeeds as a complete failure will choose the road that best suits his type and will steadily canter toward that goal.

I have picked out five excellent routes to outstanding failure and have named them after streets and highways. They are the "Toll Road," the "Corduroy Road," the "Freeway," the "Dead End Street," and the "High Road." Any one of them offers opportunity for the man who wants to really make a mark in the failure field.

One of the most scenic routes to failure we will characterize as the "Toll Road."

In this group you will have men-of-distinction for company. This is where you will find the boy-wonder presidents, the

meteoric-rise veeeps, the ball-of-fire geniuses in most any line.

Now it will take you longer if you choose the "Toll Road" because you first must be a success before you can fail.

In my school of thought, success, compared with failure, is easy to achieve since every psychologist, conference leader, and after-dinner speaker is full of foolproof advice on how to climb the ladder of success. So by following all this advice on human relations, you will undoubtedly be a great success in a relatively short time. Having done so, you then proceed to throw it away in a mental, physical, or emotional breakdown.

Gone are the days when an ordinary ulcer or a cardiac condition could qualify you as a "Toll Road" failure. Modern medicine patches you up, and within a few short months you are back on the job. You have to do better than just ulcers or a mere heart attack in this modern age if you are to be acclaimed as a failure. I suggest a complete nervous breakdown.

Suppose everyone recognizes you as an able fellow, doing an excellent job. That makes it pretty tough to be a failure. But under the Stansbury System, you're not hopelessly doomed to a life of success. In those circumstances it is a good idea to begin thinking of yourself as indispensable and infallible. Skip lunch. You are too busy to eat. Fill your briefcase, your desk, and your mind with reams of work details. Refuse to allocate any work to assistants or subordinates. They can't do it right anyway!

Let yourself be a little miffed because the committee adopts Bill's suggestion rather than yours. Let yourself be envious because it's at Dick's desk that the big boss usually stops for a bit of chit-chat when he is visiting the salt mines.

Hate or envy, for any reason, can really use up a lot of emotional energy. And with your efforts devoted to hate and envy, you will be well on the way toward an emotional blowup that will take you out of the picture.

It will help if you will develop a thin skin and take everything personally. Learn to feel that every departmental instruction and every company bulletin is actually directed right at and against you. You can reach the point where if one of your company's brass hats says "Good morning" to you as you enter the plant, you can spend the rest of the day fretting about whether he meant something by that remark.

With only a little effort you can read flights into actions or remarks where no flights were meant. These you can nurse into really important cases of self-pity—in such an extent that you can become a hypochondriac always in search of a cure for an imaginary illness.

One of the most helpful devices in your struggle upward in the failure field is to run from making decisions. If you really put your mind to it, you can reach a situation where you can never finish any task because you are busy rationalizing, postponing, seeking, and fussing to find the perfect solution. Keep your finger on every tiny detail. Insist on personally handling everything that comes along so that you can overload your brain with unnecessary stimuli.

Then, as part of an over-all campaign, on any job or project you undertake, set your sights so high that you can't hope for full accomplishment. Using this method, even though you have done a pretty good job, you are left with dissatisfaction and frustration which gnaw on your nerves and emotions. Another advantage is that you can waste a great deal of time in self-pity and self-condemnation, and you won't have time to go out and accomplish another pretty good job that satisfies everyone but you.

Work like a dog on every job and neglect your health, your family relationship, and your friends so that there will be no rest for your body, for your nerves, or emotions. Only then can you assure yourself that you are really on your way along the "Toll Road" of failure.

Maybe some of you are unwilling to spend the time necessary to become a success before achieving failure. Then the "Toll Road" is not for you.

I offer others.

The "Corduroy Road" to failure is one

reserved for the rough, tough, lie-man type. If you are ill-mannered, talk too loud and too long, the "Corduroy Road" is the one for you.

It is a rugged road and requires constant affirmative action. You must drop any cultural qualities that you have. A liking for music, literature, art—that stuff's for sissies. For you, the three B's are beef, brawn, and booze. Any attempt to engage you in conversation about anything except sports—or maybe women—brings from you nothing but derision.

In voicing your opinions, you will be very decided and positive in your views. You are required to take it as a personal affront if anyone suggests views contrary to yours. In that case, you can disagree, good and loud, perhaps making a few reflections on the other man's intelligence or motives.

This is a particularly handy approach to use on people you have just met. Right away they can mark you down as a man they want nothing further to do with, and you are therefore well along the "Corduroy Road" to failure, unhandicapped by any new friends.

One of your biggest assets in your travel along the "Corduroy Road" to failure is to be a heavy drinker, but beware of this course if all you do is slide under the table. As a result of your drinking, be bellicose and antagonistic. The happy drunk, the weeping drunk, people will tolerate, even forgive. But the drunk who wades in there swinging his marked himself as a first-class heel that no one wants around.

Drunk or sober, be quick to anger. Frequent violent outbursts of temper are valuable in causing people to avoid you.

At the first sign of adversity, let go completely! Spend valuable time giving associates and subordinates large pieces of your mind. This will make people think you'd be much happier and less bothersome in a nice quiet sanitarium, weaving bright rugs. As an excuse, you can blame the necessity to relieve nervous tension, or the rapid pace of your job. You can always comfort yourself with the thought that most great persons are temperamental.

Now, in contrast with the "Corduroy Road" traveler—rough, rugged—is the smoother, urbane "Freeway" fellow.

The "Freeway" is another road to outstanding failure. On the "Freeway" you can spend your time on the job dreaming about a promotion, transfer, or a higher paying job with another company. Or, you can devote your thoughts to entering a business for yourself. For instance, try to think up a product that costs a dime, sells for a dollar, and is habit-forming.

Don't regard your job as a reason for living, but only as a means for earning a living. You must watch yourself so that you don't develop an interest in your work so that you actually enjoy it at times. That might be fatal to your hopes for failure.

Be very open in expressing your dissatisfaction with your pay, the conditions under which you have to work, the boss' ability and his feeling toward you. Never fail to criticize the company's general policies or practices, whether they are generally regarded as good or not. And while you are at it, don't display any loyalty to your employer or company. Attack the quality of the company product, and don't go out of your way to use it yourself or to recommend it to your acquaintances.

And, always oppose the best interests of your industry or your company. A good gimmick along this line for fellows in the oil business is the depletion allowance. I've been talking in generalities—let me give a detailed case history of how a "Freeway" failure can go to work.

The depletion allowance is a 27½ per cent deduction which our country's income tax laws allow for people and for companies in the oil-finding business. Similar allowances are made in mining and in other businesses where there is a big risk to the investor who puts up the money, and when the production makes it a "wasting asset"—that is, once you take it out it's gone and irreplaceable except by new discovery. You deplete the product by producing it.

That depletion allowance is of paramount importance to oil company employees. Only because of it can your company justify huge expenditures, such as are being made offshore of Louisiana to search for more oil—oil that forms the backbone of our national security. Those huge expenditures are the stake in a tremendous crap game. Lose enough and your company is out of the game and you're out of work. The de-

pletion allowance is the little edge that lessens the nearly 10-1 odds against winning.

The depletion allowance is not very well understood by the general public, and it has been represented by its enemies as a tax "loophole." Yet practically everyone understands that depreciation on a plant or piece of machinery that produces a product is an allowable and justifiable income tax deduction. The depletion allowance for oil produced is the equivalent of depreciation on a plant. Because you're in the oil business, your friends outside the industry will want your views on the depletion allowance.

As a man on his way along the "Freeway" route to failure, you should influence your friends to believe that the depletion allowance is tax evasion by the big-money boys, that it shouldn't be allowed for the oil industry. By so doing, you can really sabotage your company and your industry; and since your objective is success as a failure, you have thus struck a telling blow for yourself.

It helps in crushing down the "Freeway road" to failure if you can find a bright young engineer or scientist who will confide his ideas to you. Then you can contrive to encounter the plant manager and can modestly start out something like this, "I know so little about these things, and undoubtedly you have thought of it first, but it seems to me . . ." and then expound, as your very own, the pilfered idea. Enough scheming of this kind and pretty soon all your associates and superiors make every effort not to impede your progress along the "Freeway" road to failure.

And be careful what you read. It might veer you from your objective of being a failure. For instance, take this quotation from Lawrence Appley, president of the American Management Association:

"If one foreman is motivated by a wish to be of service and sees his job as an opportunity for service, he has an influence that is farther-reaching than he himself may realize. For if he helps one person who works for him to be a better worker and a better citizen, that one person will be a more constructive influence in his own family, among his friends, and in the community in which he lives. Multiply that by 15 or 20 individuals

in the foreman's department and we can see that he is rendering a far greater service than would seem to lie within the boundaries of his job.

"At the same time, such a foreman is attaining the results for his company that are most to be desired, and he is destined to progress to greater and greater management responsibilities."

You had better watch that kind of stuff. First thing you know you'll be thinking it's sound and logical. Then you'll believe it and start practicing it. If you do, brother, you're a dead duck so far as being a successful failure.

"Now," you may ask, "what if I'm not the 'Toll Road' type . . . or not rugged enough for the 'Corduroy Road' . . . and can't qualify for the 'Freeway' . . . what do I do then?"

That's a good question. It encourages me to discuss the "Dead End" and "High Road" routes to failure.

To make the grade as a failure in the "Dead End Street" class, it is not enough to be just a procrastinator. This is a big help, but it has to go deeper.

Instead of letting letters, reports, and memos just clutter up your desk top without your taking any action, put them in your desk drawer and forget them!

After two or three crises—with the causes found in your desk—you'll be marked as a man who will go far as a failure.

On the "Dead End" road to failure, you must always stand on your dignity and sit on your prerogatives. Protocol, the amenities, and the red tape must always be observed.

There is no room in you for levity, hearty laughter, camaraderie, or just plain friendliness. If anyone encroaches just one tiny bit on your prerogatives, or sticks his nose in your field of endeavor, see that the whippersnapper is properly and swiftly put in his place. If you are violently jealous of what you are sure are your very own rights, your very own business, then you can keep practically everyone from helping you.

It is a nice touch to be a stickler for the rules, regardless of the circumstances. This is particularly helpful in human relations or in dealing with people. In any written rule or law, there will be found

flaws that work injustices in certain circumstances. Be sure that you insist upon the application of the letter of the law in those cases.

A further refinement of the "Dead End Street" approach is to check every possible angle on every problem, regardless of its importance. You can really have a field day on some minor type of problem while you seek everybody's opinion as to the solution and make surveys to see what other companies have done in similar circumstances.

A word of caution here. The process of checking other people's opinions and industry practices can be a valuable tool on an important problem. If you slip and go through the process on a problem that really deserves that attention, you're liable to wind up with a feather in your cap instead of making progress along the "Dead End Street" to failure.

However, even in the case of such a mistake, you can sometimes redeem yourself and make the situation an aid to your campaign for failure. For instance, having mistakenly assembled all the pertinent facts on a problem that warranted the effort and the time, write a report so long-winded and so disorganized that your busy boss will discard it in disgust. Or leave out some essential, such as the estimate of the cost, so management has to reenter it back to you.

Little refinements like those are the mark of a man entitled to travel the "Dead End" road to failure.

Probably the most exciting road to failure is the "High Road." This category is the "Living It Up" school of failure. For those who really qualify, it leaves many pleasurable and erotic memories.

As a modest beginning, you can live beyond your means. No piddling efforts like buying cars, houses, and television sets on time will do, however. Be big about it. On a Chevrolet income, go in debt for a Cadillac. That will, in turn, lead to other mismanagement of your funds and finally, on a stack of unpaid bills, you can climb to success as a failure.

Go in heavily for expensive partying and debauchery that leaves you all hung over on the job. Being thus unable to perform will act as insurance that nobody will want you around the job.

Above all, involve yourself with many, many women. For almost any man even one woman is sometimes a strain. But for the man who wants to be a "High Road" failure, it's a case of gritting your teeth in determination and making the necessary sacrifice by carrying on with at least two. And it's not enough that you have a clandestine girl friend. It's almost axiomatic that nobody cares particularly about your private affairs. It's only when you flaunt your indiscretions in their faces that the decent people become disgusted with you.

See to it that your girl friends call your office frequently, or that your wife is so disturbed that she seeks help from your associates. Or take your little playmate to social affairs where your friends and acquaintances are put on the spot by having to accept or reject her.

Getting involved in newspaper scandals or being named as the "other man" in divorce proceedings is needlessly dramatic, even though it might be effective.

You can be every bit as effective, and possibly more obnoxious, just by making a few passes at the wives of fellow employees. Then you will quickly achieve the status of a "High Road" failure.

Now those are my five basic roads to achieving outstanding failure. You can have combinations, clover-leaves, detours and by-passes, but the fundamental routes will always be there:

1. The Toll Road
2. The Corduroy Road
3. The Freeway
4. The Dead End Street
5. The High Road

Somebody could well ask now what road I took in qualifying myself to speak so authoritatively on failure. I must admit that I didn't practice what I've been preaching.

I followed none of those routes. If you'll permit me a Texas brag: I'm a natural. I didn't have to work at failure in any of the ways I've outlined for you.

Some of us who think we have an inferiority complex find out that we're mistaken. We don't have an inferiority "complex"; we're just plain inferior. That puts us in what we might call the "Parking Lot" class of failures—no effort, no striving; just plain natural aptitude.

Less than one per cent of you can qualify as "Parking Lotters," however. Most of you will have to work at it through the routes I've been telling you about, but let me pass on a tip for those of you who might want to try to belong to this inner-circle group.

Somebody asks you to make a talk like this one. Without shame you steal ideas, words, sentences, stories, examples from sources such as Lloyd Thanhouse of Continental Oil Company, from Kiplinger and Fortune magazines, from the Reader's Digest, from Shepherd Mead's book "How to Succeed in Business Without Really Trying," and from Jim Whetsell of one of Conoco's smaller competitors—The Texas Company. Mix them all together—and your "original" talk is all written.

Thus, the "Parking Lot" failure spares himself the painful process of thinking. And does a "Parking Lotter" give any credit or acknowledge any sources of his material? Heck, no! You can't be a failure by being fair to people. They'll be twice as mad at you if you let them discover your perfidy for themselves.

In all of the routes to failure, and even in the "Parking Lot" method, your attitude is the most important single factor. You can't be just casually interested if you are to reach your goal. Only when you find that your mind is constantly occupied with thoughts of failure can you say that you've achieved the proper attitude. When you're first pointed toward failure, it's all right to think about it on a part-time basis. But if you aspire to be a real resounding flop, you must develop a full-time attitude.

It is sort of like the lady who called the desk of her apartment hotel to complain that someone was banging away at a piano in the suite next to hers. The clerk explained that the piano was being played by Liberace, who was practicing for his concert that evening. The lady immediately called several of her friends to come in a hurry to her apartment. They listened with attention and appreciation to sparkling piano music by Liberace. The sounds from the next suite were the same. Only the lady's attitude had changed.

Gentlemen, watch your attitude. You, too, can learn to fail. Work at it, and I'll guarantee that ex-friends and former co-workers will vote for you as "The Man Most Likely to Fail."

Environmental Health

The meeting place for the three disciplines, industrial hygiene, safety and medicine, is their common interest in a healthy environment.

Man's external environment has three major components:

1. The *biological* component, including the living things of the plant and animal kingdoms—ranging from the food upon which life depends to those micro-organisms responsible for disease.

2. The *physical* component, encompassing the nonliving things and physical forces affecting man—such as water, air, food, chemicals, heat, light, and other radiations.

3. The *social* component including a complex interplay of factors and conditions—cultural values, customs, attitudes; economic status; social and political organization; and ability to support facilities and services.

It should be remembered that most of the total of man's external environment is found outside of industry. However, the primary responsibilities and therefore the opportunities of the occupational health team stem from the job environment of the worker. A review of the chief biological, physical and chemical agents which on occasion may form a hazard will show many areas of concern to the industrial hygienist, to the safety supervisor as well as to the physician.

Biological agents (infectious diseases: bacterial infections, rickettsial infections, virus infections, protozoan infections, fungal infections; parasitic diseases: venoms and animal toxins.)

Physical agents (abnormal temperature and humidity; abnormal barometric pressure; motion, acceleration, and gravity; vibration, noise, and ultrasound; radiant energy: light, ultraviolet, infrared; electricity; ionizing radiations.)

Chemical agents (dusts; gases and fumes; metals; acids and alkalis; solvents; other organic compounds.)

Accident Prevention

The disciplines of industrial hygiene, safety and medicine have a considerable stake in motivating workers for accident prevention. Safety devices, safety committees and various educational efforts have not and cannot do for the individual the

things he must do for himself. Human failure is still the chief cause of accidents.

Psychologists insist that accidents are not chance happenings but follow specific patterns of human behavior. The directing force arises from a strong emotional base. In this behavior the psychologist identifies a hostile component, expressed either outwardly or inwardly. Much needs to be learned about how to handle this hostility. The victim cannot wish it away; he usually is unaware of its existence. We who are dedicated to preventing human failure in industry must take time to look into the psychological problems of the people who have the accidents and who will continue to have them until their aggressiveness is redirected.

One method of help advocated by many is that of providing a channel of communication through which a person can express feelings of insecurity, doubts, anger, fears, to a friendly and interested listener. Call this emotional catharsis, non-directive counseling, or by any title that is preferred, the process represents hope for accident prevention. The opportunity for counseling comes to all members of the occupational health team. It is essential to be alert and not miss the opportunity when it presents itself.

The medical department can assist in selling safety, the safety group can back up the industrial hygiene activities and so goes the reciprocity cycle. Taking time and trouble to work safely annoys many people. Emphasis needs to come repeatedly and from several sources before some recalcitrants accept the necessity to do the job the right way in order to retain the job.

Slowly we are gaining knowledge of the relationship of impaired function of the human "machine" to the accident potential in people. The relationship is still blurred and inexact, partly through the remarkable ability of man to "compensate" for his deficiencies and to reduce his exposure to accidents through various and ingenious devices. In spite of the lack of sharpness in the correlation of many physical and some mental states with accident frequency, there are contributions which the physician can make toward accident prevention.

The individual should not undertake work which exceeds his physical capacity. The

organic diseases, impairments in function, reductions in motor and sensory responses which clearly predispose to accidental injuries afford the physician an opportunity to help. This may result in better job placement, engineering modifications, or reduction in one's physical efforts.

Things seen and reported by a plant physician can give leads to safer operations and reduce the number of injuries. This example was related by an engineer: "There were a series of first aid cases involving shoulder injuries. The minor injury reports were complete in detail and Dr. T. M. noticed that all cases involved the same shoulder. They were strains involving the same muscles, and responded well to heat and rest. Dr. T. M. went into the matter more thoroughly. He had noticed that all the men affected worked in the same house. He took time to make a trip to the scene of that operation and found that every one of the strains occurred as the men were attempting to lift a heavy lid on a dope bin that had a tendency to stick. Dr. T. M. recommended to the plant management that air cylinders be installed to raise the dope

bin lids. The suggestion was accepted and those particular minor injuries ceased."

The challenges to the health and safety team are many and varied. New processes, new material, new equipment come into industry at a rate which taxes the ingenuity of hygienists, safety engineers and physicians. Our common interest is that of keeping healthy, able workers on the job. The diversity of training and experience which this triumvirate brings to the task is a potential source of strength. That strength can be realized by our continuing recognition of the contribution each discipline can make through co-ordination of efforts and support of one another. The results are healthier workers and better places to work.

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THE CONSUMING DANGER OF ASSUMING

By KRAUS EARHART

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When Mr. Quincy V. Tuma asked me to speak on the subject, "the consuming danger of assuming," I couldn't say no.

Today, there is so much to know about so many things. Certainly one can't know it all, even though many would have you believe they do. A passage from the Scriptures gives appropriate emphasis to this opinion. It is from I Corinthians 8:2:

"And if any man think that he knoweth anything, he knoweth nothing yet as he ought to know."

I would advise you that if you must tell all you know, be sure to know all you tell. It is said that half of the problems of the human race are due to the lack of business knowledge—knowledge of what is

their business and what is none of their business.

That which is our business we should know well for it affects the well-being of our fellow men. We have a responsibility to know our business well in order that we may clearly and factually communicate with and pass information on to others so there will be no assumptions concerning accident prevention. We should objectively think things through.

A cartoon with drastic assumption appeared back in 1830 and showed the dire disasters which would befall the American people if steam power were to be used in the factories. It even went so far as to suggest that mothers have no more chil-

since proposed use of steam would do away with any possibility of jobs for them.

Around about the time I arrived upon the American scene (some years after 1830), there were many people in and out of government circles who were assuming and even predicting that the U. S. Patent Office would have to close down for lack of applications. A lot of other good and presumed knowledgeable people of that period had the feeling that they had gone about as far in their knowledge of the world as it was possible to go.

Times have changed considerably and times keep changing. Today, practically all literate people recognize that much more knowledge is available to those who make the effort to acquire it.

Opportunities today are more plentiful than ever before. Each new thing that is discovered in the world does not cut down but one the sum of discoveries to be made. Rather, it opens up a whole new vista of discovery and development in a new direction.

With more knowledge comes more progress. Sometimes, progress represents the substitution of a complicated nuisance for a simple nuisance.

For instance, we have better engines today. A little over 40 years ago, it took only 100 horsepower to keep a combat plane in the air. Today, it takes 250 horsepower to carry a 115-pound female down to the "drive-in" grocery in the next block.

We have faster cars and better roads to travel on. The old-time narrow trails where two cars could barely pass without colliding are fast being replaced with six and eight-lane highways where a half-dozen or more cars can collide at one time.

Progress of real significance was indicated a few years ago by Professor Walter S. Buckingham, Georgia School of Technology, when he made the statement,

"If properly understood, applied, developed, and controlled, automation together with atomic energy may provide the means for eliminating poverty for the first time in the history of the world."

Arnold Toynbee, eminent British historian, said not long ago:

"The Twentieth Century may be considered as the first age in history in which people have thought it practical to make the benefits of civilization available for the whole human race."

That, too, would be progress of great significance.

However, it appears that most of the great nations are giving most effort to strengthening their military posture. If World War III does come, it will be unique in that it will never be mentioned in history books.

You may think that it was a wisecrack for my talk to be titled, "The Consuming Danger of Assuming." Well, why the danger? Who's assuming? The danger results from too many people mistaking "looking for seeing," "listening for hearing," "observation for understanding" and "opinion for thinking."

In the present age of mental and moral confusion, we are in somewhat of a 20th Century Babel in which a *sea of paper, an avalanche of words, and a thunder cone of sound* are too often substituted for a rational exchange of meaning between human beings.

In your discussions of and for safety.

Just how do you rate?

Do you assume and prate.

Or do you really communicate?

Take another look at the title, "The Consuming Danger of Assuming," and think about "eating" instead of "consuming" and you may come up with a realistic assumption that it isn't what you eat but what eats you that is dangerous and gets you into trouble. Why are so many people inclined to assume worries about things over which they have no control and can do nothing about? That sort of thing eats you. Ask your psychiatrist. It's too bad that we can't do what it is said the Government does with its problems: just subsidize them.

Another scriptural passage which I think is timely is from I Corinthians 14:9:

"Except ye utter by the tongue words easy to be understood, how shall it be known what is spoken? For ye shall speak into the air."

Some other wise words were spoken by St. Ambrose in the 4th Century. He said:

"The wise man, before he speaks, will consider well what he speaks, to whom he speaks, and where and when."

Right now, I am sure that you will agree with me that it is a good policy to say what you mean, stick to the facts, and mean what you say, and make sure that you are understood by those to whom you speak. Being misunderstood can be serious.

Assuming something and jumping to a conclusion is very unwise and may break up a friendship of long standing. Sometimes it just doesn't pay to assume that you know the whole story. When you tell something, tell the whole story and be factual—not hypothetical. Facts are hard to come by, but they have the solidity of diamonds. We tend to be beguiled by what is paraded as fact.

Many adults make the mistake of not considering children and youth as people or as individuals. It works both ways, for most youngsters assume that a lot of their elders are "way out" or "squares." It is a source of joy and satisfaction when parents and their offspring come to a meeting of the minds and have proper recognition for each other. The difference between genius and stupidity must be that genius has its limitations.

A statement I heard recently provoked me a bit. It was:

"There's been so much said about selling safety: why should anyone want to buy safety when he can have all he wants for free?"

There's a brilliant assumption. Safety isn't free—certainly, not in Texaco and not in many other well-managed outfits with which I am familiar. It takes a sound, well-planned program which is nurtured on a continued basis. Just because a group of employees or a department or company has been safe, or compiled a good record over a long period of time, it's a big mistake to assume that someone won't get hurt later on.

Many years ago, I began to think seriously about the consuming danger of assuming and down through the years many tragic events have occurred to keep me aware of the fallacy of assuming—for instance:

(1) The West Central Texas rancher who for many months drove his car across the T & P Railroad tracks each day at the same crossing and at the same time.

He never saw any trains and he assumed there would never be trains at that time, but one day the "Morning Flyer" was several hours late and met the rancher and his car "head-on" at the crossing.

(2) The Indiana father who assumed that his pistol was out of reach and well hidden but his four year old son got possession of the car keys to unlock the car trunk and remove the weapon from a locked box. The fantastic and tragic feat performed by this young gunman should dwell heavily in the minds of all parents for he critically shot three other youngsters. (This story emphatically illustrates to what length our modern youngsters will go to obtain fascinating "play-pretties.")

(3) The Alabama school bus driver who assumed that the bus brakes had been repaired just because he had reported the poor condition of the brakes. Four youngsters, including two of his nephews, were killed when the bus collided with a train.

And so, on and on—countless thousands of similar tragedies occur and too many times because people are prone to assume and come up with wrong assumptions.

The trusting statistician, 6' 4" tall, assumed he could wade across a river which had an average depth of three feet. Although he drowned, it is possible that he learned, but too late, that averages are a mathematical fiction or assumption to which the real world seldom conforms.

Words form the link of communication between people. They can bring understanding or misunderstanding, according to how they are interpreted or used.

Words are tools to be thoughtfully chosen and carefully used. Good words can be poorly used and may, perhap, unintentionally convey a wrong meaning—like the signs:

in a Government office—"Executives Without Secretaries May Take Advantage of Stenographers in the Typists' Pool."

in a library—"Only Low Conversation Permitted Here."

on cemetery gate—"No Digging or Planting Here."

at hospital ward entrance—"Maternity Ward—No Children Allowed!"

Connotations of terms vary with the experience of the individual. The sentence,

"He picked up a ham on the way home," would have three decidedly different meanings to: 1) a connoisseur of food, 2) a little theater devotee, or 3) an amateur radio operator. And then, don't forget that "Ham" was also the name of the chimpanzee sent for a ride into outer space. This "Ham" was aeronautically simulated. Simulated is to assume the appearance of something without the reality. In this case, "Ham" substituted for man.

Much of what we say depends upon the one to whom we say it and his readiness to assimilate it. People who jump to conclusions or make quick assumptions are usually the most vocal and when given a chance to speak, they always seem to have so many unexpressed thoughts—you know the type, I'm sure.

Like many others, I have long been concerned about the huge amount of wastefulness coming from the expenditure of words beyond the income of ideas. I am tolerant of people who disagree with me. After all, they have a right to their ridiculous opinions. One thing that displeases me very much is the way some narrow-minded people try to impose their thinking upon others.

Did it ever occur to you that prejudice is a great timesaver? It enables you to form opinions without bothering to get the facts.

I listened with much interest to Professor Arthur Secord at the National Safety Congress a few years ago when he posed the question:

"How can we be more sure when we say something to other persons that they will hear what we think we said?"

His answer caused me to conclude that what we say is never important. The important thing is, what did the person, or persons, hear? What did they think we said? Do the words we use mean the same thing to the people to whom we speak that they mean to us? We must speak the other fellow's language. We make a great mistake in assuming that words mean. Words don't mean—only speakers do.

Many years ago, I heard an astute speaker say that listeners should be advised in these words, "Don't keep your attention on my words. Never mind what the words mean. What do I mean?"

It makes little difference how simply one speaks if, when speaking, listeners assume something different from what is said or interpret the words in their way rather than those of the speaker. The use of the right words at the right time is important.

For instance, in management's discussion with employees, we know it is much more important to say "earnings" instead of "profits," and "employee benefits" instead of "hidden wages," etc.

Many safety people labor the idea that they should have management support when their real need is for management action, direction, and participation.

Some of us are guilty of serious misuse of other words in our business, such as:

"Fireproof" instead of "Fire Resistant,"

"Inflammable" instead of "Flammable,"

"Accident Prevention" instead of "Injury Prevention,"

"Lost-time Accident" instead of "Disabling Injury,"

"Carelessness" instead of the specific cause.

There are many others—too many to detail here.

It is pretty well indicated to me that we should say what we mean and mean what we say. We definitely should prefer the familiar word to the far-fetched, the concrete word to the abstract, the single word to the circumlocution, the short word to the long and the Saxon word to the romance.

We must realize that our listeners are going to make interpretations of what we tell them. Sometimes it may coincide with or slightly resemble our meaning. Once a person knows the "why of a do" or the "why of a do not," better performance generally results, but until they do, look out! Tell him why. Tell him why not.

Misunderstanding is not always a matter of stupidity on the part of the listener. If the pupil hasn't learned, then the teacher hasn't taught. And don't forget that hindsight explains the mistake or the accident that foresight would have prevented.

Misunderstanding and assuming can sometimes be amusing without danger.

The big "boss" was attempting to fix a door in his home when he found it did not hang properly. He called to his son to get him a "screwdriver."

After what seemed an unusually long time, the boy came into the room and with apology, said: "Gee, Dad, I've got the orange juice, but I can't find the vodka."

Another instance of assumption involved a good-looking young lady. She went into a sporting goods store and ordered all the equipment necessary for a baseball game, including a baseball, a bat, a catcher's mitt, and a catcher's mask.

The salesman asked, "Are you sure you want all these?"

The girl answered, "Yes, I do. My boss said if I'd play ball with him we'd get along fine."

Most of you people here in this audience know how to either 1) draw a triangle, 2) open a pack of cigarettes or 3) tie an underwriter's knot—but can you lucidly tell me how to do any one of them? Think about it. The answer is probably "no," but perhaps you can tell and show me how to do each one. Perhaps we should do more showing with our telling.

Incidentally, not only do we not hear and interpret things alike, we also rarely see things exactly alike. Can you properly describe an elephant to a person who has never seen one? Can you describe an automobile accident in the same way as several others who may have seen the accident from the same vantage point? We have a tendency to see things not as they are but as we are.

Words are not things. Words represent things, but are not identical with them, and hence must not be confused with them. Words sometimes misrepresent things, too.

Some people use words to express thought, some to conceal thought, and others use words instead of thought. The use of words is no assurance of thought behind them.

Sometimes what you are speaks so loud people can't hear what you say. Words are in many, many cases very unnecessary to convey a feeling of disrespect, distrust, of hate, or even love . . . your attitude shows.

The right words, undergirded and backed up by proper precept and example are real musts for anyone whose life affects that of another—parent, relative, minister, teacher, manager, supervisor, safety engineer, etc. This is especially true in a behavior or action situation when the "tell and show" method applies. It is basic to an element of philosophy which was established some 2,000 years ago—the Golden Rule—and it is wrapped up in just eleven short words:

"Do unto others as you would have them do unto you."

Sometimes when you have a few spare moments, try to think of some other basic principle that would cure all of the world's ills faster than the Golden Rule put into action. And, remember, there is gold in the Golden Rule for the man who does not estimate others by the rule of gold.

Words, words, words—words are so important. The manner in which we use words can be a decisive factor in:

1) whether we make real lives for ourselves or just make livings.

2) whether we are part of the answer or a part of today's problems, and,

3) whether we are to be guilty or innocent of compounding "The Consuming Danger of Assuming."

Thus far I have used about 4,000 words, which should suffice; therefore, I hastily conclude with the few challenging words of this short poem:

Life itself can't give you joy
Unless you really will it,
Life just gives you time and space
It's up to you to fill it.

EMPLOYER—INSURANCE CARRIER COOPERATION IN ACCIDENT PREVENTION

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I should like first to establish or state what our common points of interest are. In other words, what it is that motivates us or what it is that makes it necessary, desirable or advantageous for an employer and his insurance carrier to establish a high order of cooperation. The answer is very simple and compelling; we have a common problem, the control of preventable accidents.

In some cases the employer may be self-insured. In other cases or localities, the employer or certain of the personnel may organize, own and operate an insurance company in which the employer's interests are insured. However, it would appear that most employers have found it simpler and less expensive to use an outside insurance carrier. So, again let me stress that we do have a very real common interest.

As an example of one area where improved cooperation would oftentimes help, let us think for a moment on the subject of better and more complete interchange, or exchange, of knowledge and information. Many times, an employee in a plant or industry can get, or knows, pertinent facts surrounding the cause or causes of a mishap, and these facts are only in part made known to the insurance carrier's safety representative. Employees of industry should be instructed over and over that when disaster strikes the insurance carrier is virtually standing in the company's shoes.

On the other hand, when the insurance carrier's safety representative discovers or uncovers pertinent facts surrounding the possible cause of a mishap, he should not be guilty of holding back the presentation against that time or place that could result in what he might feel would be personal aggrandizement. In view of our common interest, all parties concerned should freely and without reservation exchange or interchange any and all information that could possibly lead to a quicker or more accurate solution to our common problem, the control of preventable accidents.

Perhaps, in many cases improved and longer lasting cooperation would result if a proper first contact or introduction were made. The next time you insurance carrier supervisors assign a new safety representative to an account, or the next time your company safety supervisors assign a new man to a plant or to a department, try giving this matter of the first contact or introduction a lot of thought. When the assignment is decided on, don't just send the man out to whom it is assigned, take him. In other words, go with him.

Prior to the time of this first visit, make a definite appointment with management's top supervisor in the unit to which the new man is to be assigned, whether it be a department, a plant or a section of pipeline. If at all possible, arrange to have this top supervisor's boss present for at least a part of this first meeting. Introduce the newly assigned safety representative, reiterate to management, even though you have likely done it many times before, that the newly assigned man's purpose and function will be to offer assistance in any way that he properly can toward realizing a more efficient and smoothly running operation.

You can make good use of this opportunity to outline to management some of the background features of the newly assigned man and some of the other reasons that cause you to feel that he is particularly fitted and eminently qualified for the assignment. A proper introduction will go a long way toward establishing a friendly and cooperative relationship.

Perhaps in some instances a more cooperative atmosphere could be created or be made to prevail if the man in the industrial plant knew more about the reasons behind some of the information the insurance company safety representative may be trying to develop. If at times it may appear that the insurance company safety representative is straying a little far afield from what might be thought of as his proper sphere of activity, please

remember that he too serves several masters. It is true, and properly so, that his primary function is to serve those whom his company insures, but he also in many instances is asked to act as an information gathering agent. This information may be in connection with ascertaining whether or not the industrial operation is properly classified, the classification in this instance having to do with the type of operation being conducted; and it is therefore the classification that establishes the rate upon which compensation insurance is based.

The insurance company safety representative may be trying in some instances to develop information relative to a possible exposure contingency about which the industrial plant employee may not be aware. In any event, line supervisors should remember that whether the safety representative be from the insurance carrier or from their own safety section, his purpose is to help you work toward a more efficient operation. So whether any suggestions he might make would appear to be items of benefit to the line supervisor or items of benefit to the local safety section, as long as compliance would result in a more efficient operation, the suggestion is of benefit in all in the control of preventable accidents.

There are different kinds, or types, or forms, of cooperation that exist between an employer of workmen and his insurance carrier. These differences are due to the differences in the size and complexities of industrial organizations and to the development, or lack of it, in connection with their accident control efforts.

First, let us consider the company that has little or no accident prevention provision. We can all think of a company that falls in this category; it is usually a small or medium-sized company that has grown in all departments, save accident control. They may have been lucky and have not felt the need for accident control, when all of a sudden it is apparent that the tide has turned and all become aware of the awful realization that luck runs and works both ways.

For this company, the formulation of accident control techniques takes on the aspect of a "crash program." In a case like this, the insurance company safety representative has no trouble getting cooperation, his problem of greatest concern lies in guiding it. It

is a natural development for the insured to want and expect things to happen too fast. The tendency is to lose sight of the fact that the sorry state of affairs did not come about overnight and it cannot be cured overnight. Correction of the difficulty lies in the establishment and purposeful execution of a basic accident control program with all the speed consistent with what is attainable from a practical standpoint.

Any one now faced with a similar problem in any of his plants or departments should remember that the solution is going to call for the utmost in patience, understanding and hard work between the insurance safety representative, the company safety director and the line supervisor. Again, let me stress that the problem was not compounded overnight, and a workable solution will only be delayed through any show of tempers or any efforts on the part of any of the participants to "pin the monkey on someone else's back."

At the other end of the scale is the industrial concern with an adequate staff of competent accident control personnel. This is the type of company that we insurance company safety representatives are prone to think of as being "self sustaining." And they actually in many cases don't need much help. However, to be of help to a company like this, the insurance company safety representative must be capable of work of a high order, and he must play his proper role, that of an advisor and helper in any way that he can be of assistance in furthering the formal program of the insured company. Any industrial concern, though, however large, is not so big but that they cannot use another pair of eyes and another pair of legs.

In any consideration or study of the subject of cooperation between the employer and his insurance carrier, I think we should spend a little time in the area of safety meetings. Many words have been spoken and many people have expressed their views as to who should properly participate in safety meetings, who should be responsible for conducting safety meetings, what the relative functions of the various participants should be, etc. As far as the insurance company safety representative is concerned, I think his proper role can be easily and clearly set forth and described.

He should give understanding and patient

guidance to those who can't or don't know how to hold safety meetings and he should freely give advisory help to those who have and hold regularly scheduled safety meetings. In many small companies or in companies of some size that are for the first time trying to set up a safety organization, the word too often seems to get around to the effect that the insurance company safety representative is going to conduct our safety meetings. An insurance company safety representative has no more right or prerogative to conduct your safety meetings than he would to take over the administrative functions of any other phase of your business.

Safety meetings should be conducted under the guidance of the local or line supervisor, with the local supervisor looking to top management and his own company safety section for help, and both looking to the insurance company safety representative for advisory assistance. Personally, I think it quite proper and in good taste to invite the insurance company safety representative to your safety meetings as a guest and on occasion to invite him as a guest speaker. The insurance company safety representative should welcome such opportunities to thus be of constructive assistance.

There are certain personnel alignments and "chains of command" within companies that tend to either facilitate or hinder good cooperative work in the field of accident control. In my opinion, the placing of safety activities, or accident control, under the insurance department is not usually a very good set-up. Effective accident control must provide for a means of determining and identifying causes and potential causes of accidents, and then a means for formulating recommended suggestions for measures to correct these causes; and an insurance department is simply not normally geared to function in this area.

A personnel arrangement that seeks to cast people in the dual role of accident prevention representatives and claim adjusters is another that in my opinion is not a good combination. Under such an arrangement, no one could give adequate and satisfactory attention to one without neglecting the other.

For an example of still another undesirable combination, in my opinion, the placing of accident control under an operations department is not good and is even in the

same category as the bank examiner allowing the teller to audit his own books.

Accident prevention departments appear to have a natural affinity toward personnel departments, and such an arrangement seems to work quite well unless one man is saddled with the dual role of trying to act as personnel director and also accident prevention chief.

Not all companies are large enough to have all the departments just mentioned in a clearly defined arrangement, but regardless of company size, someone has to serve in the offices just mentioned, and no company gets small enough that accident control can just be turned over to the insurance carrier. In other words, a good safety record cannot just be bought. It must be brought about through good basic planning and good supervision, just as is true with any other successfully executed operational phase of the company's business.

The insurance company safety representative should make good use of the many opportunities he has of engendering cooperation through selling local or plant supervision on the fine work being done by their own accident prevention departments. He is in an excellent position to cite some specific examples where safety suggestions have resulted in improved production efficiency. He can in good taste point out many of the things done by plant safety departments to help supervision and how and in what ways many of them have lowered the costs of accidents.

The insurance company safety representative should stress at every opportunity that good accident prevention work and the attendant low accident costs do not indicate any lack of need for further accident prevention work or that a good record should ever be a valid reason for a slackening of efforts in this area. A good accident record and low costs indicate that somebody has done some good work to bring about this happy state of affairs; and once this state is attained, it should be a continuingly profitable situation to keep it that way.

I should now like to discuss some of the things which we might term "do's and don'ts." As I have indicated earlier, most anyone is more inclined to feel cooperative if he knows a little more about the reasons

behind the activities of the other fellow. The visits which an insurance company safety representative makes to your plant or operation are usually of the periodic or regularly scheduled type, but he at times may visit you as a result of a special request. When he comes as a result of a special request, he is usually seeking information of a specific rather than a general nature.

Whatever the reason for his visit, you local or line supervisors and your company will get the maximum benefit from his visit only if you give him enough time and assistance to make a thorough and comprehensive survey. As for insurance company safety representatives, at all times, they should try to make appointments in advance, to make their surveys on a day and at a time of day that causes the local supervisor the least inconvenience.

Another item that I should like to touch

on briefly is in the "don't" department, and it is directed at local and line supervisors. When an insurance company safety representative or a man from the company's own safety section presents a recommendation for the correction of a potentially serious or hazardous exposure, please don't procrastinate in effecting compliance, on the grounds that the exposure has caused few or no injuries. After a given exposure has resulted in a man being seriously injured or killed, no one argues then as to whether or not the corrective measure should be applied, but for the injured it is then too late.

One more item, and again it is a "don't" and again directed at local or line supervisors. A safety representative does not necessarily have to be an expert in the operational field of the company's business or activity. He must be, and is, an expert in the field of accident prevention.

DATA PROCESSING OF ACCIDENT RECORDS

By E. W. MILES

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The Ohio Oil Company's operations are wide-spread and varying. And conducting an effective safety program for such a company is a herculean task. Yet, Ohio Oil's safety department is doing just that by applying the same principles of management to its safety efforts as apply to all other vital operations. In doing so, the basic responsibility and authority for safety matters rests first with the line supervisor. And, it naturally follows that the record keeping begins with them.

As in any other business operation, the value of record keeping is wholly dependent upon efficient, accurate and complete reporting. The final analysis is no better than the accurate and comprehensive basic information provided concerning any specific mishap.

The Ohio Oil method was conceived and tailored to its specific situation and business. It may not apply to all companies. But for Ohio Oil, it has proven to be an efficient and successful method.

Ohio Oil Accident Reporting Procedure

Reporting and investigating accidents is a fact-finding job which entails accumulating and analyzing the pertinent data, and giving consideration to the reasons for the accident. While cost determination is important, the basic reason for an accident investigation is to find the cause so prompt corrective action can be taken.

With this in mind, the Ohio Oil method includes three initial forms which make up the "case record file."

1. Form 2126, Notification of Accident,
2. Form 2473, Accident And Safety Report, and
3. Form 2109, Accident and Safety Investigation.

Form 2126—Notification Of Accident

Form 2126, Notification Of Accident, is prepared immediately by the supervisor of the injured employee and forwarded to the safety department in the company's general offices. This form alerts the safety depart-

ment that an accident has occurred and that a claim will result. Its primary purpose is to expedite immediate investigation of the accident and to keep the safety department posted on current accidents and costs which may accumulate prior to receipt of the Accident and Safety Report. It should be noted that this report is confined to factual information only. It does not contain opinions or recommendations.

Form 2473—Accident And Safety Report

Following "notification of the accident," the foreman prepares Form 2473, Accident And Safety Report. This form contains all the information from Form 2126 and additional information concerning the circumstances surrounding the accident, such as the equipment involved, the unsafe physical condition which gave rise to the mishap, any personal factors which contributed to the accident, and safe practices which were violated. It further includes steps taken to prevent the injury and both the injured's and the supervisor's recommendation to prevent recurrence. This form outlines the factors which led to the accident and sets the stage for a more complete investigation.

Form 2109—Accident And Safety Investigation

Every accident is thoroughly investigated to determine its contributing and immediate causes and to provide the base for prompt corrective action. At Ohio Oil, this is accomplished by Form 2109, Accident And Safety Investigation. This form takes up where the Accident And Safety Report leaves off. It is concerned entirely with detailed descriptions of the accident, its causes, and the corrective steps which have been, or will be, taken to prevent further mishaps.

Form 2126, Notification Of Accident, and Form 2473, Accident And Safety Report, are prepared by the supervisors. Form 2109, Accident And Safety Investigation, is prepared by the division safety engineer in cooperation with the supervisor. All the aforementioned reports are forwarded to the general offices in Findlay, Ohio.

Data Processing Of The Reports

When the forms are received by the headquarters safety department, they are closely

reviewed for completeness and accuracy. Then the information from the Accident And Safety Report (Form 2473) is transcribed to IBM cards in a series of codes and fed into the data processing equipment for storage. This provides the initial record of the accident and includes everything except the following incomplete and variable factors

1. severity of the accident,
2. days lost,
3. medical, sick benefits and compensation, and
4. whether the accident case is final or pending.

These variable factors are brought up-to-date monthly by Form 1262—Safety Department Monthly Report Of Accidents, and forwarded to the general offices.

The safety department accumulates these reports and quarterly revises the data processing file by issuing a corrected IBM card.

At the completion of each quarter, an IBM run is made listing all accidents occurring during the quarter, and any pending accident cases requiring payment during the same period. The runs are distributed by the safety department to each safety engineer and each employee relations supervisor. At the completion of the second, third and fourth quarters, cumulative runs are distributed.

This modern system of reporting and recording of accident information is designed to provide a complete, accurate record. Each step, or recording form, overlaps its predecessor to carry the total report or investigation a step further—until the completion of a final record in the safety data processing system.

This system not only provides a ready reference for quick, efficient accident analysis, but it provides a permanent record of accident statistics.

It must be realized that this is a brief description of Ohio Oil's handling of accident reports. If further information is desired, please contact the Safety Department, The Ohio Oil Company, 539 South Main Street, Findlay, Ohio.

DATA PROCESSING OF ACCIDENT RECORDS

Participants: J. U. PARKER, Chief Safety Engineer, Humble Oil Refining Co., Houston;
DR. G. H. COLLINGS, JR., Medical Director, American Oil Co., Chicago;
E. W. MILES, Safety Representative, The Ohio Oil Co., Findlay, Ohio;
H. GENE MILLER, Manager, Research and Statistics Dept., National Safety Council, Chicago;
C. P. VORHES, Coordinator of Safety, Jones & Laughlin Steel Corp., Pittsburgh, Pa.

Dr. Collings listed three requirements necessary before data processing of accident records can be considered a viable tool for accident prevention: (1) a large number of reports—on the order of 2,000 per year (2) ready access to data processing equipment (3) medical reporting at a quite sophisticated level. Gathering the type of data required for reliable statistical inference to aid prevention can only be accomplished if immediate reporting at the point of injury allows for direct key punch transcription. The step necessary for combining the supervisor's report of the injury with the point of injury report was elucidated by Dr. Collings' slide presentation.

Mr. Miles demonstrated, through a slide presentation, a set of four report forms—cross-coded for key sort—which can provide comprehensive, detailed accident information: (1) Accident Record report form—which details medical information (2) Notification of Accident form—which serves frequency computation needs (3) Accident and Safety Report—made out by the supervisor (4) Accident and Safety Investigation Report—made out by a qualified safety engineer. Analysis of data contained in these forms can pinpoint accident trouble spots and go far toward explanation of their causes.

Mr. Vorhes spoke to the problem of the availability of data processing equipment. Through the use of both hand punch and machine punch key sort cards, reporting can be accomplished in all desired locations. The method of hand punching can be easily taught to the employees who must report accident in areas remote from the machine punch equipment. If, however, the number of employees in the remote areas become sufficiently large, it may be necessary to make a machine installation.

Mr. Vorhes also discussed the need for a reporting manual or guide to programming for data process equipment. As yet a comprehensive guide for coding accident factors has not been developed. The question of the agency or agencies best suited to develop such a guide might be answered by members of the National Safety Council, the U. S. Public Health Service, and the U. S. Department of Labor.

Mr. Miller gave a brief history of the evolution of machine data processing at the National Safety Council. He noted that the key sort function was once accomplished entirely by hand. Today, work requiring man-months of labor has been reduced to man-hours. In 1962, NSC will acquire the programming capabilities of the IBM 1401 system.

Perhaps the major difficulty with data processing of accident forms was stated by Mr. Miller. The difficulty lies in fitting the accident to the form. In setting parameters and limiting the number of variables to be handled, the form must necessarily lose not only the flavor but a significant percentage of the information that can be found in a foreman's narrative of the accident.

In the open discussion, Mr. Parker observed that the justification of data process techniques must always reside in specific goals for accident prevention. Dr. Collings capped the discussion by pointing out that mere collection, storage, and retrieval capability of data contributes nothing to accident prevention. Until questions leading to a suitable array of the data are put, the implications of the data must remain unknown. Dr. Collings cited the array which connected the cause of typhoid to a contaminated water supply. The distribution of victims with respect to a particular well gave the needed clue.

GAUGING FOREMAN EFFORT

By E. M. McCracken, Jr.

Supvr., Employee Communications, Area Personnel and Industrial Relations,
Pacific Coast Area, Exploration & Production, Shell Oil Co., Los Angeles, Calif.

By "gauging" I mean measuring or "assessing"; by "foreman" I mean a first line supervisor who has an assigned crew or gang. In other words, what I intend to talk about is how we are measuring the effort which the first line supervisor makes toward accident prevention.

I am assuming at this point that we agree the foreman plays an important role in an accident prevention program. It is recognized that there are differences in the degree or amount of responsibility which the foreman assumes in various companies and in addition, there may be differences in the amount of responsibility he may assume within a specific company. As a general rule, a foreman in field or scattered operations—such as exploration, production or pipeline—must, by necessity, shoulder a greater load than the foreman working within the confines of a large plant. In many plant situations, specialists such as safety engineers, nurses, etc. are more readily available to give expert assistance than they are in scattered operations.

But regardless of these variations, I think it is generally agreed that the first line foreman does play a significant part in any accident prevention program. To state this in another way: the first line supervisor has more influence on the actions of the people who work for him than any other person, and since a large percentage of accidents and accidental injuries are attributed to "human failure," the foreman is thus the key-stone in every work environment. Let me not belabor the point.

Because of this key position which the foreman occupies, it follows that there should be an accurate assessment of the kind of a job he does.

I am not suggesting that the logic to this conclusion is original. However it is important that we agree on these two points:

1. The foreman plays a key role in accident prevention, and
2. There should be some means of measuring his effectiveness.

In preparing for this session I anticipated little difficulty on the road to agreement thus far. There may be some of you who will not be so quick to agree with the route which I choose to follow from this point.

A widely-used method or perhaps one should say a "standard" method of measuring accident experience is by frequency rate and severity rate. This is a convenient method and one which can easily be used for comparative purposes. I have no quarrel with the use of frequency and severity rates for assessing the effectiveness of an accident prevention program within a company, or a plant, or a division within a company. But accident frequency rates and severity rates do not measure an individual foreman's performance with any degree of validity. This is true because they can only indicate those foremen who have had more injuries per man hours worked. Let me hasten to add that I think this to be important—but frequency rates and severity rates, while they suggest that remedial action be taken, do not in themselves suggest what kind of remedial action should be taken.

In my company, in addition to frequency and severity rates, we analyze accidents and injuries to determine trends. I'm sure that each of you do pretty much the same. We code each report so that in a few minutes time our computers can tell us the number of accidents in each of many designated classifications: by injured's length of service, his age, occupation, supervisor, part of body injured, type of injury, time of day, work location, etc. Past experience does indicate weaknesses and such information is invaluable in the overall planning of an accident prevention program.

In this sense, we are planning future activities based on past experience. Would it not be more desirable to detect the cracks in our armor in advance? This is what we have been attempting. We have been directing a new effort toward uncovering weaknesses before they can produce accidental

injuries. And I should like to tell you about this.

In January 1960 our accident prevention program was what we considered to be a well-rounded one for exploration and production activities. Our organization included an area chief safety engineer and his assistant located in Los Angeles, with safety engineers located in each division headquarters. The program included on-the-job safety meetings, fire demonstrations, first aid training, posters, signs, protective clothing, safe work practices and procedures, etc. In spite of these efforts, the frequency rate had begun to creep higher in 1957 and this steady rise had continued.

After thorough studies and many discussions we concluded that we could expect a definite improvement in accident prevention if operating supervisors at all levels would give closer attention to those factors which influence safe work practices and procedures. This added effort was to be in addition to our existing program. In other words we considered it to be a supplement to—not a substitute for—other accident prevention activities.

With this general end in view we drew these specific objectives:

1. To continuously remind operating management that the primary responsibility for preventing accidents is theirs.
2. To provide operating management with a means of measuring the performance of individual supervisors in most of the areas which affect safety.
3. To encourage operating managers to help supervisors to improve performance in areas where weaknesses are found.
4. To motivate supervisors to do a more comprehensive job of supervising for safety.

A fifth objective which we did not publicize but which is nonetheless important:

To convince employees that management is interested in preventing injuries, and not just in a good "record."

Our next step was to design an approach which would accomplish these objectives. Here I shall describe as briefly as possible the mechanics of the program which we developed, which we call our supervisor safety

assessment program. (I should like to emphasize that the philosophy of this program is the thought which I want to leave with you today. This philosophy is applicable in any company. While these mechanics are important they may not be adaptable to your operations. I am describing them only because they may clarify the philosophy.)

1. Present a safety trophy in each production division and in our gas department to the foreman or assistant plant superintendent considered to have done the best job based on the following:
 - A. Job Instruction and Planning
 - B. Foreman's Personal Rating Sheet
 - C. Housekeeping
 - D. Condition of Tools and Equipment
 - E. Effectiveness of Safety Meetings
 - F. Crew Knowledge of Safety

In addition, individual awards will be presented to the crew members of each winning foreman.

2. Awards shall be presented annually. Competition period extends from July 1 to June 30.
3. Each foreman shall be rated quarterly in two of the categories listed. The final quarter ratings will be made in those two categories which most need improvement according to earlier rating.
4. Only foremen who have operating crews or gangs will be rated.
5. Ratings shall be completed by the division safety engineer and the next two higher levels of supervision above the foreman level. In no case do first line supervisors rate either themselves or their contemporaries.
6. Division winners will be selected on the basis of the total number of points.
7. Awards will be presented at the annual safety dinner in each division.

Here are some questions which I have taken at random from questionnaires used to determine crew knowledge of safety. We believe that imparting this knowledge is part of a foreman's job and therefore it is not unreasonable on our part to ask for a measurement. These are typical questions and you can see what we are trying to determine.

(Fire Protection)

1. Of the following types of extinguishers, which would you *not* use on an electrical fire? Why?

A—Dry chemical
B—Foam
C—Carbon Dioxide (CO₂)
D—Water

2. What is the best type of fire extinguisher to use on an oil or gasoline fire? Why?

A—Water
B—Carbon Dioxide (CO₂)
C—Soda and acid
D—Dry chemical

(First Aid)

3. Why are puncture wounds dangerous?
4. Burns are classified according to severity. Please describe each of these classifications.

First degree
Second degree
Third degree

(Gasoline Plants)

5. Where are the smoking areas in this gasoline plant?
6. What are the emergency signals for fire in this plant?

(Production)

7. Where are the "kill switches" on this well servicing machine?
8. When a gas engine is down, what is the first thing to check before starting?

9. If a compressor engine is down, what is the first thing to check before starting?

(Drilling)

10. When charging or recharging a blow-out preventer accumulator or slush

pump pulsation dampener, what gas should be used? Why?

11. When raising a mast is it best to connect the weight indicator before or after the mast is raised? Why?

12. A series 900 blowout preventer assembly is rated to operate up to the following working pressure

2000 psi 3000 psi 4000 psi 5000 psi

This safety assessment program for supervisors completed its first full year last June 30. It is too early to attribute any improvement in our accident record to this, although there has been improvement.

We do believe that it is accomplishing its objectives. We are convinced that this in turn will reduce the frequency and severity of accidents and injuries.

It has most certainly involved operating management from division managers to foremen. It has provided information about specific weaknesses which division managers can use as a basis for discussion with individual foremen. District superintendents and district foremen with an assist from our training section have been coaching foremen in those areas where they need strengthening.

To sum up our philosophy of this program for you once again:

- (1) We believe that work done properly and correctly is also done safely;

- (2) We believe the foreman has more influence on the actions and performance of his crew members than anyone else;

- (3) We believe that improving the performance of the foreman will result in improved performance in his crew—and thus fewer accidents and fewer injuries.

Based on our experience thus far—we think this program—or system—of "gauging foreman effort" will be most rewarding in terms of fewer accidents and fewer injuries.

THE PERSONAL FACTOR IN ACCIDENT PREVENTION

By HOWARD C. KLOPP

Dean, Fenger Junior College & Bogan Junior College, Chicago

I. Introductory remarks

- A. Personal factors concerned primarily—the psychology

1. Psychology—study of the individual
2. Sociology—individual in groups and situations

II. Consideration of the personal factors

- A. Concern of National Safety Council

1. Build the equipment with the human factor in mind

- a. Man-machine concept as a system; i.e., Franklin Taylor—psychology of design of machines, "Man as organic data transmission and processing link, between machine and control of a machine"

- b. With hazards taken out keeping in mind man's physical characteristics.

2. Use of safety devices when hazards can't or not taken out of machines in manufacturing processes.

- a. Personal factors, attitudes toward such devices help or hinder productivity, forgetfulness or distraction, learning safe procedures

3. Increase safety through people

- a. Safety education and training
b. "Why" people have accidents.
c. Personalities involved

B. Functional approach by psychologist

1. A re-examination of the accident processes concept
Alexander Mints & Milton A. Blum

"We have pointed out that in many instances the portion of accident records attributable to

differences in all forms of accident liability is relatively small as compared to the residual variance attributable to the operation of factors, which are not predictable in terms of either the constant characteristics of people or the previous accident records. The expression 'chance factors' or unpredictable should not be misunderstood. They are not unpredictable in terms of changing features of the life situation."

2. Purposeful behavior of man
a. Need directed and goal oriented
b. Needs of people in industry—or anywhere

- (1) Belonging
(2) Achievement and recognition
(3) Knowledge
(4) "Anticipation attention"

3. Job of psychologist, safety director, foreman

- a. Understand human beings
b. Predict human behavior
c. Control human behavior

C. Application to the industrial situation

1. Willard Kerr—complementary theories of safety psychology

- a. Accident proneness—15 per cent
(1) Environmental factors—heat, ventilation, congestion, etc.

- b. Goals freedom alertness—30-40 per cent

- (1) Freedom to set reasonably attainable goals is accompanied typically by high quality work performance—more alert to hazards

Past General Chairmen—G. B. BLACK, Sun Oil Co., Philadelphia, Pa.; PAUL CLABORNE, Pan American Petroleum Corp., Houston, Tex.; PARKER C. FOLSE, Mobil International, New York, N. Y.; C. D. ATTAWAY, Chief Safety Engr., Thiokol Chemical Corp., Marshall, Tex.; D. M. FARRELL, Butte Pipe Line Co.; D. A. KLEMM, Pan American Petroleum Corp.; W. I. KENT, (Retired); J. HOWARD MYERS, The Atlantic Refining Co.; J. L. RISINGER, (Retired); H. T. MARKER, Phillips Petroleum Co.; WALTER BOON, Sun Oil Co., Marcus Hook, Pa.; C. A. MILLER, (Retired); J. H. BROWN, Tide Water Associated Oil Co.; H. W. BOGGS, Sinclair Oil and Gas Co.; A. W. BREELAND, Lone Star Gas Co.; R. B. ROOPER, (Retired); GERALD O. LOCKWOOD, Continental Casualty Co.; GEORGE F. PRUNING, Consultant

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improving, as much as possible (i.e., EM-
 PLOYEE SAFETY ATTITUDES).

We are certain that you realize the importance of and emphasis which should be placed upon this subject.

*List of Equipment and Materials
 Needed:*

- 1.—One set of 38 . . . 35 mm slides
- 2.—35 mm slide projector
 - a.—automatic . . . with remote control from your position as "leader" . . . will eliminate necessity for someone else to change slides.
 - b.—the projector "slide tray" may not hold all 38 slides.
- If two (2) trays are required, it is suggested that slides #1 through #18 be placed in one tray; and, slides #19 through #38 be placed in the second tray.
- 3.—Projection Screen
- 4.—Chart Pads—(50 sheets in each pad)
- 5.—Chart Pad Holders
 - a.—"Set-up"—same as in Discussion Leadership Training
- 6.—Handouts
 - a.—one set of 3 handouts for each participant
- 7.—Leader's Manual
- 8.—Illuminated Podium or Table Lectern
- 9.— . . . check the "Physical Setting" page
- 10.—
- 11.—
- 12.—

Opening The Session

Introduction of Discussion Leader by a Member of Management. When no management representative is available or all members of the group are not acquainted with you, introduce yourself. Welcome members of the group and begin with:

I. Introduction.

All of you certainly realize that Mr. . . . approves of our meeting with you for a discussion regarding attitudes of human beings and how such attitudes are related to a subject, in which all of us are and should be interested—Safety!

Not all of this material is original with us. We are indebted to: The State of Ohio . . . "Trade and Industrial Service" . . .

and "Management Information" . . . which is published by The Elliott Service Company, 30 North Mac Quessen Parkway, Mt. Vernon, New York.

We'll have some suggestions, later on in this meeting, regarding what we can do about some of our problems pertaining to the safety attitudes of human beings.

(show slide #1 . . . "pardon me! is your slip (attitude) showing!")

II. The title of our discussion is "Pardon me! Is your slip showing?" Our title is a take-off of an old saying . . . with which some of you may be familiar. The story is told about a man who was present at a very formal party. He noticed that a lady's "slip" was hanging below her dress. Since he was a man who was always interested in helping others . . . with their problems, he went up to her and said:

(show slide #2 . . . "pardon me madam! your slip is showing.")

"Pardon me, madam! Your slip is showing."

So we are going to begin by talking about a subject, with which you are all certainly familiar:

Waste!

Now, that's a quick switch, isn't it? We are not sure that all of us would have the same understanding of what an attitude is or what we mean by attitudes, but, certainly, we all know something about wastefulness.

Don't be too concerned, now, how this all applies in a discussion pertaining to safety. We'll tie the two together later on in our meeting.

III. "Waste, Incorporated."

Let's think of waste as being a corporation . . . a big business organization.

Mr. F. W. Stein, vice president, manufacturing, of the Standard Register Company, is quoted as saying:

"Unless we put waste, incorporated, high on the list of our competitors, we are failing to recognize an evil that can decay our business."

Are you helping to keep a tough competitor in business?

Fortunately, wastefulness is not formally incorporated. If it were, we might see advertisements like this . . . on the business opportunity pages . . . of our newspapers.

(show slide #3 . . . waste, inc.—beats all competition—losses guaranteed)

(pause . . . allow time . . . for reading)

Yes, Waste, Incorporated, beats all competition and losses are guaranteed.

(show slide #4 . . . door of Waste, Inc.)

(pause . . . allow time . . . for reading)

How does "Waste, Incorporated" get a toe-hold? What keeps this tough competitor in business? Come with me. Through this company's door. Let's visit some of the departments supervised by the officers and listen-in on some of the conversations.

We'll learn of some typical reactions and attitudes that enable "Waste, Incorporated" to survive within our companies.

(show slide #5 . . . Waste, Inc.—what's a minute here or there?)

"What's a Minute Here or There?" It doesn't seem like much but time costs money, more money than ever before.

Have you ever heard someone say something like that?

Minutes here and there soon add up to hours and dollars everywhere. The multiplication of small wastes, maintenance wastes, wasted materials, supplies, power, parts, tools and waste of time, soon means major bills—and "new business" for Waste, Incorporated.

Let's move on into another department.

(show slide #6 . . . Waste, Inc.—Some waste is normal)

"Some waste is normal." Have you ever heard something like that?

This, too, can be a dangerous assumption. Many of us are resigned to accepting a minimum waste level, and after all this is like declaring a guaranteed minimum dividend to "Waste, Incorporated."

Over in the next department another person is talking. Let's go over there and listen in.

(show slide #7 . . . Waste, Inc.—I don't waste much. They must be talking about somebody else.)

Yes, the directors of "Waste, Incorporated" like to hear this kind of talk:

"Oh, I don't waste much. They must be talking about somebody else."

The directors know that if every one of our employees wait for the next man to do something about waste reduction, Waste, Incorporated, will be in business for a long, long, time.

Let's ask some of the men . . . what they are going to do about it? One of the men replies:

(show slide #8 . . . let's reduce waste) "Let's reduce waste . . . Let's do something about it."

(show slide #9 . . . let's reduce waste—starting tomorrow)

"Starting tomorrow."

Why do we wait 'till tomorrow? Special peak loads, pressures, breakdowns, bottlenecks and many other things are excuses, not reasons. The only way to drive "Waste, Incorporated" into bankruptcy is to tackle waste reduction today . . . tomorrow . . . every day!

Pardon me, gentlemen! Was this man's slip showing?

(show slide #10 . . . Waste, Inc.—prosper)

"Waste, Incorporated prospers" where there is neglect, procrastination, indifference, carelessness, inability and irresponsibility.

Remember? These are the "officers" of our competitor's organization.

Any member of management from the first line supervisor up to the president or, as a matter of fact, any employee who wants to put our competitor ("Waste, Incorporated") out of business must translate his own savings attitude into positive employee attitudes and actions on the job.

Mr. Stein, of Standard Register Company, concluded his remarks with:

"As our company continues to grow, Waste, Incorporated, become a more imposing adversary. To meet the growth challenge of tomorrow, we must practice waste reduction today!"

(show slide #11 . . . Waste, Inc.—closed—out of business)

Yes, if we practice waste reduction today, tomorrow and every day, Waste, Incorporated, will soon be closed . . . out of business.

Pardon me, gentlemen! . . . is your slip showing?

IV. How to get opinions and feelings.

We mentioned earlier that we would point out some things we could do. Are we interested in solving our problems with people

whose attitudes help keep our "Waste, Incorporated" competitor or any of our other competitors in business?

If we are, let's begin by getting the facts! . . . And be sure we have the whole story. Let's find the real cause of his behavior.

We can help solve such problems by learning more about the individual so let's talk with him. Let's get his opinions and feelings.

If, when talking to another person, you want to get his opinions and feelings about a problem, our suggestions are:

(show slide #12 . . . how to get . . . no. 1—don't argue)

1. Don't argue!

Many times, in talking with "problem" individuals, what they say will present an opportunity for you to "disagree" start an argument. Is anything satisfactorily settled by arguing?

Our first tip, then, is if you want to get opinions and feelings of other people, don't argue! Keep in mind that you are trying to get his opinions and feelings, learn more about him, so let him tell you.

(show slide #13 . . . how to get . . . no. 2—encourage him to talk . . .)

2. Encourage him to talk about what is important to him.

You may have to vary your approaches during your talk. The more you already know about the individual the better you can vary your approaches. If you can get him to talk about what is important to him (rather than what seems, at the moment, important to you), you will soon discover that he is telling you some of his opinions and feelings, and you are learning more about him. After all . . . That is why you are talking with him.

(show slide #14 . . . how to get . . . no. 3—don't interrupt)

3. Don't interrupt! Let him talk. Once you get him talking, you may want to interrupt and make a "speech." Our third suggestion is:

When he is telling you his opinions and feelings, don't interrupt.

(show slide #15 . . . how to get . . . no. 4—don't jump to conclusions)

4. Don't jump to conclusions!

When someone is talking to you, have you ever (during the conversation) made a

"quick decision" and seconds or minutes later learned that you "decided" without all the facts? Hear him out! Don't jump to conclusions!

(show slide #16 . . . how to get . . . no. 5—don't do all the talking)

5. Don't do all the talking.

Keep in mind that you are trying to learn more about him. We human beings have a tendency to want to tell others about ourselves. In this case he will follow this tendency, so don't do all the talking.

(show slide #17 . . . how to get . . . no. 6—listen)

Our last . . . but certainly not the least important suggestion is:

6. Listen!

In order of importance, possibly, this "tip" should have come first. Why? Because if we don't listen, we won't learn of his opinions and feelings. We won't learn more about him as he talks to us.

We, as discussion leaders are always wondering if we are communicating with you, if you as participants, are listening and if you are listening, what are you hearing and learning?

Psychologists tell us that, among other things peculiar to human beings, we have tendencies to hear only the things we want to hear.

You might say that hearing is done with the ears while listening is done with the mind.

There is a big difference between "Let's sit-back and hear what he has to say" and "Let's sit-up and listen!"

So if you want to get opinions and feelings, learn more about other people, we suggest that you "sit-up."

(show slide #18 . . . stop . . . look . . . and listen)

STOP . . . LOOK . . . AND . . . LISTEN!

(turn off projector.)

(it is at this point in the meeting that you lead "group discussions" pertaining to problems in "Getting Opinions and Feelings" of others; this discussion should be planned and conducted along lines of training received in "Discussion Leadership.")

(use "chart pads" for listing the title, "direct" objectives, and headings for the

charts on which you list participants' contributions during the discussion.

(after you have summarized participants' contributions at the conclusion of the discussions, briefly thank group for their contributions and participation in the discussions.)

(a 10 minute "break" is suggested at this time; during break . . . change slide tray if necessary.)

(after "break" . . . turn on the projector and continue. . .)

1'. Introduction.

(show slide #19 . . . pardon me! is your ship (attitude) showing?)

Before we discuss some of the things we can do after we get opinions and feelings, we want to talk about another tough competitor of ours. Thousands upon thousands of words have been spoken and written about safety with all its implications.

With this group we don't believe it necessary or essential to quote some V.I.P.'s philosophy of safety.

11. "U.N. Safe, Incorporated."

So let's think of this tough competitor as also being incorporated—a big business!

It is also fortunate that this competitor is not formally organized. If it were, we would see advertisements like this . . . in the newspapers.

(show slide #20—U.N. Safe, Inc.—beats all competition—losses guaranteed)

(pause . . . allow time . . . for reading)

Yes, here again, we have a competitor that beats all competition and guarantees losses.

Did you notice that this advertisement included human beings?

How does the "Un-Safe" corporation get a foothold? What keeps this competitor in business?

(show slide #21 . . . door of U.N. Safe, Inc.)

(pause . . . allow time . . . for reading)

OK, Come with me, again. Let's open this competitor's door and visit some of their departments. Remember these departments are also supervised by the officers.

Let's listen and we'll learn of some typical reactions and attitudes in this corporation.

(show slide #22 . . . U.N. Safe, Inc.—hurry-up . . . we've only got a minute)

"Hurry-up! We've only got a minute."

Why? Why did he only have a minute? Is this a case of the old "Put-it-Off" attitude showing? Did he pay attention to some instructions given "X" minutes before? Or is the old "who cares?" ship showing? Just why is he in a hurry?

We know that time does cost money. But there are many, yes, many more things in this old world of ours more valuable to human beings (dollarwise or otherwise) than being in a hurry.

Have you ever heard "better late than never," "haste makes waste," "slow down . . . it's later than you think?"

"Pardon me, gentlemen! Is this man's ship showing?"

Let's move into another department and listen.

(show slide #23 . . . U.N. Safe, Inc.—some risk is normal)

"Some risk is normal."

Yes, this, too, is a dangerous assumption. Have you ever heard someone say, "I know this is risky business but, after all, it's all in a day's work"? Have you ever heard someone say "It's just one of those things"?

How about being around tomorrow to do the work? Yes, to do some other things we like to do.

Again many of us are resigned to accepting the products of the "Un-Safe" corporation without giving much thought to the consequences.

This, too, helps build greater profits for "U. N. Safe, Incorporated."

Let's visit another department.

(show slide #24 . . . U. N. Safe, Inc.—I don't take chances. They must be talking about somebody else)

"Ah, I don't take chances. They must be talking about somebody else."

This is sweet music to the ears of the directors of "U. N. Safe, Incorporated."

More business for their corporation.

Remember? Losses are guaranteed by this competitor of ours. Losses in human

being hours of work, materials, equipment and many other things, including life, liberty, and the pursuit of happiness.

Let's move on into another department and hear some more about this competitor of ours.

(show slide #25 . . . U. N. Safe, Inc. —let's be safe)

"Let's be safe." Yes Sireeeeee! Let's do something about it.

(show slide #26 . . . U. N. Safe, Inc. —let's be safe—starting tomorrow)

Yes, you guessed right!—starting tomorrow!

Pardon me, gentlemen! Is this man's slip showing, too?

Again, the why's: Why don't we start today? Why don't we start right now?

Many of the answers are not good reasons at all—peak loads, other things to do, don't have time, stoppages, breakdowns, and many other things are excuses, not reasons.

(show slide #27 . . . U. N. Safe, Inc. —U. N. Safe, Inc. prospers)

Yes, the U. N. Safe Corporation prospers too, where there is inattention, haste, chance taking, fatigue, excitability and ignorance.

Remember! These are the officers in charge of production at "UN-Safe, Incorporated."

All of us who want to put "UN-Safe, Incorporated" out of business must, in some way or other, translate our own safety feelings—attitudes—to other people. We must do something to develop positive actions and "attitudes" (like our own) in other people. Get them to:

(show slide #28 . . . stop — think — safety)

Stop and think and act safety—now!—Today — tomorrow — every day — and everywhere. If we can, then a sign will go up on the "UN-Safe" corporation's door, too.

(show slide #29 . . . U. N. Safe, Inc. —closed)—out of business)

Closed! . . . Out of business!

Dr. Earle S. Hannaford, safety engineer of American Telephone and Telegraph Company, has said:

"Eighty-five to ninety per cent of industrial accidents are due to human failure, caused by emotional or mental problems."

Dr. Hannaford advises to watch for these

symptoms—errors in work, changes in everyday behavior, changes in routine habits, increases in near-accidents, poor safety attitudes and safety program fatigue.

VII. Factors that determine the kind of a job an employee is doing

Before we point out some additional things we can do about some of our problems pertaining to attitudes of human beings, we want to discuss some factors that determine the kind of a job an employee is doing. What are the important things that make an employee valuable or worthless?

For clarity, we can group them under three general headings—knowledge, skill and attitude.

Knowledge is the knowing how; skill is the ability to do, and attitude is the wanting to do.

Attitude is the way an employee feels about something, may be considered as a control valve—on output—on his actions.

For example: A person may know how to, and be able to do, a thing very well, but just doesn't want to do it.

When we encounter a safety attitude problem with an employee, let's check first that he has knowledge and the skill to do what is required.

If he doesn't have the knowledge or skill to do the job, it is clearly a problem of education and training.

If he has these then it's our job to go to work on his attitude. A sufficiently strong attitude will result in action!—and we hope good actions!

VIII. Now, let's take a look at some of the important considerations, in developing attitudes in those people we supervise.

(show slide #30 . . . important consideration no. 1)

1. Attitude, to be developed, must be consistent with employee's goals and the total situation.

An employee's personal "goals" would be what he is working toward to fulfill his desires—his needs—things an employee believes he must have for a successful living.

(these were discussed in our Understanding Human Behavior course)

The total situation refers to the employee's background, native endowment,

financial status, health and others, including the job itself.

(these were discussed in our Understanding Human Behavior course)

(show slide #31 . . . important consideration no. 2)

2. Employee must be led to recognize that he is actually involved in the problem.

We may have to spend some time personally going over a situation with an employee to help him see that this problem is his problem.

(show slide #32 . . . important consideration no. 3)

3. Employee must freely accept an attitude. We can't force it on him from outside.

Have you ever heard of someone telling someone else:

"You better change your attitude . . . or else!"

How would you feel . . . if you were the one being told?

(show slide #33 . . . important consideration no. 4)

4. Facts alone won't change anyone's attitude. The way one feels about the facts is more important.

So when presenting facts to your employees, the employees should appear to discover the facts for themselves; then they are their facts.

(show slide #34 . . . important consideration no. 5)

5. Attitude to be developed will be strengthened if any action proposed seems to get the employee closer to his goal.

(show slide #35 . . . important consideration no. 6)

6. Employee will not accept a new attitude if he feels he is being attacked.

(show slide #36 . . . important consideration no. 7)

7. Changing a person's attitude takes time.

We can't do it over-night. Don't expect miracles to happen. The small, but numerous positive impressions that we make on the employee are the things that count.

For some time, experts in the field of human relations have emphasized the im-

portance of sensitiveness—sensitiveness on the part of the supervisor to his employee. You see, there's a lot more to being a good leader than just knowing in general what makes people tick, or how to shape attitudes.

The most sensitive supervisor is one who is sensitive to the real needs of his employees. It is only when we understand the whole person, his individual traits, his joys and his sorrows, his drives and his goals, that we can supply the kind of leadership that pays off in higher productivity and a safer, healthier, happier existence for everyone concerned.

(turn off projector)

(it is at this point . . . in the meeting that you lead "group discussion" pertaining to problems in "developing attitudes." this discussion should also be planned and conducted along lines of training received in "discussion leadership.")

(use chart pads for the same purposes as indicated for your first "group discussions." after you have summarized participants' contributions at the conclusion of the discussions, briefly thank members of the group for their contributions and participation in the discussion.)

(start projector . . . show slide #37 . . . pardon me; is your slip (attitude) showing? . . . and continue with:—)

At the conclusion of our meeting today, we have a set of three handouts we want you to take with you. They will serve to remind you of the important points we have been discussing:

1. How to get opinions and feelings
2. A check list which will help you gauge your own listening habits . . . and
3. Important considerations in developing better employee safety attitudes.

1X. We want to close our meeting today by—

1. Asking a question . . .

2. Answering the question . . . and

3. Offering another suggestion.

The question:—Pardon me, gentlemen! Is your slip showing?

The answer:—Your slip (attitude . . . regarding the importance of safety) is showing. How much? . . . We don't know.

Our suggestion:—Don't let anyone talk you into covering it up.

(show slide #38... let 'er hang...)
Let 'er hang! The farther down, the better!

Thank you, again.

(distribute sets of handouts)

(important instructions... to discussion leader: (it is expected that you will prepare complete "minutes" (report) of both group discussions... and forward one copy of each "group" discussion... through proper channels... to our Safety Director.

HANDOUT NO. 2

Few virtues are more prized and less practiced than good listening. This check list, though by no means complete, will help you gauge your own listening habits. Try to answer each question objectively.

LISTENER'S QUIZ

When taking part in an interview or group conference, do you:

	Usually	Sometimes	Seldom
1. Prepare yourself physically by sitting facing the speaker, and making sure that you can hear?..	()	()	()
2. Watch the speaker as well as listen to him?....	()	()	()
3. Decide from the speaker's appearance and delivery whether or not what he has to say is worth while?	()	()	()
4. Listen primarily for ideas and underlying feelings?	()	()	()
5. Determine your own bias, if any, and try to allow for it?	()	()	()
6. Keep your mind on what the speaker is saying?	()	()	()
7. Interrupt immediately if you hear a statement you feel is wrong?	()	()	()
8. Make sure before answering that you've taken in the other person's point of view?	()	()	()
9. Try to have the last word?	()	()	()
10. Make a conscious effort to evaluate the logic and credibility of what you hear?	()	()	()

WHAT'S YOUR SCORE?

Score yourself as follows: Questions 1, 2, 4, 5, 6, 8, 10: Ten points for "usually," 5 for "sometimes," 0 for "seldom." Questions 3, 7, 9: Zero for "usually," 5 points

for "sometimes," 10 for "seldom."
IF YOUR SCORE is below 70, you need training; 70-85, you listen well but could improve; 90 or above, you're an excellent listener.

From: "The Management Review," a publication of the American Management Association, Inc.)

HANDOUT NO. 1 HUMAN RELATIONS HOW TO GET OPINIONS AND FEELINGS

1. Don't argue
2. Encourage him to talk about what is important... to him
3. Don't interrupt
4. Don't jump to conclusions
5. Don't do all the talking yourself
6. Listen

(From the Trade and Industrial Education Service—State of Ohio—Course in Human Relations Training)

HANDOUT NO. 3 UNDERSTANDING HUMAN BEHAVIOR

Important considerations in developing attitudes:

1. Attitude to be developed must be consistent with employee's goals and the total situation.
2. Employee must be led to recognize that he is actively involved in the problem.
3. Employee must freely accept an attitude.

4. Facts alone won't change anyone's attitude—the way one feels about the facts is more important.
5. Attitude to be developed will be strengthened if any action proposed seems to get the employee closer to his goals.
6. Employee will not accept a new attitude if he feels he is being attacked.
7. Changing a person's attitude takes time.

(From The Ohio Fuel Gas Company's training course in Understanding Human Behavior)

FIRE FIGHTING NEAR LIVE ELECTRICAL APPARATUS

By G. W. N. FITZGERALD
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Tests have been made to determine the limit of safe approach to live electrical equipment with fire hose streams. Tests were made with various nozzles at pressures from 30 to 100 psi. Results indicate that spray or fog stream nozzles may be used with safety up to the limit of safe working space. Solid stream tips up to 5/8-inch can be used, providing a reasonable distance is maintained from the electrical circuit. Solid stream tips above 5/8-inch may be hazardous if used on live electrical circuits.

One hazard encountered in fighting fires is the possibility of accidental contact of the fire hose stream with live electrical circuits or live electrical apparatus. Since a solid column of water is a conductor of electricity, the column must be long enough to limit the current to a low value. If this value increases beyond safe limits it may create a hazard to the operator of the fire hose line.

The resistance of the water column will decrease as the size of the column increases, and it is necessary, for the same measure of safety, to maintain a greater distance from electrical apparatus with larger hose streams. The electrical resistance of the water stream will increase very materially

if the water column breaks up into separate droplets. Thus it should be safe to approach closer to live electrical apparatus with spray stream nozzles.

In order to determine the limit of safe approach to live electrical circuits and apparatus, under varying conditions of fire fighting, tests were made during which fire hose streams were played on a metal target that could be energized from a test transformer at a power frequency of 60 cycles per second. These tests were made with the co-operation of the Fire Services Division, Office of the Fire Marshal, Ontario. The Fire Services Division supplied a pumper, equipment and personnel during the tests.

Test voltages ranged from those encountered in domestic and industrial service to the highest transmission voltages encountered at power stations.

Various types and sizes of nozzles were tested, at water pressures varying from 30 to 100 pounds per square inch, at the nozzle.

The specific resistance of water samples from various parts of the Province of Ontario was examined to determine the range of resistance to be found in water from various parts of the province.

In order to determine what types of nozzles were to be tested, it was necessary to consider the types of fires that might be encountered in or near electrical apparatus.

First, class A fires where live electrical circuits might be adjacent to the outside of buildings, or within the buildings.

Second, class B and C fires in electrical equipment. In these cases, equipment failure may result in a flammable liquid fire and adjacent electrical circuits may still be energized.

For the first case, solid streams may be employed to pour a large quantity of water on the fire or to obtain a long reach of the fire stream.

A standard 2½-inch shut off was used with replaceable tips in sizes from ½ inch to 1½ inch.

Also to consider plant installations where permanent hose lines are usually 1½ inches, combination off-log-solid stream nozzles were used. These have a ¾-inch tip for the solid stream position.

In the second case, spray or fog stream patterns are generally more effective in blanketing the fire without the danger of spreading the fire as might happen if solid streams were used. The spray stream pattern was used on the combination nozzles and tests were also made with a 2½-inch adjustable nozzle and a 1½-inch Poweron Nozzle.

The tests were conducted to allow a maximum current of three milliamperes in the fire hose stream. This value is generally considered to be at the lower threshold of feeling for most normal people. In addition, tests previously made to determine the safe approach of fire hose streams to live electrical equipment have used the same maximum value of safe current.

The nozzles were mounted on an adjustable platform on a rubber-tired truck or on the boom of a sky-worker vehicle. Between the end of the hose and the nozzle, a pressure gauge adapter was inserted, so that pressures at the nozzle could be measured.

An insulated conductor was rigidly attached to the nozzle and connected through a milliammeter to the grounded side of the test transformer.

The nozzle was positioned at a fixed dis-

tance from the target and, with various tips and water pressures, the voltage was raised until the current of three milliamperes was flowing down the hose stream, through the nozzle to ground.

The tests were made using Toronto city water which has an electrical resistance of 1800 ohms per cubic inch at 8.5°C.

Solid stream patterns maintain a fairly solid water column up to the limit of a good stream. Beyond this point the water column begins to break up into showers of spray. The limit of a good stream may be decreased by wind conditions, but all results were plotted considering the maximum reach of the stream in still air.

With most nozzles a slight "necking" and "crossover" of the water stream occurs between 10 and 20 feet from the nozzle, depending on the size of the tip and the pressure. Thus, up to this point the water column decreases in size slightly, then increases. Beyond the "crossover," for all solid stream patterns up to the limit of a good stream, the water column conducts current which increases with pressure at the nozzle, and which also increases with the size of the tip used.

For tests on low voltages a minimum approach of five feet was used. The results of these tests indicate that for all tips below 1½ inch the current was less than the safe limit of three milliamperes. With a 1½-inch tip at 30 psi, the limit of three milliamperes was reached at a distance of five feet.

Tests at voltages above 600 volts were made at distances from 5 to 30 feet. With the smaller tips the solid stream began to break up before the 30-foot distance with increasing resistance in the hose stream and thus a lower current.

Graphs showing the distances at which a current of three milliamperes was reached for various tip sizes and pressures are reproduced in Figures 1 to 4.

The pressure at the nozzle materially affects the approach distance with most tips. With tips over ¾ inch and pressures of 100 psi, approach to or contact with live electrical apparatus may be hazardous.

In most cases the stream from combination nozzles was not as good as with a straight tip of the same size. There appeared to be some difference in good stream distances with different nozzles of the same

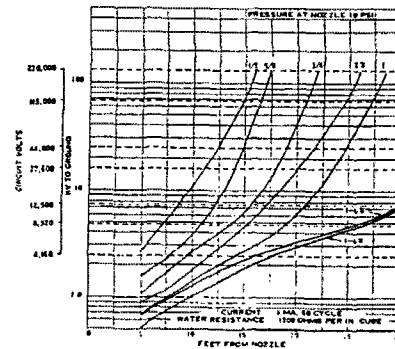


Figure 1

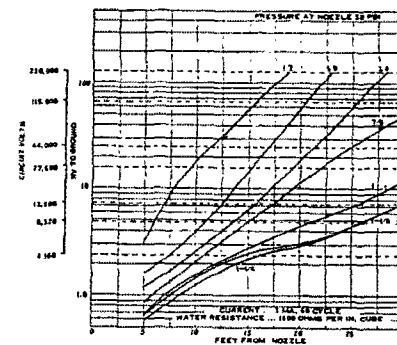


Figure 2

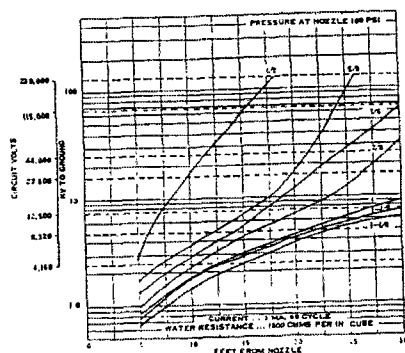


Figure 3

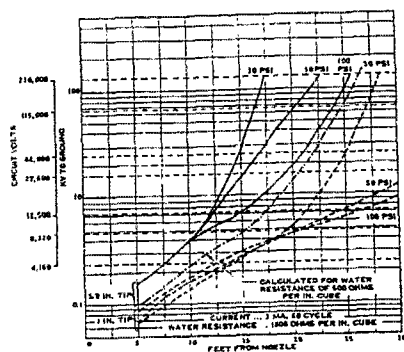


Figure 4

type. Considering that a well designed combination nozzle will have the same effectiveness as a straight nozzle of the same size, safe distances for a $\frac{3}{4}$ -inch straight tip should be used for all $\frac{3}{4}$ -inch nozzles.

Because the water column of a 3/8-inch tip begins to break up into showers of spray at a distance of about 20 feet from the nozzle at 100 psi, it is safe to use a 3/8-inch tip on live electrical apparatus provided a reasonable distance is maintained.

In order to consider the effect of low resistance water on the hose stream, calculations were made to consider the use of 600-ohm water in place of Toronto city water at 1800 ohms per inch cube. From a survey of water resistances from various locations in Ontario, it is considered that the minimum resistance of water used for fire fighting would be 600 ohms per cubic inch.

The curve shown with "dash" lines in Figure 3 is plotted based on 600-ohm water, and Table I shows the minimum approach distances for various circuit voltages.

TABLE I
Limit of Safe Approach to Live Electrical
Apparatus
¾ Inch Solid Stream Pattern
100 PSI—Water Resistance 600 Ohms
per Cubic Inch

Volts to Ground	Circuit Voltage	Minimum Safe Distance in Feet
2,400	4,160	18
4,800	8,320	20
7,200	12,480	22
9,600	16,640	23
14,400	24,960	25
18,000	27,600	25
25,000	44,000	30
66,500	118,000	30
130,000	230,000	30

Because the spray or fog stream patterns project separate droplets of water, the resistance of the water stream is greatly increased.

Consequently quite close approach to the target was possible with complete safety. Spray nozzles are safe to use within three feet of 65,000 volts to ground (equivalent to a 115,000-volt circuit).

However such close approach should not be considered for hand held hose lines. Considering the limits of safe approach to live electrical circuits for trained electrical utility personnel, a table of safe approach for use with spray or fog streams is set out in Table II.

Public Utilities Industry

TABLE II
Limit of Safe Approach to Live Electrical
Apparatus
Spray or Fog Stream Nozzles

Volts to Ground	Circuit Voltage	Minimum Safe Distance in Feet
2,400	4,150	4
4,800	8,320	4
8,000	12,500	4
10,000	13,500	4
14,000	24,800	4
16,000	27,600	4
25,000	44,000	6
55,500	115,000	8
130,000	230,000	14

With a minimum distance of five feet from nozzle to electrical contact no hazard should exist for all solid stream tips up to 1½ inch at 100 psi.

In summary, with high voltage circuits:

(a) Solid stream tips up to $\frac{1}{4}$ inch may be used with care, provided distances are maintained as shown in Table I.

(b) Solid stream tips above $\frac{3}{4}$ inch should not be used near live electrical equipment.

(c) Spray or fog streams may be used up to the limit of safe working space on all voltages of electrical equipment; see Table II.

REFERENCES

National Fire Protection Association
Handbook of Fire Protection—Chaps. 10, 12.
Fire Department Equipment, Manufacture, Selection,
Care and Testing of Nozzles
School of Technical Training, Oklahoma Institute of Technology.
Studies of Fire Department Fog Nozzles.
N.F.P.A.

APPENDICES

Specific Resistance of Ontario Waters
Ohms per Inch Cube

[illegible]

ELECTRICAL RUBBER GLOVES IN THE PRIMARY AREA

By E. A. SHULTZ
Vice President-Operations, Illinois Power Company
Decatur, Illinois

My assignment is to tell why we use electrical rubber gloves in the primary area. In carrying out this assignment I hope no one gets the impression that I am arguing with any of my distinguished colleagues on this panel. I am certainly not trying to sell you on the idea that the way Illinois Power Company does things is the only right and safe way.

There are many instances where a lineman should put on rubber gloves before he leaves the ground. Some work must be done from platforms. With the developments being made in insulated aerial baskets, and with their singular characteristics to prevent serious falls, I believe we all will find increased use of aerial baskets. However, most of us will be doing a lot of work from poles for several years. My philosophy of getting line work done from poles safely includes the use of rubber gloves when within reach of energized primary conductors, that is 2300 volts to ground and 4160 volts phase to phase. So I will confine my discussion to that area, what we believe in, what we do, and why.

That linemen wear electrical rubber gloves when working on energized primary conductors is a part of their craftsmanship that is not too old. It is only during the past 40 years that electrical gloves have come into use as personal protective equipment. One of our executives, now retired, has told me of working on energized 2300 volt-wires regularly. His only insulation was the rubber gloves he used. When electrical rubber gloves were introduced, linemen bought their own and used them as barriers between the conductor and their hands. So they have always been known as personal protective equipment.

From all the summaries of questionnaires that I can find, it appears that at least 80 per cent of all electric utilities believe about as we do. Because electrical rubber gloves are personal protective equipment, the use of them, like other lineman tools is much

more a matter of determination out on the job than one to be determined by rigid operating rules.

I want to quote for you what our safety manual says on the wearing of rubber gloves. It is not extensive. It has been changed very little during the past 15 years. "Employees shall put on rubber gloves with leather protectors before entering any areas where there are live conductors carrying 400 to 5000 volts. The rubber gloves shall be kept on until employees have left such live areas."

"Employees will be expected to wear rubber gloves to do many jobs in which the voltage is below 400 volts, where there are such conditions as: damp weather; excessive perspiration; substandard or close construction; unusual strain or body position (a slip is more apt to occur); or wet equipment."

The wearing of rubber sleeves is optional to the foreman and his men.

Now, as safety rules, those are not very specific. We make no attempt to define the primary area in any greater detail.

Perhaps I should explain that our whole safety program is built around the line organization and that includes delegating responsibility for safety out to the foreman on the job. We don't do much in the way of large group safety meetings but we do stress tailboard conferences.

There are two good reasons why our rules on electrical rubber gloves are so written.

1. The rules are short and understandable, whether linemen work up on poles or on the ground. Guiding pole butts, manipulating hydraulic booms, or tending wire reels while standing on the ground are just as hazardous as tying in conductors to insulators. On all of them electrical rubber gloves may have to be worn.

2. Whether men are doing electrical work in power stations, sub-stations, on towers or poles, the rules are the same. All of our men doing this work belong to the same

craft union, so the rules should be consistent. If we attempted to spell out more detail on the wearing of rubber gloves, the various situations would be endless.

I have already mentioned that I consider electrical rubber gloves to be personal protective equipment. By personal, I mean something pertaining to the individual lineman just as are his climbers and body belt. Rubber gloves are not necessarily furnished by the lineman now. Neither are other personal items. Practices vary among companies.

Electrical rubber gloves are personal protective equipment because they are a barrier between his hands and live primary conductors. They insulate him from the live wires.

A lineman air tests his gloves because they are intended to protect him. He carries them with him, just as he does other personal tools. Gloves are inspected and tested periodically in the laboratory, but a lineman still gives them a going over just before he uses them.

I am drawing a distinction here between gloves and the other protective devices that the crew tools or crew equipment. Some of the crew usually maintains them or directs the caring for them.

I repeat again. We expect a lineman to use judgment when to use his rubber gloves and we expect him to choose the proper size that he carries. He is a craftsman.

If he doesn't come to us as a journeyman, he goes through the long standing training procedure of apprenticeship. The proper use of rubber gloves is a part of apprenticeship training. We try to emphasize the positive approach to protection, the exercise of good judgment, and above all the necessity for the lineman to think for himself. We know that when he goes up a pole, each job will have some variations more or less from every other one. So the thinking for himself is pretty important. He must think about what he is doing, what the hazards are and why, in order to do his job properly and safely.

We have not refused to consider ground-to-ground rules. There have been several well prepared papers by capable men that have endorsed the ground-to-ground rules. We have weighed the proposals in terms of

our own operation. We conclude by leaving our practices as they are. Here are some of the reasons why:

1. Each year more of our primary lines become 7200 volts to ground. We have always used 10,000 volt rubber gloves and our limit of 5000 volts came into being when we had very little 7200 V. We serve a lot of small communities and rural lines, but any time we work 7200-12,500 volt energized, we have always done it with hot sticks and without rubber gloves.

Now any one crew can finish a 4160 volt job and move directly to a 12,500 volt job.

It would hardly be logical for us to tell men to wear rubber gloves ground-to-ground on the first job, then tell them they don't need gloves to climb on the second job.

That leads me to the second reason.

2. I don't like to see men encumbered as they climb and descend poles below the primary zone. I believe the rubber gloves and leather protectors increase the hazards of slips and falls. I realize that men can and do climb with gloves but it seems to me that so doing, as a general rule, introduces an unnecessary hazard. There is also greater likelihood of unknowingly puncturing rubber gloves on nails, tacks or barbed wire in the lower parts of the pole. Ordinarily these items are very few up in the primary zone.

3. The third reason ties in with our emphasis on tailboard conferences. If safety can be discussed with more meaning out on the job, it can be considered with still more clarity up at the beginning of primary zone. When a lineman stops just below the primary zone to put on his rubber gloves, he has a chance to observe the whole pole top close up and to plan his moves and work. The conditions observed from this point can be quite different than they are from the ground. The forced stop, when there is work to be done in the primary zone, can be one of the most important steps in safe work on the pole. It develops the habit to stop and look things over.

4. I have quoted from our rules that we expect men at times to wear rubber gloves when working on secondaries. I believe our practices wherein men must exercise judgment and they routinely stop part way up the pole, gain greater use of rubber gloves when working on secondaries than if we tried to spell it out in detail.

Throughout this discussion, I mentioned rubber sleeves just once. I have not yet mentioned other protective equipment—rubber blankets, line hose, insulator hoods, and so on. Our rules pertaining to the use of such equipment are in the same vein; there are a minimum of directives.

I should mention too, that our continuing investigations and analyses of accidents and near accidents do not indicate that we would improve safety by more specific rules on the use of gloves and other equipment.

In summary, I want to repeat:

1. Our line work requires craftsmen, not automatons. Our rules on the use of electrical rubber gloves are in line with craftsmanship training and encourage thinking.

2. Electrical rubber gloves are personal protective equipment. Our rules recognize that they are to be treated as such, just as are other pieces of personal equipment.

3. When a man has a definite reason for a stop part way up a pole at a good observation spot, it becomes habit for him to observe and plan on-the-spot means to accomplish his job safely.

GROUND-TO-GROUND USE OF RUBBER GLOVES

By L. C. MEYER

Electric System Specialist, Employer Mutuals of Wausau

If every job went the way it was supposed to go, there would be no accidents. If men acted like machines and could be counted on to always perform their work in the prescribed manner, again the result, no accidents.

But men are not machines and some jobs do go wrong—sometimes the unexpected occurs and another accident results. If we keep in mind that an accident is the clue to something going wrong, then we can proceed with the premise that hand contact electric shock accidents are of great concern in the electric utility industry. They are of great concern because of their high frequency in comparison to other parts of the body involved.

Putting it more bluntly, there exists a need for a better procedure of getting rubber protective equipment on the hands of the men before contact is made with energized equipment. Current accident reports continually emphasize this need.

The problem resolves itself into one word—"HOW." How can we get rubber gloves on the hands in time to prevent the accident? What method or procedure offers the fewer loop holes, the least chance of human error, and the greatest consistency of compliance?

It is my sincere conviction that "rubber gloves from the ground up" or "gloves—

ground to ground," (the two terms are synonymous), provide the best solution to the problem.

Let me discuss the various procedures that are being followed, pointing out the advantages of each.

First, there are some few utilities that still follow the policy of permitting the men to decide for themselves when and where rubber protective equipment is needed. Perhaps they have rules covering this but these are so completely disregarded that the rule might as well not exist. The men themselves operate on the theory that "they can take care of themselves" and believe that they know, by training and experience, when they should wear their gloves.

At first glance, this appears reasonable because it seems that an experienced lineman would know, if anyone did, the disastrous effect of contact with high voltage. All too frequently one of these systems has a rude awakening and expresses surprise that it had to happen on their system. Why should they be surprised, all they had to do was look and they would have seen it coming. The only unknown was "when."

The basic reason for these accidents is probably due to the old adage "familiarity breeds contempt." With linemen working near and around energized equipment so often they lose sight of the potential danger

in the nearby equipment and apparently relax their vigilance and care as they proceed with their routine work.

I don't believe I could get much of an argument from any of you on the impracticality of this particular practice.

The next procedure, and this one has a goodly number of advocates, is the policy requiring that protective equipment be put on when the working position is reached but before starting the job. I have no particular quarrel with the procedure, if they could follow it. I am sure that many of the utilities represented here that follow or have followed that practice have had serious hand contact electric shock accidents.

This is explained by a basic principle in safety engineering. If a man will expose himself to danger often enough, sooner or later he will become injured. More specifically, if a lineman without proper protective equipment gets within reaching distance of energized circuits often enough, sooner or later he will make an accidental hand contact. No, he doesn't intend to, but, a climber gaff cutting out, a moment of forgetfulness, a riser wire to the transformer hidden behind the pole, and he becomes another accident statistic before he even gets belted off. Granted that the incident of occurrence is small in relation to the number of times that things go according to plan, I defy you to find a volunteer to be the next victim of such an accident.

Can you pin the blame for such an accident on the foreman or supervisor? I don't think so unless you are looking for an excuse for the accident and not the cause.

If the procedure calls for protective equipment before entering the working or reaching area, then perhaps the foreman or supervisor can be involved. But it seems to me that if you are going to follow that practice you are putting an almost impossible responsibility on supervision. In effect, you're asking them to watch closely every time any man climbs any energized pole.

Looking at this procedure another way, what you are doing if you subscribe to this practice, is drawing a thin invisible line somewhere on every pole. Below, and out of reach, a safe area; above, and within reach, a danger area where gloves are required before entering. Keep in mind that the location of this invisible line will shift

with the circuits and equipment on each pole. Could a transformer case be energized? Could a shock from a secondary cause a fall that could be as permanently disabling as a double amputation? And tell me, what good was that invisible line to the fellow that climbed a new pole, watching his feet so as to miss the knots, and suddenly found that his hands had run out of pole?

Even if a good job of training and education has made everyone conscious of that invisible line, even though supervision is outstanding, isn't there still the chance that some day—perhaps the foreman is checking the work order just as the lineman is climbing up, thinking about a fishing trip or last night's date. As far as time and place are concerned, this man can get into trouble, and I do mean trouble, before he gets his mind back on the job and before anyone can warn or stop him.

We know this can happen because a few years ago I received three accident reports where the work was three or more feet from the nearest phase wire, yet a primary contact was made. The question comes up in those cases—what were these men thinking about? It makes a good question, but very difficult to get a good answer.

I am sure that all of us would admit to having experienced such mental lapses, occasions where our eyes were open but our minds sure weren't, but fortunately we came to in time to avoid injury. Quite often we hear of, or experience such mental lapses in connection with driving. We all do pretty well when driving in heavy traffic but how good are we when we get out on the open road?

But to get back to the practice of requiring rubber gloves before entering the danger area. I would have no particular quarrel with this if a foolproof method of obtaining 100 per cent compliance could be established. I am sure that efforts are being made to improve this procedure but the accident reports indicate there is still a long way to go.

So, let's consider the "ground to ground" practice. In the hundreds of group safety meetings that I have discussed this subject, I have heard every excuse against that practice that was ever dreamed of. Clumsy? Not as much as trying to eat with metal claws instead of hands. Hot? Nowhere near as hot as 12,000 volts, or even 2,300. Slow

production? Developing dexterity while wearing rubber gloves is largely a matter of practice.

Further, consider the time element, the length of time that the rubber gloves would be worn under the "ground to ground" rule. Why don't you do a little checking and try to find the per cent of time that your average lineman actually spends on energized poles on an average day. I am sure you will be surprised at the low percentage figure you come up with.

Possibility of puncture while climbing and not having protection when you get to the working area? Possible but not too probable if the glove protectors are in good shape. In 30 odd years in the utility industry I have only heard of two cases of burns through a faulty glove, and both of these were minor. Besides, daily air tests and regular dielectric tests will detect puncture in most cases before injury can develop. Besides, with the high distribution voltages in use today, gloves are to be worn, according to the National Electric Safety Code, for protection against an accidental contact, not for direct hand manipulation of the energized equipment.

Wearing rubber gloves "ground to ground" has every logical reason for being the solution to the hand contact electric shock accident. It is the most sure way of getting rubber gloves on the lineman's hands before he gets within reaching distance of energized equipment. Besides, it is far better to wear rubber gloves, and not need them, than to need them and not have them.

The reason I favor this practice over the "below the invisible line" method is primarily because of the time element. Assuming the man forgets and starts up a pole without his gloves on—ten seconds will have elapsed before he reaches the danger area, the area where he actually needs them. During that time interval there is a greater opportunity for the man himself to recognize the omission he has made. There is also more opportunity for supervision or

some other crew member to see the omission and to stop him.

There is also the chance, on vertical single phase construction, of the phase becoming dislodged by vibration of a pole being climbed, due possibly to a cracked insulator that was not visible from the ground. With rubber gloves already on, the man at least has a fair chance to catch it or ward it away from his body. Without rubber gloves, you provide the answer.

A normal human characteristic is that of resisting change. That calls for discarding old established habits and developing new ones, and we are all guilty of it. It may appear like a radical change to go to "gloves ground to ground." It probably was for the many utility systems that have already done so. We have no way of knowing how many lives have been saved or how many burns have been prevented by this practice. Periodically I receive an incident report—that is a report of how rubber gloves prevented an accident. They are not as dramatic or tragic as many of the accident reports but much more preferred from my point of view.

In my present position over the past 15 years I have made an intensive study of electric shock accident causes and costs. Bare hand contact is still the most common type, yet the frequency of all shock accidents is less than half of what it was 15 years ago, according to my figures.

Yes, progress is being made, but there is still a lot of room for improvement. My crystal ball is no clearer or better than yours, but I can see the day coming when any electric utility that has not adopted the "ground to ground" rule will be in the small minority. Probably many more lives will be lost before that day comes, many more hands and legs will have been amputated. Yet each one of these accidents will add emphasis to the need for a more positive procedure of obtaining consistent use of rubber protective equipment. And that is where rubber gloves "ground to ground" comes in.

WORKING FROM LINEMEN'S PLATFORM

By H. E. HATFIELD
General Supervisor of Safety
Georgia Power Co., Atlanta, Ga.

The full protection of our linemen is a problem that has been with us for some time, and it is my aim to pass along a few ideas that I fully believe, if adopted, will greatly reduce the frequency and severity of linemen accidents.

By the way of review, and to emphasize the problem, I would like to quote from an address that was presented to the Electric Utilities session of the National Safety Congress on October 21, 1954 by Fred Harman, who at that time was the safety manager, New England Power Service Company, Boston, Mass.

"The fact that, year after year, electric utility linemen suffer the greatest number of fatalities in the industry, about 60 per cent of the total, or about 90 of the average of 150 fatalities per year, based upon recent Edison Electric Institute figures—makes it appropriate that we talk about protection for linemen."

Seven years have passed, many lives were lost in that period and I wonder if we are doing all we can to educate and train our employees to eliminate these tragic accidents?

Progress has been made to be sure; however in 1960 the Edison Electric Institute reported 105 fatalities in our industry; of these 105 cases 49 occurred on poles and when these 49 cases are analyzed they point to a significant fact "Path to Ground." The same is true when we analyze non-fatal electric shock and burn records.

Several factors are always present when these accidents occur, these factors were best expressed by Tom Hughston of the Texas Power and Light Company in a recent talk when he referred to an analysis of electric shock and burn cases as follows:

1. All occurred on simple jobs
2. No one was looking
3. Little or no planning
4. Failure to follow the rules

This analysis indicates to me that we

as supervisors and the workers themselves have a responsibility that must be a co-ordinated effort if we are to improve our safety performance and that criticism without being constructive is not the answer. Line work is inherently hazardous, the wires and devices which linemen work on regularly carry voltages which can kill, but, like other hazardous work, it can be made safe if the protective devices which have been developed are used.

By failure to get full use of protective equipment, isolating linemen from the "Path to Ground" which he does not do for himself, presents a challenge which I believe can be solved. The solution to this problem goes hand in hand with the required voltage increase in our primary distribution lines. This higher voltage in the 15 kv range can be maintained affording the lineman a greater factor of safety than he has had in the past while working on the lower voltages.

It can be worked with rubber gloves, class 2 (15kv), or class 3 (20kv) from an insulating platform, insulated skyworker or insulated ladders; this method will remove the problem of "Path to Ground," place the worker in a position to work with less physical strain and it will be necessary to make two simultaneous mistakes before he could be injured by electric current. The method in detail is as follows:

1. Work the specified voltages with class 2 (15kv) or class 3 (20kv) rubber gloves with 18" cuffs and glove protectors.
2. Workmen insulate themselves from a ground contact by the use of approved insulated safety boards, insulated ladders or insulated baskets supported on insulated booms of sky lift equipment.
3. Workmen must maintain clearance or provide insulation from metallic paths to ground and from other phase conductors.
4. Work on lines of the 15 kv range must be done only during proper weather conditions. Work of this type must not be done during periods of rain, mist, or heavy fog conditions.

5. All work must be done with complete isolation and insulation from paths to ground. This includes the covering of conductors with rubber protective equipment.

The electric utility industry is making progress in the reduction of frequency. The 1961 figures show our rate to be .582, slightly lower than the all industry average of 6.04, however our severity rate is one that should give us much concern with our rate being 1.222 or 210 days lost per mil-

lion man-hours worked, as compared to the all industry average of 729 or 121 days lost per million man-hours worked. I know we can do better.

It is my belief that if this method is followed in detail as has been outlined here today, we will put the lineman in a safer position, afford more physical comfort, remove the possibility of "Path to Ground," and greatly reduce or eliminate the "shock and burn" problem.

AERIAL BASKET UPS AND DOWNS

By BASIL J. LORENZ

Manager of Safety, Northern Indiana Public Service Company
Hammond, Ind.

"Cut down on man-hours needed to perform aerial work." "No rubber protective equipment needed." "Put your employee in a safe insulated work position." "Work energized conductors bare handed." "Save thousands of dollars a year."

These are but a few examples of the promotional material which has greeted us during the past few years as a result of the rather sudden realization regarding the work potential of the aerial basket in the utility industry. Add to this the many, persuasive verbal dissertations on the merit of this type of equipment, and a general picture of a money-saving, fool-proof, accident-free method of working energized overhead lines and equipment is developed. Our operating people, and rightfully so, are really "up" on this when they realize the potential benefits which can be derived from use of the aerial basket.

I wish to make clear at this point, that I am not opposed to the use of the aerial basket. Quite the contrary, I feel that it is an invaluable aid in safely and efficiently performing many and varied job assignments. A survey of 73 companies revealed that from a primary use in tree trimming operations, the aerial basket is now extensively used in distribution line work, transmission line work, substation work, and on street light installation and maintenance.

Much has been said about such advantages, but like any other tool used in our work,

there are certain inherent hazards connected with its operation and use. We cannot be lulled into a position where these are overlooked. The very selling features of the equipment contain suggestions that are contrary to principles of safe practices that we have been advocating for years. The emphasis is placed on what the employee does not have to do and therein lies the challenge to the safety man.

A positive, down to earth approach is needed. Established safety rules, procedures or practices may have to be revised, but they should be established on the basis of what to do not on what you don't have to do.

There are a number of controversial areas relating to the necessary safe practices in the operation of aerial baskets. Variations in construction of booms and baskets make generalization difficult, however, I will attempt to cover a few which in my opinion are of primary importance in realizing the full safety potential in the use of this equipment.

One of the principal areas of "time-saving" is in the use of protective equipment such as line-hose, hoods, blankets, etc. The aerial basket places the worker in such a position that much of the equipment that normally would be covered when working from the pole is now beyond his work area and consequently would not need to be covered. This reversal of what previously would have been normal practice tends to have the

effect of a general relaxation as far as the use of protective equipment is concerned. The worker is apt to apply the same reasoning to the exposures within his work area and neglect to use the necessary protective equipment. If he, himself, or anything that he is handling becomes involved in a direct contact, phase to phase or phase to ground or neutral, the same tragic results will occur even as it did when he worked from the pole and neglected to use protective equipment.

Experience gained from the limited survey mentioned previously, plus individual reports, has already pointed out fatalities and lost time cases due to contact aloft when working from aerial baskets. The solution of course, is the training of your people to realize that the aerial basket is not an insulated cure-all, plus the establishment of positive safe practices in the use of protective equipment in conjunction with the use of the aerial basket.

The concept of an insulated boom and basket can lead to a relaxed attitude by ground personnel in relation to the possibility of receiving an electric shock. The average reaction is to touch freely the truck body regardless of the proximity of the boom or basket to energized conductors or equipment. Experience here again has already produced fatal and other types of injuries due to not following the usual practice of staying clear from any equipment which might possibly contact energized conductors.

One supervisor received a fatal shock as he stood leaning against the truck bed when the supports of the basket contacted an energized conductor on a 12.5 KV circuit. A metal reinforced air hose installed in the field by an unauthorized employee provided the path to ground.

In another case, an employee was removing tools from a bin on the truck when contact was made by the lower non-insulated portion of the boom. He was fortunate in that the results were not as severe as the previous case.

These are outstanding examples of what can happen in the everyday operation of this equipment. Add to this the fact that most of the equipment in use today does not receive an adequate periodic dielectric check and you have the ingredients of a potential accident.

The establishment of a "stay clear" rule, in my opinion, is the best preventative measure regardless of the type of equipment you may have and regardless of the testing procedure you may follow. The innovations, repairs or even contamination which may occur in the field can easily by-pass all insulation and render it useless. Keeping the people on the ground from touching the equipment unless proper precautions are taken is a positive procedure in effectively preventing this type of accident.

"Belting in" to the basket while working aloft is a practice adopted by many companies. A number of objections to this practice can readily come to mind. At first thought it may seem almost ridiculous to tie a man down when he is working in an enclosure that rises at least waist high. Add to this the thought that any means of attachment will be in the way, hinder movement and will probably prove difficult to sell or enforce and the reaction will be to shy away from such a practice.

Here again our limited experience has indicated that serious accidents have occurred which could have been prevented by the practice of "belting in." In one situation, the leveling cable broke causing the basket to tip over throwing two employees some 20 feet to the ground. One employee was killed and the other severely injured. In another case the brackets holding the hydraulic piston broke due to mis-adjustment, causing the basket to tip throwing the employee to the ground.

In still another case, two employees were using a length of pipe anchored at the basket as a boom in lowering a 35-lb. tool. This operation caused the basket to tip throwing both men to the ground. In yet another situation, planks were placed across the rim of the basket and used as a working platform. An employee fell when he stepped on the plank beyond the edge of the basket rim. These are actual cases which point directly to the advantage of establishing "belt-in" rules.

I am sure that all of us can readily visualize a situation where the positioning of the basket puts the object to be worked on just beyond the reach of the employee. The basket cannot be moved any further due to obstructions. What is the next step? The employee, more than likely, will attempt to climb up on the rim of the basket and from

this precarious position attempt to perform the job. It takes no stretch of the imagination to further visualize the step, the fall and the injury.

In my own particular company, we have gone to a nylon lanyard and with the D-ring located in the back of the belt. Our reasoning in adopting this particular combination was predicated on the following:

1. We wished to limit the free fall and by locating the attaching ring or bar at the rear of the basket and having the length of the lanyard only long enough to allow free movement within the confines of the basket, we feel that a foot or so of free fall is all that would be experienced should the basket tip over.

2. This arrangement does not give the employee enough movement to allow him to stand on the rim of the basket.

3. The lanyard and belt have a shock load rating that is at least four times that of our standard lineman's body belt and safety strap.

4. We have an existing practice that the snaps of a safety strap cannot be engaged in the same D-ring of the body belt when belted in. It was felt that the natural tendency would be to use one D-ring only if the standard safety was used to belt in. The use of the lanyard eliminates the possibility of a daily noncompliance with an existing practice and subsequent undermining of its observation in other phases of work.

5. There is also a possible benefit in the event of a fall. With the D-ring located at the back, the initial impact strain is taken by the stomach muscles rather than the back muscles and the possibility of a severe injury may be lessened. The potential here is questionable, however, it may be a factor.

Our experience with this practice has been favorable. There has been no indication that the arrangement has hindered the movements of even two employees in the basket at the same time. The confines of the basket are rather limited and the lanyard and belt does not interfere with movements needed to effectively work from the basket.

The question of whether to allow any movement of the truck while the basket is extended with one or more employees in the basket has plagued many companies. Practically all of the original models and a large

majority of the present ones require the use of outriggers when ascending the basket. Recently, models have been developed which do not require the use of outriggers. It is certainly a tremendous incentive in the pursuit of saving time to consider allowing at least a minimal movement under certain conditions. The lack of any accident experience, at least to my knowledge, due to movement of the truck with boom extended is probably related to the fact that very few companies at present permit movement of the truck under these conditions.

In general, I believe that this approach is good, safe operating procedure. We have only to look back on our experience with aerial ladders. I am sure that many of us here today can recall instances where, in spite of electrical and mechanical safety warning devices, ladders have been sheared off by tree limbs, telephone cables, and many other types of overhead construction. With the ladders, only material damage was involved. With the aerial basket, you have not only the material damage, but also the potential of serious injury to an employee.

There is no question in my mind that the accident experience would follow that of the aerial ladder should free or limited movement of the truck be permitted with the basket extended.

One of the major considerations arising in connection with the use of the aerial basket is concerned with the maximum voltage which can be safely worked with rubber gloves. I shall not endeavor to voice an opinion on what this limit should be, but merely re-emphasize that whatever the voltage decided upon, a careful and thorough study should be made and again a positive set of safe practices should be established.

Time does not permit the exploration of other areas of consideration in the use of aerial baskets. Future developments of this equipment will present future problems. The safety man will be confronted with old and new pieces of equipment, each having operating characteristics of its own. The challenge will be to allow for the new without relaxing the necessary precautionary measures for the old.

In conclusion, one might say that the aerial basket while being a boom to the industry in the assistance of efficient operation, offers a distinct challenge to the safety

people. The very selling points that make the equipment so desirable in operations—mobility, ease of reaching elevated locations, insulation value, reduction of necessary protective equipment, reduction of necessary personnel to do a job—have a tendency to undermine or minimize the safe practices which we have been developing for years. This shift in practice and in the employee's attitude which follows, can have a detrimental effect on the entire safety program.

The safety man should recognize this potential reaction, and when the aerial basket

makes its appearance in his company he should be prepared to make a positive approach in the safe practices to be applied in the operation of the basket. He should be ready to prescribe what has to be followed in the operation and not fall into the trap of letting the idea of what safe practices the employee does not have to follow predominate.

The aerial basket can be one of the best accident prevention tools available if you come "up" with a positive approach and don't let "down" on your safe practices.

THE OHIO FUEL GAS COMPANY'S DRIVER IMPROVEMENT COURSE

By R. G. CLAAR
Safety Dir., The Ohio Fuel Gas Co., Columbus, Ohio

The training we have chosen and are giving to our employees centers around what is perhaps the best known and most talked about driver training in the country today—the Harold L. Smith System of Defensive Driving.

Our program consists of a four-hour session limited to a maximum of ten drivers per session. Since its inception we have trained approximately 1,800 drivers. We begin with a 16-millimeter sound movie entitled "What's your Driver Eye-Q?". This film describes and shows fifteen common traffic situations—situations in which we find ourselves nearly every time we take a vehicle out on the road.

The film is narrated and after the narration, the scene stops for a brief period during which time the participants check either "A," "B," or "C" as the correct answer on a prepared test sheet. The period of time allotted for the decision of the driver is, in most cases, more than the reaction time required if he were facing this situation while actually operating a vehicle on the road.

After the film is finished, a brief discussion follows during which time the participants give their reasons if they do not agree with the stated correct answers in the film. We find that there is never a

decision where all of the participants agree with all of the answers.

The purpose of the film is to stimulate discussion rather than to say if John Doe has all of the correct answers he is an expert driver and if Joe Smith misses seven that he is a poor driver. The test sheets are not graded but disposed of following the discussion.

We have no formal "break" in the session but immediately following the film the drivers are given an examination of vision with the Bausch and Lomb Ortho-Rater and a hearing test with Ambico-Oto-Chek.

When the tests are evaluated, a confidential report of the results is given to each employee in a sealed envelope.

A summary of all tests, noting deficiencies, is then furnished to the department head for a follow-up by the supervisor who urges the necessary correction for employees who are below minimum standards.

This period, with only one employee being tested at a time, offers the instructor the opportunity to guide and continue to stimulate discussion of our own local vehicle-accident problems. What might appear at first glance to be a period of idleness becomes a valuable addition to the effectiveness of the program. Following the testing period, the program continues

with an illustrated lecture based on the Smith System. (We obtained a film strip and Leader's Manual on this system, and from this we wrote the manual for our own use. The film strip was processed into 35-millimeter slides which makes them much more adaptable and permits us to include additional slides pertaining to our driving problems and statistics).

We proceed on the basis that our drivers know *how* to drive. Otherwise, they would be unable to obtain a state driver license. The *how* part of driving consists of manipulating the vehicle, applying the brakes, turning left, turning right, stopping and the many manual skills necessary to control the vehicle.

We also are convinced that our drivers know *what* to do. The *what* part of driving consists of a basic knowledge of traffic rules, observation of the speed limit, granting the right-of-way, consideration for other drivers and, of course, what can be expected from other drivers or how other drivers should operate their vehicles.

Since these first two steps are elementary, we mention them only in passing. The third step, and this is the heart of the Smith System, indicates when to make the necessary moves in traffic to blend with the traffic pattern and avoid conflicts with other vehicles, pedestrians and fixed objects. The *when* part of driving indicates if a driver is expert or mediocre.

The five "Seeing Habits for Expert Driving" are as follows:

1. **Aim High in Steering.**—This allows the driver to set his eye on a target in the center of his lane far enough ahead that he will be able to keep his vehicle in the proper lane without conscious effort. It also relieves him of the probability of over-steering and fighting the steering wheel.

2. **Getting the Big Picture.**—By scanning the total traffic picture ahead and to the sides and to the back, the driver is aware of how his vehicle relates itself to the movement of other vehicles and pedestrians and gives him the opportunity to regulate his speed to conform with the traffic pattern and thus avoid conflict. Conflicts cause accidents.

3. **Keep Your Eyes Moving.**—By scanning the scene ahead, to both sides and the

rear constantly, the driver is aware of the total traffic pattern and does not allow himself to be lulled into a trap which might cause him to have an accident. If his eyes move constantly to the scene ahead, to the left and right and to the rear view mirror, he will avoid a fixed stare which would narrow his vision and cause him to overlook important developments in the traffic pattern.

4. **Make Sure They See You.**—If a driver desires to pass a slower moving vehicle it is to his advantage to give a friendly "beep" of the horn to let the driver ahead know what his intentions are. In a situation where a pedestrian or a youngster on a bicycle or perhaps an animal might suddenly dart into the driver's path, the same courtesy should be observed. In any case, in an uncertain situation the expert driver will take his foot off the accelerator and either apply the brakes or allow his foot to hover over the brakes to touch it if necessary.

The driver who intends to make a turn or a stop will signal his intention well ahead of the maneuver to allow the other driver the necessary time to adjust his speed or direction to conform with the traffic pattern.

5. **Leave Yourself an "Out."**—The driver who observes the other steps consciously may still find himself the victim of another person's poor judgment. However, this need not cause an accident if he has allowed himself a "pace cushion" of at least one car length for each ten miles of speed between his vehicle and the one ahead.

The expert driver who practices this step will unconsciously allow himself a swerving path if the driver ahead makes a sudden change in the operation of his vehicle. He drives in such a way that he can compensate for the change in traffic ahead and he can slow down, sound the horn and pass if safe to do so or go off the road and stop if necessary. In other words, he avoids being boxed-in in a situation which might result in an accident.

We conclude our program by summarizing the five seeing steps in visual form and issue a challenge to the drivers to consciously practice the five seeing habits. The statement is made that the true expert drivers avoid accidents by practicing these habits and we are sure our drivers can do likewise.

We issue two hand-outs at the conclusion of the session. First, a booklet, "The Eyes Have It" which summarizes the Smith System and includes some timely information and advice pertinent to safe driving. The second is a pressure-sensitive label printed red on a white background listing the five seeing habits which the drivers are requested to post in a prominent place in their vehicles. We also make these labels available to the

employees for use in their personal cars on whatever vehicle they are driving, the expert driving habits are called to their attention constantly.

While this is only one of the devices necessary for a successful fleet driving program, we note with satisfaction that in the areas completed in our company there is an encouraging decline in vehicle accident frequency.

MAINTAINING INTEREST IN SAFETY

By FRANK P. MUELLER

Dir. of Safety, The Peoples Gas, Light and Coke Co., Chicago

The importance of employee interest in safety cannot be too strongly stressed, and the accident prevention efforts of any company surely cannot succeed without it. Ways in which this interest can be stimulated and preserved are perhaps as numerous as they are varied. The approach to the problem will not be the same in every case, and what may prove highly effective in one company may be entirely without results in another. Let's consider some of the different approaches to the problem of maintaining employee interest in safety.

1. **Management's Part in the Safety Program.** The statement that top management must be behind a company's safety program if it is to succeed has been worn threadbare. Let's assume for the moment that this is not a problem here. The fact remains that it is equally if not more important that all levels of management and supervision be *all* on safety if the rank and file is to be at all concerned. The average worker has much closer contact with his supervisor or with his foreman than he has with the chairman of the board or with the president of the company. It goes without saying that the interest shown in safety by the first line supervisor will be pretty closely followed by the workers. If the immediate boss is disinterested in safety or indifferent to safe job performance, so, too, will be his men.

2. **Non-Management's Part in the Safety Program.** It is oftentimes a mistaken idea that the accident prevention activities of an

organization should be restricted to the safety section or safety department of the organization. Nothing could be further from the truth. The safety program, if it is to succeed, must involve as many employees as possible. This involvement must mean something more than an indifferent participation on the part of the employees. It must mean the personal interest and enthusiastic support of everyone. This might be accomplished by appointing employees to serve on departmental safety committees, or on inspection committees, or even as safety deputies within the various departments. These committees will usually provide a real service in the interest of safety if given proper recognition. Their findings and recommendations should be made to someone in authority who can take action when and where necessary to correct hazards or unsafe conditions.

3. **Safety Meetings.** Safety meetings provide an excellent way in which to present topics of interest to all employees. Meetings should be held regularly and frequently and should be conducted by someone in the line organization—preferably the first line supervisor. Subject material for discussion might best be provided by the safety section, and the meetings should be diversified enough to stimulate audience interest. Every effort should be made to keep the employees informed of what is happening accident-wise throughout the company. Discussion of accidents and injuries should be encouraged for the purpose of reducing the

possibility of their recurrence. Visual aids, such as films, slides, flip charts, flannelboard presentations, are all helpful and should be used in stimulating interest in the safety meetings.

4. *Incentives and Awards.* There are many incentives that might be used to help maintain interest in safety. Recognition of a job well done is an effective way of motivating people, and this is true in safety as it is in other fields. This may mean the issuance of safety awards to individuals or to departments, such as certificates or plaques. It may mean little more than the personal commendation of the individual or department by an executive of the company. It might mean publicity either in the local house organ or even in some of the local newspapers. People like to be patted on the back for a job well done, and a compliment earned and sincerely given will do much to stimulate interest in the safety program.

5. *The Suggestive System in the Safety Program.* Employees should be encouraged to use their suggestion system as a means of calling attention to existing hazards or to the need for changes in job procedures or working conditions. Suggestions often call attention to situations overlooked by management that might constitute real hazards and require correction.

6. *The Investigation of Accidents.* The more serious accidents should be personally reviewed and investigated by members of management. The purpose of such investi-

gations should, of course, be made clear to the employees involved in the incidents. These reviews are not intended to be fault finding but rather fact finding. They are held primarily for the purpose of learning something from the misadventure and, most importantly, to try to arrive at some conclusion as to how similar incidents can, in the future, be avoided. Such interest manifested by management cannot but help favorably impress the non-management employee and make him want to do everything possible to avoid future involvement in an accident.

7. *Safety Promotional Materials.* There is a great variety of safety promotional materials that can be used effectively in stimulating interest in safety. These include leaflets, booklets, colored posters, questionnaires, and articles of all kinds having to do with safety. Information is available from the National Safety Council, the American Gas Association, and local safety organizations specifically directed toward the establishment of a good safety program in any company, and the maintenance of employee interest in that program.

Surely there is a variety of approaches to the problem of stimulating and preserving interest in safety. It's a job that requires real effort, imagination, and dogged perseverance. Unfortunately, it is a problem that will not solve itself. The results can be really rewarding—a better safety record, which means fewer employees getting hurt. Maintaining interest in safety is important.

YOUR TRIP TO "SUCCESS"

By J. WESLEY SAMMIS
Safety Representative
Philadelphia Electric Co., Philadelphia, Pa.

Are you on dead center?
You are if you have not been wondering about your safety program!
Been around a long time?
Maybe you've maintained the status quo too long!

Ah, you're new at it and puzzled! Puz-

zled because you've inherited a patch-work quilt?

In either case, you are on dead center if you don't think it's time to reappraise your program.

Maybe you think you are tops as a salesman

You can sell yourself . . .

You can sell your program . . .

You can sell your supervisor . . .

You don't need management backing . . .

Well, perhaps a good hard look at your accident program will tell a story.

Let's take a ride. Join me in the Safety-Mobile. Fasten your seat belt, and we'll be off on the road to success. The town whose population is limited only to those who conduct successful safety programs.

To get there we must be alert for the guide posts which will help reduce the detours of poor programming, the cross-roads of indecisiveness and a wrong turn in failure road.

Our car moves over program road but progress is impeded by indecision excruciation. Good back filling and packing with the solid materials of management directives will soon have us on the way again. The crew foreman shows us that the leak was plugged by using just the facts. This plug is manufactured using the raw materials of accident costs, operating and productive efficiency, human benefits, and frequency rates.

The hole filled, we are able, now, to make a right turn into top management highway. As we move along, the side streets of confusion and poor planning whiz by, at legal speed of course. New construction on top management highway suggests that an alternate route will make our journey less hazardous. Thus, we will continue on cooperation road.

A refreshment stand in the oiling, suggests a recommended driving break. Partaking of the elixir of freshness, cooperation road gives pause to review a problem.

A near miss—an accident without an injury—but a solution had to be found. Cooperation was the key to this successful solution. At one of our gas plants, a mobile crane, performing a job done for 20 years without incident, contacted and tore down the overhead lines feeding the plant substation. The lines carried 66KV and, although no one was hurt, presented a problem.

Local Supervision contacted us and asked for recommendations for a solution. Our solution was to bring the lines in underground. Next came the coordination job.

Contacting the Electric T. & D., Engineering and Gas Departments, all details were worked out. These details involved obtaining agreement on several important points. The company being largely electric and with 53,061 miles of overhead transmission lines posed a selling problem. The incident occurred on a gas facility. The cost was computed to be about \$75,000.

Not only was agreement obtained on these points, but, additionally, all future installations for feeding this type substation would be underground. The plan, solution, and allied information was submitted to top management. Little time was wasted in approval since all the facts, agreements, and information was individually available.

Refreshed, it is time to move on. We gear in, slip into traffic.

Shortly, a flashing yellow light ahead indicates a slow down for the sometime speeding traffic on line supervision hesitancy, on the road to safety meeting. Brake quickly! Here comes a stop light runner! The speeding blur, just slow enough to recognize, indicates that "I'll do all the talking" and "I'll be in the vehicle. This is to be expected. These two are a pair when it comes to the matter of going to safety meeting. One will not listen to any suggestion, the other doesn't believe in its importance. The next car comes to a stop; we would expect this. "I know the value" recognizes the importance of observing all the signs, signals and road conditions important to arriving at a good safety meeting.

Entering next to engineering freeway, we have three good lanes upon which to travel: planning, coordination and field survey. This freeway ultimately passes through the towns of good construction, fewer mechanical hazards and mutual understanding.

Leaving the freeway, again we enter management highway, but the gas tank is low. We cannot reach success without more fuel. Employee reaction service station is just the place! Each flowing gallon of tail-board conference, following safework rules, suggesting new safety items, and training indoctrination help give the highest octane for good go power.

Management highway looms large and broad as the side road of regular safety inspection, visual aids, accident analysis are

passed, each contributes to the flow of traffic, but without disruption.

Our seemingly uncomplicated journey nears an end as we approach the town of Success, population unlimited. Towering before us is the peak of Upper Management.

At times it seems to overshadow our destination. The ribbon of concrete stretches before, winding from the base to the summit like a carelessly scattered string, giving cause for concern as to how easy might be the trip.

The stolid traveler, however, can attest to a smooth ride up the slopes. Smooth through careful planning and coordination.

The highway will continue onward. The ever improving roads are made possible by alert, prepared safety men. The alert plan. Planning prevents stagnation and lethargy.

Whether you continue your journey with top management support, and without consequence, can only be determined by how you plan your trip.

STIMULATING EMPLOYEE USE OF PROTECTIVE DEVICES

By WARREN E. FUHRMAN

Safety Dir., Milwaukee Gas Light Co., Milwaukee, Wis.

It amazed me to learn that some gas companies have problems getting employees to use safety protective equipment. I was surprised to learn that many had to utilize incentives, or discipline, to encourage the use of these articles. In Milwaukee we don't have this problem. Our people wouldn't think of using the air hammer without protective glasses, wouldn't think of cutting a pipe without a bonding wire, would never work on live gas without a gas mask, or the fire extinguisher near the ditch.

I'm talking, of course, about Milwaukee, Utopia. Now, let's talk about Milwaukee, Wisconsin.

May I assure you at this point that we have just as many obstinate, unpredictable people in our labor force as you do and it has been a long struggle to win them over to safety awareness.

Each year we have a safety shoe promotion. The local dealer uses a truck display room to bring his products to our employees. The great advantage is that we can in this manner, take the shoes to the employees at his work site wherever it may be in our city.

Expert fitting is a vital part of this program—if the shoe fits—they'll wear it. The inside is as attractive as it can be under the circumstances. This vehicle holds 1100 pair of shoes in sizes from 6 to 15 in all widths

However, in the event that a style or size is not available, it is delivered the next day by special messenger to the employee.

During this drive, the company contributes two dollars and 50 cents toward each pair of shoes, and the dealer discounts another dollar. We also allow the employee to have the cost deducted from his check in two payments. The reduced price is held open for two weeks after the truck visit to enable employees on vacation to participate. At any other time of the year, nothing by the dealer, and the employee must visit the retail store on his own time.

Our safety glass program incorporates both plano glasses and prescription glasses. We provide various types of non-prescription glasses depending on the job. I'm sure these are familiar to you gentlemen. If not, they are all on display at the various booths in the basement of this hotel.

Our prescription safety glass program may be different from yours though, so I will explain it to you. We charge the employee \$9.00 for single vision and \$11.00 for bi-focals. This includes the examination, the fitting and the glasses themselves.

All of our people desiring prescription safety glasses go to an ophthalmologist for the examination. We have decided on an

M.D. because we feel that he is better qualified to find other problems and offer advice or treatment as needed.

When the glasses are ready, the employee is fitted by a dispensing firm. Our purpose here is to eliminate complaints and at the same time, give our people the best of attention. All prescription glasses are furnished in this two-tone frame again to encourage their use off the job also. Any damage incurred on the job is repaired here at no cost to the employee.

We are one of the few companies in the country that demand the use of a hose mask while working on live gas. Our concern in this regard is because of the fire hazard. If a fire should occur in the trench, we want our employee to have his eyes, nose and mouth protected. Perhaps some of you have read of hospital accidents where the anesthetic has burned in the patients lungs killing the patient. We emphasize these cases pointing out that a combustible mixture can be present in the employee's lungs at any time gas is present in the ditch.

We have even gone to the extent of negotiating a clause on gas masks into the labor contract with our union. It states, "Foremen in the distribution, construction and repair departments shall not direct employees to work on live gas on mains or service piping without the employee wearing a gas mask." If you will note, it is written in a negative manner. If the foreman shall not direct them to work without the mask, then they must work with it.

Let me assure you at this point that a paragraph in the labor contract is not the complete answer to getting the employees to wear the mask. We also had to analyze their objections to the equipment and see if we could eliminate those also. Let me give you some of their objections and see how familiar they sound to you. "It's too old in the winter, it's too hot in the summer, it fogs up, it's too bulky. You can't breathe in the damn thing."

Fortunately, one of our superintendents came up with a solution that stopped most of the objections. The answer was a small squirrel cage 12-volt blower installed in the center of the mask case. The motor is one designed to clear the bilge of motor boats of gasoline fumes so it is perfectly safe for natural gas.

This blower keeps enough air supplied to make breathing easy and to eliminate fogging. During the summer it keeps the face cool.

In winter, we reverse the process and keep his face warm by placing the case under the truck heater in the cab. The blower can be equipped to fit in a cigarette lighter or two clips can be used as we do so that it can be connected to all equipment even the air compressors.

The fire extinguisher has become second nature with our construction and repair crews. It is almost automatic the way they take it off the vehicle and place it near the trench. We use the dry chemical extinguisher and I attribute its complete acceptance to its demonstrated performance. At several demonstrations we have had the extinguisher representative work with our employees on very large fires.

In addition, many of our foremen and employees have attended a three-day school at the fire extinguisher's home plant in northern Wisconsin. I can personally vouch for this school as being outstanding. After three days, you have inhaled enough baking soda to keep you sober for the next month.

We also provide what is commercially known as the "Sankey Foot Guard" to all our air compressor operators. This item was made mandatory after a child broke and the hammer dropped on an employee's foot. However, we could only make it mandatory during the summer. When winter arrived, we suddenly found that most of our compressor operators had big feet and the large Sankey guard made would not fit over their overs. So we had to back up on our rule. If anyone here has an answer, I would appreciate hearing it.

One of the items that we have not stressed to any great degree has been safety belts in our vehicles. However, you may have read that Wisconsin just passed a law requiring that all 1962 vehicles must be delivered with two seat belts installed on the front seat. Obviously, if we are going to get these with each new vehicle we purchase, we are also going to promote their use.

In addition to all of the items and methods that I have shown you we use, we also use the ordinary approaches to promote the use of safety equipment—methods such as bullet-

tin boards, posters, slogans, contests, the Wise Owl Club, Golden Shoe Club and so forth.

I was asked in this short address to tell you what we do at our company, not what

we would like to do to promote the use of protective equipment. Maybe next year they will invite me back to tell you what we would like to do. That would take much longer.

THUMBS DOWN ON VIOLATORS

By RICHARD K. AYERS

Managing Dir., Metropolitan Safety Council, Denver, Colo.

Utilities people have been among the finest leadership we have ever had, and the particular service to safety they have rendered over the years, and are now engaged in, can not be questioned.

I was invited to explore some of the principles upon which safety programming can be effectively formulated and perhaps give an example or two of workable programs that can be the basis for your own efforts.

In the midst of this wonderful age in which we live, we are still each concerned with some real down-to-earth problems. The same problems that have been with us ever since man came down from the trees and out of the caves—to develop patterns for more successfully living with each other—*safely!*

I am dubious of my ability to tell you much that is new or remarkable. Perhaps my function can best be to review, if you please, some of the fundamentals, maybe find a new perspective. That could be a worthwhile objective and one I might wish to contribute to.

You may know that I am by profession a public relations consultant and, as such, usually attempt placing everything in a public relations perspective. Perhaps then, my experience as a safety council manager can come into play to tie the thing into one ball of wax.

Let's take a look at the major objectives of industry from a public relations point of view. Any successful enterprise must be concerned (perhaps even more today than ever before) with projecting itself as being good to own and invest in, as being good to work for, as being good to deal with and

buy from and as good to have in the community.

Programs geared to project these purposes form the shareholder relations programs, employee relations programs, customer relations programs, and community relations programs. Taken together they compose the public relations programs for that concern. In broadest terms they might be said to dictate the operations and management policies and interpretations that may be placed on them.

The broad and overlapping spread of the communications industry today, maybe even more than in any other industry, brings every segment of this relationships endeavor into every other segment. Certainly the employees of Bell Telephone are owners and shareholders as well as customers and active members of the community. Owners are found in each segment. Everyone practically is a customer and you reach the entire community with every interest you have.

We can almost safely say that any program that affects the community and its people can affect the communications industry—for either good or bad, depending upon which direction it points.

If it is to reflect good for you it must, in my opinion, be away from the old paternalistic image, perhaps even the materialistic image often held, and be a truly humanistic projection.

I don't think I need dwell on this point with you people. But, let's just say that any program to be properly useful must project your leaders and your industry as truly interested in people. It must project a human concern for owners, employees, customers and the community.

So much just now for your motives and requirements for a program.

Let's consider the safety council movement.

Here, too, we find motives and objectives parallel to those of the industrial community as they relate to helping improve our communities. Here, too, we find the major impact area the local scene, for accidents happen to you and to me and to others, where we live, where we work, where we play, and where we raise our families.

Actually, our objectives are interrelated. They can almost be said to be mutual.

Communications and other utilities have long recognized safety as an appropriate goal for use in every phase of public relations programming and to every segment of their publics. It may well be the one strongest tool! They have accepted the mutuality of objectives with the safety movement and cooperated to the fullest extent. My earlier remarks indicated some of their efforts and many more could be cited. Their use of community programs and backing for effective programs at all levels and in all attacks on accidents.

Since it is necessary for you to be aware of how the safety movement operates if you are to use it effectively, let's review a bit. Likely you already know more about it than can be stated in this short summary.

Let's put it simply, that any good safety council approaches its programming on a four step basis:

- (1) Determine the facts about accidents with all the implications.
- (2) Inventory the resources that are already working against the problems and discover and develop new resources that may be needed.
- (3) Establish effective programming to bring to bear the resources against the problems on a priority basis.
- (4) Continually evaluate and reevaluate programs in the light of ever changing conditions.

You are so familiar with this process it is useless to go into it more deeply. But, now and then, it may pay to review the entire procedure as established by the National Safety Council and made available for local use of councils.

It may be well to point out, here and now, that this process is workable. But, it can be only as effective in your own community as your community leaders will help make it. That, it seems to me, is where you people have always been most generous and willing. You must give substance and leadership, work with the program and use it to the fullest advantage for both yourselves and the community. Likely any success will depend on just how far you and other industry go to make the safety movement vital not only in accomplishing your own objectives through it, but helping it accomplish its own objectives; again, mutuality of purpose and effort!

I said we would take a little look at a specific program that might serve as an example. The one I wish to discuss and demonstrate, I believe embodies the best principles of safety programming. It recognizes a major problem, establishes resources and methods for attacking the problem, and serves as a general emphasis sort of promotion. It should be pointed out, though, that this program must fit into a pattern of well rounded efforts geared to create a climate for safety in every field. This is not just the one or the only program. It is one of a group that fill the needs of a specific place at a specific time. (It might find use for you in your area also since the attack is based on a rather general problem.)

We intend to look at a problem and an approach to a logical solution through a massive program—a program we chose to call "Thumbs Down on Violators."

First, it was apparent from the death rate that we were killing far more people in Denver and the state of Colorado during the first six months of this year than ever before. That was the real problem. But—a close look indicated that at the current rate we would reach a new all time high of terrible proportions before the end of the year unless the trend was reversed or at least slowed down.

Facts were placed on paper. What was happening? What is the cost? What can be done about it?

It was obvious that the accident rate was the direct result of violations of our laws—both man made and those of common sense. It was also obvious that if violations

could be stopped a lot of lives could be saved. We must make traffic crime unpopular. And the traffic safety committee went to work.

The approach to a program was developed after long study. Materials were made available in substantial quantities. They included window cards, posters, bumper stickers, mail inserts, handout flyers, discussion sheets, radio, TV, and newspaper material, house organ material, slides, proof sheets, plates and mats. Everything was tied to that one theme "Thumbs Down on Violators."

The committee appealed to every segment of the community. Letters and followup were directed to employers, association leaders, religious leaders, civic leaders, service clubs, women's clubs, youth groups, farm groups, labor groups, government agencies, media and everyone else we could possibly reach. Every group was contacted and asked to assist and they were also asked to help improve on the program to help make traffic crime unpopular. This has been regularly followed up, too.

A steady flow of material was presented to the press and radio-TV was given material to help keep the pressure on. This is still being kept up.

You may logically ask at this point, "What has happened? Did people flock into this program? Did you get a lot of support from everyone you asked to assist?"

I should like to mention here that a tremendous job was done and it is being done by our committee and pay a deserved tribute to chairman Phil Milstein (President of the Banker's Warehouse Co.), Mrs. Henry McLister (the vice-chairman, and a real working community leader) and the entire committee. They not only have a good program but they are keeping the pressure on and getting results.

Within one week after the appeal was made, a résumé shows that the forward looking people in each segment appealed to were on the ball and working on the program. Cooperation was and has been good from those who always cooperate in such efforts, fair from those who do a bit now and then and not so good from those who rarely cooperate. The heartwarming indicator however is the new

groups and firms which got into the act with this program and now—after some three months—the program is gaining momentum and growing week by week. Let's cite just a few examples.

Clubs gave us help. The Pilot Clubs produced their own stickers and featured the program at their national convention in Denver. The Colorado Jaycees are just now entering the total program in a big way. Federation of Women's Clubs is proposing this as a major effort this winter throughout the state. Others are using the program in mailings, meetings and other ways.

Employers, of course, are the backbone for they go all out to help reach their employees. They take the bull by the horns and add new twists of their own to make it effective. There is one contractor who created graves on each of his paving compactors, with white crosses labeled "Joe the Dragger," "Tom the Speeder," etc., flowers and the works, all backed with the "Thumbs Down on Violators." You can imagine the interest these pieces of equipment create around the area.

Many have used the total program to advantage just as did the Mountain States Telephone & Telegraph Co. Bob Mills had his own bumper stickers printed and distributed, they placed them on company vehicles. They attempted to reach employees and the community as a whole through all their resources and that hits a lot of people!

Some of the labor unions went to work on this. A bakery drivers union is a good example. They bought bumper stickers from us at cost with their own label, secured permission to place them on the trucks of every major bakery in the area, and got the message out.

Many cities officially joined the effort hoping to help make traffic enforcement easier. In Denver, Mayor Batterton cooperated with the erection of the first of 60 death scoreboards being kept up to date with each added death. One city manager (Aurora) placed stickers on all city vehicles. The police chief in Englewood had posters, flyers and stickers distributed and the city mailed 13 thousand cards to homeowners carrying the theme and the message. All over the area city officials cooperated in getting signs up and the word spread.

Media have given the program rather good support and it is expected that as more results are obtained more will be done. Radio-TV is giving good support and the newspapers carry a lot of material. The Denver Post commented editorially and urged all to take the message to heart.

Advertisers have assisted in the program too with use of the material. General Outdoor placed 25 bulletins in strategic spots and helped us keep the message alive. And we could go on and on.

Just one more sample. The religious leaders of many groups have helped in a great measure to call the moral implications of the program to the attention of their parishioners. Many have used sermons and mailings to good advantage as you might know they would.

Now you probably want to know about the results in a more material way. Has it saved lives? None are more aware than we of the danger in accepting figures at this early date. I do believe, however, it can be safely said that it's working!

We do know that accidents are reduced now and that a lot of attention has been paid to traffic crime. Maybe we are just lucky. Maybe it would have happened anyway. Who can ever know?

The facts show that at the end of July we had killed not the 48 predicted for Denver, but just 42. At the end of August we hadn't killed the 49 anticipated, but 45. And at the end of September we hadn't killed 71 but just 49. And in each of these months traffic injuries and fatalities have

been reduced from many previous years! In fact we are at this time just six more than a year ago, while when we started this effort we were 12 behind.

Fatalities in the state have shown similar trends and at the end of September the gap was closing. It was just three more than a year ago.

Sure, that's far too many. But—we haven't stopped our "Thumbs Down on Violators" program and, what's more, I doubt it has really reached its peak. We may actually save a lot of lives in the long term and we intend to keep going until it loses its effectiveness or until someone can come up with a better program!

I want to close by saying that I do believe this is the sort of program that can be developed to meet a real need in a community. One that you can be proud to be associated with and one you can put your teeth into and do something about. I believe it gives you an opportunity to take your rightful place as well as project your own objectives.

Safety and industry can find mutual concerns, institute and prosecute action on a priority basis, and cooperate to do a worthwhile job just as we always have, and likely always will.

And, because of this mutual concern and action—because of what you do—our own communities, our states, our nation and the world, will be safer and better places in which to live, to work, to play, and to raise our families. And, incidentally, those who have participated will have profited.

PUTTING ACROSS YOUR SAFETY MESSAGE — A TOUCH OF GLAMOUR

By FRANK BURROWS

Field Service Dir., Citizens' Traffic Safety Board, Chicago

I hope to impart to you a variety of ideas to advertise good safety tips. This collection of ideas first began to accumulate when I was asked to lecture at Northwestern University Traffic Institute. Since a large part of my work consists of lecturing before all kinds of groups, old and

young, large and small, a need to do something other than just talk safety arose. I discovered that a large part of the audience very often did not receive the message. I began to incorporate little attention getters to hold interest. The audience seemed to receive the safety message more

strongly, and in a sense I became a better communicator for safety.

To understand how an idea, or "gimmick," should be used, one must keep in mind three definitions which when used through all your safety planning will enable you to attain the maximum results. The three definitions are:

1. **Safety**—Doing the "job" the right way. Job is anything a person undertakes to do—standing, sitting in a chair, crossing the street, driving a car, running a machine, peeling potatoes, etc.

2. **Safety Education**—The art of making a man want to do what he ought to do.

3. **Safety Program**—To create an appetite in people who are not hungry.

Keep these definitions in mind. Observe the next ten minutes of my lecture. I am going to demonstrate how I sell safety. . . . (Here a short traffic safety lecture was given in which several visual aids, gimmicks, magic and humorous stories were used as an example of what adding a touch of glamour to a safety message means.)

. . . But I do feel I have "thumbing" important to point out to you. Supposing you're driving your car and you approach an intersection. Now, I'm in the other car approaching the same intersection. This is an unmarked intersection. There are no signs, no signals for either one of us. We are both traveling at the same rate of speed, and we both will arrive at the corner at about the same time.

The only difference is this—you happen to be in the car on my right, and I happen to be in the car on your left. Now, by law, who has the right of way, the car on the right, or the car on the left? (The car on the right.) Well, now, perhaps we are not reading the same law book because in my law book it does not say that the car on the right has the right of way. My law book simply states this—"the motorist on the left," and that's this fellow here, "must yield the right of way to the motorist on the right." It does not say that you have it. It says he must yield it to you.

Now, I may be a little bit stubborn, I may step on the gas, blink my headlights, blow my horn, speed up a little bit. You will slam on your brakes, to avoid an accident, and you may say something to me

as I pass by, besides that isn't my name anyway. But you do not have the right of way by law. It says I must yield it to you, and if I don't yield it to you we know you do not have it, and if by law I'm supposed to yield it actually I do not have it. So you see, neither one of us has the right of way.

What about a traffic light? You have the green light, and I have the red light. Do you have the right of way over me? No you do not. The law simply states that for the red light I must stop and yield the right of way to those of you traveling through on the green, but for the green light the law does not state that you have the right of way. It simply says that you are allowed to go through that intersection if you can do so safely. And if I run through the red light, you don't do so safely.

Of course, I would get the \$10 traffic ticket for running a red light and causing an accident, but what good is a ten dollar ticket going to do you or me if both of us are in the hospital. You see, even with the green light you do not have the right of way by law. And I know a case in court where the man who ran a red light caused the accident and received a ticket, won the case because they proved in court the person traveling through on the green light could have prevented the accident.

Supposing you're traveling on the main street, the through street, a state route, boulevard, or whatever you want to call it. I'm approaching from one of these little side streets, and I have a stop sign . . . by the way, in case some of you have forgotten what this actually says, it says, *Stop On Pedal, not Spin Tires On Pavement*. If it looks to you like I am not going to stop, what do you do?

Well, like nine out of ten of the motorists, you remind me, don't you? Beep . . . beep . . . beep . . . you blow that horn to remind me, look out fella you're supposed to stop for that sign. I'm going first. What happens if I don't stop for that sign? Even then, you do not have the right of way. The law only states that I'm supposed to stop at the sign and yield it to you. It does not say that you have it.

What I'm trying to point out to you is this—out there on our streets and high-

ways, I don't care where you're driving or what you're driving, you never have the right of way by law. Never. The law only explains who is supposed to yield it. It will not say that you have it.

Another example of communicating a safety lesson is . . .

Now, I've never ridden with any of you and I don't know what kind of drivers you are, perhaps you're very good. But supposing you're driving your car on a dry street, you have four good brakes and four good tires. You're traveling at the slow rate of 30 miles per hour, and that isn't very fast. Suddenly, up ahead someone backs out or walks out in front of you and you have to hit the brakes.

Now, in how many feet could you stop your car traveling at 30 miles an hour on a dry street with four good brakes and four good tires? . . . 66? . . . 30? . . . 150? . . . 45? . . . Well, the answer is 88 feet. Eighty-eight feet! Eighty-eight feet it would take you to stop your car traveling at 30 miles per hour.

Let's analyze this. I have a ribbon here one-half inch representing a foot, one-half inch to a foot. The top of my case here will represent the highway. You're traveling at 30 miles an hour, that's 44 feet per second. You come along this highway and right here at the corner of my case you see danger and that (snap) quick, you put your foot on the brake, but you can see by my yellow ribbon here that you will travel 33 feet, the approximate length of two cars parked bumper to bumper, before you can get your foot on the brake.

Then, after you put your foot on the brake it will take another 55 feet to come to a halt, making the total stopping distance from the time you see danger, slap your foot on the brake and stop your car about 88 feet. Now if you're real good, you might stop your car in about 79 or 80 feet, but if you happen to be tuning in the radio, lighting a cigarette, or talking to someone next to you, it might take you 100-some feet. But the average person will take 88 feet to stop his car at 30 miles per hour.

Now, I'm going to double the speed from 30 to 60 miles per hour, twice as fast, to show you what it's like should you be traveling on one of our turnpikes, expressways or out on the open road where you can

travel 60 miles an hour, 88 feet per second. You are traveling 60 miles per hour, as you come along the highway here and right here at the corner you see danger and that (snap) quick you put your foot on the brake.

But if you double the speed from 30 to 60, you will double your reaction distance from two car lengths to four car lengths. Instead of 33 feet you will now go about 66 feet, the approximate length of four cars parked bumper to bumper, before you put your foot on the brake, and ladies and gentlemen I don't care if you have power brakes, I don't care if you throw out an anchor, it will take you another 300 feet to stop your car.

Three hundred feet, that's the length of a football field from goal line to goal line. Three hundred feet, making the total stopping distance in the neighborhood of 366 feet to stop a car that's traveling at 60 miles per hour. You see, when you double the speed you don't double the stopping distance, you multiply it.

This is one of the reasons why we have multiple accidents on our super highways. I don't know what people tell you, but I know what they tell me. They say, "Burrrows, if I do what you say and follow at a safe distance everybody cuts in front of me." "So, a person is allowed to change from one lane to another if he can do so safely." I reply, then they say, "But they keep pushing me back." "Wait a minute," I say, "if you're on a city street, how fast are you going? About 30 miles per hour? Out on a super highway, how fast are you going? About 65 miles an hour? Then kindly explain to me how they push you back when you're traveling straight ahead at 30, 40, 50, or 60 miles an hour?"

I can't figure this out, can you? But I usually turn to them and I say, "Hey, when are you going to fill out that blank?" And they say, "What blank?" And I say, "The one between your ears."

And that is the way I attempt to present the safety message to the people here in our area.

You know, sometimes those of us who have a safety message to sell overlook the obvious. Sometimes we create our own illusions. Our own most trying problems are often the result of self-deception. And too many people selling an intangible safety

message are prone to assume that the doors are locked against them when the difficulty is actually a mental block. Remember Harry Houdini? He was an ingenious entertainer.

Behind Houdini's skill as an illusionist was a profoundly scientific mind and a keen grasp of the application of modern mechanics to intricate physical problems. He matched wits with locksmiths and prison wardens, and never failed to escape within the time limit. But he almost failed on one occasion by overlooking the obvious.

The warden who nearly outwitted Houdini used a simple artifice. He placed Houdini in an "escape-proof" cell and closed the door. Houdini tried all his ingenuity on the lock but could get no action from the mechanism. A few minutes before the deadline, in desperation, he tried the knob or the ponderous door. Presto! It hadn't been locked in the first place.

Ladies and gentlemen, I want you to use gimmicks, humor, or anything else you can think of to add that touch of glamour to your safety message. Let's stop overlooking the obvious. Let's use proven advertising principles. Let's encourage people to at least look at or want to hear what we have to offer.

Let me encourage you to use some of these ideas. You will not only be doing a good deed, selling safety, but you will enjoy it more, and you will be creating an appetite in people who are not hungry by making them want to do what they ought to do—that is, to do every job the right way.

Look at some of the ideas I have here. You could build a whole routine around these gimmick types of glasses, "Goo-goo" glasses—funny to look at, aren't they, Goo-goo glasses—make me look sick, don't they. Open and shut glasses, and what about this pair here that makes me look as if I'm pop-eyed. When I wearing these I could tell you that I want to see what's actually causing accidents. See what you're doing, ladies and gentlemen, you're laughing at what I'm doing and how I look while I have these glasses on. But think, while you're laughing you're listening to my message. This is what you have to do with your safety program. People will enjoy it more, and they will receive more from it.

How about these articles here. I have

a little police badge, a little boy's police cap, his gun, his whistle and his handcuffs. Any one of these items can be tied into a safety message. You can tell the audience while twirling the handcuffs that with their cooperation you can "handcuff" a certain cause of accidents. With the gun you could pretend that you are out "gunning" for crime and that is the thing that causes accidents in a specific field. Blowing your whistle can be tied in with blowing the whistle to stop accidents, and so forth. You could build a whole safety message around dollar bills that come in many shapes and forms—large comic dollar bills, little dollar bills, rubber dollar bills. With a little bit of imagination you could tie in the cause of accidents or stretching your money, stretching money through the prevention of accidents. See what I mean? Let's add a touch of glamour—demonstrate.

Earlier I was able to plant a piece of corn in everyone's pocket or purse. I have developed a little SAFETY SIX PACK in order to help you plant a safety message in everyone's mind. This SIX PACK contains six items which have retention value and are very inexpensive. The six items are:

1. A piece of string—"string along with our message of safety."
2. A kernel of corn—a pocket or change purse reminder of the need for cooperation of the individual in the safety program.
3. A safety pin—to be pinned on one's clothing as a reminder to keep one's guard up against accidents and be safe at all times.
4. A band-aid—to be placed on the back of the hand or dashboard of a car as a reminder that traffic laws or good safety rules practiced will hardly ever result in an injury serious enough to need more than a band-aid for repair.
5. A rubber band—"you must stretch your efforts for safety."
6. A lollipop—"don't let accidents make a 'sucker' out of you." Work hard to "lick" the problem of accidents.

Let me give you an idea of how to think about glamorizing your safety message. See, I have here what's called a "Hypo-Phony." This looks like a regular doctor's syringe, and, as you can see, it looks as if I am drawing blood right out of the air. I saw this article in a drug store. It costs a buck

and a half. I felt I could use it in a safety message, so I purchased it.

Shortly thereafter, I received a telephone call asking me what the title of my lecture to be presented before the Woman's Auxiliary to the American Medical Association would be. I looked at this toy on my desk and told the caller that the title would be *You Can Get Blood Out of a Turnip*. Ladies and gentlemen, I made the turnip resemble their impossible task of selling safety. I then proceeded to tell them how to use good programming to sell safety, and I concluded my speech by saying that if you use the right tools, the right safety programs, etc., you can do the impossible. Of course, the right tool for extracting blood is a doctor's syringe. See, I inject my syringe into this bloodless turnip and extract blood. This is

the only time in my life, ladies and gentlemen, that I ever received a standing ovation for a lecture, and it cost me a buck and a half.

The ideas expressed here are audience tested. If used as suggested, or as you see fit, they will make your safety lecture a little unusual. This alone will create an interest in the audience. Some of these ideas, by nature, will bring a chuckle or smile to the faces of those who observe them. The laughter tells you that they are listening. Please do not be mistaken about the laughter. It is not directed at you but at the "gimmick" which emphasizes your point.

I personally challenge you to use some of these ideas and see how you will improve the communications between you and your audience with a touch of glamour.

THE PRINCIPLES AND PRACTICE OF HEART-LUNG RESUSCITATION

By ARCHER S. GORDON, M.D., Ph.D.

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What....? Heart-lung resuscitation is an emergency first aid procedure that combines artificial respiration and artificial circulation. The best rescue technique for artificial respiration is mouth-to-mouth resuscitation (MMR). The best rescue technique for artificial circulation is external cardiac resuscitation (ECR). These techniques are most effective when used together.

When....? Heart-lung resuscitation should be started at once in any case where there is absent respiration, heart beat or pulse. Time is crucial—seconds count. Adequate ventilation and circulation must be restored within minutes if resuscitation is to be effective. Don't waste time seeking help or equipment. Begin at once.

Who....? You—or anyone can learn and perform effective heart-lung resuscitation after minimal training. Remember, almost 70% of successful rescues are accomplished by persons at the scene—family, neighbors, friends or passers-by. Don't delay. You can save a life NOW.

Where....? Resuscitation should be performed anywhere a victim is found. Don't waste valuable time moving him—finding special equipment—seeking additional help—getting him out of the water, etc. It is necessary to move him only if gases or fumes are present.

How....? Learn, practice and follow the simple principles and instructions below.

PRINCIPLES

1. *Clear Air Passages.* Effective resuscitation can only be accomplished with unobstructed air passages. Sometimes this maneuver alone is sufficient to allow the victim to resume spontaneous breathing. The air passages can usually be cleared of anatomic obstruction by tilting the head into maximum extension. Obstruction by foreign bodies requires removal by the rescuer's fingers or inversion of the victim.

2. *Inflate Lungs.* Rhythmic inflation of the lungs through the victim's nose or mouth may restore spontaneous breathing if there

is any effective heart beat. Artificial respiration must be started immediately in order to oxygenate blood which is circulated either by spontaneous heart action or external cardiac resuscitation.

3. Compress Heart. Then begin rhythmic External Cardiac Resuscitation and continue it—until a palpable pulse and spontaneous breathing have resumed. Be sure the victim is on a firm support, such as the ground, floor, table or bed board. For adults use both hands to press on the breast-bone; in a child you can use one hand to compress the breast-bone while the other hand is slipped under the back to provide firm support.

Head Tilt Method, Mouth-to-Mouth Resuscitation—Closed Chest Method, External Cardiac Resuscitation

1. Clear Air Passages.

Lift Neck

In an unconscious person, relaxation of the jaw usually results in blockage of the air passages by allowing the tongue to drop backward into the pharynx. When the neck is lifted, the head drops backward into extension. This alone will sometimes clear the air passages and allow a victim to resume spontaneous breathing.

Extend Head

The head should then be tilted into maximum extension. One hand pushes the jaw upward from below; the other hand pushes the crown of the head under from above. When the chin is pointing almost straight upward, the jaw and tongue are drawn forward and the air passages are cleared.

2. Inflate Lungs.

Open your mouth widely. Place it over the mouth OR nose of an adult or large child (the mouth AND nose of a small child), make a tight seal and blow into the air passages until you see the chest rise and feel the lungs expand. Adults require a deep breath from the rescuer; infants and small children only need small puffs of air. Your cheek rests on the victim's mouth and prevents air leakage during mouth to nose breathing. The victim's mouth may be kept open for mouth-to-mouth breathing by drawing down his lower lip, while air leakage from his nose is prevented by

your cheek—or you may pinch off the nostrils with the other hand. Now remove your mouth and take your next breath as you hear and feel him exhale. Reinflate the lungs 10 to 12 times per minute for an adult, at least 20 times per minute for a child.

3. Compress Heart.

Be sure the victim is resting on a firm surface. Place the heel of one hand in the center of the chest over the lower portion of the breastbone and place the other hand on top of it. Rock forward and use the weight of your body to exert pressure vertically downward. This moves the breastbone an inch or two and compresses the heart between it and the spinal column. The pericardial sac which surrounds the heart is non-elastic so this compression propels blood out of the heart into the lungs and the body. When the pressure is released the chest re-expands and the heart refills with blood. The cycle is repeated 60 to 80 times per minute for adults, 80 to 100 times per minute for children.

Cycle

Heart-lung resuscitation is accomplished best by two rescuers who alternate in performing mouth-to-mouth resuscitation and external cardiac resuscitation. A series of five cardiac compressions followed by inflation of the lungs at a rate of about 60 to 80 heart beats and 12 or more breaths per minute provides excellent blood pressure, blood flow and blood oxygen saturation. Faster rates should be used for children.

Two rescuers can also do mouth-to-mouth and external cardiac resuscitation simultaneously instead of alternately. However, in cases where there is liquid or semi-liquid material in the lungs, air passages or stomach (i.e., drowning, pulmonary edema, vomiting, etc.) simultaneous application results in stomach and pulmonary contents being discharged into the face of the rescuer performing direct Mouth-to-Mouth Resuscitation. When chest compression and lung inflation are alternated this is avoided. Better pulmonary ventilation is also provided without any significant sacrifice in the effectiveness of circulation.

In an emergency, a single individual can alternately inflate the lungs and compress the chest. In this case it may be desirable to follow each lung inflation with a series

of eight cardiac compressions, instead of five.

Alternate Method

Silvester Heart-Lung Resuscitation

When a completely manual technique is desired, the Silvester method can be combined with External Cardiac Resuscitation to provide Silvester Heart-Lung Resuscitation. The victim is placed on a firm surface with a towel, block, or some other slight elevation under his shoulders so that his head will drop back into maximum extension. The rescuer kneels at the victim's head, grasps both of his wrists, places them on top of each other in the center of the chest over the lower breast-bone and rocks forward using the weight of his body to deliver a series of cardiac compressions. He then rocks backward raising the victim's arms above his head to produce lung inflation. The complete cycle is then repeated 12 to 15 times per minute.

Adjunctive equipment is not required for effective MMR; is second aid rather than first aid; if used, should have the following characteristics:

Small, compact, light weight—no valves or moving parts—easily cleaned or sterilized—fit all faces and configurations—only extend one inch into mouth—firm bite-block between teeth—flexible, tightly-fitting face piece—can be used with "Head Tilt" method of MMR.

Drainage

If you are unable to inflate the lungs with mouth-to-mouth resuscitation, check for foreign body obstruction by quickly sweeping your fingers through the mouth and throat. If this maneuver does not remove the obstruction, a child should be picked up quickly, inverted over the rescuer's arm and given firm blows over the spine between the shoulder blades until the obstruction is dislodged. When the stomach is distended following submersion or feeding, a child may be similarly inverted for drainage.

exerting pressure on the abdomen with the underneath hand.

An adult with airway obstruction may be rolled up onto his side and his shoulder placed across your knee and thigh for drainage. Firm blows over the spine between the shoulder blades may dislodge a foreign body in the air passages. Pressure exerted with your hand between his navel and ribs will promote the drainage of stomach contents with reduced danger of aspiration into the lungs.

These maneuvers should be performed quickly followed by resumption of heart-lung resuscitation.

Training Aids

Very little training is required if these principles are understood and applied.

You can begin by practicing the principles on each other. A clean handkerchief or cloth (A) may be used between "rescuer" and "victim" for practice or in actual emergencies. It does not interfere with Mouth-to-Mouth Resuscitation. However, if not available in an emergency, don't worry about infections from direct contact when a life is at stake.

You can also practice placing the hands over the breast-bone and exerting moderate pressure. A single operator, or two operators, can practice the 5:1 rhythm of ECR: MMR. It helps to count out loud to synchronize your efforts.

Various manikins and models are available for practice. Some of these closely simulate the feeling of actual lung expansion and chest compression. They allow you to extend the head and inflate the lungs (B) or combine mouth-to-mouth and external cardiac resuscitation for complete heart-lung resuscitation practice (C). Breathe Life Trainers can also be used (D). These jackets are worn by the "victim" and simulate the action of the lungs during mouth-to-mouth resuscitation.

WATER UTILITY SAFETY

In speaking of safety on the reservoirs and lands belonging to a water utility, Mr. H. D. Harman, vice president and general manager of the Gary-Hobart Water Corp., Gary, Ind., said that the ground rules of a water safety program must deal with these areas: the utility and its employees, the customers, the equipment, the quality of the water, and the elevated storage facilities supplementing the reservoirs. He defined a reservoir as any impounded supply of water.

Mr. Harman gave an example of the dangers of having a reservoir near a community, pointing out the pressure exerted by citizens to gain permission to fish in the reservoir, usually followed by extensions to allow row boats, then motor boats, and from there through water-skiing to a full-fledged resort and pollution of the water.

Mr. Harman mentioned that the 10-12 elevated tanks in Gary, located at pumping stations, were a constant safety problem. He said that the greatest dangers were from intrusions by teenagers, and that barbed wire, locked gates, and solid, high foundations were barely enough to prevent them.

Mr. J. C. Vaughn, chief filtration engineer, South District Filtration Plant, Bureau of Water, Chicago, discussed safety at the water treatment plant, and said that the functions of a safety program there should be to eliminate existing hazards, provide protective equipment, and ensure safe-work practices through a safety education program. He said that his plant owned \$30,000 worth of safety equipment.

Mr. Vaughn, in an excellent series of slides, showed the range of safety devices in use at his plant: bulletin boards and suggestion boxes, monthly safety bulletins, chain guards at steep stairways, plastic protectors on pumps and grinders, striped guards on couplings, voltage signs to warn of electrical wires, safety clothing for work with chemicals, washing facilities for acid burns, and gas masks, solvay kits, and other equipment for work with poisonous gases.

Speaking of safety in the storage and distribution of water, Mr. Merrill H. Anderson, safety advisor, City of Duluth, Minn.,

mentioned that Lake Superior was the reservoir for Duluth, and that the pumping station at Lakewood turned over 15.5 million gallons of water per day. He pointed out the attendant problem of obtaining a satisfactory pressure of flow from the distributed water. Another problem arose from the use of cast iron mains, which developed leaks after years of use, probably due to electrolytic deterioration, and necessitated large-scale replacement and even the laying of entire new systems of mains.

Mr. Anderson said that most accidents resulted from misadventures during routine operations, and that unusual or particularly hazardous operations were so carefully attended to that accidents were few and minor.

Mr. Oliver Summers, plant engineer, Indianapolis Water Co., Indianapolis, Ind., discussed the problems of administering a safety program at a water utility. He said that water utilities were somewhat behind in the safety endeavor, but that an encouraging start had been made through the adoption of a safety manual and increased contact with smaller utility plants.

Mr. Summers stressed the need of having top management take an active part in the safety program, by attending safety meetings and by meeting with supervisors. He said that tail-gate sessions were a must in any safety program, and that such sessions should be held with the engineering and meter reading departments, but not necessarily with the office staff. He stressed the role of the supervisor as the main line of safety defense, and the necessity of keeping records.

In a note on automotive safety, Mr. Summers outlined a two-point program for the maintenance of a safety fleet: inspection of vehicles (most important), and the detailed investigation of accidents. He said seat belts were an excellent idea.

In the question-and-answer session that followed, the means of disciplining safety-rule infractions were discussed, and two different solutions were proposed: penalties of suspension or loss of pay, and compulsory attendance at safety training sessions.

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PULP & PAPER SESSIONS

A NEW CHALLENGE FOR SAFETY

By H. M. GRAY

Vice President, Seairight-Oswego Falls Corp., Fulton, N. Y.

A group of individuals whose working life is devoted to the protection of human life and limb performs a service the importance of which it is difficult or impossible to surpass. We of the Seairight-Oswego Falls Corporation are proud of our record in this important activity. Therefore, we want to support it in any reasonable way in which we find it possible to assist. There is another reason, and that is my own personal deep interest in industrial safety, as well as safety in all other activities of human endeavor.

Perhaps I was fortunate. The first day I worked in industry was during my student days in 1919. That day I was a member of a crew of men whose duty it was to unload manually rather large pieces of limestone from a freight car. These stones were so heavy that the only way I could get them out of the car was to first get them on top of the side of the gondola and then just push them off, which apparently was the practice of the entire group. Before getting one rock out of the car, I was successful in injuring one finger. There wasn't any one concerned as to whether or not I injured fingers, hands or any other thing. It was assumed that each workman would protect himself.

Before the first morning's work was over, one of the more reckless of the group was successful in dropping one of the large rocks on his finger, which at that moment was on the edge of the top of the gondola and he amputated the finger at the second joint. The only comment made by the foreman of the group was, "Get back to work fellows, there are lots of fingers in the world." That comment made a lasting impression on me.

From the beginning of the building of the American industrial empire, the importance of safety was not fully recognized. Management paid a day's wages for a day's work. There was usually an abundance of personnel available and if not, it was not difficult

to recruit from the crowded areas of Europe. These things were not the result of a cruel, heartless and indifferent attitude; they were the result of not recognizing the expense of replacing the trained workmen who would become injured or ill, or the good production practice which resulted from insisting upon safe working rules and all that goes with it. That condition was the product of the time.

With the advent of the compensation laws, and state and government controls, and with the development of enlightened management, safety came into its own as an absolute, indispensable part of the modern day industrial activity.

During the Second World War production pressures were very great. Accident rates rose in some plants to alarming levels in a short period of a few years where industrial safety activity was allowed to slip back or was simply ignored.

In fact our own plants became so busy, and management became so occupied with the sheer pressure of producing things, that to our great horror and sadness, we discovered we had a frequency rate in the 30's, and then that was that. It was decided that never again would that be allowed to occur. If you work at something intelligently, you can influence it for good or bad. In the case of safety, the influence desired was for the good and the objective was a frequency of zero.

Zero frequency was not achieved, but a frequency below two was achieved and an average of about two has been maintained for many years.

Any problem which has a solution can be brought to a favorable decision if sufficient quantity and quality of the proper thought is brought to bear upon the situation. Thus it is with safety.

The objective of excellence in this area was zero frequency, which is not often achieved and may not be achieved. Nevertheless, the end result was most gratifying.

along with all of the concomitant favorable results accruing to the workmen, and the personnel in general.

It was inferred earlier in these comments that management was not as sincerely and deeply interested in safety in the past as it is at the present. Just a word of explanation about that.

I do not want to leave the impression, which I believe would be completely erroneous, that management was unconcerned with human suffering. On the contrary, it has been my experience that American industrial management, at least during my working life, has been deeply concerned about these problems; and the lack of an earlier and more aggressive safety program for plants may be laid at the door of the group foremen, or department heads, or mill managers who seem to have a tendency to read into management's policy things which are not there and were never intended to be tolerated.

Enlightened management has always recognized that no amount of remorse, however sincere, has ever restored life or limb, or healed an injury or alleviated pain.

Anything worth doing is worth doing in a safe manner. One of the most depressing things that management can hear is to learn of an accident and then be told "Well, we were in a hurry." Surely sometimes it is necessary to work faster than at other times. But at no time does management expect the worker to go at a rate which jeopardizes life and limb.

With the competition for labor in the boom periods following World War II, the greatest progress has been made in safety practices in American industries. A good, intelligent, American workman will simply refuse to sell his services to a business where the working conditions are so hazardous that he does not know whether or not he will return home to his family at the end of his working day free of injury.

What are the present challenges which industry must face in its safety program for the future?

1. It seems apparent that there will be unending competition for the service of the skilled worker. The result will be that the skilled worker will demand a safe place in which to work and safe working rules and practices.

Pulp and Paper Sessions

2. Labor is going to cost more each year. This probably will eventually lead to serious conditions such as the pricing of a product out of profitable competition with other equally good or satisfactory products. Since labor will constantly increase in cost, the cost of having labor unable to work because of injury will also increase.

3. For some reason or another which I do not understand, it seems to be increasingly unpopular to want American industry to make a profit. Yet, it is only through the American profit system that we have worked ourselves up to the highest standard of living in the history of the world.

Let me give you a bit of advice. Never work for a company which does not make a profit. Do not plan to continue working for a company which does not make a profit. No employee of a company can for long be more successful than the company for which he works. Now it is certainly easy to understand that good safe working practices rigidly followed and enforced go a long way toward assisting a company in making a profit.

Therefore, if not for humane reasons—and they, of course, are the more important—then for selfish reasons, you in your chosen work in this great pulp and paper industry, which has served us so well, and of which we can be so proud, must plan to constantly work toward a lower number of man hours lost because of accidents.

4. You must to justify your existence in a world which is constantly demanding more and more of all of us, develop an attitude of excellence toward this very important work, that there can be an assurance of continuing quality of product with safety.

5. You cannot as safety directors assume the responsibility of management in this important field, but your first duty is constantly to inform management of their responsibilities in seeing that the proper program is set up and enforced. This will require personal attention by the highest members of management, and it deserves the best attention.

You cannot assume the foreman's responsibility for enforcing safe practices in his group, but you can constantly educate him, to a point where he feels that it is a personal affront if workmen under his supervision get hurt.

6. Take an uncompromised stand. A practice is safe or it isn't safe. If it isn't safe, it should not be allowed to continue.

7. Have constantly before you as your objective in your working-day life a frequency rating of zero. It will not often be achieved, but that should not keep you from trying. What you will achieve as you persevere is the great goal of making the pulp and paper industry the safest industry in business.

Is the pulp and paper industry to be satisfied with a frequency rating of 0.93 and a position of 20th place when it is so easy to get the frequency below two (while we are shooting at zero), and then go from there to lower rates, approaching perfection?

Not only develop and maintain an attitude of excellence toward this important work but also indoctrinate management, the foremen, the rank and file of workmen, so that they display a vigorous attitude of righteous indignation when any injury occurs, however trivial.

You have a good industry in which to demonstrate your ability. You have a rather uniform rate of operation and employment, with a low turnover. You are just as well trained and just as capable as the safety directors in other industries.

All of these things being true, can you think of any reason, other than perhaps a

lack of continuing vigor and perseverance, which keeps your industry at such a high level? You can do in life almost anything within reason that you think you can accomplish. In this your full time work you must recognize but three basic things.

1. Safety is everybody's business.

2. The objective in safety is a frequency of zero.

3. Perhaps this is the most important of all. You must recognize that you are responsible for the program which results in the education of all employees to the fact that safety is everybody's business; and that zero frequency is achieved and maintained at many places, but that it is never the result of a haphazard or undirected program. It is never an accident when such a record is achieved. It is the result of hard work and the everlasting drive of the crusader, of the man dedicated to his mission and willing to put forth the energy and courage to achieve the objective, and to refuse to accept defeat. This I know you can do.

I hope that you may dedicate yourself anew to go back to your place of work after learning more, and carry forth your work to success. You have already done much. Indeed, you have done even great things. Therefore, with that experience in back of you, you are capable of greater achievements.

INCREASED ON-THE-JOB FIRE TRAINING (A must in the Pulp and Paper Industry)

By M. M. "SMOKEY" BATZER

On-the-job Industrial Fire Prevention and Damage Control Trainer, Philadelphia, Pa.

In probably few other industries is the dreaded cry—"Fire!"—feared as much as in the pulp and paper industry.

In the woodlands, a carelessly dropped match or cigarette butt may start a blaze that in a scant few days can wipe out tens of thousands of acres of prime timber and with it perhaps a mill's chances of expansion, if not survival.

In the mill itself, a collection of rags or oily waste may be the springboard for a

fire that will burn the plant to the ground, taking with it millions of dollars in invested capital, years of hard work and the jobs of hundreds of workers.

The pulp and paper industry has recognized this grave danger and thus its fire record, so far, has been a good one.

But this is no reason for your industry to rest on its laurels. Vigilance and on the job training are "musts" if those "small" fires which do occur from time to time

are to be kept from becoming major disasters.

I'd like to tell you a true story to emphasize this point. It happened to me in a Canadian pulp and paper mill.

While we were doing some in-plant fire protection training, I went up to an employee standing on the uncomfortable back-side of a large paper machine, rolling along at usual hoped-for breakneck speed.

"Suppose," I said, "you discovered a fire here on the floor, a fire that was big enough so that you couldn't positively stamp it out with your foot. What would you do?" Know what the reply was? "Well, I guess I'd get the hell out of here. I'm not paid for fighting fires."

That was the unfortunate attitude of this employee. Sure he might have saved his own bacon by getting out of there; but by running, instead of turning in the alarm and bringing portable fire fighting equipment into play, he would have given the fire a big head start and helping hand. That fire—undetected for even a few more minutes—could have endangered the lives of many other employees and burned the mill to the ground.

Now you may very well say: "Ah, SMOKEY, that happened in a practice run, but it wouldn't happen if a real fire were involved."

Want to bet? It happens every day, everywhere and in every industry.

Here's a case almost as bad. It's listed in a Fire Commissioner's Report under the heading: Typical Fires, 1957.

"April 25, Seminary and Classical College, Iowa \$1,170,120. While welders were installing a new metal stairway fire broke out in an unsprinklered shallow roof space of the otherwise completely sprinklered 9,500 sq. ft. 3-story brick, wood-jointed building. Welding sparks were the probable cause."

"The welding crew attacked the fire with several fire extinguishers and the alarm was not transmitted until someone outdoors saw smoke pouring from the building. The fire spread through the unsprinklered parts of the roof space and although sprinklers operated in certain parts of the roof space and in the fifth story to protect these areas,

they had no effect in the unsprinklered areas."

"Hose streams also were unable to reach the fire raging beneath the roof."

Eventually the roof collapsed breaking sprinkler piping in the fifth story and later the bell tower fell in and caused most of the building to collapse."

Don't misunderstand me. Let's give those welders full credit for doing their duty as they saw it. But the critical point is they attacked the fire with hand extinguishers and the alarm wasn't transmitted until someone outdoors saw the smoke. It's a matter of history and record now that by the time smoke was sighted, it was too late. If the alarm had been turned immediately, there's a chance the building might have been saved.

Think that's an isolated case?

Same Report, same year, and I quote:

"May 29, restaurant et al.; loss \$514,530. Four buildings, housing stores and apartments. Originating within a nonfire stopped partition in the first floor restaurant, fire was first discovered when heat ignited papers on the floor adjacent to the partition. Employees attacked the fire with buckets of water but the fire persisted and when it started to spread along the wooden and combustible fireboard interior finish, they fled and notified the fire department."

"Flames were coming from the roof of the 215 foot by 70 foot three-story wooden building when firemen arrived. Fire spread to two wooden buildings on one side and one on the other before sufficient fire apparatus could be assembled to make an effective attack."

Get that? Fire spread to two buildings on one side and one on the other before sufficient fire apparatus could be assembled. It may be a hard, blunt way to put it, but it boils down to hiding while home burns.

I cannot stress too strongly that it is within the first thirty seconds of the life of a fire that the most effective headway can be made, against it—even by people of limited know-how.

Even in industries as fire conscious as yours, few people realize the full extent of the terrible toll that fire, exact from the nation every year.

In 1960, fire claimed the lives of 11,350 men, women and children. That's one life every 47 minutes, 31 times a day. In addition to that number killed, countless thousands of others were seriously injured, many of them to spend months in hospital, many of them unable to work again.

In terms of property loss, last year's toll was \$1.5 billion. That's a good deal more than it cost to build the entire St. Lawrence Seaway, the hydro electric power phases of that great project excepted.

Frightening, isn't it? Fire is a vicious, wanton thief and killer that respects no one.

It is one of the most serious problems that confronts the continued prosperity of the North American economy today. It is a problem that is growing more serious annually. It is one that we are all guilty of doing too little about.

What makes the terrific annual loss of life and property due to fire even more tragic is the fact that virtually all of it could have been prevented through proper care and proper training.

That's why I want to show you what a formidable and frightful enemy fire is. Fire losses are difficult to assess with any accuracy, and they are even harder to predict.

Nevertheless, as far as 1961 fire toll is concerned, I'll stick my neck way out and say this: If fatalities conform to the national ten-year average, more than 11,600 people will be killed by fire in the United States this year. If the pattern of property loss experience established in the last decade is true, then fire losses in 1961 will top the one \$1.5 billion mark by a wide margin.

This will happen—and remember it could happen to you—unless all of us, starting right now, get out and do something about it.

Fire loss figures are apt to be misleading. Virtually every source you look at will give you a different dollar figure for losses sustained in any given year. Claims paid out by fire insurance companies are often taken as a useful yardstick, though bear in mind this presents far from the whole picture.

Some companies are self insurers; some

insure only part of the risk. Frequently, the actual amount of the physical loss exceeds by far the amount of insurance carried. The sad fact is that according to figures compiled by the National Fire Protection Association, the dollar value of fire losses has been increasing more rapidly than the number of fires.

As I said a moment ago, figures are apt to be misleading and they seldom tell the whole story. Fire does not respect statistical averages, which are computed from hindsight information. If you have a fire in your mill, don't be lulled into the security of thinking that the loss is going to be confined to your just, proportional share of the industry average.

Now can you forget about the intangible losses that result from major fires—losses that can't be or aren't measured in direct dollars and cents terms; ones that probably can't be covered by insurance are ones which, none the less, are very 'real' and which have a direct bearing on the well being of the enterprise.

There are many of them. Surveys in the U. S. have disclosed these sobering facts about severe business and industrial fires:

43 per cent of the concerns hit by bad fires were unable to resume operations.

17 per cent of those firms able to furnish financial statements before a fire were unable to do so afterwards.

14 per cent suffered a severe reduction (from 30 per cent to 66 per cent) of their credit rating.

26 per cent, unaffected as to credit rating, nevertheless suffered a severe loss in customer relations.

Just think about that for a moment. If you expose yourself to fire risk and loss, priceless records, plans, documents, and the like which took years to produce and assemble and which are the very life blood of your business may go up in smoke in a very few minutes.

I'm thinking, for example of production and test lab reports. You can't insure the true value of these reports, and you can't buy back the information contained in them for any amount of money. Believe me, if money could reproduce these records, your nearest competitor would have bought himself a set years ago.

Then too consider what happens to your business if a disastrous fire puts you out of operation for an extended period. Have you thought about the good will of customers who depend on you for materials? If they can't get their requirements from you, they'll have to turn to alternative sources of supply—in all probability your competitors.

And once a competitor gets a foothold in your market, it may take you years to get him out again. In fact, you may never be able to regain all of your former markets.

In such a highly competitive industry as pulp and paper, I think you will all agree it is poor business indeed to let fire give your competitor the upper hand in your own markets.

There's another important consideration too—your labor force team. Quite apart from moral and social considerations, if you have to shut down for fire repairs, you'll probably have to lay off a considerable portion of your work force.

As you know, we all have to eat. Once laid off, your workers will probably try to find alternative employment. Will you be able to get them back again once you reopen? It's almost a certainty that part of the work force will be lost to you for good. When you re-open, therefore, you'll have to take on new men and will have the added expense and production set-back of having to train them from scratch.

Bear in mind too that fire insurance companies aren't set up as charitable institutions.

And I'll tell you right now that the last time I made this suggestion, a manager came up to me and said: "Smoke, who are you trying to impress? You should see the premiums we have to pay each year."

Well, that's exactly the point. The insurance principle is very simple. Premiums are collected from the many to cover the losses of the few. If industry has a bad loss record this year, everyone's premiums go up to compensate for it next year. Thus fire costs everybody money. It's a vicious circle, and you can't beat it any other way than by cutting down the fire losses.

And there's much more to the insurance angle than just that. If your plant has a bad fire record, believe me, you are going

to feel it in the size of the insurance premium you pay.

As I said a moment ago, insurance companies aren't charitable institutions. They, like you, are in business to make money. They come in, gauge the risk, and set premiums accordingly.

I'd like to turn for a moment to the moral and social implications of the fire problem. You, as members of the pulp and paper industry are the employers—the "job-givers" to a large number of Americans. As a result, the burden, as well as the responsibility, placed on your shoulders is a very heavy one.

In many smaller communities across the nation one pulp and paper mill is the sole industry—virtually the sole source of employment—and for all intents and purposes, the only reason for the community's economic existence.

On the management of such companies rests the responsibility for the well being of the entire community. If the mill burns down, shareholders are not the only ones to suffer. The death warrant for an entire community may have been signed.

The sad fact is that technology and markets do not stand still in today's fast changing world. If a manufacturing operation is burned down, economic conditions may dictate that it remain closed forever. If it is to be rebuilt, it may have to be rebuilt elsewhere. One need only look at the trend towards establishment of pulp and paper plants in the southern states to find proof of the validity of this argument.

There is also the human element to be considered. In North America, business and industry help look after the employee's welfare in many different ways. Employers contribute to unemployment insurance; many pay part of health, sickness, life insurance, and pension plans. They may even offer a stock purchase plan so that employees can participate to some extent in the profits of the business.

Surely the very life of the employee is no less important than the fringe benefits he received!

I think everyone in this room would do everything in his power to avoid having to call on the wife of an employee—the mother of five children—to tell her that

she has become a widow. Yet each year in the United States, there are dozens of businessmen on whom this sorrowful duty falls.

The real tragedy is that in almost every instance death could have been avoided by proper training, proper precautions, taken at the proper time. This will suffice, I think, to show how great and how far-reaching the economic and social implications of fire loss are.

Let me just add this: some authorities suggest that the indirect losses due to fire are more than five times greater than the actual damage to any property. To the best of my knowledge, no one has yet been able to contradict this statement.

The real problem in industrial fire prevention today is not one of equipment; it is one of training and attitude. Contrary to widespread opinion, there has been nothing radically new in methods of extinguishing fires for many years. Our basic tools have, for the most part, been in use for the past fifty years, or so.

The real deciding factors in whether there will be a fire loss or not are these:

Have fire hazards been recognized and effectively eliminated?

Do plant personnel know—instinctively—what to do if fire breaks out, how to do it, and when to do it?

Has the plant availed itself of all possible fire fighting and fire protections services and facilities that are available to it?

Few people realize the speed with which usually small fires get big and uncontrollable. For example, it is often pointed out that an average fire at the end of two minutes is three times as large as at the end of one minute. At the end of four minutes it can be twenty-five times as large as it was at the end of two minutes. And at the end of ten minutes it may be one hundred times as large or larger than it was at the end of four minutes.

These estimates are conservative. Where combustible vapors of petroleum and similar products are involved, the acceleration rate is much more rapid.

It follows, therefore, that more can be done with less know-how and less equipment in the first thirty seconds than the best trained and equipped fire department

can often accomplish when it arrives on the scene ten or more minutes later. That is why management must accept the challenge of getting the man on the job-level to realize he must deal with a small blaze intelligently and immediately, whether or not this is part of his particular job. If management doesn't succeed in this mission—it is missing the boat.

When dealing with fire protection problems, we often hear the term fireproof. Unfortunately, fireproof is one of the most abused adjectives in the English language.

There are virtually few substances on earth that won't burn under certain conditions. If there were, scientists wouldn't have had to spend so much time and effort trying to devise methods to effect re-entry of space rockets into the earth's atmosphere.

Probably one of the materials that comes to mind most easily as one that supposedly won't burn is water. That's because water is widely used to extinguish fires. However, we need only recall that during World War II many incendiary or fire bombs were dropped by both sides. To fight the resulting fire with water was soon found to be suicidal. The reason: An incendiary bomb, being made out of a material called thermite, burns at about 8,400 degrees Fahrenheit. When water is exposed to a temperature of 8,400 degrees Fahrenheit, it decomposes into its component elements, oxygen and hydrogen. The former supports combustion, and the latter actually readily burns, given the right conditions.

Thus I leave the result of fighting thermite fires with water to your imagination. Like water, supposedly fireproof buildings have a nasty habit of burning when they are not supposed to. I'd like to quote again from a Fire Commissioner's Report: dealing with the destruction of a hardware Company Building at a loss of \$700,000.00.

"Destruction of a noncombustible (steel framing, aluminum siding and roof) with noncombustible contents (hardware, plumbing supplies) probably seemed to be a remote possibility to the owners and may have accounted for their decision not to sprinker the building. As it turned out, the combustible attic floor, stored papers in the attic, office furniture and combustible crates and cartons of stock provided adequate fuel to cause total destruction of the building.

"The fire originated when sparks from a welding torch being used on the roof fell on papers stored in the attic. The fire burned an estimated 30 minutes before employees in the first story discovered it. Public fire fighting was ineffective due to poor water supplies, the nearest hydrant being 2,000 feet away."

In the past few years the march of science has created two or three thousand new, combustible products that didn't even exist a decade ago. All are potential fire hazards, particularly if you don't know them, their properties and behaviour.

To sum up, recognition of fire hazards and in-plant fire prevention and fire fighting training are the keys to lower industrial fire losses.

At your respective companies or plants, if you do nothing else, I urge you to do this:

Make a careful, thorough inspection to see if you can spot any fire hazards.

Eliminate any that you find.

Find out whether you have sufficient fire fighting equipment and, above all, whether what you have actually works.

Find out whether your employees on all levels have sufficient training and know-how to deal effectively and immediately with any fires that may occur.

Satisfy yourself that both your employees and your fellows in management are fire prevention "oriented."

If you haven't established a mutual-aid fire fighting agreement with neighbouring industries, work one out. This is particularly important in small communities with only limited municipal fire fighting resources.

Don't look on plant visits by fire inspectors as the coming of the seven-year plague. On the contrary, make a point of inviting your local fire fighting authorities into the

plant before disaster strikes. If they know the layout and their particular problems, they will be much more effective in dealing with any blaze that may occur.

I cannot impress on you too strongly that you can't take too many precautions and that you can't give your employees too much training. Ocean-going vessels, by law, are required to hold a weekly fire and boat drill. Yet ships still burn!

This is in spite of the fact that they are floating in a sea of water and have much more fire giving equipment built right into them than the average industrial plant.

Recently, Ambrose B. Kelly, general counsel of the Associated Factory Mutual Fire Insurance Co., summed up the fire loss problem very neatly. He said, "... experience in loss prevention indicates that the attitude of management is just as important as good construction and physical protection against loss. A reinforced concrete building fully protected by automatic sprinklers by having a management indifferent to loss, an attitude which is reflected in the attitudes of the employees, is not a good risk.

"Fire starts because of carelessness of employees or because of faulty maintenance, and when it comes there is no plant organization trained and ready to extinguish it promptly and with a minimum loss.

"Automatic sprinklers have proved their worth, but a single shut valve can destroy the effectiveness of the entire system.

"For effective loss prevention, we must have both proper physical conditions and a proper management attitude. Given both... losses can be substantially reduced."

And that is expert opinion. It comes from an insurer who judges you as a fire risk in the dollars and cents you must pay.

As an industrial fire fighting and fire prevention trainer, I can only add one word: "amen."

INFLUENCING BEHAVIOR FOR SAFETY

By GLENN F. GRIFFIN

Training and Safety Consultant, Park Ridge, Ill.

I believe we are not paying as much attention to influencing behavior as we ought to. Behavior is the most important factor in safety or in accidents. When I say that behavior is the most important factor I am not thinking of the outmoded concept that 85 per cent of all accidents result from unsafe acts and only 15 per cent from unsafe conditions. If we could take a few hours and examine a thousand or so accident reports I could convince you that unsafe conditions probably occur just about as often as unsafe acts.

When I say that behavior is the most important factor in accidents or in safety, I have in mind that unsafe conditions are the result of somebody's behavior and that any given unsafe condition is really an unsafe act just one step removed. When you look at it that way it is not a case of 85 per cent due to unsafe acts and 15 per cent due to unsafe conditions but rather 100 per cent due to unsafe acts although not necessarily unsafe acts of the injured persons.

But whether you follow me in all this reasoning or not, I think I could get an affirmative vote to the proposition that most accidents result from the way people act. The thing that worries me is that many of my friends in the safety business tell me that accidents result from unsafe acts of people and in the next breath tell me that after all you can't do much about the way people act.

Now when people say that I know they are just discouraged by some instance of unsafe conduct that seems quite inexplicable because, of course, we can do much to influence the way people act.

Human behavior and how to control it is such a broad subject that I have selected just three factors influencing behavior that seem to me to be very close to the actual point of contact in accident occurrence. They are:

- Knowledge and skill
- Attitudes
- Temporary states, physical, mental and emotional

I can't say which of these is the most important factor; in fact, when we investigate an accident it is often difficult to tell which of the three is predominant. One leads to another. A very simple example is that of a man who is assigned to a job that he does not understand. (A lack of knowledge and skill). Because of this he becomes worried and frustrated. (A temporary state). The continual worry and frustration eventually leads to a feeling that he doesn't like this job and that the whole safety program is a lot of bunk. (An attitude).

If you really want to make a complicated case of it you can say that having arrived at such an attitude he then shuts his ears to further instruction and as a result gets in bad with the boss and as a result of this his attitude gets worse and worse. That can go on endlessly and sometimes it does.

But we have to start somewhere and it seems to me the logical place to start is with the matter of knowledge and skill. Certainly we can't expect that a man will work safely unless he has the required knowledge and skill and certainly we can say that the boss is responsible for seeing that he does have that knowledge and skill. I will have to illustrate the importance of this factor by a negative example.

A man was told to empty a tank of solvent. Having given the order the foreman walked away and the next he heard the man had suffered an injury trying to tip the tank over to empty it. The fact of the man's ignorance then came out when it was disclosed that there was a drain cock on the bottom of the tank.

The obvious remedy for lack of knowledge and skill is instruction, instruction about safety, yes, but mostly just plain simple thorough job instruction. People need to learn how to do the job as it is done in the place where they are working and this includes knowing the names of things, knowing the principles behind the actions, knowing the why as well as the how. It also includes not only knowing but

includes practice under observation until a supervisor knows that the man is going to do it right.

If this kind of an instruction program is going to work it means that the people responsible for instruction know that the amount and kind of instruction varies with different people, that with some people it has to be repeated more often than with others but that with all people it is a never-ending process.

Job instruction has to be done on the job by the responsible man on the job who is the foreman, and here we safety men get our first and biggest alibi, which I am afraid we have used until it has worn pretty thin. That alibi—"the foreman is responsible."

Does this mean that we can leave instruction up to the foreman and that we can blame him for accidents that result from ignorance? Certainly not.

If our job as safety men amounts to anything at all, it is up to us to see that the foreman acquires the necessary knowledge and skill to transmit the necessary knowledge and skill to the people under his supervision.

And so I am giving away what is, perhaps, the most important point of my talk which is that while all the things we are talking about are part of the foreman's job, they are our job, too, and perhaps first.

A foreman has so many things to do! He is being crowded for production, for cost control, for quality control, for work simplification and methods improvement, and the management people who are pushing many of these other activities are not always alert to the important job of influencing the behavior of employees. And yet if we allow the job of influencing behavior to be neglected, the whole operation deteriorates. Controlling the behavior of people is still the most important function of the foreman; in fact, the very reason for his existence.

So it is up to us to see that foremen get training in job instruction. I won't insult your intelligence by telling you how it is done because I think you already know. Call it JIT or call it the Allen Method or call it by any new-fangled name that has been invented, foremen need it and most of them

will not acquire it by absorption. We have to teach that over and above the knowledge and skill needed to do a job, it requires a very special skill to teach the job and we have got to teach people the old JIT maxim that if the student hasn't learned the teacher hasn't taught.

This job of learning and improving instructional methods has to be continuous. If the instruction dies out good practices become neglected, as many of us can attest from observation.

But how to keep teaching the same thing over and over? That is what so many training men and safety men ask me. Don't people get tired of the same thing and just stop listening?

No, people don't get tired of it if we use our imagination and skill in presenting it. Here are just two ideas for keeping instruction alive and keeping it new and interesting:

1. Start a program of getting foremen to work on safe work methods and job breakdowns for the jobs in their departments. Possibly tie this up with accident investigations. Hold some meetings, discuss with them the best methods and have them tell their experiences in teaching.
2. Let foremen learn by teaching others how to instruct. Practical training men know that job instruction is more often done by other people than by the foremen. And yet when job instruction is taught it is usually taught only to the foremen. If this job instruction by other workmen is to be done right, the people who do it have to be taught and the foreman is the one who should do it. This is the best possible instruction for the foreman who, even as you and I, learns best when he tries to teach others.

That's about enough to say about job instruction and I haven't said anything new but if I have started you thinking again about something that you long ago thought was good but that finally fell into disuse it will serve a useful purpose.

Now let's look at attitudes, the way people feel about things. I think when management people talk about attitudes for safety they really think about attitudes for

accidents. A few years ago President Dearborn of the National Safety Council made a speech called, "Seven Deadly Beliefs." In this speech he pointed out that all of us run into danger because we believe such things as these—that accidents are an act of God, that taking chances is necessary in order to get the job done, that safety is for weaklings, that too much safety takes all the fun out of life, that people will think we are afraid if we practice too much safety.

Now that kind of preaching is all right and we need some of it but if we are going to influence people for safety we have to concentrate also on some safe attitudes rather than on unsafe attitudes. I have asked many in groups of safety men to tell me some safe attitudes and I find that it is pretty hard to think them up quickly. This indicates to me that we do concentrate more on the unsafe attitudes than we do on the safe ones. Let me give you a few safe attitudes that I think all of us need to know and teach.

An accident can happen to me at any time when I take a chance.

Accidents can always be prevented.

It is a mark of good sense and skill to work safely.

We can always take time to work safely.

The men I work with will think well of me if I practice safety.

Many other safety attitudes could be added to this list and I would like to suggest to you that if you hold safety meetings you make this the subject of a meeting. Let each man tell you what he thinks is the most important safe attitude and then discuss them.

In order to build safe attitudes among employees, it is necessary for management people to know what they themselves believe about safety. We should have these safe attitudes straight in our own mind if we are going to impart them to somebody else. We have to make a conscious effort to get people to accept these very attitudes.

Now how do we get people to accept attitudes? Consider for a moment how attitudes develop.

Attitudes grow in an environment that is favorable to them. They grow as a result of example. They grow if the safety in-

struction is consistent. They grow if the instruction is backed up by firm supervision. They grow if people have a chance to talk about how accidents can be prevented. They grow if the men themselves have a part in the whole safety effort and if their part is recognized.

Creating the environment, setting the example, giving the instruction and discussing safety with the men is a job for the foreman to do but again who teaches the foreman? We are the specialists. If we don't do it it won't get done.

That is a pretty brief discussion of the development of safety attitudes but possibly just mentioning some of these things will cause you to think about them and if you think about them I'm sure you will know the answers.

Finally let me come to that very troublesome factor in accident occurrence, temporary states, physical, mental and emotional.

This is the toughest of all. In accidents I have observed, in unsafe and harmful conduct that pops up every day, in my own personal life, the bad temper, the forgetfulness, the abstraction due to worry about real and imaginary troubles, the anger at unfair treatment, the lassitude due to fatigue and boredom and ill health, these are the states that I know the least about curing, but we can't pass them up just because they are difficult to handle. We have to do something about them.

I used to tell foremen that the remedy for these temporary states is to be alert and to know when men are troubled and to give them help and advice. I was always pretty satisfied with this solution until I ran into a bunch of foremen who were not properly docile and respectful. In effect what they said to me was, "O yeah? How do we know when a man's got trouble? Maybe he doesn't want us to know. If we do know, what can we do about it? Can we say, 'Don't worry now. It isn't as bad as you think.' How can we say that? Maybe it's worse. And anyway, the man has to work. Pulling him off the job would only add to his troubles."

So I asked these foremen what they thought we should do about these men with troubles. And we talked about it for three or four sessions. Here are the best thoughts that we could come up with.

First, counselling and helping are OK if you get a chance and if it seems called for.

Beyond that, remember that many of the troubles and frustrations are job created. Let's try to keep from causing troubles. Let's always be available when men have gripes or a worry, not to soothe them, but to try to do something about the thing that is bothering them, before it gets to the point of a neurosis.

You know we talk a lot about men who bring troubles to work. Let's think about the fellows who take work troubles home with them. Psychiatrists tell us that much domestic trouble and illness and many off-the-job injuries result from worry about job troubles. We tell the foreman to say good morning when men come to work. Do we think enough about being around to say good night when they leave so that when they go home they won't have that gnawing feeling that maybe the boss is mad at them, or that he has forgotten some complaint or request made during the day.

So much for preventing the troubles, but there is more. We know that everybody has troubles of many sorts and we can't cure them all. But we can teach people well enough and supervise them well enough and develop good enough work habits so that even when a man is disturbed he won't get hurt. That is not too difficult and we can apply it to ourselves as well as to the men who work in the shops.

And we can create safe working conditions so that safeguards will protect the fellow who forgets. Actually, many of the most familiar safety devices and guards are not needed at all when we are fully alert but are there to protect us when we forget.

Again, I say that a very large number of the serious accidents result from temporary states, physical, mental and emotional, and that you and I and our friends and our families are subject to these states just the same as the man on the job. Together, we and all the other management people should give consideration as to how we can prevent these states from resulting in job injuries.

These are just a few of the things that we can do about the three factors we have been discussing:

1. Knowledge and skill.
2. Attitudes.
3. Temporary states.

I am aware that some of you are saying, "Well OK, but that's pretty elementary stuff. He hasn't told us anything new." But listen to this. I have been talking to people about their safety programs and I find that many of them are giving almost no time to activities consciously and specifically aimed at improving behavior. Why?

Here is what they tell me: "Oh, we had some job instruction training once quite a long time ago." I can't refrain, in that connection, from reminding you of the old gentleman in the club who was talking with a member whom he had just met. The member offered him a drink and the old gentleman replied, "No, I tried it once, didn't like it." "Then, how about a smoke?" "No, tried that once, didn't like it." "Like to play cards?" "No, tried it when I was young, didn't like it."

About this time a young man walked in and the old gentleman introduced him as his son. Whereupon the member who had been attempting to cultivate his acquaintance said, "Your only child, I am sure."

Let me assure you that training and job instruction tried once, a long time ago, is not enough. If it is not done continuously it dies, and you and I have seen it die. Another thing that safety men tell me is that they tried a program of having their foremen talk regularly to their men about safety. But the foremen got tired of it, couldn't think of anything new to say and so it just petered out. That is an excellent program.

Some companies with good safety records say that it is the most important part of their whole safety program, having a foreman talk to two or three men every day about safety. But it won't work unless it is kept alive and promoted by some management person, and that ought to be the safety man or the training man. The companies where it works best have occasional meetings with their foremen in which the foremen all exchange experiences and tell about the things that they have been talking about with their men. But it will die just like job instruction training will die if you don't keep pushing it.

The bottom recorder in the operator's station presents the profile of the basis weight as the gauge scans across the sheet. On the return scan the target weight is shown as a straight line. The scale on the recorder shows the position of the slice screws. This enables the machine tender to reference the weight variation to the appropriate slice screws and make the necessary adjustments. Because six to ten profiles per reel are obtained, more uniform profiles result.

The top recorder, on the Operator's Station, presents the averaged basis weight of each scan across the sheet. This is presented as a straight line on the scale that reads in absolute basis weight. The actual weight seen by the gauge is then compared to the target weight. If this weight varies from target more than is desired, a signal is fed to the automatic control, contained in a second electronic console. The control opens or closes the stock valve or stuff gate to make the appropriate correction to basis weight.

Presently, there are more than 150 Accu-Ray Basis Weight Systems on Fourdrinier and cylinder paper making machines. More recently, systems have also been installed on off-machine coaters. More than 177 systems are installed on coaters and gummers. Also, more than 140 systems have been installed on extruders and extruder laminators. Different types of source detector units are designed to do specific measurement jobs.

U-Frames are used in a number of applications, available for sheet widths up to 160 in. Source detector units are designed for the metals industry. One used on high speed steel tandem mills weighs in excess of 2500 pounds, to give you an idea of the ruggedness of design. There also are "O" type brackets.

Another application of the absorption principle of radiation is used in the measurement of fluid, slurry, and in some cases, solids streams. The signal can be fed to a recorder or recorder controller for manual or automatic control of the process.

These composition analyzer systems are being applied today in pulp and paper mills for black liquor, lime and slurry, white liquor, calcium hydroxide slurry, clay slurry and clay-starch slurry measurements. They are also being used to control evaporation, absorption, extraction, drying, mixing, classi-

fication, filtration, size reduction, material handling, and filling operations in industry.

II. Blocking of Radiation

In this case we find level measuring devices in which the mass of liquid or solid material blocks the radiation between the source and detector. This principle can be used for detecting levels in vessels with solid walls, such as steel and concrete, without having any contact with the material within the vessel. By extending the detector, this principle can be used to measure continuously the level of material in a tank or bin.

These level measuring devices are of interest in pulp mills for level measurement in a number of areas. Digester level specifically has received considerable interest. Since this type of measurement system was introduced some three years ago, over 400 devices have been installed.

There are some other interesting applications of this device. Since it can "see" through solid walls, it can be looked at as a sort of gamma radiation photo cell. It can be made to disregard foam, froth, dust, and other gaseous materials. It will average out turbulence and occasional interrupting matter such as agitators and paddles and will be unaffected by them.

There is an installation on a clinker cooler in a cement plant. The source looks through the walls of the cooler and measures the height of the bed of hot cement clinker. This level is controlled to permit the most efficient operation of the cooler.

Another installation uses two level switches on a standpipe feeding powdered coal to a boiler in a power station. The radiation passes through the stream of powdered coal. If the coal bridges the pipe, the radiation is cut off and the switches initiate a shakedown to remove the coal build-up.

The blocking principle can be used to detect the height of fill in cans on a conveying line and the signal is used to control the filling machine. Underfilled or overfilled cans can also be automatically rejected from a conveyor line using a similar system.

Of course, the one outstanding advantage of these systems is that level, density, weight, or thickness can be accurately measured without contacting or without affecting the measured material.

What is involved in the use of radioisotopes? We have discussed why and where radioisotopes should and can be used. Let us turn for a moment to see what radiation really is.

Over simplifying, there are two types of radiation. The first of these is Corpuscular radiation. This type of radiation exhibits the properties of particles such as size, weight and velocity. The flow or movement of electrons is an example of corpuscular radiation.

The second type of radiation is exhibited in wave form. Heat, light, and radio waves are examples. Wave radiation covers the spectrum from alternating current, radio and ultra high frequencies, infra-red, white and ultra-violet light, x-ray and gamma ray, and finally, through the cosmic ray region which possesses the highest frequency and energy level and shortest wave length of all energies in the spectrum.

There are approximately 50 radioactive elements found in nature. Radioactive means that the element is unstable and the atoms are disintegrating or emitting a charged particle from the nucleus. Eventually all radioactive elements reach a stable form. When a half life is mentioned for a radioisotope this means the time required for one half of its energy to be emitted. The half life will vary for every radioisotope from seconds to thousands of years.

Radiation can be found all about us in nature. For example, there is enough Potassium 40 found in the average human body to emit 150,000 beta particles per minute with energies up to 1.5 MEV. Carbon 14 is continuously being formed in the atmosphere by the action of cosmic rays on nitrogen in the air.

Radioactive isotopes are generally referred to today as being artificially created since they are produced from a chemical element not normally radioactive. Bombardment in a reactor rearranges the neutrons and protons in the nucleus of atoms of these elements.

There are various types of radiation being used in industry. These are:

(1) *Alpha radiation:* This is radiation of a helium atom nucleus (helium atom without two electrons). Alpha particles have a large mass and a slow speed. A few inches of air will stop alpha particles.

(2) *Beta radiation:* This radiation consists of high speed particles, electrons, with little mass. Approximately .030" of steel is required to stop these particles.

(3) *Gamma radiation:* This is high energy wave type radiation, and 0.65 inch of steel or 4 inches of water is required to cut this radiation in half. A fourth type is X-radiation, and Bremsstrahlung, both of which exhibit the same properties as gamma radiation. (a) X-radiation is generated by high voltage acceleration of electrons, generated by heating an electron emitter. These electrons are directed to strike a target, generally tungsten, and the X-ray is generated. (b) A similar technique using a beta radiation emitter (electron) and striking a target will produce higher energy radiation called Bremsstrahlung. Except for energy levels and method of generation, these two types are identical.

Let us define terms used in radiation.

Curie: This refers to the quantity or amount of radioactive material present. A curie is defined as the quantity of radioactive material in which 3.7×10^{10} atoms disintegrate in each second of time. This term is analogous to power in electricity.

MEV: Million electron volts. Refers to the energy level of the isotope. This is analogous to voltage in electricity.

Röntgen: A röntgen is an energy measurement difficult to express, however, this can be done practically by defining energy in terms of the specific effect produced in a specific apparatus. The most convenient method is to collect and measure the number of ions, caused by radiation, produced in a given quantity of air. The röntgen is a unit of dose of total energy exchanged. The intensity of a radiation beam is expressed in terms of dose per unit time and the common terms is roentgens per hour, or more commonly, milliroentgens per hour, abbreviated mr/hr. The reading of an ionization survey meter can be in mr/hr and can be used to determine the radiation intensity level around an isotope system.

Dose: Is the quantity of radiation absorbed, per unit of mass, by the body or any portion of the body. Total dose will specify an amount over some period of time. Several units of a dose are in current use, however, the most common is the rem. A. E. C. Regulation 10CFR20 gives infor-

mation to compare this measurement to other units if necessary. A rem is defined as a measure of dose of any ionizing radiation to body tissue in terms of its estimated biological effect relative to a dose of one roentgen of X-rays.

Let's now consider the actual construction of the source itself and its housing in a source-detector unit used in an industrial measurement system. The size of this hermetically sealed unit is about as big around as a nickel and about $\frac{1}{8}$ to $\frac{1}{4}$ inches high. The source is then placed in the source holder assembly with a shutter assembly. The shutter is power activated and spring closed so that in the event of a power failure the shutter will automatically close. It is mounted on a "U" frame, and the access panel contains a lock to prevent unauthorized entry.

An alarm window protecting the source is a printed circuit. Should any one attempt to get into the source from this side the circuit is broken. Once the circuit is broken an alarm horn sounds and the shutter automatically closes. The horn will continue to sound until the window is replaced or power is removed from the gauge.

In the density gauge, the source capsule is sealed in mechanite. The mechanite is welded onto the process pipe, allowing a small air space. This type of gauge has no shutter since it becomes an integral part of the pipe.

In a small radium source unit used for level once again we find the source sealed into the unit. Because of low radiation levels no shutter is required on such a unit.

In a larger source unit used in level devices a center "cannon ball" rotates, focusing the radiation into the solid mechanite, reducing radiation to low levels. The unit can be locked in this position, thereby permitting handling or entry into the area of the measuring beam.

The largest of the source units will take up to 1 curie of Cobalt 60. The weight of this source assembly is approximately 850 pounds.

What must be done to get isotopes into the plant? Uses of radioactive isotopes fall under the jurisdiction of the Atomic Energy Commission. This agency has very actively promoted the use of isotopes and has been extremely helpful to potential users. In or-

der that the safe use of isotopes is assured, certain restrictions and precautions govern the use of isotopes.

Regulations pertaining to radiation devices are contained in A.E.C. Regulations 10CFR20 "Standards for Protection Against Radiation" and 10CFR30 "Licensing of By-product Material." This type of equipment can be obtained under either specific or general license.

Specific licenses are granted by the A.E.C. to cover specific situations such as the distribution of isotope gauges and to cover their use in specific situations or applications.

The Commission has also attempted to encourage the broad use of isotope radiation equipment by setting manufacturer's standards compatible to safety requirements of other manufacturers of industrial equipment. If certain conditions are met by the manufacturer of isotope equipment and other requirements are met by the user, the user can acquire radiokotope systems under a general license covered by 10CFR30, Par 30.21c. This exempts the user from the conditions of 10CFR20 except for those sections dealing with reporting of accidents.

I suspect that some of the above has been confusing. If it has, further studies of the A.E.C. regulations is recommended if you have or contemplate isotopes in your plant. I also suspect that once you are familiar with the subject it will be no more confusing than your electrical or building codes. Whether you are licensed generally or specifically, there are some reporting requirements involved:

1. Theft must be reported as explained in 10CFR20

2. Telephone and telegraph reporting to the A.E.C. on any of the following:

- Exposure of any individual to 25 rems or more of radiation
 - Release of radioactive material, averaged over a 24-hour period, that could exceed 5000 times the stated limits.
 - Loss of one work week due to the operation of facilities
 - Damage to property over \$100,000.
3. 24-hour notification by telephone or telegraph.
- Individual exposure of 3 rems

b. Release of material, averaged over 24 hours, that could exceed 500 times the stated limits.

c. One day loss of facilities

d. Property damage over \$1000.00.

4. 30-Day report

This report is generally necessary with accidents less serious than the above, where individuals have received some excess of permissible radiation levels. This report would contain notes to the above and precautions for the future.

Before leaving the subject, I must mention that most states also have regulations concerning isotopes. It would be well to be knowledgeable in this area also. Another good practice is to inform your plant fire group of the locations of isotopes, or at use town facilities, the town fire marshal should also be informed. The use of radiokotopes does present potential hazards from exposure to radiation fields and contamination by radioactive material. The Atomic Energy Commission governs both areas very closely. Additional safeguards are imposed by the manufacturer of the device, local authorities, and plant safety groups.

Exposure to radiation fields is minimized by the manufacturer of these devices through the construction and location of the source unit. For example, Industrial Nucleonics restricts the maximum radiation field to 5 mR/hr at 12 inches from any surface which is normally accessible to personnel. In most AcumRay equipment, external radiation is far below this figure. Contamination by radioactive material presents the greatest potential hazard with the possible exception of exposure to gaseous sources. Great care is taken to prevent any possible contamination.

If plant safety groups are not directly concerned with plant insurance, you are probably expected to know to what extent and degree the use of isotope equipment could affect your insurance coverage. In general, two distinct types of insurance are involved with the ground rules different for each. These are general liability and fire insurance.

General liability provides third party coverage to property and persons. Industrial Nucleonics Corporation General Liability would cover the claims of our customers. General liability policies have nuclear exclu-

sion clauses but these clauses do not apply to our types of equipment.

The second form, fire insurance, covers loss of property and profits or the loss of the use and occupancy. The nuclear exclusion clause does apply in the case of fire insurance.

Having radiation devices does not void fire insurance, but if you want to be covered for loss caused by radioactive material you would have to pay a surcharge. This surcharge depends on the type of structure covered and other considerations. It would be determined in the same manner as standard fire insurance is determined. For example, the rate would be higher if the type was located in a frame building rather than in a brick or concrete structure.

These devices have been through fires, floods, and explosions and no additional loss has been incurred due to the presence of radioactive material. Because of our rugged construction, as you have seen, we have been able to maintain this record with more than 3,000 installations scattered throughout industry.

Examination of a density gauge after it had been through an explosion and fire in a rocket fuel plant revealed no contamination, even though the source detector unit was badly damaged.

Unfortunately, insurance companies do not yet recognize improved encapsulation techniques, or other safety techniques. In some instances, where a gaseous source is used, common in the paper industry, no contamination hazard is present.

Some of our customers pay the additional surcharge for the added protection in their fire insurance policies. Others do not feel the risk of loss caused by radioactive material contamination is worth the extra charge. In no case has a customer decided not to install the device for insurance reasons, as very little risk is involved.

Before, during and after installation it is extremely important that all personnel coming in contact with the unit be thoroughly instructed in the matter of radiation safety. The manufacturer of the equipment should be properly equipped to give assistance in this area.

What must be done on a continuing basis once isotopes are in the plant? With the radioactive material in the physical and

chemical state described above, the likelihood of failure of the encapsulation is extremely low. If a failure were to occur it is thought that it would be extremely gradual. The initial indication of such failure would be the presence of radioactive material on the external surface of the source carrier. The presence of such radioactive material would be detectable by wiping its surface with a test swab and inspecting the swab for the presence of radioactive material with high-sensitivity radiation detection equipment. The sensitivity of these tests permits detection of the presence of radioactive material in quantities hundreds of times below the amount considered hazardous. Such tests are routinely carried out at six month intervals, either by the gauge supplier or by the user when he has suitable facilities and personnel.

In closing let me compare the safety aspects of a radiation level device with that of conventional methods of tank level control. Suppose the radioactive level device was used to measure level in a 10 foot diameter tank 10 feet high. The device would be used to turn on and off a pump in order to maintain the desired level.

The presently used technique might be a float system. This system would inherently

have more failures than a radiation level device. Therefore, someone would be required to climb into the tank periodically to check and repair the float system. Certainly climbing a ladder is not a great hazard but it is more of a hazard than standing on the ground.

Assume that operating procedures called for cleaning and painting the inside of the tank every three months. Warning signs mounted at the access to the tank would instruct personnel to close the source shutter before entry. With the shutter closed there is no possibility of entering a higher than tolerable radiation field.

There is, of course, always the possibility that a negligent person will ignore the warning. The danger of this is no greater than that of ignoring a warning sign on a 440 volt electrical line. The results of the negligence is a different matter. In the case of radiation received for a limited time, it is unlikely that any damage to the individual would occur. In the case of ignoring a power line warning it is likely the person would be injured, perhaps fatally.

Look upon radiation devices as an extremely useful form of energy offering many industrial benefits. Properly used, they are worth their weight in gold.

SAFETY IS BUILT INTO THE KAMYR CONTINUOUS DIGESTER

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There are in operation today a number of distinctly different types of continuous cooking systems, each one custom-designed to handle a particular raw material, utilizing a specific process, producing a particular grade of pulp. This paper deals with the subject of how safety is built into a continuous digester.

On the North American continent the greatest interest today is in kraft cooking, and so we shall in this paper deal with the continuous kraft digester. In order to discuss the safety aspects of the unit, it becomes necessary for us to go into a gen-

eral technical explanation of the principles involved in a continuous digester of this type.

First, let us examine the basic difference between the familiar batch process and the continuous kraft process. In a batch operation a vertical stationary digester shell is filled with chips, along with the required amount of cooking liquor, and spent make-up liquor. The vessel is capped, and steam is applied to the system in order to raise the material to cooking temperature, and is held at temperature for the time required to complete the reaction. Non-condensable gases are

released from the digesting vessel during the rise to temperature, and the pressure in the vessel is approximately equal to the corresponding vapor pressure of steam at the cooking temperature.

In this type of system there is a tendency for overcooking the outside of the chips, and undercooking the center of the chip, due to the fact that impregnation of the wood chip with chemical takes place during the rise to temperature. There is also lack of uniformity between the top and bottom of this vessel due to the fact that the chips at the bottom are getting a partial pressure impregnation, due to the static head of liquid, while the chips at the top of the vessel are barely being washed by the liquor.

This lack of uniformity in the batch digester was the initial basic reason for designing the equipment to conduct the process continuously.

Basically, the typical kraft continuous digesting system consists of the following steps:

1. Metering of the raw chips together with a light presteaming to prepare them for impregnation.
2. Impregnation with cooking liquor at 220°F to 240°F for approximately $\frac{1}{2}$ of an hour.
3. Uniform rise to temperature.
4. Adequate time at temperature with no mechanical action on the chip. This is accomplished by two independent liquor circulation systems, one at 15 psi pressure using the chip chute pump, item 7, which pumps liquor into the chip chute and flushes chips and liquor into the through-type pocket of the feeder when the pocket is in the vertical position. The chips are retained in the pocket by a coarse grid on the casing while the liquor passes through to the suction of the pump and is recirculated.
5. Cooling and washing of the cooked chips prior to discharge.

Referring to the flow sheet, the foregoing steps are achieved as follows:

Item 1 is the surge hopper, which stores chips at the head of the system; the size of this bin varies from mill to mill, depending on what other storage facilities are available, but in general no less than 20 minutes storage is recommended.

Item 2 is the chip meter, which controls the rate of feed to the system. The meter has a five-pocket rotor, and each pocket delivers its entire contents to item 3, a low pressure feeder. This feeder is a steam valve which holds against the 15 psi chip pre-treatment or steaming vessel pressure.

To avoid damaging the chips, the low pressure feeder—which like the chip meter

has a pocketed rotor—rotates at a faster speed and has larger pockets than the chip meter. The rotor, which is tapered, is equipped with an advancing mechanism to provide clearance adjustment in the casing which is necessary due to wear caused by sand and grit entering the system with the wood chips.

The steaming vessel, item 4, not only acts as the chip pretreatment vessel but also serves as the heat recovery system, since the low pressure steam used for pre-steaming comes from the flash tank located at the discharge end of the digester vessel. Release vapors from the steaming vessel can be piped to a condenser for the production of hot water for pulp mill use. The vessel itself is about 5 feet 6 inches in diameter and 24 feet long, and is equipped with a screw conveyor for moving the chips toward the discharge end. The chip level would be less than one foot high, thus providing the maximum steam volume and opportunity for all chips to become equally pretreated.

From the steaming vessel, the chips fall by gravity into the chip chute, item 5, and then are transferred to the 165 psi operating pressure of the digester shell by the high pressure feeder, item 6, which is the heart of the system. This feeder, traveling in the order of four to six rpm, does the difficult job of transferring chips at 15 psi to 165 psi without performing any mechanical action on the chip. This is accomplished by two independent liquor circulation systems, one at 15 psi pressure using the chip chute pump, item 7, which pumps liquor into the chip chute and flushes chips and liquor into the through-type pocket of the feeder when the pocket is in the vertical position. The chips are retained in the pocket by a coarse grid on the casing while the liquor passes through to the suction of the pump and is recirculated.

When the feeder pocket rotates 90 degrees to the horizontal position, the second circulation system using the top circulation pump, item 8, flushes the chips out and on up to the top of the digester shell. This circulation pump derives its suction from the top of the digester vessel, where the liquor is separated from the chips by means of the top separator, item 9, which consists of a cylindrical slotted screen equipped

with a cleaning screw to ensure chips moving down into the digester.

The high pressure feeder has been made a continuous operation by having four through-type pockets at 45 degrees to each other, thus insuring that at all times there will be the equivalent of one full pocket in the filling position. The feeder, also having equal pressures on both sides of the pocket in both the filling and discharge positions is completely balanced and requires a minimum of horsepower to operate.

The rotor of this feeder is tapered to allow for wear, and because of the high pressure in the discharge position, a slight flow of liquor takes place from the high pressure side to the low pressure side, thus providing a seal of lubricant liquor in which the rotor rotates. As the pocket will be filled with liquor in the discharge position, this liquor in turn provides the flushing medium when turned to the vertical position and an excess is built up and carried away to the liquor supply pump, item 10, to be returned to the digester shell, item 12, along with the make-up cooking liquor and the necessary bulking spent liquor. This liquor is pumped to the digester at a hydraulic pressure of 165 psi.

In order to have distinct temperature zones in the digester shell, the liquor is maintained as indicated above at a hydraulic pressure of 165 psi, which is higher than the vapor pressure at the highest temperature in the shell. All boiling has been eliminated, and due to the faster rate of chip flow downward, the rate of heat conduction upward has no effect in maintaining a relatively cool zone at the top of the vessel. In the upper portion of the shell, therefore, impregnation takes place with the active alkali at a temperature of 240°F, and not until the chips are approximately one-third through the vessel are they subjected to the higher temperatures.

The rise in cooking temperature is accomplished by two separate liquor circulation pumps, items 13 and 14, each deriving liquor suction from headers, nozzles and slotted strainer plates located inside the digester shell. You will notice that the inside diameter of the strainer plates is the same as the inside diameter of the digester shell in the penetration zone, the shell increasing in diameter to provide the space required

for the screens without having to reduce the diameter of the chip plug moving down the shell. Heating can be provided by indirect tubular heat exchangers, or direct steam, the heated liquor being returned to the digester by means of two central pipes, one inside the other, each ending at the top of its respective strainer zone.

The upper heating zone will increase the temperature from 240°F to, say, 300°F, the second zone from, say, 290°F to 330°F, the blank space between each zone being a dwell zone or equalization area where the temperatures of each individual chip evens out throughout its mass. No further heating takes place, and the chips are retained at cooking temperature according to a cooking graph until they reach the discharge zone some 90 minutes later. To avoid fibre degradation while still at cooking temperature, it has been found most essential to cool the chip mass in the digester shell prior to discharge, before subjection to the action of the bottom outlet device, item 18, a slowly rotating paddle required to break up the compressed chip mass prior to actual discharge from the shell.

Cooling is performed in a manner similar to the heating mentioned above, by introducing spent black liquor at approximately 180°F from the brown stock washing system through a high pressure pump, item 19, and through a small central pipe inside the two heating zone central pipes, and discharging into the chip mass at the top of two further slotted strainer plate sections. Again, the digester shell diameter is increased to maintain a uniform chip plug diameter. With the addition of the cool liquor, the hot high solids liquor is displaced and extracted through a set of screen plates, nozzles, and a header to a flash tank, item 20, where the hot liquor is flashed at 15 psi and the resultant flash steam going to the pre-steaming vessel, item 4.

Although the one-to-one displacement gives the maximum heat recovery from the system, it does not sufficiently lower the temperature of the chips to a point where degradation cannot occur, so further cooling is added and extracted as above to a second flash tank, item 21, where the liquor flashes at 0 psi. Also, the liquor from the first stage flash tank flows to the second stage flash tank and flashes at 0 psi. This

steam can be piped with the relief from the steaming vessel to a condenser for the production of pulp mill hot water. This system, now referred to as the diffusion-extraction system enables the stock to leave the digester shell at approximately 200°F or less.

This system although installed primarily for uniform cooking with maximum heat recovery, also results in improved brown stock washing. It is obvious that the high solids liquor is being removed from the system before the pulp goes to the washers and can be sent directly to the multi-effect evaporators, thereby reducing the load on the washing system. In effect, we have now introduced a partial washing stage in the digester shell.

Relief of the digester pressure is taken care of in the blow unit, item 22, which is a pressure vessel equipped with a variable orifice blow valve and a rotating wiper paddle to keep the outlets free of knots or foreign materials. The pressure drop is accomplished in the blow line through two valves; and as most of the heat has already been removed from the chips by the diffusion-extraction system, discharge can be made into an atmospheric blow tank.

Having covered the general principles of the system, let us now examine the potential danger points in the system and the steps we have taken to ensure safety of operation.

First, with reference to the pre-steaming vessel—it has been designed for an operating pressure of approximately 15 psi with a maximum pressure of 30 psi. The vessel is equipped with a relief valve discharging to atmosphere in order to prevent overpressure. Since the vessel is filled with chips and steam, it has been necessary to place a screen in the relief line at the point where it is connected to the steaming vessel shell. A small 40-pound steam line is connected to the relief line behind the screen. Periodically the operator will clean the screen by blowing back into the steaming vessel with 40-pound steam.

The lower portion of the steaming vessel is clad with stainless steel for 180 degrees of the surface. This cladding is necessary to combat the erosive action of the chips and the corrosive action of the condensate cooking from the chips. The steaming ves-

sel should be checked at least once a year internally for signs of corrosion.

The high pressure feeder also acts as a sealing valve between the digester which is at 165 psi pressure and the steaming vessel which is at 15 psi pressure. You will note from Fig. 2 that the high pressure feeder is so designed that at no time is the high pressure side of the system connected to the low pressure side. Thus if there is a power failure, there is no danger of a blow-back of high pressure liquors from the digester to the steaming vessel.

The digester shell is designed with extreme care, from the point of view of safety. The smaller shells up to, say, 150 tons per day capacity are shop-fabricated to ASME code specifications and are completely stress-relieved and tested to 280 psi, as compared to the operating pressure of 165 psi. Generally, digesters with a capacity of more than 150 tons per day must have field-erected shells. In this case, rolled cans are shipped to the site and the complete shell is erected and welded in place. After welding, all welds are X-rayed. After approval of the welding, the exterior of the shell is insulated and the entire shell is raised to a temperature of 1100°F for stress relieving. After stress relieving, the shell is hydrostatically tested to a pressure of 280 psi at the top.

Since this particular type of continuous digester operates with the vessel 100 per cent of liquor at all times, and since the digester is held at a uniform temperature for months on end, we do not appear to suffer from the shell corrosion that is so common in batch digesters today. The units in operation on this continent today show negligible loss of metal on the shell walls due to corrosion. However, as a precautionary measure, we still include approximately one-quarter inch of shell wall thickness as corrosion allowance over and above the code requirements. It is advisable to audit the shell wall every year or two during the first five years of operation to determine if your particular combination of liquors and woods is resulting in any corrosion.

We have had some history of erosion in the bottom head of the digester at the point where bottom scraper has been discharging the chips. We today stainless-clad the bottom head to combat this erosion.

We have had some history of corrosion in the top head of the digester due to improper relief of the vessel allowing a small vapor pocket to form. We also stainless-steel the top head of the digester shell as a precautionary measure.

The digester shell can be completely isolated from the feeding and discharge system by closing valves 51, 52 and 81. This is normally done when stopping operation for short periods of time due to interruptions in the rest of the mill and in some cases as a regular practice, where mills operate for only six days out of seven in the week.

Since the material in the center portion of the digester is at a temperature of approximately 340°F and the material in the top portion of the digester is at only 240°F, there will be a gradual rise in temperature of the liquor in the upper portion of the digester. This results in a thermal expansion and it is necessary for us to provide a relief valve to compensate for this. This relief valve must operate under difficult circumstances, since the material in the digester is a mixture of super-heated liquid and chips.

The relief valve utilized in this case is valve P10 on the flow diagram. This is set to automatically open if the digester pressure rises to higher than 185 psi. The amount of liquor that has to be extracted from the shell to compensate for expansion is very small.

There is always the possibility that the relief valve would open to compensate for thermal expansion and then would remain open due to being plugged with a small chip under the seat. This could result in draining liquor from the digester shell. In order to combat this we connect the relief line to the shell behind the cooking circulation screen.

We also provide valve 55 immediately ahead of the relief line. This is a hand-operated shut-off valve and should be wired open. In the event of valve P10 failing to close, the operator can close the hand

valve to prevent complete drainage of liquor.

The piping on this type of digesting system must be designed to take care of rather large expansion problems. All piping connected between fixed equipment and the digester shell is provided with expansion loops, and in some cases the pumps and heaters are equipped with spring-loaded foundations to allow them to move upwards and downwards with the digester shell.

Special safety switches are provided between the digester shut-off valves 51, 52 and 81 and their connecting piping. These valves cannot be opened until the connecting pipelines have been filled with liquor and brought up to pressure. If it were possible to open these valves without the connecting lines being filled with liquor, the high pressure liquor in the digester would be released at such a high velocity that the feeders connected at the other end of the pipelines would probably be torn completely from their foundations and the pipelines would most probably rupture. Great care must be taken to see that the pressure switches on these lines are not by-passed.

All piping connected to nozzles at the digester shell utilize male and female flanges at the point of connection to the digester. This is done in order to reduce the possibility of blowing a gasket at the digester shell.

We have, in the course of this paper, covered very briefly the general principle of the operation of this type of digester and have enlarged on some of the major facets of the safety features which we do build into the system.

A digesting system such as we have described is simple, and safe to operate so long as the safety features which are designed into it are not by-passed. Thus those people connected with safety in the mill should make sure that modifications are not made to the system without investigating to determine how they effect the safety features which have been incorporated into the original design.

WHAT DOES TOP MANAGEMENT EXPECT FROM AN INDUSTRIAL SAFETY PROGRAM?

By G. A. OECHSLE
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I sincerely believe in sound industrial safety programs.

The subject assigned to me—"What Does Top Management Expect from an Industrial Safety Program?"—could possibly be answered in one sentence: *Management expects a safety program that will reduce industrial accidents and their resulting costs to an absolute minimum.*

I'm sure that each of you could probably agree with me that this sentence is, and well should be, the objective of any safety program worthy of the name. I am also aware that each of you is undoubtedly better versed in the field of industrial safety than I am—so while some of my observations may seem somewhat basic or elementary to you, at least they will give you an idea of what one manager expects from safety.

Although there are some rumors to the contrary, top management people are human beings just like anyone else. First and foremost, they abhor the physical suffering which results from any industrial accident, and when such an accident results in permanent disability, or even death, any of you who have had such an experience will attest that the matter is given the attention of even the highest executives of a corporation.

Most states have statutes which fix the amounts of compensation to be awarded for various disabilities, but who can really set a price for the lost limb, the lost eye, or the lost life? Even if the worker is able to resume active employment, chances are that his future earnings may be greatly limited due to his disability. I am sure that all of you probably have some examples which come to mind, especially in the paper-making industry where you are considered a rookie until you have lost a finger or two in a calender stack.

Another group which may well suffer as a result of an industrial accident is the employee's family, not only because of temporary or permanent loss of income of the

bread-winner, or of reduced future income, but also the discomfort and shock of seeing good old Dad laid up, to say the least; or permanently maimed or disfigured, to say the worst.

No good manager can ignore the suffering which can be brought about as a result of industrial accidents, so no good manager can expect less of his safety program than to keep accidents and injuries to an absolute minimum.

Money spent in caring for and compensating those who have experienced needless industrial injuries is pure waste. It adds nothing to the business, and if permitted to get out of hand can well mean the difference between making a profit or not. What top manager worthy of the name can fail to realize the economic impact of unreasonable compensation costs?

This, then—the *keeping of cost to an absolute minimum*—is the second great area of what a manager expects, or should expect, from a good safety program.

I am sure that I do not need to emphasize or even discuss the direct costs associated with any injury. There are, however, indirect costs which are associated with any injury that I would like to call to your attention.

1. *Last production.* This occurs when the injured employee is part of a crew, and, without the injured employee the crew cannot function.

2. *Repairs and waste.* This is something that each year adds thousands of dollars to our cost of doing business and something which management wants to see reduced.

For example, the power truck driver who drives into a retaining wall, or loses a load of cartons or board and a truck off the end of a loading dock. I'm sure this is a familiar area to most of you.

3. *Morale effects—Supervisory time lost.* The effect on the morale of the employees is another cost item difficult to measure in dollars and cents, but can be substantial.

JOINT SESSION WITH WOOD PRODUCTS SESSION

SAFETY IN PULPWOOD LOGGING

By CHARLES T. WRIGHT
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Last February, I had the pleasure of meeting with the Safety Section of the American Pulpwood Association in New York at their annual convention; an informative meeting.

Many constructive ideas and plans were developed. However, on several different occasions, I heard the supposition mentioned that a rather wide difference in educational levels exists between worker groups in the woods in different geographical areas of the United States. Somehow, this so-called "educational level" was getting the blame for differences in work methods, types of tools, etc., between different geographical areas. The impression was left that this somehow created an insurmountable problem safety-wise. Nothing tangible, mind you, just an impression.

For instance, one man gave an opinion that this "educational difference" is the reason the bow-type chain saw is used down South while the blade-type saw is used farther North. I leave it to you to judge whether or not this is significant in the measure of accidents.

I mention all of this only in making the point that we sometimes use pointless and often unrelated excuses for not having effective accident control in our operations. Is it not a fact that when we have a problem to cope with we must take *whatever* approach and action is necessary to an effective solution? You might say that "Teddy" Roosevelt's policy of "walk lightly but carry a big stick" meant that when he had a tough problem he managed to get just a little bit tougher and solve it for a desirable solution.

About two years ago the North Carolina Forestry Association decided something had to be done in the logging and lumbering industry in North Carolina, as a whole. Putting their decision into action, as a first step they organized an insurance committee and began doing research analysis to de-

termine just what the reasons were behind the high cost of insurance in logging operations.

The committee, after much study, found out what insurance companies and the various state labor and compensation departments had known for some time. They found that while a number of factors were actually involved, just one major item was visibly responsible. What was this? Just this: The logging industry was having a high frequency of accidents which were, for the most part, of a rather severe nature. That is, they were costing a lot of money in hospital bills, doctor bills, and in many other tangible, directly related ways. All of this cost was in addition to the very high cost of inefficient operations which resulted from the same basic causes as the accidents.

What are these basic causes? The most important, at least the most basic and most in need of immediate attention, were:

- (a) Lack of adequate top management safety policy.
- (b) Poor to no enforcement of any existing policies.
- (c) Poor liaison or supervision between management and field.

The basic lack of top management policy had resulted in a disparity in equipment, tools, etc., used in the woods. A nearly complete lack of adherence to any safety standards existed. In a nut-shell, everything was wrong. Something had to be done about it.

On receiving the committee's report, the North Carolina Forestry Association and the North Carolina Department of Labor, who had worked so effectively in development of accident prevention in other industries in the state for so many years, called on some of the insurance companies' safety engineering departments to work jointly toward the attainment of the safety objective dictated by the high accident frequency referred to earlier. American Mutual had

opened to be one of those available and willing to do everything within reason to help.

The over-all record in both the pulpwood and saw log experience indicates that a lot of people have either forgotten some of the things they do know, or else they just aren't taking time to plan ahead and be guided by the things they have learned.

The main points we are trying to make here are:

First, people who are concerned with pulpwood in its various phases of production and use, go to great length to assure full growth and high production of pulpwood timber, but give *considerably less* attention to safety, in either the use of proper tools and equipment or in training workmen in safe work methods and practices.

Secondly, I would like to show that these same people are capable of accomplishing the latter by showing evidence of certain types of effective planning which they are doing, in a contrast comparison to some of the weak points where planned attention is missing.

Workmen's Compensation insurance carriers and other organizations, as well as individuals interested in safety, found many years ago that high accident frequency and severity go hand-in-hand with low operating efficiency, and therefore, result in high operating costs. The same sound engineering principles that can and do control accidents will normally produce highly efficient operations as well.

Safety in pulpwood logging can also mean efficiency in pulpwood logging.

The forest in North Carolina is third-ranking in product value in the state. It produces approximately \$730,000,000 in product value annually. The forest is second only to textiles as a source of industrial employment, furnishing 78,000 jobs. The total annual payroll amounts to approximately \$243,000,000.

These figures give us a basis by which we may estimate the value of safety as an efficiency factor. They also provide a measure of exposure to accidents and suffering in the industry as a whole. A relatively high percentage of this exposure, and certainly the majority of severity is to be found in the log woods.

The forest, in most any area, is a beauti-

ful place, that does not readily reveal the vast number of hazards that lie there waiting to trap the poorly equipped, the poorly trained, or the careless pulpwood worker.

The great progress that has been made in controlling and improving the growth of forest timber is phenomenal, to say the least. Read the story in growth rings. Is there any doubt that the same brainpower that has developed such control could also develop controls that would prevent accidents and suffering to workmen? No, I'm sure there isn't.

There are examples of the results of very poor or no attention to planned forestry. Misshapen and damaged sections of trees which you often see are proof that many men in the pulpwoods are operating or have operated unsafely and without planned control of accidents.

An outstanding example of control of timber growth is found when a tight intersection of growth rings indicate the forest was being choked off by too thick growth for the first 15 or 16 years, but after thinning, the width of the growth rings increased immediately. Such a tree grew as much in the last six years after thinning, as in the 15 years prior to thinning.

When you see planning in action, the forester marks the butt of a tree, using a yellow dye and a manually operated pressure can. The tree is marked also at a higher point. When this tree is harvested, it will be cut because it is marked, and the stump, left in the ground, will show the mark. Trees that are not marked will not be cut. This is planned thinning.

The forester checks height of trees, and measures diameter. Often he takes a boring sample as a means of checking width of growth rings to determine rate or speed of growth. Seedling trees are used in reseeded clear cut land.

Certain tools should be available and used by pulpwooders in the woods. Fire control items are a must for a well rounded control plan. Unfortunately, on many woods operations, we do not find these items.

Woods workers must learn basic safety precautions. Often you may find a man filling a chain saw gasoline tank by using an unsafe type can, perhaps with a spout too short and too large to enter the opening in the tank. Gasoline is often spilled on

saws with this type of unsafe equipment. This creates a rather serious burns hazard to the operator, to say nothing of the potential for setting fire to the entire woods area. Explosion is also a major accident producing potential.

Another unsafe operation is often found in starting the saw. On a very still day, the fumes that have risen from the gasoline filling operation are still hovering in the area. When the saw is started, the fumes may be ignited. If the unsafe gasoline can is too close, this can, and probably will, start a fire. It isn't necessary to explain the many heartaches that could result from this unsafe practice.

When felling a tree, the men should be properly equipped with safety helmets. When a tree is over 10 inches in diameter, it should be notched before cutting, in order to be sure of controlling direction of fall. Many other things must be taken into consideration but this is a primary need in directional control.

The men should be warned about felling a tree without first properly clearing or "swamping" on the back side of the cut, although the opposite area is clear enough to allow a proper escape route.

When you see a man pushing the tree with his hand, to control direction of fall, this puts him in a rather awkward position. Obviously it is necessary that he push the tree, because he has not notched it. It is all right to push the tree, but this should be done by another man with a pole long enough to reach well above the man using the saw.

When the tree falls through brush that was not properly cleared before the cut was started, the brush could whip back and strike the eye of the sawyer. A man experienced in this type of occurrence usually will turn his head well away from the potential whipping brush. However, this does not constitute proper protection. Certainly the man should have spent just a few seconds clearing out the area before cutting, thus minimizing the exposure.

When a felled tree has lodged on the heavy limbs on the underside, the sawyer may limb the tree by cutting underneath the log to remove the supporting limb. This means a high probability of the tree falling

and causing injury to the man. He should have properly blocked the tree to prevent its falling. Better yet, proper study of the tree would probably have dictated falling the tree in another direction where there would have been no blocking limbs.

When a sawyer is cutting tree into pulpwood lengths without proper support underneath, his saw will probably hang, creating additional hazards in trying to loosen the saw. It is conceivable that damage could be done to the saw causing interruption of work. Need for proper shoring here is obvious.

Woodsmen must be always on the lookout for the "widow maker" (broken limb hanging above men who are preparing to cut a tree below). Any disturbance of this broken limb could drop it on a man's head or shoulders.

At times you may find a sawyer breaking just about all the rules of safety in felling a tree. You can see that he does not have on a safety helmet. He is pushing the tree with his right hand while holding the saw with his left, throwing himself into a rather awkward position. Then you'll observe the vulnerability of his head to any loose or dead limbs that may be overhead and become dislodged. The brush is so thick that the saw could hang and cause it to jump into the man's leg. Worse, the brush will probably obstruct his escape route. In addition to creating unnecessary hazards, this is a case in point of complete inefficiency in the woods.

After the cut the tree may hang suspended in the air and the men are going to have to cut other trees before they can drop the intended one. This means they will expose themselves to serious "falling objects" hazards.

Proper pre-planning for direction of fall and good clearing would have allowed a clean fall to ground. This further demonstrates what we mean when we say safety and efficiency are one and the same.

When a small tree is bent over by the tree that hung, the man cutting it with a hand axe may be setting up a dangerous situation by cutting from the top side of the tree rather than underneath. With his first cut, a long sliver splits off and springs outward. This frequently causes injury to either the axeman or other personnel. This is a completely unnecessary operation that

could be eliminated or avoided if proper planning is utilized in the first place.

Fortunately, there are occasions in the woods when you see a little more planning for safety. The men are all wearing safety helmets, and are properly dressed otherwise. The sawyer who will be wading out in the swampy areas is wearing snake bite leggings in addition to the safety helmet and good protective clothing. Men with yellow helmets are supervisors. You may see the producer who stays with and supervises this particular pulpwooding crew.

You will see one of the sawyers approaching the tree, with his foreman looking on. The sawyer will be sizing up the tree, determining best direction of fall, etc. He will take into consideration shape of top, location of other trees, direction of wind, velocity of wind, most advantageous point on ground for limbing, etc.

Prior to cutting the tree, the sawyer will use an axe to swamp out around the tree or clear the area for freedom of movement and safety. This is being done to prevent saw from hanging and jumping into his legs and also to give him a clear path to get out of the way of the tree when it begins to fall.

When the sawyer is making a cut, in the properly cleared area, he will be using both hands on the saw. This demonstrates what we referred to earlier. That is, the sawyer can hold onto his saw with both hands while another man uses a stick with a sharp point that will reach up some 10 feet on the tree for the purpose of pushing so it falls in the proper direction. And the supervisor will be looking on.

The limbing operation with chain saw presents the hazard of the saw hanging in brush and jumping into the legs. Severed limbs should be moved out of way as they are cut, as a means of improving controls over this potential accident producer.

A limbing operation with an axe should be done on the opposite side of the log from which the axeman is standing. Loose limbs also present a very serious hazard here in that they may be deflecting the axe into the person.

In some operations, logs are snaked out of the woods into a clear area for additional cutting and loading. There will be a protective cover over the tractor cab. This

protection is a must for safety of operators. The hard hat will protect against relatively light limbs, etc. and will give a measure of protection against larger trees. However, the sturdy cab protector is necessary for full protection of the operator.

One of the most hazardous situations in logging is found where a man is operating a farm type tractor which shouldn't be in the woods in the first place. In addition to the fact that it does not have any protection overhead this machine is not designed to snake logs. The tow chain is positioned above line of axle.

The center of gravity, that is the line of force, is located well above the axle and if the log hangs, the tractor can turn backwards onto the driver. This frequently happens.

In a specific accident resulting from one of the farm type tractors turning backwards on to the operator occurred recently down near Beaufort, North Carolina. Investigation revealed that the operator was 15 years old (violation of the North Carolina Labor Law) and had been placed on the tractor without any previous experience, although he had told the pulpwood producer that he had driven a tractor some place before.

At any rate, the log being towed by the tractor hung against the stump and the youth's foot slipped off the clutch and the automatic drive caused the tractor to turn backwards and crush the young fellow. The details of the investigation of this accident are too numerous to mention here but they did reveal many areas where planning was lacking and apparently absolutely no attention was given to safety of workmen.

Another major producer of accidents is lifting and handling of heavy materials. This produces serious strains. The safe handling of material requires a thorough knowledge of the correct way to lift; requires putting this knowledge into practice at all times, not just part of the time. It is estimated that manual loading of logs is practiced in approximately 90 per cent of the cases.

If anyone doubts that loading a truck of pulpwood logs is a big job, just multiply the weight of the log (about 80 to 90 pounds) times the distance it is handled, times the number of logs on the truck and you get a pretty good idea of the foot pounds of energy expended during a loading operation.

By monitoring the radio channel, the inspectors can determine the location of the company trucks. It is an easy matter, then, to follow and watch for poor driving habits. This procedure allows the inspectors to pick out those drivers who need to improve. Further, since the drivers do not know when an inspector may be near by, they tend to use safe driving habits all the time. This company has improved its safety program with this procedure. It could not have been accomplished without two-way radio.

In another industry, ready mix concrete, the value of radio is looked at in a different way. One company reported that its safety record was in poor shape—so poor that the insurance companies were inquiring about it. With the aid of a radio system, this company built its safety record to the point that it was specially honored by the National Safety Council. How was this accomplished?

In this company, many of the dangerous situations encountered by the drivers occur not on the road but at job sites. Much of the safety supervisor's time is spent traveling from job site to job site for routine inspections. Radio has been installed in the supervisor's vehicle. Now, when a driver encounters an apparent hazard on a job site, he does not proceed. The driver contacts the safety man, by radio, and he moves to the job site immediately and sees that the hazard is eliminated. This procedure has substantially helped efficient and timely delivery of ready mix concrete and once again the safety record was improved.

Portable two-way radio has been successfully applied in the construction business to provide greater safety. A company engaged in the erection of steel frame work in multi-story buildings has made good use of radio. The crane operator unfortunately does not always have good visual contact when moving a girder into position. This lack of visual contact allows some potentially dangerous situations to exist while the beams are moved.

These dangerous situations were eliminated by providing the foreman with a pocket sized transmitter and placing a radio receiver equipped with a loud-speaker accessory in a central location. The foreman can use the transmitter, no matter where he is located in the structure, to talk directly over the loud-speaker. He can give instructions to the crane operator or the rigging

crew and everyone is simultaneously alerted. All personnel on the site are now aware and alert to girder movements and safety is maximized.

There are more specific examples of which I am aware and thousands of which I am not aware. The point made is that the ability to communicate alone can substantially enhance your safety program. The ability to get the right person to the right place at the right time can prevent accidents. Most of you have operations which require movement of personnel and equipment so that they cannot use standard wire line communication.

Radio is the only answer. In many cases, the increased efficiency obtained through the use of radio in your operations can more than cover the cost of equipment purchase. In these cases, the increased safety is a bonus. In other cases, the increased protection to life and property will fully justify equipment purchase.

Let's move to some specific examples closer to your interests; namely, the logging industry.

One of the most modern methods of signalling in yarding operations is a radio device known as the "Talkie Tooter." With this device, members of the rigging crew can directly control the Yarder whistle. Through the use of a whistling coding system, everyone in the area is kept informed and alert to movements. Keeping the working crew alert to movements makes the operation substantially safer.

Use of the Yarder whistle as a method of signalling was in use prior to the application of radio. It was handled by running a wire line from the Yarder to the point where the rigging crew was working. One man was assigned to the job of controlling the whistle from the wire line. This was the man's only function.

The application of radio, then, did not improve safety, but it provided a means to have equal safety at substantially lower operating cost. The man previously assigned to controlling the whistle is no longer needed because the rigging crew chief can control the whistle directly from the small transmitter which he can carry on his belt. This allows the crew chief to move about freely and perform all of his normal functions.

Credit for applying radio to the specific requirements of the logging industry, in this case, goes to Rottenbuhler Engineering of Sedro-Wolley, Washington. This company has taken this standard radio product and added modifications which perform the signalling function. The system works like this.

The rigging crew chief carries a small transmitter which has an encoding device added. When he wants to actuate the Yard whistle, he depresses a lever switch on the belt unit in accordance with the predetermined code. This signal is transmitted to a mobile receiver with a decoder unit which is mounted in the Yarder. The signal is received, decoded, and actuates the whistle. When a situation arises not covered by the code, a voice message can be transmitted from the belt worn unit to the Yarder.

This is a relatively simple system, but it is effective and reliable. It satisfies the safety requirement and at substantially lower cost. One logger using "Talkie Tooters" on three sides, reports that he saves \$1,200 per month because he needs three less men. He paid for the equipment in less than four months of operation.

An extension of the "Talkie Tooter" principle was outlined in an article in the January-February 1961 issue of the *Western Construction Journal*. It was written by John Gruddall of the Shagit Steel and Iron Works. The article describes a system which combined a radio controlled sky car with a Mobile Logger, equipped both as a grapple loader and a self-propelled mobile tower to support the sky line. In this system, the movement of the sky line carriage and the choker lines is radio-controlled by the rigging crew utilizing the same "Talkie Tooter" which I described. The system provides efficient operation with maximum safety because movements are controlled by the workman who has visual contact.

This example represents a case where remote control of machinery is provided through the use of radio. It is probably in the area of remote control of equipment, or automation if you will, that great advances in equipment application are yet to be made. And it is here, that radio will play an important role as the communications link required to provide the remote control. Unfortunately, standard products

will not generally be available for this purpose because each system will have a uniqueness. But standard equipment will provide the necessary building blocks for our systems engineers to provide workable, reliable control systems to help solve operational and safety problems.

I shall not take your time here today to review the many standard radio products which Motorola has available. Many of you are already quite familiar with our line. I would like to mention two specific products, however, in our portable line of equipment, since portability is so important to many of your operations. One unit is a fully transistorized pocket transmitter with an R.F. power output of 1/2 watt. The smallest, lightest, most reliable communications class transmitter yet made available.

Another unit is a fully transistorized pocket receiver with performance equal to that of any good mobile communications receiver, except for the antenna efficiency. These two units combined can provide easy to carry, two way voice communications never before possible. The ability to communicate with the roving man on foot without burdening him with a large package to carry, has opened up new applications in many industries. Perhaps some of you can already see where equipment of this type can aid in your programs.

In a brief period of time, we can only scratch the surface of the possible application of radio to safety programs and your business in general. I hope that some of the examples and equipment applications discussed may have application in your operations. As a manufacturer, it is our responsibility to learn about your industry and your problems so that we may demonstrate to you new systems which can benefit and serve you. Our representatives in your area stand ready to assist you in working out answers to your communications problems. Call him in on your problems. Motorola has the systems engineering department ready and capable to evaluate your problems and recommend solutions. Motorola is expert in the communications business, but no one knows more about your business and problems than you. With our combined knowledge, I know that systems can be evolved which will aid you in your safety program.

PRINTING & PUBLISHING SESSIONS

THE CRAFTSMEN'S INTEREST IN SAFETY

By MICHAEL IMPERIAL

Mgr., Finishing Dept., Skinner Kennedy Co., St. Louis, Mo.

I have had a very busy schedule the last month traveling practically all over America. I have visited many, many printing plants and I think I can speak from experience, from visitations, and also from my long experience in actually working at the trade with my hands, and I have the hands also to prove that some 32 years ago I thought I was smart but machinery is just a little smarter than we are.

In my opinion, I think that our safety programs are essentially based on good communications. Without communication, all the posters, all the backing up of management, and so forth, is of very little use. Back in 1938 the firm that I work for now had many small accidents in printing plants. Incidentally, the principal supervisory capacity I have at Skinner & Kennedy is with about 80 per cent ladies and about 20 per cent men.

We find that in any bindery there is room for human accidents, made by the human being. They are not accidents that ordinarily would have happened. They happened because we want them to happen—carelessness. I think that we as supervisors—I consider myself in the supervisory field rather than the top echelon—we carry the ball. We are the men that make safety worthwhile. My job is production, getting things done, getting them done on time. And many, many times our workers will sacrifice not only production but their limbs and their lives for the sake of doing things easily. It is up to the supervisor to create an image and an attitude, and I like to use the word "willingness." If people don't do things willingly, then they don't understand them. It is up to the supervisor to create that image and that attitude of doing things willingly, have them understand what safety does and what it means.

Communication. Let people understand what we are trying to say. Reverting back to 1938, in our plants we had many accidents. At that time I was chairman of the policy committee and I knew the advantage of having a safety program that would work. We didn't want management to run the safety program. We wanted their backing but we supervisors wanted to run the program. We have some fifteen supervisors in the plants and we delegate three each month, and one person to be chairman. They go through the building and inspect every known hazard there is. We had a report that we would make out. But this is the thing that is important. Reports are no good unless they have teeth in them.

If there were violations, the report would go directly into the department that was responsible for it. If they weren't corrected in ten days, they would go to management and then management would see that they were abided by. That is where we need the support of top level management. Without their support, a safety committee is of no use.

Then each month you would have three new men that would find some of the hazards that the other people wouldn't find, particularly in the department that they were working in. They overlook some of the hazards in their own department. But when you had a new chairman and new group, they would find the faults in these other departments. The thing we liked about this program, which I believe had the greatest amount of benefit, was that some supervisors weren't in favor of safety, but once they were on the committee, they too became enthusiastic and willing, and once they became willing, you had a safety program that would work.

Printing and Publishing Sessions

It is important that the individual worker understands safety for their own good. We say that safety sometimes holds up production. It certainly does. If we were to be selfish, we would admit that every accident that we have in our printing plant costs money. It holds up production. In a bindery

operation, if you take a girl from the street and try to break her in on a given operation, it takes from three to six months to become anywhere near proficient. If that girl should be hurt and you start a new operator, you are holding up production and it costs money. Safety does not cost. It pays.

SAFETY LOOKS TO MANAGEMENT

By O. R. SPERRY

Senior Vice Pres., R. R. Donnelley & Sons Co., Chicago

There are no unimportant people in the printing industry because wages and salaries comprise well over half of the cost of our operations. Therefore we are dependent upon people for our existence, and when we are dependent upon something, it is not expendable. So, strictly from a cold-blooded and hard-nosed business standpoint, to maintain the safety of our people at the highest level is a profitable endeavor.

I doubt whether this opinion is generally shared by all of our top management people. If it were, I think we would find greater interest, greater concern and, above all, greater participation by these VIP's in safety. The big question is, how interested is the top management of your company in this subject?

The title that was assigned to me is "Safety Looks To Management." I imagine that if this were erroneously printed in the advance notices of this meeting to read—"How We Can Eliminate Safety Programs Because Safety Programs Cost Money"—most every one of your top management people would be here. If there is anything lacking in industrial safety today, it is too much tolerance and not enough demonstrated personal interest on the part of top management. What I have to suggest on the subject may be more properly directed to your top management, and may more appropriately be entitled "Safety Looks To Management For Help"—or, "Safety Depends Upon Management."

First, let's discuss management participation and management support and I emphasize *participation*—not just approval. Now the term "management" is relative and

must include every level of management from the first-line supervisor to the president of the company. Assuming that any first-line supervisor not interested in safety would be replaced, let's talk about higher echelons of supervision.

Of course we don't expect that the chief executive officer of a corporation will participate in every meeting of a safety committee, but we can expect that he will be kept informed, and that he will communicate to this group in such a manner that they know he is informed, and, above all, that he takes serious interest in their accomplishments (and, conversely, that he is seriously disturbed if there is a lack of accomplishment). People like to know that the big boss is aware of what is going on, and who is involved, in areas of activity other than the bread and butter operation, mainly those in the field of quality, service and production.

It is my belief that most of the people in top management have to be pushed, urged, egged and, above all, staffed, on this phase of managerial function and of course that is the responsibility of the person who is in charge of the safety program.

And it is a continuing chore on the part of this person, because if there is anything that can cause this activity of safety to bog down, it is a one-shot program without regularly repeated boosters.

Now, about "management support." I'm not referring to the normal day-in and day-out approval of expenditures for a series of safety posters—meetings on company time—improved first-aid kits and the like. I am referring to the enthusiastic support of safe

practices, rules, regulations, policies, etc.; enthusiastic support of always making safety first in the order of importance of any and all company policies. And, included in the term "enthusiastic support," I refer to backing up the line management organization in support of strict enforcement of safety practices and rules—most of which are developed as a result of experience (and sometimes sweat, bitter and costly experience). I happen to believe that there is no such thing as a workman being "accident prone." It is a worn out cliché. What I do believe is that to the extent that management will tolerate the repeated use of unsafe methods of procedure and, of repeated carelessness, a workman may repeatedly sacrifice safety for production, and consequently be more susceptible to accidents.

Let me give you a case example. A number of years ago we had one particular man out of a group of several operating similar machines—and by comparison it was a relatively hazardous operation. As a result of experience, we had developed a safety procedure for handling the product on this operation that actually reduced the daily output of the operator. This particular man was an exceptionally efficient operator but on the liability side in this case he was allergic to any change that reduced his output. Now this is a most remarkable asset except that it cannot be tolerated at the expense of sacrificing safety. If safety is first in the order of importance, and it well must be, then there is no choice but to make something else second, and since quality was not involved in the case at point, it was production.

This man insisted on reverting back to what we had previously determined were unsafe practices and the foreman finally had to demote him because he was unable to change his habits. As a result of the change, the unit cost of the operation increased considerably, because this man, by comparison, was our highest producer to the extent of some 20 to 30 per cent, under any method. Here was a case where safety looked to management (for support) and got it—and it is a good thing that top management did support it, because I was the foreman. A reflection on the supervisor for not being able to change the man's habits—certainly—but a clear-cut case of safety first, meaning what it implies.

Another basic factor, not specifically related to management but in my opinion, one that may be too often overlooked in safety promotion, is that of "change." Unlike the philosophy of "let us not change simply for the sake of change," when it comes to retaining worker interest in safety, "change for the sake of change" is the life's blood of the program. I'm not in any sense referring to the development and maintenance of safe practices and procedures, but specifically to the gimmicks, the glamor, the novelties, the attractions that will keep people conscious of and interested in the subject of safety. In this field, today's standards are tomorrow's antiquities.

Have you ever noticed that the completely demolished automobile that you occasionally see in the main circle of a small town to remind motorists of the terrible consequences from reckless driving, usually impresses the tourist who is driving through the town, but a week after it is put on display, the townspeople walk by it countless times without ever seeing it. It's old hat and they are not interested until the display is changed after someone else has been killed. The same is true in our plants with respect to safety posters, safety records, and other conventional procedures. Let's change for the sake of change. Let's constantly look for something new, something different, something novel, and then remember that when you find it, change it—frequently. Safety committees are rotated frequently and each committee should be charged with the responsibility of coming up with something new, novel and different to keep up the workers' interest in safety.

Now, in conclusion, I want to touch upon what you may call a cold-blooded approach, a thought for attaching more significance to the factor of frequency of accidents that we are in the habit of attaching to the factor of severity.

If we are ever to reach perfection and eliminate accidents entirely, we would automatically eliminate both of these factors. We of course know that we will never attain that goal. However, I do believe that if we succeed in effectively reducing the frequency of accidents, we will automatically reduce the severity factor. This same philosophy worked at one time in our company when applied to the principle of spoiled work. "Spoilage" we called it, where every

item of cost related to repairing a defective product had to be isolated, classified and accounted for separately in each instance. We laid so much stress on frequency, that taking out a spoilage job number became a reflection of sin. In one particularly large department having almost a thousand employees, the idea took hold so well that anyone who caused a spoilage was actually frowned upon by his co-workers and, as a result, in one year that I recall, the frequency was reduced by 50 per cent and the

severity, in this instance, the cost, was reduced by 90 per cent.

I believe that if we attach enough importance to frequency in our safety programs, so that we will take corrective action to reduce frequency, we may be saving a person's life. We need disciplinary action to reduce frequency and when we get it, we will reduce severity.

Yes, it's just good plain business sense for safety to look to management and for management to support safety.

WITHOUT KNOWING IT YOU MAY BE KILLING YOURSELF

By ALFRED A. JASSER
Chief Chemist, Anchor Chemical Co., Inc., Brooklyn, N. Y.

Safety is everybody's business. Members of the National Safety Council especially should be aware of the hazards present in our industry. We owe it to ourselves, to our employers and to the men under us to spread the word and the habit of practicing safety.

Directors of safety know that workers are safe workers if they have the proper knowledge of potential hazards and the correct attitudes toward their jobs and the tools and equipment with which they work.

Practical psychologists, and I guess every director of safety has to be one, recognize that one of the most powerful forces controlling human conduct is the desire for self preservation.

That in a nutshell, is the reason for the startling title for my talk on the chemical hazards in the graphic arts. Its purpose is to bring to your attention the little known but definite dangers that lurk within some of the materials many of us use in our everyday work.

For purposes of discussion, I classify these hazards into three groups:

1. The danger of fire.
2. The danger of toxic fumes.
3. The danger of skin ailments.

The danger of fire is too frequently caused by ignorance as well as carelessness.

In my visits to hundreds of plants, I've found men who did not know that the solvents they were using were EXPLOSIVE. In some cases the men were confused by the words "Inflammable" and "Non-inflammable." Webster says that "inflammable" means "Easily set on fire, that which will burn readily or quickly." "Non-inflammable" means, "Not easily set on fire, will not burn," etc.

In New York City, the fire department regulations define an inflammable liquid as one which has a flash point below 100 degrees Fahrenheit. The ICC requires a red caution label on materials which have a flash point below 80 degrees F. Some cities have regulations which require red labels only on products which have a flash point below 70 degrees F.

It certainly is a confusing situation.

Most safety engineers use the Underwriters' Laboratories lists as their guide and usually consider any product that has a flash point below 100 degrees F. as requiring special precautions in use.

The vapors of those inflammable solvents which have a flash point below 25 degrees F. are usually explosive. In this class are such solvents as: ether, acetone, methyl ethyl ketone, benzene (benzol), gasoline, carbon disulphide, collodion, most lacquer thinners, and paint and ink removers that

contain these. Whenever possible they should be replaced with safer materials having higher flash points.

You would be surprised to know how much gasoline is still being used to remove ink from type, rollers and blankets. Recently on one of my trips, I had the opportunity to visit one of our governmental agencies. The duplicating department was a neat clean looking shop. But whenever the men need blanket wash, they would send down to the Division's garage for some "gax." "Of course," the foreman hastened to assure me, "we always send down a safety can." He was aware of the potential dangers. But what precautions had he really taken? Hardly any.

For when the safety can was brought upstairs, the men poured a quantity of gas into an open pan which was kept alongside the press. You see, they claimed the safety can was too heavy. The men felt it was a nuisance to lift it each time. It was easier to dip the rag into the pan. No one thought of buying small bench cans or quart dispensers.

They never stopped to think about the three hazards involved.

The car in which we drive to work each day is powered by a motor designed to use the EXPLOSIVE FORCE of each molecule of gasoline. On the coldest day, even way up in Alaska, just a faint spark is all that is necessary to explode that drop of gasoline. The chemists of the petroleum industry have added chemicals and changed the octane rating of all gasoline to the highest it has ever been.

In the plant, the foreman forgot to think about the spark generated by the electric motor on the press. He forgot about the static electricity generated on the press, about the gas flame on the Kelly Press nearby, about the heat generated by the friction of the rag due to the "elbow grease" needed to loosen the dried ink because gasoline at best, is a poor solvent. Any one of these factors, plus a careless smoker could have turned his plant into a flaming inferno in seconds.

A plant in Massachusetts forgot to care for the "gas-soaked" rags and the effect of spontaneous combustion. The semi-headline was, "\$25,000 payroll lost." There was no watchman, so nobody was injured, but the

plant was damaged, and people were out of work for some time.

But even if the plant continued to be lucky, what about the second danger—that of toxic fumes. Most gasolines, including the "regular" and less expensive grades contain tetraethyl lead. This lead salt and other additives make its use as a cleaner prohibitive. Many states now have regulations which prohibit the use of gasoline as a solvent in order to prevent lead poisoning.

Lead poisoning is that same disease which we used to worry about in composing rooms and line-casting shops years ago. Today, there are few cases because we are careful to exhaust all vapors from the melting pot and we wash our hands thoroughly before eating.

Then why should we use as a cleaner any liquid which already contains a dissolved lead salt, easily absorbed by the body? It doesn't make sense. Furthermore, the continued use of this poor solvent very often leads to dermatitis. Over 17 per cent of all compensation claims are found to be in the class listed as dermatitis and skin troubles.

Maybe gasoline is cheap, but I think it only proves that old adage, "The cheapest things are usually the dearest in the end."

Because gasoline and the rest of the petroleum derivatives are such poor solvents for dried inks, many people have turned to the more powerful coal tar solvents—benzene—benzol and toluol.

Benzene is a darned good solvent and it is fairly inexpensive. It is a colorless liquid with a pleasant but penetrating odor. You may have smelled it when you used your rubber cement thinner or watched the shoemaker apply adhesive to a rubber heel.

Not only is benzene highly inflammable with a flash point down near zero degrees Fahrenheit but its vapors are highly explosive. It is one of the most poisonous solvents used in the industry. Safety regulations require that its vapors be confined and down draft exhaust ventilations be present whenever it is used.

Inhalation of its concentrated vapors can lead to death. Pamphlets distributed by the U.S. Department of Labor warns that "chronic poisoning, due to daily exposure of unsafe concentration of benzene may so

reduce the blood forming functions of the bone marrow as to cause anemia. Contact with the skin should be avoided."

What is an unsafe concentration? Imagine a pressroom 30 x 100 with a ten foot ceiling. Allow to evaporate over a period of eight hours, only one pint of benzene and you have reached an unsafe concentration.

What size is your pressroom, or stripping department, or composing room? Half that size? 50 by 50? Then all that can be evaporated is eight ounces.

Is your room 25 x 50? Then all that can be safely evaporated is only four ounces. In the pressroom that is as much as you might use in only one wash-up.

The injurious effects of benzene poisoning are usually slow in being noticed. The body stores up the toxin until suddenly the effect is pronounced. Very often, unfortunately, the symptoms are easily mistaken for other common ailments, such as that tired feeling, frequent headaches, dizziness, loss of appetite and even nosebleeds.

Listen to what the U.S. Public Health Service says in their booklet, "Clara gives benzol the run around"—"Chronic benzol poisoning comes from breathing small amounts of vapor every day. Not all workers so exposed become ill. If it goes on long enough without being noticed, it may at least have the same effect as an acute attack. It also makes people more susceptible to infections like pneumonia, blood poisoning and other germ diseases."

When the patient drops dead, the doctors may call it "heart failure" or people may say "Poor Joe, he worked hard."

But pressmen and compositors are not the only ones susceptible to this poisoning. I know of a bookkeeper who contracted this illness while he worked for a printing company. Only recently a stripper in a litho shop dropped dead at his desk. The coroner found the cause to be benzene which he had been using to clean the film before sending it to the camera.

Cases of benzol poisoning have also been found in the bindery, where girls were tipping in art work with a rubber cement.

Benzol degenerates your skin and makes hands dry, scaly and sore—then they are easy marks for infections.

While benzene has its place in many

industries where proper safety measures and methods of handling it are part of a controlled operation, you must agree that it should not be used in the graphic arts field.

After many printers took notice of these facts they wanted replacements for benzene. We found that many were supplied with cleaners which were formulated with methanol, Methanol, or wood alcohol, as you may know it, is an excellent solvent for aniline dyes but it too is very poisonous and inflammable. Its flash point is 65 degrees F. It is one of the few solvents that the government suggests should carry a skull and cross bones warning label.

When methanol is absorbed into the body, it affects the central nervous system and does particular damage to the optic nerve. It also has a damaging effect on the kidneys, liver, heart and other organs—irrespective of how it enters the body.

The maximum allowable concentration is only 200 parts per million of air. Poisoning from methanol is slow and symptoms may be delayed because it accumulates in the body and is slow in being eliminated.

Handling of wet rags can cause very dry skin, sores and dermatitis. But the most common complaint with methanol is the damage it does to the eyes. Many cases of blindness have been due to the use of this dangerous material. Here too, it doesn't matter how it gets into the blood stream—by mouth, through the skin or nose—it is dangerous.

Unfortunately, the odor of methanol causes it to be confused with "corn liquor." Many serious accidents have occurred when this solvent was dispensed from unlabeled cans or bottles.

Methanol is quite corrosive to lead. This, added to all the other facts outlined above, should make you agree that methanol does not belong in the graphic arts.

Because people are aware of the fire hazards of the inflammable solvents, many have switched to those that will not burn—and thus assumed that they were safe.

If these fluids contain carbon tetrachloride, and most non-inflammable cleaners do, then they are dangerously in error. The vapors as well as the liquid itself, are capable of causing serious poisoning and even death.

Several years ago, a large tag and label printer in the east, decided to save some money by buying naphtha and adding carbon tetrachloride to raise its flash point. The alchemist who decided this, thought that they would surely be protected by mixing the two—50/50.

Everything went smoothly until one day, several of their pressmen became ill. The doctor discovered that they were suffering from carbon tet poisoning. But that's not all. They suddenly had a fire caused by static electricity due to the flow of the naphtha from the full drum through an ungrounded hose. After the plant was out of production for several weeks, the supervisor decided that only safe mixtures, bought outside, would be permitted in the plant.

Let's get back to the carbon tet. The maximum allowable concentration of carbon tet vapor permitted by safety engineers is 25 parts per million of air. Compare this to deadly carbon monoxide gas with which you are all familiar. Carbon monoxide has a rating of 100 parts per million and you now can see how deadly carbon tet can really be.

This is what the state of California says in Bulletin #125—"This concentration (25 parts per million) would result from turning into vapor one-half a teaspoonful of carbon tet in a room 10 feet long by 10 feet wide with a 10 foot ceiling. Don't rely on your nose to detect harmful concentrations of carbon tet. It won't detect concentrations of less than about 80 parts per million, and when you can smell the odor, it may have already harmed you."

Many people have become ill from exposure to this popular solvent without realizing the cause. The symptoms of carbon tet poisoning are similar to heart, liver and kidney diseases. In milder attacks, the symptoms are headaches, nausea and a tightness in the chest.

I know a man who operated a small offset duplicator in an office. Each evening, upon his return home from work, he had to sit on the porch for at least ten or fifteen minutes to "catch his breath" before going in. He told me that he lost his appetite and that he didn't feel right, until he had filled his lungs with "good country air again."

I learned that he was using a blanket wash which I knew contained 60% of carbon tet. Not long after, he followed my suggestion to stop using that mixture, he wrote me that "he felt good again."

There have been cases in shops where only some people in the group using carbon tet, became ill. Investigators have reported that those who are most susceptible are those who drink alcoholic beverages, those who are malnourished and all those who have had a case of poisoning before.

Sometime ago I read a news story about a husband who returned from a drinking "binge" with his clothes dirty. While he was lying on the sofa, "sleeping off his hangover," his good wife attempted to clean his clothes with a carbon tet mixture. The windows were closed. The husband died of poisoning, but his wife was unaffected.

Although carbon tetrachloride is the most deadly of the chlorinated hydrocarbons, many others, often found in cleaning fluids, are also potentially dangerous. These include: trichloroethylene, perchlorethylene, chloroform, trichloroethane and ethylene dichloride. They should all be used with care and only where there is sufficient ventilation.

When any solvent accidentally spills on your clothes it is important that you remove them at once. The portions of the body which have been touched by any solvent should be washed with plenty of soap and water immediately.

Although much of my talk has been about solvents, there are other dangerous materials found in our plants. Time prevents my doing more than listing some:

1. Among the inks are the yellows and reds which contain lead and chromium salts.
2. Rotogravure ink which contains coal tar solvents—benzol, toluol, etc.
3. Aniline dyes found in flexographic inks and toners.
4. Spray fluids and powders that contain silicates, carbonates, talc phenol and formaldehyde.
5. Chromic and bichromic compounds found in platemaking and fountain solutions—even spills on shoes should be removed at once.

I know of several cases of platemakers who had severe cases of dermatitis and it

was traced to the fact that the material spilled on the shoes, and the people didn't take the trouble to clean it up, to change the shoes.

6. In the bindery may be found adhesives that contain phenol and formaldehyde preservatives.

7. Care should be taken with thinners used in finishing operations. Static electricity, built up on cellophane and plastic laminates can cause explosions when loosely handled.

8. Care should be taken with nitric acid and other acids used in platemaking. Nitric acid can cause explosions as well as give toxic fumes.

9. Lye, caustic soda and other such potential disablers should be used with extreme care.

Some printers, who have not kept up with next advances in chemistry, have been giving their synthetic rubber rollers a weekly lye bath to get rid of glaze. This operation of soaking the roller and scrubbing it with steel wool and benzene, has caused many an accident. It is a risky job even with gloves, apron and goggles. It is no longer necessary. You can now clean every roller in your plant without using lye or benzol or any of the toxic materials—and do a faster and better job at that.

Another risky habit which should be discouraged is the use of naphtha, turpentine, typecleaner, etc. to remove ink and dirt from the skin. Some of these solvents may be toxic, some highly inflammable, but all have a drastic de-fatting action which can lead to infection.

I hope that my remarks have succeeded in making you aware of some of the chemical dangers. Unfortunately, time does not permit me to give you more details.

In closing, may I repeat this advice:

1. Accept nothing in your plant which is not properly and freely labeled.
2. Be sure to read these labels.
3. Replace toxic materials with safer substitutes.
4. Store inflammables in a safe place, away from work rooms.
5. Dispense inflammables only from approved safety cans.
6. Be sure to label each flammable container correctly.
7. Dispose of waste inflammables carefully. Spent liquids should not be poured down the sink.
8. Know what you are using and handle it properly.
9. See that everyone else in the plant does too!

SAFETY MOTIVATION

By LARI BURKHART

John L. Gwydir Co., Inc., New York City

This area of motivation is not peculiar to safety alone. In fact, we are coming in at the very hind end of it. You have been exposed to motivation in advertising for many years. The cereals that your children browbeat you to buy for them, the automobiles your wife wants you to buy, all this type of indirect stimulation is by motivation.

What I am going to try to do this afternoon is to speak broadly of the concept of motivation, and then to tie this in with specific safety examples as others and my-

self have been able to apply them to printing plants and newspapers.

Dr. Sonntag states that motivation is nothing more than directed learning. "The basis for all learning is the striving by the individual to lessen anxiety by mastering problems as they arise." Keep this in mind. We will be using it a little later.

Dr. Earl Hannaford has developed a sequential definition for motivation, where he takes motivation and then several parts of it and defines them in turn. "Motivation," according to Dr. Hannaford, "is supplying

the incentives which impel an individual to achieve a pre-selected goal and the incentive is anything the individual feels will satisfy a drive or a motive." And he says, "A drive is a persistent stimulated condition usually arising out of body tissue needs which demand immediate satisfaction. A motive is any condition, and it is usually emotional that arouses, sustains and directs an individual's activities toward a pre-selected goal."

Obviously, from our definitions it would seem that motivating people for safety would center primarily about proper individual incentives, which is a motive, since safety is not a one shot thing but calls for sustained persistent, directed activities on a continuing day after day basis. Moreover, it has a high emotional content.

Before we make any more conclusions and comparisons with respect to drives and motives, let us allude to a few of the basic drives and motives: Hunger, sex, exploratory instinct, masterliness. All are familiar with the drives which are shown in the order of dominance. Actually, masterliness lies between drives and motives. There has been recent research which places masterliness more as a drive than it does as an emotional motive. This is a natural deduction because there is new evidence that our motives have their own roots in the natural drives. The important thing to remember is that drives have an order of dominance; in other words, a precedence which operates so that the strongest one in that order of precedence gets attention before the others. With motives it is different. Motives, being emotional, do not have a natural fixed order of dominance but can vary in strength, depending on the appeal to the emotions. Since many motives can be and usually do compete for our attention at times, the one that appears to be the greatest—*anxiety or fear*—usually wins out over the others.

A motive must withstand repeated competition with the other repeated drives and assaults over a period of time. Drives with their tissue order do not have to face such competition. In fact, it is obvious when thirst or hunger are extreme, these override all others. We see that the particular motives can face several fates. The motive can be successful in competing with other

motives or it can be only partially successful. It can be replaced or give way to a substitute or block inhibition. I am afraid too often in safety we find our motives blocked or inhibited. From this we can see why motives must be strong. In the struggle of the survival of the fittest, we know from experience that safety has strong competition, so it behooves us to know the facts and use them realistically.

Let's list some of the motives that we are talking about: Social appeal; conformity; security; achievement; belonging; attitude; self expression; interest; and prestige.

Probably many of you are wondering why I haven't included praise, reproof and reward. That is just the point here. Before we can arrive at the secret of motivation, we must be sure of what we mean by drives, motives and incentives. There is a good deal of confusion on this point and how they function. All too often incentives and motives are interchangeably talked about and this, of course, is wrong. It leads to conflict and confuses the effort to motivate. The underlying truth is this: Drives and motives are the same for every one. They are broad concepts. Incentives vary with the individual, for they are the intermediate achievements which impel the person to achieve the goal. Remember our definition of motivation: Supplying the incentives which impel an individual to achieve a pre-selected goal. Incentives may be anything which makes an individual feel will satisfy a drive of a motive. Such things as praise, reproof, reward, participation, and so forth, are incentives. It is the incentives we must supply. Far too often we are trying to supply motives. Motives are universal, human conditions are the same for every one, the same as drives are the same for everyone.

Our definition of motives, we said, is any condition, usually emotional, that arouses, sustains and directs an individual's activities to a pre-selected goal. Motive is a condition, we also said, that drives an individual but is a different kind of a drive, a persistent, stimulated condition, usually arising out of body tissue needs of the individual and demands immediate satisfaction. Here is the important concept that distinguishes drives and motives from incentives. Drives and motives are conditions. A condition is

something that precedes and sets up the climate for an action and the result, and does not in itself produce that result. It is the incentives which produce the result that is the achievement of the goal. Any one drive can provide the necessary conditions under which the incentives can function.

Before we sum up the key facts about drives, motives and incentives, I will get down to some actual accident situations, case illustrations.

There is a very important concept, the pivotal concept. I borrow this from Hannaford. He has dug up quite a word which we are using across the nation. This pivotal concept is the point of departure which determines whether we are going to motivate in the true sense, or if we are going to try to prevent, divert, practice thought control, brainwash, propagandize, or what-have-you. The pivotal concept is this: There are two kinds of motives—positive and negative motives. In the partial list of motives we spoke of a couple of minutes ago, we mentioned the positive motive. Too often discussions deal with the positive motives, because precisely only things that give pleasure reduce that tension. That gives us a distorted picture.

We have motives that can be both positive and negative: Attitude, tension, punishment, discipline; then going down to negative discipline, negative tension and negative attitude. They appear on both sides of the pivotal point. These four motives of discipline are what we psychologists call ambivalence. They are opposites of love and hate.

Let's take discipline. Understanding discipline in the interest of the person being motivated is positive. While discipline solely in the interest of the motivator, and particularly when not in the interest of the motivated, is negative. At the same time, this is true of punishment. When both are negative, they have a close kinship with fear and anxiety. Too highly and solely negative motives can disable a person and in the extreme case cause panic. When they are positive, they are among our strongest motives. It is unfortunate these two motives are viewed from the negative standpoint, and the same is true of tension. People see attitudes differently. Most people agree it

can be good or bad. We can see further out from our pivotal point.

Here is an interesting thing about the ambivalent motive. It has an unconscious added impact on an individual. When he senses the intent behind it, the effect can be intensified and amplified. This can be true even when the person is griping about it. Why? His ambivalent feelings are associated with an authority figure. When we have confidence and respect for the authority figure, we get a relief from tension by assuming the responsibility.

Emotional content, impact and positive and negative nature of this motive are dependent on the use made by them by the authority figure. The solely positive motives are effective. So the negative ones are barriers to goal seeking attainments. Even so, negative motives—fear and anxiety—can be strong motives. Here is an example of its use in a field which requires strong motivation. This I borrow from Dr. Barnes, who is the psychologist for the National Collection System. He consults with the collection agencies. The basic approach in the collection of debts is the creation of fear and anxiety in the debtor, which he can only dispel by paying the debt. He can't get away from the use of fear and anxiety as motives and the collector has to create a certain amount of anxiety and fear.

From Herlock works, in three carefully chosen incentives, where the discipline is the startling factor, he used four groups: A control group which was given no incentives; a group which received high praise; a group which was given severe reproof in their own interest; and a group which was ignored, but heard both the praise and reproof.

Using the control group's performance as a percentile figure of 100%, the ignored group had performance of 104; the reproof group had performance of 105.8; and the praised group a performance of 180. Discipline of a positive nature is a motive which is inherent in all of our captive groups. It is a condition and climate which probably cannot be duplicated. The praise group increased its performance by 80 per cent over the controlled group. This is direct testimony to the solely, socially approved motive effectiveness when praise is used as an incentive. We must keep in mind that

praise was given to a captive group, operated under a state of discipline, and whenever the praise was warranted. This incentive can be associated with the discipline and a usually approved motive of this kind is closer to the discipline motive.

Please understand why I am dealing with ambivalence. It is not because I am ranking discipline above the other motives but because of its key position and impact. It is all too frequently misunderstood. All the jobs of safety motivation take place in a setting where discipline exists as the way of life. We don't have free choice, but we do have on-off-the-job work.

When we motivate, we select a goal, decide upon what motives are most closely related to the goal, and then proceed to provide the incentives which will appeal to the individual or group as satisfying that motive or motives. Because of the possible mortality or fall-out of motives, it is best to use several and to choose your incentives accordingly. We don't provide motives but we supply incentives which satisfy a motive that already exists for all of us.

A couple of simple examples of how we can put this to work. Because of the time element, I will take just one example which we all run into in our composing rooms and stereotype departments—eye injuries. This is our goal—no eye injuries; positive motive, security; positive discipline, dealing with security. These are possible incentives: publicize loss of sight cases; publicize cases of eyes saved by safety glasses; provide safety glasses, and also paying the cost for prescriptions ground into safety glasses, the taking of personal responsibility. Possible incentives were the plus motivation of discipline, enforcement of the rule of wearing safety glasses at a time when on the job.

Appropos to this, when we try to get full use of glasses and are paying for prescriptions, we achieve 70 per cent reduction of eye injuries. When we made it mandatory to wear glasses all the time on the job and enforced it, we brought our eye injuries down to virtually nil.

Talking about how to successfully motivate people for safety, we have to be realistic. I am going to use four actual cases: two concern group motivation and two deal with motivation of individuals. Since we

took time to explore just what motivation is and also discuss basic definitions, we can cash in on it. All we have to do is put the pattern of successful motivation in flow diagrams which I am sure you use for routing of material. We will use it in discussing our four cases.

First, in setting up our flow diagrams and what to do, on this hand, and how to do it. We selected our goal. We became acquainted with the objectives. We reiterated frequently what these goals and objectives are: Develop and sustain good safety attitudes. On the other hand, personal contact, individual and group participation. We test for achievement, check for better performance, persistence, interest and attitude and goal. As the goal is approached, we inform the people of our progress—again personal contact and mass media. We command, when it is justified, on what to do and how to do it; again personal contact. I work this personal contact to death. It is the only way I know of selling safety.

The only new term we have introduced in talking about the motivation pattern is goal grading. If motivations work, the nearer we get to the goal, the stronger the motivation. It also applies when we provide a continuing long term goal, with intermediate, successive goals. For instance, if you want to achieve "no amputations" in your pressroom, rather than give the whole setup as to your goals, start with no accidents for, say, seven days, then for longer periods, until one of these goals is achieved and you build on each one until your pressroom will be running without amputations. If we'd analyze these cases in detail, we'd be here for hours but I am describing briefly what was done and some of the factors involved.

The first group was a group of 900 women, divided among five newspapers throughout the non-mechanical departments—phone solicitors, clerks, runners, girls in secretarial positions, editors, and just about anything you can mention outside of the mechanical operation. When we started this, we had a frequency rate of 1.19. This was reduced to 0.16 over a twelve-month period. The people I work for aren't interested in frequency figures. They are interested in dollars and cents. We had a figure of \$2,595 at the beginning, and the

costs for the next twelve-month period were running \$172.

When we started out, we made a careful and detailed field study that showed all of our safety programs and activities were basically oriented to the mechanical department needs, objectives and the way the men were thinking. We got a couple of our lady editors together and tossed the ball in their laps. What are we going to do to interest the dolls in safety so they won't stand on chairs or trip over phone cords? The women's safety committee was oriented and developed objectives, programs, material and activities in terms of women's needs, incentives, interest and thinking. The program activities were given to women by the women. The men stayed completely out of it, much to the ire of several of our managers.

Here are some of the motives and incentives used: The motives—belonging; the incentives—participation in small groups of ten or twelve discussing subjects such as "A Woman's World," "It Is Smart To Be Safe," and actually working on safety activities suited to women and their needs.

Another motive—challenge and achievement—and here we had individual rivalry, group rivalry, women vs. men, and women vs. women. The motive—social approval. Top management had personal interest in what these women were doing and paid frequent visits to their departments and spoke with them. There were many more motives and dozens of incentives and all of these items were designed to follow the pattern of successful motivation. There was evidence that they did.

Case No. 2 was a diversified group of 90 mechanics and pressroom workers, working under stop paper conditions. The frequency rate, under normal working conditions, is 1.9. Under emergency conditions, no accidents whatsoever. This case differs from the preceding one in group motivation. It has situational motivating factors which Case 1 didn't have.

Looking at our pattern of successful motivation, we can see that the goal is clearly defined. When we got to sheet rolling, the previously developed safety attitudes, habits and training were all brought into focus due to this emergency. We had to get the edition out. Without question, the achieve-

ment is constantly before them as to the progress of their work, and warranted praise is quickly given to them, including word of praise by rival departments—stereotype, composing and editorial.

An added incentive arising out of the situational motive operates to strengthen the pattern of motivation in this case. As for these incentives, there is a multitude of them. For some, it means to help in the time of need; for others, the reward of overtime; for others, the group effort and the esprit de corps; for others, rivalry between the different gangs getting the web back up and putting in the new roll and putting on the new blanket. All these things came into play. The critical thing about situational motivation centers on this one point. Unless the situation impact has been preceded by good sound safety attitude development, habit formation has nothing to build on and will increase injuries rather than reduce them or prevent them.

The third case is one I think most of you probably run into if you have just one truck driver or anyone driving for you. This was a situation where we had a man with a very poor driving record, having continual accidents, both personal injuries to himself and damage to equipment, but yet the circulation department wouldn't let him go. He was the one fellow who would get out in the poorest weather and get the paper delivered. In both this case and the last case I am going to talk about, I will limit the discussion to the unique aspect rather than to reiterate the principles we have discussed.

This case concerns a driver with a very poor accident record, but whose physical and mental qualifications were quite satisfactory. The incentives were group and individual rivalry, financial reward, participation in the motive of achievement, conformity, identification. The poor performer was put in with three drivers with good records. These rules were applied: Each driver was to get \$50 bonus at the end of the accident free year. If all four drivers had an accident free year, all four would receive \$150. These three good drivers really went to work on this poor one, and he tried to conform and identify with the good ones. It worked so well that all the drivers in this particular company, which is on the coast, are now work-

nure looks even better. So what we are doing and what we have done works for us fairly well.

When our safety engineers call on a printing company, these are the objectives that we have: We try to help the insured; we try to help the printer help himself safety-wise. We do not attempt to do the safety work for him. We feel that isn't our province, that it is strictly management's job and, frankly, we can't get there often enough. If we are able to call on each policy holder every 30 days, that would be fine. I know some companies do that and do beautifully at it. I mean, some insurance companies.

But our aim is to advise with the insured, to help him plan and set up a plan that is appropriate for the size and nature of his operation. Obviously, we wouldn't use the same plan for a large plant employing five or six hundred people, as you would one that has 35 or 40.

We start, of course, with the owner, the top management, and filter down through the supervisors and foremen, working on them primarily. The thing that we are trying to get over to them is to make sure that they understand clearly the relation between safety, accident prevention, and efficiency. It is rather difficult to sell safety on its merits alone. It has to have a dollars and cents value, as Mr. Burkhardt mentioned. That is what they are interested in. We try to increase their safety activities and stimulate their interest in safety, and finally—I purposely put this last—we make inspections of the plant, not that that is less important, but we think it is something they should do themselves on a regular basis—a daily inspection, a weekly inspection, a monthly inspection, in degrees. We try to show them how to do it most effectively.

We will take a small printer with 50 employees, who is mightily concerned with getting business, getting the work out and getting it delivered and collecting the money. Accidents with him are not a real serious problem as a rule; not that their accident record is better, but they don't have accidents on the scale that the larger plant does, or where the insurance company is looking at hundreds of plants.

The one thing that we have learned is that somebody in the plant understands every

machine in there and every operation, and understands it thoroughly. They understand it far better than we outsiders, even those who make a living in safety work. Now, the question is, do they always make use of the knowledge they have of that machine? Obviously, they don't. That is why there are accidents. Where we put a great deal of our stress, safety-wise, is with the manager of that department or that area, who is responsible for the people that operate the various machines, to make sure that they make a job study as needed for each operation.

The printing industry, I believe more than any industry that I have had any experience with, is geared to production. I mean, that is their bread and butter, their life, that is their life's blood—production—and sometimes it is such a problem that safety comes way down the ladder, just about the last place. So we come to the type of accidents that we have. I am going to hit the highlights of this and talk about accident types, with just one or two illustrations later.

Machinery accidents. In other words, getting caught in moving machinery is the most serious type of accident that we have encountered. In our analysis by types, we found that 18 per cent of accidents involve some type of machinery, I mean, getting caught in it, or by it. The average cost—and this is always important to a printer, the man who pays the policy—the average cost of a compensation claim in this category is \$223. Perhaps I should also explain that in figuring cost, for instance, we don't figure frequency, like the National Safety Council, where lost time injuries are involved. Quite often we don't even have that information. These cost figures are composed of medical expense and hospital, if any, the adjuster's expense that had to handle the claim, and compensation payment, those three things. Out of 100, 93 of the claims did not involve any workmen's compensation payment with medical and adjustment cost; only 7 involved that. So, you see, we have the total cost here, and that is what the insured is interested in, because that is the bill he is going to pay.

The second most expensive kind is material handling, usually lifting and moving materials, resulting in back injuries, muscular troubles, hernias. That involved 13%, with an average cost of \$206.00.

Falls is the third highest category in terms of cost, being 6%, with \$154 average cost per claim for that type.

Then other types of lesser consequence, objects struck someone, or vice versa, someone bumped his head, and so forth, with an average cost of \$28.

Cuts, foreign bodies in the eye, dermatitis, skin rash, burns, things of that sort, make up the others.

The one thing that we recommend after we have had our discussion with management is that they persuade their foremen and supervisors, whoever has the responsibility for a certain group, that they actually go out and make a job study of every operation, and by that we explain what we mean, the procedure, like time studies in a Ford plant, or something like that. But determining the most efficient, the most productive and the safest way to do every job. Usually, we work with them on that if we can. We find that oftentimes very simple rearrangement of material or stock, or changing the floor plan, or the positioning of the operator can mean the difference between a safe and an unsafe operation, and we thoroughly recommend that.

In the smaller plant particularly—we will in all plants—but in the smaller plant, we ask the owner to talk frequently with his employees about safety, about their welfare, pointing out that he is interested in their welfare, he doesn't want to see anybody hurt, and that is very true. The smaller the plant, the closer the relations. Also pointing out that involvement in an injury can seriously affect not only their own well being, but their income as well, which we are all vitally interested in. Once again, the emphasis is on the foreman part of it.

As we go into any plant, the first thing that we are concerned with, and I am sure all of you are, is housekeeping conditions. Believe it or not, it is a simple thing but it is the one thing that causes so many accidents. If you don't believe it, just look over the list of accidents that you have had during the past year in your plant, or that you are familiar with. You will find that you've got probably one very serious accident that cost \$1500 or \$3,000.

Due to the fact that there was a little puddle of oil or grease, someone hurrying by stepped in it, his heels shot out and he

tell and sustained a bad injury. This is so elementary that I feel ashamed even to mention it, but it is the thing that creates really bad accidents.

Crowded conditions. Sometimes there is not much you can do about it. But other times it is the thing that has grown like Topsy—you haven't become aware of it. You have let things be stocked or piled in an area when they really belong out in the warehouse or some place apart from the working area. Whenever you have crowded conditions, you have an unusual accident hazard.

Hand trucks, dollies and things that are left in the aisles, even mops and brooms. That is a frequent violation that we find. Obviously, it can be corrected and it should be corrected, and the only way to do it is to make sure that somebody is continuously alert for those things.

One particular hazard that one of my engineers points out is the use of fork trucks, industrial trucks, in the plant. He said, "My experience is that they travel far too fast for the safety of other people," and he mentioned that they are always difficult to hear because there is a lot of noise when the prestes are running, and they can sneak up on you. It is a thing that usually grows in proportion to the use of the number of trucks. They really form a serious hazard, and accidents will attest to that.

The cleaning of the rolls presents a serious accident problem and we have had mighty serious injuries from that. It will always be a problem. The one thing that you don't want to use is carbon tetrachloride. But I am sure the method you use, and every man that works at that job knows how he should do it, but too often takes the short way out. They do it the hard way. If they use the rag, the rag is caught while moving and the hand is put in and it is a very serious injury.

The thing that we look for as we visit a plant is what the foremen are doing. If we see some workmen doing something that is obviously unsafe, that any school boy would know wasn't safe or the best way to do it, if he does it in front of the foreman and the foreman ignores it, he doesn't notice it or passes it off, then we have a foreman problem, and we talk to

the foreman rather than to the man that made the violation. We feel that it is the foreman's position to correct that, and we think that is the biggest field we could work with—the foremen of management.

Last year the safety manual for the graphic industry was discussed. It is a fine publication. It was put out by the National Safety Council, but the objection to it was that it dealt mostly with books and periodicals and such, and had very little newspaper production in it. I believe there was some thought given to revising or making a new one for the industry. I don't believe that has been done yet. But it is a fine thing for anybody that has time to study it. But that is the catch in it—having time and interest to go through it. We bought a lot of these and began giving them out to our larger printers, feeling that they would be interested in it. They had never seen it. But just like if somebody had given it to me I would probably turn it around in my hand and say "That looks good and I will read that when I get time." But the point is I probably would never have gotten time.

We have found that in order to get through to a busy man, a man that is running a printing business, we've got to boil it down to essentials, and that is what we have done in our one-page basic safety program, "A Basic Safety Program To Prevent Injuries to Employees." We have listed six principal points, with subheadings under each one. If we can get them to take the time, after we have left their office, to read that and consider doing as much of it as they can, we feel that we had made great progress. I don't blame them, and I don't blame you folks for not taking time to go through that. It isn't your field. You haven't the time, but if you can try to do as many of these six basic points, it would help you.

For instance, the proper selection of new employees. That is basic. It eliminates a lot of needless expense. If you hire somebody that has a back injury or a hernia, weak heart, diabetes, epilepsy, you have hired yourself a workman's compensation claim that is going to cost from \$1,000 to \$10,000. Not only do you save on compensation cost, but you get a more efficient, a more dependable work force by selective hiring. Your unemployment taxes, an even greater cost to you than your workmen's

compensation insurance, is vitally affected by your hiring program. It even affects your hospitalization, Blue Cross, or whatever you may have. So it is extremely important that you give thought to that. However, you've already got a houseful of people and there is nothing you can do about that. But when you hire new people, that is very important.

Then teaching and training everybody for a job. I think it is important that you teach every man, I don't care if he has worked twenty years at a particular job and you are going to place him on one just like it, he still should be trained and taught. He should be shown what you want done, not the way they did it somewhere else, because that is not the way. He may have twenty years of bad experience instead of good experience behind him, so it is worthwhile to take the time to train him.

Then supervise the working practices of all employees regularly.

Then institute a safety education program, a thing that each company has to work out for its own needs, to stimulate employee interest, keep it alive, give them safety tips.

Make plant inspections, do that yourself and don't wait for the insurance company, and study and analyze past accidents.

We have found that inasmuch as we can only get around to each printing company once, twice, three, maybe four times a year—I would say that twice a year perhaps is the average for our visits—obviously we are not going to do a great deal to improve the safety record of that company, unless what we do the day we are there carries over. In other words, have we helped them to help themselves?

Now we supplement our engineers' visits, maybe two or three a year, with a monthly safety suggestion letter, a simple little letter that we write with a certain industry in mind, and we mail that to the owner of each company we insure. We try to get over a very simple message about safety.

We thus give twelve more shots, and they are rather painless for the insured. They don't break into his working day. They don't tie him up in his office for an hour or two hours. He reads it, and I think we have accomplished a great deal by that.

If you have an interesting message and say it simply, and leave lots of white space, that is the best part of the message—the white space. You know, somebody has said that anybody could make a good speech, or write a good letter, if they have the three principal ingredients: A good opening, something that catches your attention and attracts your interest, then a good ending, a good summation and summary, then practically nothing in between. So that is what we try to do.

When we first called on them, the safety engineer inquired about their safety program. He said, "What sort of a safety program do you have, if any? Perhaps we can work with you on that." The man was very frank and said, "Well, we don't really have a safety program. We are interested in preventing accidents and we have done a pretty good job, we think, but we just don't have any formal program. We are very careful who we hire. I don't want to hire anybody that isn't going to be an asset to us. We want somebody that we can build on and we are very careful. They fill out an application form and we check back with former employers for at least four or five years. We check on all of the jobs they have had, and we inquire by telephone what they thought of the man, what his work record was, what his accident record was, what about his health, and so forth. Unless it comes up to real good, we are not interested in hiring that man."

Our engineer said, "That is good. What else do you do?" He said, "Well, we hire nobody without a thorough medical examination." The engineer said, "That is even better, that is wonderful." The man continued, "Oh, yes, we have little meetings every once in a while. I have them in our office with the foremen and then the foremen have little meetings on the floor when time permits, with his people, but we don't have any safety program."

Our engineer said, "It seems to me like you have a pretty good safety program, whether you know it or not. What do you do about accidents, when an accident happens?" The man said, "Well, we are concerned when somebody gets hurt and we try to find out exactly what caused the accident, what went wrong, and then we try to prevent it ever happening again. Let

me show you what we do. Here are some that recently happened.

"Every time they have an accident of any consequence, or one in which there is a lesson to be learned, particularly, after they have investigated it thoroughly, they go back to the machine on which that accident happened, or wherever it happened, and they take a photo. Then they reproduce that picture. And let me just read what it says:

"Safety is a full time job. Think safety in every task you undertake. Know your machine and respect it. You will never be asked to perform a task which doesn't provide you with safe working conditions."

"Then it says what happened:

"The printing department was short-handed and all of the pressmen were busy. The operator wanted to help, so she started washing the large impression roller on the 20" printing press. The clean rag got caught and the operator followed a natural tendency to try to pull it out of the press. Instead, her hand was pulled between the two metal rollers. The press was not running, just on jog, but the roll of this press was enough to pull her hand into the press."

"That is what happened. Then it describes the nature of the injury, how her hand was hurt. Then it says 'How could this accident have been prevented?' All operators should have sufficient knowledge of the equipment they are working on before they undertake such a task. Experience in handling this equipment would have taught her caution in this operation. She should have waited until a pressman was available before attempting to clean the machine."

"That is one accident and they went to extreme lengths and yet they felt they didn't have a safety program. I just wish we had about 100 per cent of our printers that had 'no safety program' like that."

So often we get committee reports, perhaps minutes of a safety committee meeting, where they have been reviewing accidents that happened, and they will describe it thus: "John Brown accident; did so and so." Then down at the bottom, they say "We voted guilty." That isn't the point. We are not trying to pin guilt on somebody.

1961 National Safety Congress

Where we have safety committees, and lots of your plants probably do have safety committees, I would advise that every man on that safety committee see the National Safety Council safety film entitled "Cause and Cure."

I just wonder how many here have ever seen that film? Do you remember the title? It is an extremely interesting and very informative film, which shows a safety committee in action. It really makes a member aware of what he is trying to do and how he should go about it.

Those of you who are responsible for safety back home, or are interested in it, or have anything to do with it, don't be afraid to repeat a good idea, or every day instructions if they are needed. Believe me, so many things can be repeated dozens of times and be just as effective the second time. Perhaps you think you are wearing it out. You are wearing the people out by telling them to mop up, clean up, keep the aisles straight and don't put things in the aisles. If you think that, if you think you

are wearing it out, believe me, it isn't true.

I was interested in a little article from the NATIONAL SAFETY NEWS for October, 1961. It is on page 9 under the heading, "The Safety Valve," by Carmen Fish. I am just going to quote the first part, which applies not only when you are writing a directive, a bulletin, but also when you are doing it verbally.

"Old Stuff. One of the shortcomings of most publications is that they are so afraid of repeating. Editors kid themselves by thinking every reader has read everything they published. Inevitably, of course, editors do repeat. But they always feel guilty about it. It is an admission of sterility when they dish up old stuff and even dress up well worn out ideas in new dress."

Whether you are a supervisor, or whether you are the man in charge of the supervisors, or whether you are going direct to your employees, believe me, don't be afraid to repeat the good old fashioned safety rules that make a lot of sense.

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REPORT OF THE RAILROAD-HIGHWAY TRAFFIC SAFETY COMMITTEE

By G. M. DEMPSEY
Chairman

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First, I would like to point out that the statistics of the Interstate Commerce Commission for the past 26 years, ending with 1960, show an annual average of 3,787 highway-railroad grade crossing accidents with an annual average of 1,596 deaths and 4,140 injuries. The number of accidents ran from a high of 4,489 in 1937 to a low of 3,075 in 1959. The high figure for the fatalities occurred in 1942 with 1,970 and the low of 1,203 in 1959; the high in the number of injured occurred in 1937 with 5,136 and the low in 1958 with 3,161. The number of casualties (killed and injured) per accident ran from a high of 1.61 in 1935 (the beginning of the 26 year period) to a low of 1.40 in 1956. The grand total of all motor vehicle deaths during this same 26 year period was 901,038 and those which occurred at rail-highway grade crossings amounted to a grand total of 41,551 or 4.6 per cent of the total. For the year 1960 this percentage was 3.6, representing the ratio between 1,364 grade crossing deaths to 38,200 total motor vehicle traffic deaths.

Taking the figures for the year 1960 we find that the family automobile accounted for 2,332 of the total of 3,195 rail-highway grade crossing accidents, or 73.0 per cent and motor trucks accounted for 621 of the total of 3,195, or 19.4 per cent.

Instances where motor vehicles were struck by trains amounted to 1,923, or 60.2 per cent, and those where trains were struck by motor vehicles amounted to 1,086, or 34.0 per cent.

So much for the statistical record. Now, let me tell you about a few of our activities during the past year. Bear in mind that the new Committee on Motor Vehicle Traffic Safety at Railroad Grade Crossings of the Traffic Conference has been, to a large extent, in the formative stage. Having started from a small beginning with a few railroad safety officers we now have the following representation from all conferences of the National Safety Council:

Industrial Conference—10 representatives,
5 each from Railroad and Petroleum Sections.
Motor Transport Conference—6 representatives.
Traffic Conference—6 representatives.
Farm Conference—2 representatives.
Womens' Conference—2 representatives.
Labor Conference—2 representatives.
School and College Conference—1 representative.
Religious Activities—1 representative.
Members at Large—6 representatives.
Total—36

In addition we have several alternate members which we think is a good thing guaranteeing full representation at all of our committee meetings.

Attended by 26, the initial meeting of our expanded committee on September 13, 1961 got off to a splendid start by being addressed by General George C. Stewart, executive vice president, National Safety Council, who outlined the desirability of having definite objectives and invited use of the Council staff and solicited recommendations on which the Council could take action.

Pertinent remarks were also made by Henry G. Hoeffer, Asst. Genl. Mgr. and Harry Porter, Jr., Manager, Traffic Dept., both of the National Safety Council.

The scope of activity of the new committee was explained as follows:

- 1—Assemble and analyze the facts about highway-railroad crossing accidents.
- 2—Undertake to study and promote the following activities:
 - (a) Uniformity of State Laws pertaining to vehicle operation at railroad grade crossings.
 - (b) Stronger enforcement of traffic laws and improved engineering at railroad grade crossings.
 - (c) Safer operation of School and Inter-City buses at railroad grade crossings.

(d) Programs to help prevent accidents involving trains and commercial vehicles at railroad grade crossings.

3.—Recommend actions and activities the National Safety Council should conduct to reduce highway-railroad crossing accidents.

4.—Assist the National Safety Council in conducting its nationwide Signs of Life educational program, which reminds motorists of the need to know and obey traffic signs, signals and pavement marking, particularly those guarding highway-railroad crossings.

5.—Develop an annual summary report suitable for publication and distribution among all agencies and interests involved in preventing railroad-grade crossing accidents.

To implement these objectives, the following subcommittees were established and chairmen and members of each were named. The subcommittees and the chairmen selected are:

Committee A—Publicity and Publications—Herschel H. Patterson, Chairman.

Committee B—Uniformity of state laws covering operation of motor vehicles at railroad grade crossings—Ralph F. Gross, Chairman.

Committee C—School bus operations at railroad grade crossings—D. M. Ferguson, Chairman.

Committee D—Operation of commercial vehicles at railroad grade crossings—E. W. Hobbs, Chairman.

Committee E—Traffic law enforcement at railroad grade crossings—Robert E. Raleigh, Chairman.

The duties of each of the subcommittees were outlined but to conserve the time these will not be explained at this time.

On October 17, 1961 during the National Safety Congress and Exposition, another meeting of the committee was held with

26 attending. Duplication of engagements during the congress prevented attendance by several committee members.

At these two committee meetings separate group meetings of the subcommittee were held.

These resulted in several suggested items for further handling, among them (1) a recommendation that the American Association of Motor Vehicle Administrators urge state administrators of motor vehicles to include more questions about railroad grade crossing safety in the state driver license examinations (2) a recommendation to the National Committee on Uniform Traffic Laws and Ordinances to consider a provision prohibiting stopping, standing or parking on railroad tracks at any time or place. (3) a recommendation was also made to the American Association of Motor Vehicle Administrators that consideration be given to making a traffic law violation at a railroad grade crossing a serious one, having a high point value (4) that railroad chief special agents be urged to contact state police associations or similar organizations to which they belong and request more enforcement attention to violations of traffic laws at railroad grade crossings and (5) that a news release covering the activities of the committee be prepared and distributed on a nationwide basis.

These are some of the things on which the committee has taken definite action. It is only a beginning. There is still a great deal to be done. With the outstanding spirit of cooperation which exists between all members of the Committee which represents varied interests as the record shows, even greater accomplishments will be made. A deep conviction of the magnitude of the task ahead and a fervent desire to obtain results prevails throughout the entire group of individuals dedicated to the prevention of rail-highway grade crossing collisions.

WHY OFF-THE-JOB SAFETY?

By R. P. HAMILTON

Supt.-Safety, St. Louis-San Francisco Railway Co., St. Louis

How many of you have asked yourself this question? It would be interesting to know how many others all over America are asking the same question. I will try, in a few minutes, to tell you why it is felt that we should have an active off-the-job safety program, the same as we do on-the-job.

On February 17, 1961, the following headline appeared in practically every newspaper in America: "93,000 Die in Accidents. 9,400,000 Injured during 1960." Accidents killed 93,000 and injured 9,400,000 men, women and children; they cost \$13,600,000,000. Traffic accidents, as usual, topped the list with 38,200 killed, followed by home accidents with 27,500 deaths; accidents at work caused 13,800 deaths; accidents in public, excluding traffic fatalities, resulted in the loss of 16,500 lives; deaths from burns totaled 7,300 and drowning, 6,500.

Let's take another look at the accident picture in America during 1960: needless deaths, injuries and destruction of property. The property that was destroyed can no doubt be replaced, but no one can replace the lives of the 93,000 who were killed, or erase the suffering of those who were injured.

You will note that out of the total of 93,000 killed in accidents during 1960 only 13,800 were killed at work. This leaves a total of 79,200 killed off the job. Of the 9,400,000 injuries, 1,950,000 occurred on the job, which makes a total of 7,450,000 injured off the job. These figures, in my opinion, clearly demonstrate why we should have off-the-job safety programs.

Another good reason is that if the money paid out for accidents during 1960 could have been used constructively, it would have meant much to America and to each of us as citizens and taxpayers. A large insurance company estimated that the \$13,600,000,000 could have provided a 100 per cent salary increase for every public school teacher, principal, supervisor and school superintendent in the United States. It could have built more than 300,000 Class A school

rooms for 9,000,000 youngsters; it could have provided a four-year college education for 12,000,000 students; it could have given every taxpayer a 30 per cent reduction in taxes; or it could have built more than 100,000,000 new single family homes. Yes, it would have meant much to have saved those 93,000 lives, the suffering of the 9,400,000 who were injured, and the \$13,600,000,000 which was spent for loss of life, suffering and destruction of property.

There are those who continually talk about the hazards of working in industry, yet records show us that we are twice as safe on the job as we are at home. We are safer at home than we are on the streets and highways of our nation today. That brings us to this question: What are you as an individual doing about your safety and the safety of your family? Do you read about the accidents which occur in your community, your city and your state and say, "That's too bad," then forget them? Or do you really do something to prevent the same thing happening in your home to your family?

We teach our children literature, art, music, drama, cultivation of the voice, but are we teaching them to meet the ordinary hazards of this mechanized and perilous age? We would not arm our children with machine guns or place in their hands poison, drugs and narcotics with which to amuse themselves, yet we often leave those things where the children can reach them, or we take them by the hand and walk across the street against a red light or "don't walk" sign. If you don't believe the latter statement, stand on any street corner in any city and see how often this happens. This is another reason why we need off-the-job safety.

It has been my privilege to serve as chairman of the off-the-job safety committee of the industrial conference, the Railroad Section of the National Safety Council, and the Safety Section of the Association of American Railroads and I know what the leading companies of this country

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are doing to promote off-the-job safety. There are 28 sections of the industrial conference and seventeen of those 28 have off-the-job safety committees. I am proud that the Railroad Section was one of the first sections to start this worthwhile safety activity.

If we are to have a good safety program, either on or off the job, foresight and advanced planning are essential in every operation but the planning should be done at the proper time and place. We are frequently caught in a whirlpool of thoughts of things that happened yesterday or become lost in a muddle of thoughts of the future. We should clear our minds of the troubles of the past and the expected troubles of the future while at work, at home, on the highway, or wherever we may be.

You realize, I'm sure, that in the space of a few short years, we have been handed

the automobile, the tractor, the diesel, the radio, the television, radar and the atom bomb; and as you know, scientists are working to perfect rocket and space ships. It is an old axiom that man can finally accomplish anything he can imagine. Would it not be fine if we could imagine everybody taking safety seriously, whether on or off the job, and reduce the needless number of fatalities and injuries occurring in America today. We have been able to do practically everything else but be safe.

A man's first duty is to his home and family and he must fulfill each and every obligation to insure for them a full, safe and happy life. When we do the best we can to promote safety everywhere, we will always have the satisfaction of knowing that the good deeds we do as we go through life are etched deeper in the hearts of our fellowman than all of the material wealth we may acquire.

REPORT OF COMMITTEE ON HOME AND OFF-THE-JOB SAFETY

By R. P. HAMILTON

Supt., Safety, St. Louis-San Francisco Railway Co., St. Louis

The National Safety Council wrote to all railroad members of the Council requesting them to submit a resume of their home and off-the-job accident prevention program for the year 1960, for entry in the competition for the Council's Public Safety Activities Award. Twenty-two railroads furnished the Council with a brochure outlining their off-the-job safety programs, and fifteen of them won the award. A few of the fifteen railroads have won the award for the eighth consecutive year. The winners were:

*Atchison, Topeka & Santa Fe, *Atlantic Coast Line, *Canadian National, *Canadian Pacific, *Chesapeake and Ohio, *Chicago, Burlington & Quincy, Chicago, Milwaukee, St. Paul & Pacific, *Cincinnati, *Delaware and Hudson, *Duluth, Missabe & Iron Range, *Illinois Central, *New York Cen-

tral, Norfolk & Western, *Pennsylvania, *St. Louis-San Francisco. (*Also won the Public Safety Activities Award for the year 1959.)

The Council asked for information concerning the following activities: off-the-job accident prevention program (employee and general public), type of program (traffic, home, school, employee), safety meetings (family, public, school), active in city-state safety work, signs of life program, other public safety projects, promotion through advertising and other media.

In practically every instance those who submitted an entry answered "yes" to each question.

The total number of meetings, signs of life material distributed, etc., by the railroads furnishing the information requested by the Council is listed below:

Kind of Meeting	Number	Attendance
Family Group Safety and Public	4,462	730,118
School Safety Meetings	2,658	1,481,232
Civic Clubs	444	24,312
Boy and Girl Scouts	1,225	65,015
Families & Children conducted through Safety Car County Fair Safety Exhibits (2 Railroads)	325	4,554
Tours of Railroad Property for children	912	36,457
Radio and TV Programs	75	?
Films loaned to Industry & Others Number of times shown and attendance	2,302	481,958
	12,383	3,057,466

Safety material such as signs of life pamphlets, posters, key chains, reflectorized auto bumper stickers, safety calendars, drinking cups and book matches with safety messages on them, distributed and used — totaled 1,537,990

Other Safety Activities	Number	Attendance
Employee safety meetings on-the-job in which off-the-job safety was stressed	88,846	4,842,300

Railroad Industry

Your committee noted with interest the following projects being undertaken by those railroads that submitted brochures to the Council:

Trespassing programs, talks to safety conferences, Boy Scouts, safety councils. Civic meetings, local and state safety conferences.

Public safety meetings, and work with other industry.

Maintenance of film libraries, safety instruction cars, and activities of operating and safety officers in local safety projects.

Good program of reporting grade crossing violations by school buses and gasoline transports.

Many other things were mentioned that help to promote safety both on and off the job.

The railroads that submitted brochures to the Council are to be commended for their safety programs. Your committee is confident that there are a number of other railroads with outstanding safety programs of their own but they did not furnish the Council with the information requested. We hope that each railroad will submit a resume of its safety activities to the Council for the year 1961 so the railroads may receive the credit they deserve for the safety work they are doing both on and off the job.

THE RELATIONSHIP BETWEEN SAFETY AND TRAINING

By T. L. HILDEBRAND
Safety Supervisor, Soo Line Railroad Co.
Minneapolis, Minn.

In its report to the American Association of Railroad Superintendents at the meeting in Chicago, June 6-7-8, 1961, Committee No. 5 gave a report called "Effective Safety Action." In this report, the committee decided that "It must originate with the supervisor, and, of course, the supervisor is management."

To further stress the point of the supervisor's job in safety, the following paragraph is quoted:

"The supervisor should have a clear understanding as to just what is expected of him; in other words, how to prepare reports, proper investigations, proper corrective action, proper minimum on-the-ground safety meetings required, and proper method of property inspection to uncover safety hazards, etc. and how to handle them for correction. We are attempting to stress that unless the supervisor is thoroughly versed on all phases

of a good sound safety program, there can be no effective safety action."

In this report, the record is silent as to who is going to train this supervisor; what type of training he should have; and with what materials he should be supplied. It is this aspect of training that I will discuss today.

It has been said "knowledge is power." Knowledge is power only when properly used.

If a supervisor is to be effective in any phase of his work, he must first be trained himself and then be able to teach others.

Since we start with the premise he must be trained, and must be trained to teach others—who is going to do the training?

In most organizations, the training is going to be assigned to the safety department. The officer in charge of this function will then have to decide how best to approach the job. In the smaller organizations, the job, probably, will be given to someone who is qualified either by experience or by having some of the personnel functions already assigned.

There are several ways open to management to train the trainers:

1. Many progressive companies feel that it pays to spend a little more money and are willing to send their people to a university or college for a period of time. This has the advantage of giving the person on-campus training in a concentrated period. The college has many resourceful people and can do a better job of teaching. The results from this kind of training have been excellent.

2. Many colleges have extension courses through their business service departments. Through these departments, they can supply teachers in a company to do a specified job, if there are enough people involved to make it worth while. The teaching can be done on campus or on the property of the company ordering the service. If the training is done on the property, the teacher can draw on the company for resource people. This method is less costly per man than the campus training, since the men would not have to have expenses paid while away from home. The latter method is one with which I am most familiar, having taken several courses this way.

3. In a place like Chicago, for example, the National Safety Council, through its many services, could set up a training course tailored to the needs of the railroads in the city. The course could be so set up that all railroads could take advantage of the training offered. This method has many things to recommend. The council could draw on the railroads involved for people in all fields to augment the staff of the council itself. This program could well be integrated with the other courses in safety direction that the council now gives. The cost to those railroads in and about Chicago would be reasonable.

For those who have limited budgets and want to do the job, there are many ways to do it. The National Safety Council has two home method courses which can be used effectively. All they need is someone who will spend the time to study the leaders' guides, which are supplied with the other material. If the directions are followed carefully, the course can be well presented.

The two courses I am talking about are:

1. Supervisor's Safety Manual—This consists of a hard-covered book which is divided into 12 chapters. Each chapter can be used in one discussion period for one hour. As stated before, a leader's guide is available for use with the book. The advantage of this item is that the employee has a book which he can use for reference if the occasion should arise.

2. The National Safety Council has recently put out another series of six pamphlets entitled "Men and Motives in Safety Supervision."

Should you choose either of these two courses, you probably will want to use some of your own materials to add to the value of the course. Both are good vehicles for safety training.

Now that we know how to go about getting the job done, the next question is—Whom do we train?

We should train men who have most of the training work to do when out on the job. These are the trainmasters, yardmasters, roadmasters, general foremen, and others at this level. Since these men are in constant contact with the other supervisor levels of the company, they are the logical

men for training others. These men have been chosen for their jobs, partly, because they are leaders. When we train these men, we increase their value to the company. They have an additional asset in that they know the job; its hazards; how it should be done; best method of doing the job; and know and understand the people with whom they work. There is no better place to start than at this level. These men must train the foremen under their jurisdiction, so they can take the program to the employees.

We now know how to teach, and we have suggested whom to teach. The next question is—What do we teach? I have a few suggestions. I know that, as I go along, you will have many more ideas of your own.

1. It is important that they know the company policy on safety before starting any training. How does the company feel about accident prevention? If a recommendation is made, will something be done about correcting the condition? Is the company really interested in suggestions from its people?

2. The trainers should know all about the term "accident." They should know what accidents are disabling, reportable, or just reported when a man is hurt and wants to go on record with the company. They should understand that we must consider all accidents in the prevention program. We cannot make a safe railroad if we count only the reportable accidents. When we cut the frequency, we will, naturally, cut the severity. They must be instructed in such a manner that all accidents are reported.

3. They must know how to investigate an accident. Too often we have been satisfied to find that someone has been careless and let it go at that. We have not taken the time to explore all the possibilities. An accident is not fully investigated until such a time as the following conditions have been checked:

a. The tool, machine, or type of equipment involved.

b. The type of accident or the manner in which the employee was injured. Did he fall; was he struck by a falling or flying object; caught between moving parts of a machine; or boarding or alighting from a car or locomotive? Was he injured setting a hand brake;

throwing a switch; coupling or uncoupling cars or engines? Just what was the thing which hurt him?

c. What was the condition of the tool, machine, or material being handled—the brake, the steps, the switch stand points, or rod? If a guard or some protection was provided, was it used?

d. The unsafe act of the employee. If the employee was guilty of an unsafe act, was it due to lack of knowledge? Did he disregard instructions? Was he thinking about something else when he was injured? What about his physical condition? We must analyze the whole make-up of the man so that we can do something about his education. If his health is not good, we can help him by suggesting that he see his own doctor or have him examined by the company surgeon. Many people do not know that they are not well. How is his eyesight? We must do a complete job.

4. They should learn the importance of good housekeeping. This should include how to make a good inspection, and, if suggestions are made, the importance of follow-up.

5. Since "no man is an island unto himself," they must be taught that it is important to correct conditions or circumstances which cause accidents. They must not only correct the conditions under their own jurisdiction but must transmit ideas to other areas of the company where a similar accident might occur, so that corrections can be made before an accident of the same type does occur. We learn from one another. It has been my experience that, if it had not been for many of the men sitting in this room, mine would have been a dismal record of accomplishment.

A good safety program must have good records. These records are only as good as the man receiving them and the way he interprets them. When the safety department sends out periodical reports, we expect that they will be clear and to the point. When we train our supervisors to be teachers, we should train them to use the reports we send them as tools to prevent accidents. We, as the safety people on the railroad, should do everything in our power to make the re-

parts clear, concise, and readable. We should endeavor to make them interesting. Last, but not least, we should give reports to these men so that they are enthused about them and will do something about running a safe operation.

We should teach them how to use the educational literature we send them. Posters should be hung carefully. They should be replaced regularly with fresh ones with a different theme. Posters and hand-outs are only as effective as they are used, and when and where they are used.

Our men who are being trained should be taught not only the three main facets of the safety program, "Engineering," "Education," and "Enforcement," but must add another big "E" for "Enthusiasm." A mediocre safety man with enthusiasm often will do a better job than one better equipped but who lacks enthusiasm. We can do much if we get excited about this safety idea. Without enthusiasm, we lose much of the drive to get the job done.

In talking about this program of training trainers, I know there are those who think that railroading is entirely different from other industries. I have been told this many times by the people in my own organization. Since I do not come out of a railroad background, I find this difficult to believe. I spent five years of my time with Employers Mutuals of Wausau as claim adjuster and claims manager.

In my experience adjusting workmen's

compensation claims, I had the opportunity of visiting many different types of industries. Each of these had some individual peculiarities, but, across the board, their problems have been the same. I have come to the conclusion that, with the exception of the fact that we put cars together and make trains of them, the accident causes run pretty much the same. We must orient our thinking to our problems instead of our peculiarities. We can lick our problems, and, when we do this, the differences disappear.

Whatever training course you decide on, you will have to tailor it somewhat to your own needs, but, in the main, the program that fits others can be made to fit the railroads.

The railroads have made great strides in the direction of safety. We cannot look back on past accomplishments—we must train for the future, if we are to make the gains in the future that have been made in the past. Our railroad economics are changing—more and more, we are accepting automation. We must educate our people in the latest methods of accident prevention and look to the future, so that we can meet further changes, which are sure to come.

Train for the future—train leaders who will think about things that are coming and who can take care of the present. Well trained supervisors and foremen pay dividends.

Knowledge is power, but only when properly directed.

RELATIONSHIP OF OPERATING RULES TO SAFETY RULES

By **WOODWARD B. BAUGH**

Gen. Supt. Transportation
Richmond, Fredericksburg & Potomac Railroad Co., Richmond, Va.

The relationship between operating rules and safety rules is very close, so close that, in fact, they "lovetail." To those who have made a study and have a thorough knowledge of the operating and safety rules, this fact can be truly appreciated. However, it is evident that a large number of our employees are not familiar with the relation-

ship, because we continue to have entirely too many accidents and personal injuries on our properties.

Through our operating rules, we learn the physical operation—how to go into a shipper's siding, move the loaded car, deliver it to the classification yard and through the proper lining of switches, proper sig-

nals and proper orders, deliver the car to its destination. Through the operating rules, we learn the hard, cold facts of railroading, which is the backbone of our nation, our economy and the first line of our national defense. Here, we are concerned with the mechanical functions only.

From our safety rules, we learn how to carry out the operating rules safely, or, in other words, to perform our respective duties without personal injury. Our good companies have spent an untold amount of money to provide us with the proper equipment, safe tools, compiling safety rule books, pamphlets, and arranging for safety meetings, demonstrations, etc., this being done with the thought of and desire to protecting us, their employees, from injuries or loss of life. This reflects the warm interest our management has in each of us. Here, we are concerned with the human function and here we find the true relationship between operating rules and safety rules.

Each operating rule has a historic background, based upon an operating failure in the past. When we have an operating failure, we usually have an accident. When we have an accident, it saps the strength of our employer, but, usually, money can replace the loss.

Each safety rule, also has a historic background, based upon many hours of misery. When we have a personal injury, this also saps the strength of our employer, but no replacement can ever be effected.

Many times, the subject of safety has been referred to as "old stuff," but so has eating, sleeping and breathing. For almost a thousand years, church bells have rung each Sabbath, to remind you and me to go to church. Religion has been preached to the people since the beginning of time. Still, we deem it necessary to continue preaching, day after day, so that salvation can be brought to our attention. There is no substitute for these things, or for the "old stuff" concerning safety.

No one objects to having a problem if it can be solved. But, one of the most frustrating experiences one can have is to be constantly faced with a condition that, although previously corrected, is continu-

ally recurring. Such is the problem about which we are talking.

I have observed, in attending many safety meetings and meetings of this nature, that supervisory and so-called "white collar" employees are predominantly in attendance. We attend, we have made a study, we have prepared ourselves.

Some years ago, I had two buddies who were ministerial students. One of them completed his education and was ordained and assigned a church. We were very close. He confided in me quite a bit. I remember, one Sabbath morning, after the services, we were seated at the front of the church. The congregation had gone. He said, "There is one thing that gives me a lot of concern. I'm wondering if it isn't true that too often the melodious tones of this huge organ, the beautiful hymns from the hymnal, the reading of the Scripture of God's Word, and my feeble efforts to deliver the true Gospel stop at that door." He said, "As I look about the congregation, I know that they have heard the truth, most of them have seen the light and accepted salvation, but my concern is how far does my message get beyond that door?"

I'm thinking the same thing. We have a nice meeting, a splendid spirit of fellowship, we know what we are dealing with, but I, too, am wondering if it doesn't too often stop at that door. Does the work stop here, or are we delivering the message where it rightfully belongs?

Mr. Khrushchev made a statement, a few days ago, that intrigued me somewhat, and I might say that this is the first time he has made a comment or statement that I felt was worthy of consideration. Just recently, Mr. Khrushchev said, and I quote, "No Communist has a right to be an onlooker." Couldn't we apply this thinking to our subject this afternoon? Couldn't we say, "No railroad safety worker has a right to be an onlooker?"

I once heard a supervisory employee say that he did not have the necessary qualifications, that he didn't know the proper approach. This reminds me of the popular song of just a few years ago, "It's What You Do With What You've Got." If you would just have the initiative to approach the employee on the job who is violating

a safety rule, correct him, show him the proper way, and thereby, possibly, prevent his being injured or having a fatal accident, you would accomplish far more than the man who knows, who has the ability and qualifications, but stands by and permits these things to happen.

I am wondering just how many of us, more especially yardmasters, have turned our backs when we saw a trainman adjusting a drawbar, knuckle, or lock pin between moving cars, or a trainman standing in the track to board an approaching engine, or a man cutting cars down the ladder too fast for the "rider," or how many of you shop foremen have witnessed men working at a drill press, lathe or welding job, without their safety goggles. These and many others, too numerous to mention, are violations of the safety rules, but we turn our backs, simply because we thought we might be advancing the job slightly.

I also wonder how many of us have given real thought to the seriousness of this thing, of its far-reaching effect, how it may affect that which is most sacred to him, that for which he has striven and worked, his home, his castle; how it could even mean the loss of the home, his life savings, or how it may affect the family, perhaps, necessitating the wife, the mother, having to go into the business world, leaving the children, his loved ones, with relatives or neighbors, and it could mean having to place them as wards of the state, making them orphans. I shall never forget a safety poster which I saw a few years ago, on our property. There was the picture of a small child, a little girl of five or six years of age, with out-stretched arms, and it was worded: "Take care of my Daddy, he is the only one I have."

What are we going to do about it?

I believe it was Ruskin who said, "What we think or what we know or what we believe in is, in the end, of little consequence: the only thing of consequence is what we do."

We know there are only two things that cause personal injuries, namely, defective equipment and safety rule violations. We know that statistics have proved that injuries attributable to defective equipment have been few, so it seems that this gen-

eral situation calls for greater efforts to instruct, train and know the weakness of each man on the job. The knowledge of how to do things safely is gained by experience properly directed. It simply means that we must educate all of these employees. Our men are not different from those in other fields.

You ask if you are your brother's keeper. Our companies have seen fit to appoint a number of us to supervisory positions, not only to see that the job is done properly but, also, to protect our men, and to see that the job is done safely. So, we are, in a sense, indeed, "our brother's keeper." He may, or may not, have read the safety rule book; we require him to have a copy of the safety rule book but how many of us require an examination on the safety rule book? Some weeks ago, I was walking over our freight yards with the terminal trainmaster, and we observed a yard conductor, an employee with 17 years' experience, walking from one side of the yard to the other, and frankly, I don't believe he failed to step on a rail over the entire 31 tracks.

Now, you may think this is a minor violation to use as an illustration, but, it ceases to be a minor violation when 31.1 per cent of the total personal injuries on our property, during the year 1960, were attributed to insecure footing. This violation was promptly brought to the attention of the yardmaster, who went directly to this employee and corrected him on the scene.

The following night, I attended a meeting and when I entered the auditorium, I was met by this employee, who informed me that he was very much embarrassed, the previous day. I concluded that I knew what he was referring to, and I told him that he had no reason to be embarrassed, he had a copy of the safety rule book and the rule was in the book. He replied, "Yes, I have a copy of the safety rule book, and I have read the book from cover to cover, but, frankly, I have forgotten a good portion of what I have read. Now that I have been corrected on the ground, I can assure you that I will never be guilty again."

May I emphasize to you supervisory people that far more can be accomplished on

the ground, at the scene, not only in getting the job done, but also, in getting it done safely, than can ever be accomplished with bulletins, letters, telephone calls, etc.

We must take the message back to the property, on the ground, where it rightfully belongs. We just can't continue to attend meetings, such as this, study, prepare and train ourselves, and then selfishly keep it within ourselves. We must take it on the property. We have fallen down on the job, have neglected our duties. Lend a hand to the employee who isn't here, instruct him, correct him, and if he should be one who doesn't seem to give a "Continental damn," then reprimand him.

The question has been asked about the habitual violator. I know of but one answer. Call him into the office, on the carpet, so to speak, and straighten him out. We've had such cases on our property, and this procedure has proved to be effective.

Next Thursday night, on the occasion of our annual RFP Family Safety Program, as the leader of the Transportation team of

the railroad, I am to be the happy recipient of the National Safety Council Award of Honor. Our Transportation Department worked almost a million man hours, 831,781 to be exact, during the year, 1960, without a reportable injury. We understand this is a singular honor for a railroad transportation department, and we, as a team, are, indeed, proud of this honor. I am satisfied this record would not have been accomplished but for the diligent efforts of our supervisory people on the ground. For example, in addition to our regular monthly safety meetings for all crafts, we have a regular monthly safety meeting for our yard operating people and our trainmaster or one of his staff has a regular monthly safety meeting for our road service people. These meetings are conducted around the clock, in a small building equipped for the purpose with a meeting for each individual crew called. The crews are called 15 minutes earlier than actually needed and the time is allotted to a discussion of previous accidents, picture slides, short talks and safety suggestions.

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SCHOOL & COLLEGE SESSIONS

SAFETY — FOR WHAT?

The Gordon Graham Memorial Lecture

By DR. S. M. BROWNELL
Superintendent of Public Schools, Detroit, Mich.

Living is precarious. It always has been. It probably always will be. There are constant forces and circumstances—natural and artificial—which may endanger the life and safety of individuals. One of the great concerns of man through the ages has been to reduce the hazards which would hurt, harm or kill individuals. As civilization has progressed this process of safeguarding the physical well-being of mankind so that his living would be more safe has become organized as safety programs and safety education.

It was Gordon Graham who provided leadership in school safety in Detroit for many years. The influence of his constructive work extended far beyond Detroit. As one who called upon him for advice when I was in a school district neighbor to Detroit and who now sees day by day the fruits of his work since I now am superintendent of the Detroit public schools, I welcome this opportunity to pay tribute to Gordon Graham and commend those who recall and extend his influence through the Gordon Graham lecture.

As I have reviewed some of the materials from your previous sessions and the excellent volume "Safety in the 60's" I realize that I am an amateur amongst a group of pros. For me to try to present to you information on safety and safety education would be presumptuous. But perhaps I can raise some questions in your mind and can help to set our concern for safety education in the broad perspective of education by asking—*Safety for What?*

Why do we want persons to be safe? I presume most of us would answer safety in order that they will be spared pain and discomfort; that they will be economically more productive; that they will contribute more to the well-being of others and make living more worthwhile for all. We could

generally subscribe to each of these as valid reasons.

When I grew up many of us joined the Army to make the world safe for democracy. Our concern was not for physical safety but safety for the values which to us were more precious to life than mere physical safety.

How much progress have we made in safety education for advancing individual freedom and responsibility since that time? I should like to address my remarks to some of the problems of safety of our ideas and our ideals as they are challenged today by Soviet education. I should like to consider some of the problems facing our schools today as we face that same problem of making this world safe for the ideas and ideals that "brought forth upon this continent a new nation conceived in liberty and dedicated to the proposition that all men are created equal." This education is challenged today by Soviet education, and of what profit is education for physical safety which fails to safeguard and strengthen the safety of that which makes the difference between existence under communism and living under the freedoms of constitutional democracy.

You and I probably should assume that the education which brought to us our strong convictions about the importance of making safe in the world human freedoms would bring the same convictions to those who followed us in the same educational pattern.

What is it, then, that makes some people today worry lest the youth of today will be less convinced, less willing to believe in freedom, to understand the consequences of loss of freedom than we were when we were their age? Do we have less faith in them as persons? Do we have less faith in our schools? Do we distrust the education of American democracy? Or, are there

things about Communism and Communist education more appealing to this generation than to us as we grew up?

I think the answer to the first question is "No." We still have faith in youth, in schools, and in American democracy. At the same time we feel that conditions today call for youth to know more about Communism than their parents did and to understand better what American democracy means to them. Our problem is a tough one because we are trying to get them at their age as concerned about the perils of Communism and as aware of the values of American democracy as adults are with added maturity and experience.

One of the fallacies which exists in the thinking of many is that people react to the same information in the same way. They believe that if we expose them to the same materials and ideas the same learnings will result. They believe that what impresses and excites them will do the same for others. We, as adults, wonder why young people aren't concerned about conditions, facts, information which concern us. They, in turn, wonder why we aren't interested in what interests them.

Any article in the paper on schools or education I never read. My son, an electrical engineer, reads the same paper and may miss those items, but sees items on electronics that I didn't notice. My son-in-law, a psychiatrist, picks from the same paper items on the behavior of criminals, politicians, movie celebrities, or others which have a relevance to him that my son and I had not noticed. And when my wife and daughter have finished the same paper they can tell you about new fashion notes or sales that none of us men realized were in that paper. All of them will have a wonderful laugh together about *Peanuts* or *Pogo*, and I failed to even recognize such characters existed.

How, then, can we hope to get all pupils to believe in American democracy and to want it more than Communism? Are there some things about Communist education which make it especially effective? Should we pattern American education after what is taught in Russia?

I know very little about Russian education. I've never been there. But I have read about it. I have discussed it with educators

who have observed it. I have attended international conferences which included Russian educators, and have conferred with Russian educators about education in the United States and Russia.

There are a few conclusions I have gained as a result:

1. *One great strength in Russian education is the importance which the Russian government, parents and pupils attach to education.* Each reinforces the other. This commitment to education is characteristic of other Soviet countries, including the Red Chinese. It is otherwise notable in the emerging nations that are not Communist.

Education is recognized almost universally today as essential for the development and progress of any country. This is a new factor in the world which may turn out to be as important to our future as the spread of nuclear energy and development of space travel to all ends of the earth. We have not as great a relative commitment to education in the U.S.A. as is true in the Soviets and in other emerging nations.

2. *Education is what makes the difference between an uncivilized and a civilized person.* That difference for a person takes place within his lifetime. We are all born uncivilized. There is no difference that researchers have been able to discover in the innate ability of babies born today from those born hundreds of years ago or in one part of the world from another. There is about the same distribution of ability to learn in all races. Some learn fast and some learn slow in every race.

If you were to pick up 1,000 babies in a United States city and exchange them with 1,000 babies in Russia, or China or the Congo, the chances are pretty good that the 1,000 United States babies thus exchanged would grow up as typical Russians, Chinese or Congolese youth. The babies from Russia, China, and the Congo would become typical United States teenagers. How civilized each generation will be is thus dependent upon the education of that generation.

3. *We are faced quite suddenly with a commitment by Russia, by China, by India, and all of the new nations that all of their children shall be educated.* This commitment is shared by the Arabs, our Latin American neighbors, the European nations

which heretofore have been highly selective in those who should receive education beyond elementary levels. I saw this pressure for extension of education in 1954 when I represented the United States at the UNESCO Conference in Montevideo. I was greatly impressed by the spread and advance of this commitment to the principle of education for all which has been made in six years when a year ago this past summer I served as chairman of the United States delegation to the International Conference on Education in Geneva. In this meeting we had the official reports of the ministries of education of more than 70 nations. Here we had the facts and figures on what national governments were doing to support and to extend education. The evidence is clear that Russia, all the Soviet countries and all of the new nations count on having an educated citizenry as rapidly as possible. They are committing whatever funds and manpower resources are necessary to accomplish this purpose. They are making remarkable progress.

4. *The Russians face the same basic problems in education that we do.* They are dealing with human beings, just as we are. The same fundamental laws of growth and development hold there as here. Young children have hurts and pleasures, are squirming, are ambitious, get tired and have remarkable recuperative power, are inquisitive, learn and forget just as do United States children. It takes the same number of months for them to be born and for them to become adolescent. Their educators are concerned about what to teach, when to teach it, how to organize instructional materials, and how to divide up the 24 hours to gain the most effective learning. These decisions, however, are made in the Central Ministry, rather than locally for the most part. This is true in most nations other than the United States.

They are concerned about the fact that not enough of their young people want to use their schooling to produce the goods and materials they need. They want to increase the efficiency of their instruction and have better teachers, just as we do. They raised more questions at Geneva about our co-operative vocational program, our vocational technical education and our use of television in teaching than about other parts of our educational system. They want to

learn from our experience. We would be well advised to see what we can learn from them. To put these conclusions in another way, we should never forget that the education of each child, wherever he is born, must start at scratch. You can inherit the ability to learn. You cannot inherit education. This is what makes it extremely important that the educational program be maintained at a high level continuously. There is much more in common about education in all nations than there is difference—but, as is true in comparing the similarities and differences between men and women—how important these differences are to us!

One of the important differences in United States and Soviet education, and one which troubles me because as yet I do not see that we are making any progress toward lessening the difference, lies in our failure to arrive at common understandings with them on how to guide conduct. Until they and we accept in common a belief in the value of individuals as creatures of God, what firm base have we upon which to rely for moral behavior, for faith and for confidence in each other?

I think that because of our difference in basic principles and our abhorrence for what the Soviet government seems to countenance or inspire, we sometimes credit to communism accomplishments or behavior beyond what it deserves.

Not all persons who dislike the United States or who do not believe in capitalism are communists, and yet some persons give the impression that anyone who questions practices in the United States or who disagrees with their ideas is a Communist. Some of the ruthlessness and intrigue which we associate with Communist Russia appears very similar to practices under the czarist regime. Some of the economic and industrial progress in Russia is paralleled in non-communist nations. So it is that I think we must ever be on guard against attaching the Communist label indiscriminately to troublemakers or to ideas disagreeable to us. Nor should we give Communism credit for all of the progress made where Communism controls.

There are other differences between United States and Communist education. Communist education is totalitarian. From its beginning and continuously throughout the education of youth the principles, doctrines and beliefs of Lenin and Stalin are taught and empha-

sized. Furthermore, as I recently heard Dr. T. H. E. Chen, of U.S.C. explain Red Chinese education, school instruction is coordinated with total political and all other forms of contemporary activity. When the government has a "Hate America" week schools at all levels and the press, radio, theatre, museums and political speeches are all geared to this theme. Demonstrations accompany exposition of ideas. It is a case of seeing that action and ideas are synchronized. This is a great difference between totalitarian education and education in these United States.

I don't know how successful totalitarian Communist education will be in the long run, or how consistent it is actually in its basic practice. But I do know that it is in accord with some of the fundamentals of learning that the effectiveness of learning is increased as it is reinforced by experience. Perhaps when we wonder why we are not more effective we should examine how we reinforce what we teach in our schools.

Now let me turn to the problems of preparing American youth to meet the challenge of Communism. It may be well to ask ourselves what are the reasons that might make American youth believe in Communism or any other "ism." I shall mention four and comment at some length on the fourth possibility.

1. *They might be dissatisfied with what they have.* This is possible under any form of government. We recognize it in our common saying that grass is always greener on the other side of the fence. It is a characteristic of youth—even Communist youth—unless they are made to see, understand and to believe that what they have is the best. The effectiveness with which this can be done is demonstrated by the loyalties developed by colleges and service academies to those institutions. But even in these institutions we have campus leaders who are sure that changes are needed in what is done, or how it is done. This is particularly noticed about this time of year.

2. *They might not see the dangers of what is made attractive to them.* Inexperience and curiosity are just as much an aid to bad learning as to good learning. Many a college youth of ability has found himself outside of the college gates because non-scholastic activities were made to seem more attractive than his studies. He didn't

see until too late the dangers of pursuing these activities. Dialectic materialism can have an attraction in many persons who may look upon it only as an interesting idea, and who fail also to see how it is used. What you and I call maturity is usually the result of experience in which the individual has had the chance to make decisions of importance to him and to others. From the responsibilities he has had grow his recognition of what is involved in making choices that affect him and others. Without experience of this nature the dangers may be overlooked and disregarded.

3. *They might have been frustrated in attaining and in the prospects of attaining what seems important to them.*

There are many things which young persons consider important. They want some money that they can call their own and the chance to decide how they shall spend it. They want the independence from their home which is associated with a job. One of the effective procedures of communists and the organizers of other "isms" is to give those who have not been recognized by their peers a mission to accomplish. It is a way to gain their loyalty and support because it satisfies their desire to feel that they count for something as a person.

4. *They might feel that what they have been taught is not very important or that it is not true because what they observe in life does not square with the teaching.*

This is the reason that I wish to discuss at some length. If we teach them that democracy is important to human progress we need to show not only the progress of individuals in freedom and justice in the Western World, but also to show what has happened under Communism. We have a good record to match in this respect and we need to display it effectively. This is a task appropriate for schools. At the same time, if we are to be effective, we also need to have current practice which squares with what we teach.

Let me examine for a few moments some of the problems we face in this respect. What do young people see and read about today that does not square with what they are taught in school about democracy? They see and hear about:

1. Persons in leadership positions in government, business, industry, entertain-

ment, or labor who violate moral or civil laws, and exploit others in order to gain for themselves privileges, power or prestige. They see this condoned by many adults, publicized in the press, and glamorized by movies and television.

2. Persons of lesser education and competence being selected for jobs because of their race or religion or their connections, rather than upon their competence.

3. Persons barred from living in sections of a city because of their color or their nationality or their religion.

4. Persons not eligible to attend tax supported schools, to eat at public lunch counters, or to ride on public conveyances because of their color.

5. Individuals in the United States deprived of voting because of their color.

6. Labor unions which have no members of certain racial or religious groups.

7. Unemployment so lopsided in reference to the per cent of colored and white in the population of the area as to make it clear that the odds of this being merely a coincidence are far greater than chance.

These are things they see and know from experience. If they have been taught well to make judgments based upon evidence, I ask you how effective do you think the schools can be in instilling a firm belief that the principles of American democracy are what we say they are, that they are important to the individual, and that the freedom of American democracy is as precious as we teachers try to make them believe?

There is another aspect of the problem of making what we teach about the importance of American democracy as effective as we would like to have it in our schools.

We pride ourselves on individual initiative and upon our freedom to solve problems by private enterprise or on a local basis, without having to wait for the state or the Federal government to solve them.

Let us take a look at what our teachers see—the ones we depend upon to teach how much better is American democracy than Communism. They see in my state, and in many others, that a city which wants good schools has almost insuperable odds. Local support has been limited by state law or by

the state constitution to one form of taxation—property tax. Business and industrial leaders who want the best schools for their children have moved from the city and sent their children to more adequately supported suburban schools or to privately supported schools. At the same time the representatives of their business or industry, working with the legislative representatives, help to pass constitutional limitations on the property tax rate and against measures to open up other sources of taxation to local school support for the cities they have left.

I am as sure as can be that many of these fine, public-spirited men who speak often about the need for better quality education do not realize that more effective than their words are the activities of their company representatives in preventing increased local support for schools. This is also true at the state level. These same forces are at work to prevent additional state funds for schools. All of us here are concerned because we do not have more effective teachers and teaching, especially about the values of American life as compared with Communism. But when a professionally trained teacher, who has much preparation for his job, and who has the responsibility for helping young people to gain the knowledge, the skill, the insight, the ambition and the value judgments that will guide wisely or unwisely business, industry, family fortune and government ten years from now, can expect to gain a maximum income of even to eight thousand dollars after 15 to 30 years of devoted service, what can you and I expect?

It can't make very good sense to them to hear the leaders of business and industry saying we must have better schools, and then paying their often relatively untrained legislative agents who work against school support at local and state levels more than they make it possible to pay the best prepared, ablest, most dedicated teachers. This is a situation which I regret to say can be found in nearly every state to some extent.

Eight years ago I took a federal job as Commissioner of Education. In the session of the Congress immediately following my taking office, a bill was passed which I had recommended and which became a part of the administrative legislative program. It authorized a White House Conference on Education to follow upon conferences on

education in each state and in localities. These conferences were designed to give grass roots consideration to education needs of the locality and state so that there could be developed programs to remove roadblocks to local and state educational progress. The White House Conference was to give a chance for the local and state leaders from each state to share their ideas and thus to speed up efforts to improve schooling. This was prior to sputnik and the emphasis on Russian educational progress.

As I survey what has happened since that time I am convinced that the investment of money and effort in that White House Conference program has paid good dividends in arousing interest and action to improve education in this nation. The most disappointing development, however, is that states have not removed the legislative and constitutional roadblocks to local and state school support. The result is that if cities and towns are to do what schools must do, if youth are to compete with Communist-prepared youth in this world, they are forced to look to the only other tax collector there is—the federal government.

We are thus faced with the age-old dilemma of having to decide whether we will eat our cake or save it. Our cake is the perpetuation of a strong faith in individual freedom and American democracy. We can save it if we have adequate and competent education of youth. We can't have adequate and competent education without paying more for it than at present. This has been repeatedly documented by study after study by all kinds of individuals and groups.

It will cost money, much more money than we are now paying to provide enough well-prepared teachers and give them the working conditions they need to do the job you and I believe needs to be done. In other areas of our life we have spent the money and made the progress. Look at the investment in hospitals, drugs, x-rays, specialized equipment and auxiliary staff we provide each doctor and dentist today to treat us on physical problems that are far less complex to diagnose and treat than are the problems of diagnosing and treating Jolynn's difficulties in learning to read, to spell, to write, to do arithmetic problems, and to make sense out of the problem of our contemporary civilization. Look at the office equipment and the air conditioned

offices and the skilled consultant and research service you provide in your business and industry to make it able to survive and keep ahead of Communist business and industry. Look at the investment in scientists, researchers, technicians and material to develop weapons of defense against Communist aggression that would take away our American system of values.

Then take a look at schools on a comparative basis. You probably can go back to the school building you attended and maybe even the same school desk. The teacher will probably be a different one, a person with two to six more years of specialized education than your teacher had. The texts and the curriculum will have changed a good deal. But the teacher and pupils will not have much better working conditions, nor anything like the specialized help that has been provided to make medicine, dentistry, defense, agriculture, business and industry meet the competition of Communism. If we are to compete in education we have to provide more adequately for education besides just information about communism and democracy.

If we are to make young people convinced that we really believe in American democracy, there are other ways in which we need to bring our practices more closely in harmony with our preachings. We cannot expect the millennium, but if what we say is to be accepted by youth they must at least be able to see that we are making steady progress in the direction we point as our goal. This we must do locally, statewide, and nationally if we are to convince young people that American ideals are more than pie in the sky and are worth preserving.

One of the things we preach in school and out is that every citizen should contribute his share to the economic strength of this nation. We expect that every boy or girl who goes to school should become able to be a productive worker and a taxpayer. He will some time be expected to enter the world of work to make a contribution at some level. Increasingly and very rapidly the levels of necessary preparation for entrance to employment and success as a worker have increased. Unskilled and lower skilled jobs are decreasing. Skilled and specialized job needs are increasing proportionately. This is true in service fields as well as production jobs.

It follows that if limited ability persons are to be economically productive, rather than economically dependent, we must use them in the available unskilled jobs. Persons able to enter and hold lower skill or skilled jobs must be prepared for and enter jobs at this level rather than allowed to enter and remain in unskilled jobs. And so it goes for the whole range of employment—it we are really to utilize effectively all levels of jobs. We cannot afford the luxury of unemployed unskilled labor and shortages of highly skilled personnel because we have let able youth be satisfied to take unskilled jobs when they had the ability with more preparation to become highly skilled and technically prepared. In other words, we have to upgrade school preparation at all levels and see that all talent is discovered and developed more effectively than present. We have to do it by wise instruction, counsel and guidance of teachers and parents because we don't believe in the totalitarian scheme of forced placement. Then when these young people are prepared we have to make it possible for them to enter the work force.

Today in our cities we are sending from our schools and colleges thousands of young men and women who find the world is not a world of work but a world of unemployment. They have the energy and ambition of youth. They have been taught that this is the land of opportunity. They want to be doing something constructive, to be considered important, to have the independence that comes with employment and income. If they are left unemployed, how long will it be before they are unemployed because of the habits and attitudes they develop? How likely are they to hold fast to the teaching of the values of democracy as against the promises of Communism or some other "ism"? There are thousands of these young people in our great cities. They are our great hope or our great threat for the future.

One of the great challenges of the Soviet to American education seems to me to be, to see if we can find for American youth a bridge from school preparation to membership in the world of work other than through a Soviet type compulsory labor force or through compulsory military service. Let me suggest that one possibility lies beyond our present vocational courses in schools, guidance

and counseling, job upgrading and other programs, work camps for delinquents and other constructive measures. It is one which some of us have discussed because it seems to be one that could be operated locally on a state basis, or nationally. It could be expanded or contracted as the supply of jobs fluctuated. It would recognize that most of the young people today reside in and are going to live and work in urban areas. The program has been called "An Urban Service Corps." I shall not take the time to spell out what is proposed, but I feel confident that if youth can see that they have a place in the work force of the nation they will be much less vulnerable to Communist propaganda than if they are idle.

So, if we are to maintain and advance the safety of freedoms for individuals we must meet the challenge of Soviet education to American education through greater understanding of Communism by American teachers and youth. In the schools, through systematic study of constitutional democracy and of communism, young people need to be made fully aware how the striving of mankind for a better life has prospered and is more possible under constitutional democracy than under any form of totalitarianism. But if this teaching is to be effective it calls for operation of our society so that it is consistent with the promises of democracy. Significantly increased financial support of schools is essential so that education at all levels can compete effectively with Soviet education. So, also, it is necessary that all American youth be able to count on entering the world of work and contributing their share to the economic strength of the nation.

As I look ahead in this world I see little chance for life that is meaningful and significant to be other than insecure and dangerous. We are developing with great rapidity new and stupendous possibilities for devastating destruction and crippling of the human body and mind. It seems inevitable that man will unlock with greater ease the forces that will take him to all parts of this earth and into space with increased speed or which will send anywhere powerful and sophisticated weapons designed to destroy, maim or paralyze mankind. It seems certain that the greater numbers of mankind, living closer together as they must, will find that survival increasingly depends

upon development of personal reactions, group procedures and careful instruction for protection and safety.

I am glad that you are carrying forward the objectives set forth by Gordon Graham to protect individuals from unnecessary hazards and from needless injury or death.

This concern for the dignity and the preciousness of each human being we need to make clear to American youth today. The physical safety of the individual is of little significance unless we also make safe the freedom and sanctity of the human mind and soul under God.

SCHOOL TRANSPORTATION

Presiding: JOHN M. PARSONS, Supvr. of Transportation, State Dept. of Education, Columbus, Ohio

Discussion leader: IVAN L. ELAND, Dir. of Safety Education, Iowa State Teacher's College, Cedar Falls, Iowa

Recorder: T. F. RHOTON, Supvr. of Pupil Transportation, State Dept. of Education, Nashville, Tenn.

Subjects of interest, suggested by members present:

1. Should pupils leave the bus by passing in front of the vehicle or by passing to the rear?

2. Problems of transporting mentally or physically handicapped pupils.

3. School bus evacuation in case of accident.

4. Accidents which happen because a school bus is stopped, loading or unloading.

5. Standards for employment of bus drivers, and what are the reasons drivers are dismissed?

6. Transportation of parochial school pupils.

7. Training of bus drivers.

8. How far are pupils expected to walk to school or to catch a school bus?

9. Loading or unloading problems on one-way streets.

10. Special license demanded for bus drivers?

11. Use of student control lights for loading or unloading.

12. Problem of school bus stops in cities, resulting in traffic jams.

13. Support given bus drivers by school officials in court.

14. Use of seat belts in school buses.

15. Number of pupils transported and accounting for afternoon load.

16. Pre-bus safety drill required by law?

17. When is a supervisor for pupil transportation needed?

Discussion by topics:

1. The general belief is that pupils should go in front of the bus in loading or unloading because (a) the driver can better supervise pupils entering or leaving the bus, (b) fewer accidents happen when pupils go in front of the bus, and (c) drivers of other vehicles have become familiar with pupils using the front of the bus in most sections of the country.

2. We are obligated to transport mentally or physically handicapped pupils with public funds. Special buses constructed for easy loading of wheel chairs or those on crutches are recommended. Parents should assume more responsibility for getting handicapped pupils to and from the bus. Safety belts and other special safety measures should be used on buses for the handicapped. A supervisor and/or a nurse, in some cases, has proven most helpful with handicapped pupils while riding buses. A special driver, well trained to handle such pupils, is recommended.

3. Some training in evacuation of buses is needed in case of accident. The training can be given with the bus parked on the school ground. Extreme care is to be used if drills take place on the highway. A few systems train a student to stop the bus and activate bus signals in case the driver be-

comes ill or is hurt so seriously that he cannot perform his duties.

4. There seems to be little information on the numbers of accidents caused by buses being stopped to load or unload pupils. Many such accidents could be avoided by selecting safer stopping locations, where buses could be seen for greater distances. Better use of stop signals will help prevent accidents caused by stopped school buses.

5. Some areas have special tests or requirements which have to be met before drivers are employed to operate school buses. Special tests given by the state safety department, physical examinations, special school bus driving schools, local check on moral character together with fingerprinting, running of drivers by local school boards or representatives, and minimum and maximum age limits are some of the devices used to check ability of proposed bus drivers.

Dismissal of drivers may occur under any of the following heads: violation of traffic laws, one chargeable accident, attainment of a certain age limit, except in those areas where there is no such limit.

6. Transportation of parochial school pupils is practiced in some areas at public expense, under any of the following conditions: where they live on the bus route, when their riding will not overload the bus, in cases where regular runs are made to such schools, and where local or state funds are specifically earmarked for such transportation.

7. Interest is increasing in driver training for school bus drivers. Some areas require the training before employment. In other areas, on the job driver training is required from once a year to once in three years.

The training is received from one of several sources: representatives from state

departments of education, special courses conducted in state schools, local supervisors of pupil transportation using driver education instructors in the program, in which the training ranges from classroom instruction to a combination of classroom and behind-the-wheel activities.

8. It appears that school bus service ranges from front door loading to a walking distance of two miles. The trend is to offer more service to pupils in traffic hazard areas, regardless of distance to a school or to a regular bus line. State approval is required in some areas for reducing the regular walking distance. More attention is being given to selection of safe school bus stops and increasing the distance between stops in congested areas.

The lack of time prevented a full discussion of the other topics.

The question was raised, in closing, of how many buses must be in operation before a pupil transportation supervisor can be justified.

It depends on: the number of miles covered, the number of runs made by each bus, and the number of pupils being transported.

It was suggested that a fleet of fifteen vehicles would justify a transportation supervisor.

Another question was raised in regard to loading and unloading from the rear of the bus when the vehicle was stopped on the left side of a one-way street. The general opinion was that the bus should park on the right side of the street and load and unload in the regular manner.

The pupil is accustomed to right front door use with pupils going in front of the bus. Special doors would be required for rear service, thereby increasing the cost of vehicles.

EMPLOYEE SAFETY

Presiding: IVAN J. STEHMAN, Coordinator, Highway Safety Education, State Department of Public Instruction, Harrisburg, Pa.
Discussion Leader: LESTER L. WASSERBURGER, Supervisor, Employees' Safety and Accident Prevention Unit, Safety Section, Los Angeles City Schools
Recorder: H. JAMES ROKUSEK, Teacher, Montgomery County Schools, Rockville, Md.

Mr. Stehman asked Mr. Wasserburger to briefly describe and provide background information on the topic in question. After this had been accomplished Mr. Stehman asked that the group conduct an informal question and answer period on employee safety and that the remaining time be devoted to this action.

The first portion of the question-answer period was devoted to the organizational plan used by various states, and particularly California, in determining the responsibility and authority of the various departments concerned with safety. Both the Los Angeles plan and the Chicago plan were diagrammed on the chalkboard and compared.

The question of policy forming also came up during this time and Mr. Wasserburger responded to this item by stating that recommendations are made by his department to the head of each department concerned with an accident. Once the department receives this recommendation, it is necessary for them to take some action with a copy of their directive sent back to the safety director.

The second portion of this meeting was concerned with employee accident reports. Mr. Wasserburger encouraged all persons in attendance who had this responsibility for employee safety to procure a copy of every employee accident report and to analyze these accidents in several ways.

Through analyzing these accidents it is possible to call them to the attention of school officials, and to make recommendations to various department heads in all phases of the educational program. The question of standardized accident report forms was brought to the attention of the group and most people in attendance indicated that they used the standard accident report form prepared and distributed by the National Safety Council.

In the matter of reporting employee accidents, as well as reporting student accidents, Mr. Wasserburger strongly emphasized that it is necessary for the safety director to convince or attempt to convince school administrators to set up a formal procedure in handling accidents and in recording accidents. His next point was that once this convincing had taken effect responsibility has to be established for employee safety.

Although this session was primarily designed to consider the topic of employee safety, several questions were asked relative to student accidents. The question of treatment of pupil injuries was given some consideration in addition to the question of student accident insurance.

The third and last portion of this meeting was concerned with some of the procedures used by industry in dealing with the safety of employees. Two procedures used by industry for dealing with this problem were brought to the group's attention and seemed to be applicable to school plant operation.

One procedure concerned the matter of recording and analyzing employee accidents. By using the three words "Material", "Action" and "Accident" as heads for three columns, an industrial representative explained how all accidents might be recorded and analyzed. Through this method safety directors can spot major problems and causes of accidents.

The second procedure identified was concerned with a foreman accident prevention program. Through this procedure a conference between the safety director, general foreman, plant manager and perhaps another administrative official would be scheduled by the safety director after each accident occurred. During this session questions such as "What happened?", "Why did it happen?", and "What action can be taken to avert a similar accident?" would be

discussed. It was brought out that most foremen do not particularly enjoy appearing before the plant manager for this type of conference, and that it seems to indicate an area of weakness in his section.

Thus, this procedure if handled properly can help to prevent accidents and to better insure that the foremen will have day-to-day contact with his men on safety problems and issues.

WHAT YOU DON'T KNOW CAN HURT YOU

By A. F. SCHAPLOWSKY
 Education Consultant, Div. of Accident Prevention
 Public Health Service, Washington, D. C.

When your public health department studies those community problems which are affecting its health and well being, accidental injuries and deaths always appear as a major problem. The health officer determines the relative importance of various community health conditions by comparing the number of premature deaths, cases of disability and the amount of lost productivity which they cause.

Accidents continue to be the leading cause of death for individuals in this country between the ages of 1 and 35 years and the fourth leading cause when all ages are considered. The National Health Survey also tells us that each year 10 million people in this country incur a bed-disabling accidental injury and 1.7 million of these are hospitalized. We are told these disabilities result in the annual loss of over 107 million workdays. You can rapidly calculate that this is equivalent to the absence of over 400,000 men from our work force everyday.

Today we are at a time in our country's history when every resource, human or material, is vitally needed and therefore, those measures essential to conserve these resources have a special urgency. We cannot continue to afford human losses among our promising young people nor among men and women of age and experience.

All of you know as well as I that accidents can be prevented by bringing about changes in man's environment and in his behavior. Most of us in this room are more concerned with changes in his behavior. We know that behavior may be changed as a result of an increase in man's knowledge, improvement in his skills or modification of

his attitudes. We also know that lack of knowledge affects attitudes and beliefs.

In accident prevention we are faced with some of the same thinking that public health and medicine faced with the communicable diseases not too many years ago. Before the causes for various diseases were known, people blamed sickness upon evil spirits or bad air or some other superstitious belief. It was only after specific causes for these diseases were discovered and understood by the people that these beliefs were largely dispelled. Today since the causes of accidents are not generally known, people blame them on luck or chance. As more specific information about the causes of various kinds of accidents become known and are understood these beliefs will also change.

In traffic many accidents can be traced to genuine lack of knowledge about the rules of the road, mechanics of the motor vehicle or the physical laws which govern the performance of the automobile and capabilities of the driver. Yet today there are 85 million drivers and 180 million pedestrians in this country who must have a complete understanding and acceptance of the rules of the road if we are to reduce the number of injuries involving motor vehicles. Many people are still uninformed or misinformed about the advantages of using safety belts in the family car. Yet the evidence is very substantial that the number of serious injuries and deaths could be markedly reduced if a large portion of the motoring public habitually used this simple device.

Lack of knowledge about the quality of air to be used in the compressed air containers used in SCUBA diving recently re-

sulted in death for two individuals and serious illness for a number of others. It seems these individuals recharged their containers at a local gasoline service station. Unknown to them the air compressor at the station filled their containers with air containing tiny droplets of oil. After breathing this air they developed a form of pneumonia, called lipid pneumonia, which was difficult to treat. Since pathogenic organisms had not caused the pneumonia it would not respond to the usual drug therapy.

From the large number of accidental poisoning cases among children which involve aspirin, it can be assumed that many adults do not regard aspirin as a medicine or know that it can be poisonous if ingested in large amounts. There is also general lack of knowledge that many common household articles can be poisonous if ingested.

In rural areas the misuse of liquefied petroleum products have resulted in many accidental injuries. Since these products are bottled under pressure, they have been used for such things as inflating flat tires on trucks and farm tractors and to provide air pressures for paint sprayers. The users because of lack of knowledge about the explosive and flammable properties of this material were not aware of the possible hazards involved.

Lack of knowledge about the properties of ultra thin plastic bags during the past several years have resulted in their being used in ways which have caused the suffocation of many children. Many mothers without realizing the danger have used these material to cover pillows or mattresses in baby beds or have left them within reach of small children.

Lack of knowledge about the side-effects of certain drugs such as tranquilizers and anti-histamines has resulted in many accidents. It may be particularly dangerous to drive an automobile after taking some of these medications.

All too many deaths are caused each year because the properties of carbon monoxide are not understood. It is difficult to comprehend the dangers of something which is colorless, colorless, and tasteless.

These examples are just a few of many that could be given to illustrate the point that many accidents can be traced to a lack

of knowledge by an individual. How can we do a better job of imparting knowledge?

Perhaps we need to be more dramatic and utilize more imagination and ingenuity in preparing our safety educational messages.

Perhaps we also need to give more consideration to helping people recognize and understand the human factors which underlie many accidents. These factors are generally thought to be of three types: physical factors (poor vision and hearing, disease), emotional factors (hate, fear) and physiological factors (fatigue, drugs, alcohol).

It has also been suggested that a list of premonitory signs could be developed to help people recognize when they are not functioning up to par and, therefore, more likely to have an accident. One individual I know has developed a few such warning signals for himself. For example, when he is working in his woodworking shop, if he makes several errors in judgment or in such things as measuring a piece of wood, he regards this as a signal to change his pattern of work or to discontinue work in which he is more likely to injure himself. He has developed similar personal warning signals which he uses in driving his automobile. He believes helping people to recognize such individual premonitory signs may be more fruitful in reducing accidents than trying to impress upon people all the possible hazards in their environment.

Perhaps we need to concentrate more on teaching people the "WHY" of safety gadgets or rules rather than insisting that people simply learn the rules, use the gadgets or adopt a safe behavior. When an individual learns why he does a thing a certain way, his precautions become a part of him. In talking to a group about the advantages of using a safety belt in their automobile, one is likely to succeed in having them recognize the value of the device if they can see a film for example, which shows what happens to occupants with and without seat belts in an automobile when it is involved in a collision. He may not be as successful if he shows them pictures of the gory results of accidents or tries to impress them with the statistical results of the research.

When we help people to understand how accidents happen, we are helping them want to be safe and helping them to recognize that accidents like diseases have causes.

As an example of helping people understand the causes of accidents, let me briefly describe a project that the Public Health Service has supported during the last few years. This project was located in Mississippi County, Ark., where the number of fires and burn injuries and deaths were unusually high when compared to other sections of the country.

One man was assigned to the local health department and he developed a program using the traditional public health approach in attacking a new problem. The approach essentially follows these steps. Defining the problem, selecting an appropriate solution and applying the solution.

In defining the problem an extensive reporting system was set up in order that all information about fires and burns could be assembled and studied. A comprehensive investigation of most of the fires occurring in the county was conducted in order to obtain information about all factors possibly related to causation. As a result of the information gathered it was learned that most of the fires were caused by inadequate elec-

trical wiring, misuse of petroleum products, and poor installation of heating and cooking stoves.

In relation to these causes, it was also determined that many residents did not know the purpose of the fuse in the electrical system and in general just how the electrical system worked. There was misunderstanding about the properties of gasoline and kerosene. Individuals did not understand that the vapors given off by gasoline are heavier than air and that gasoline was explosive only when its vapors became mixed with air. There was general lack of information about the flammability of other materials like hair sprays and fingernail polish removers.

The solution to the problem seemed to be the development and conduct of an educational program directed at eliminating these deficiencies. Such a program was developed. It was made as simple and yet as dramatic as possible. Intensive efforts were made to reach a large per cent of the total population of the county.

CIVIL DEFENSE AND DISASTERS DISASTERS YOU HOPE WILL NEVER COME

By FRED H. BRANTLINGER

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As presiding chairman for the civil defense and disasters meeting, I was informed by Dr. Ronald Patterson that one of the two speakers scheduled could not be present. Therefore, after introducing Francis Svarc as the recorder, the chairman announced that he and Dr. Patterson were prepared to fill in the time that might be used by the second speaker. The writer indicated he would cover the general area of *safety and fallout protection*, with special emphasis on some of the misunderstandings and misconceptions in the field, and present guidelines as a basis for use by schools that are preparing operational procedures. Dr. Patterson planned to present the practices followed in the Detroit Public Schools, and to indicate places where smaller school systems might want to make

changes. His presentation could be considered a "model" for a school fallout protection shelter program.

I am sure that you who are engaged in safety education are more aware of the potential effects of a major disaster than any other group of professional educators.

The expression disaster preparedness implies advance planning. The plans must consider all emergencies, encompass all sources of aid, and they must be flexible. Further, there must be a continuing evaluation and updating of these plans to assure maximum readiness, efficiency and life-saving potential.

Certain simple but fundamental concepts must be understood by all concerned with disaster relief. For example, it is important

to know that refuge in the appropriate part of a basement will afford protection against tornadoes and hurricanes. It is equally important to know that this is precisely the wrong thing to do in event of a flood.

Any disaster involves both primary and secondary effects. For instance, most people tend to associate only high water with a flood, and high winds with a tornado or hurricane. Obviously it is necessary to take precautions against these primary hazards. Not so obvious, however, are the secondary effects of such situations. High winds and water can disrupt communications, causing confusion and panic. Power and light failure can hamper rescue operations. The water supply may become contaminated, thereby spreading disease. Highways and bridges may be washed out making evacuation extremely difficult or impossible.

One of the major problems in establishing a school disaster preparedness program is the development of a realistic, factual, awareness of the problem. Many people believe, for instance, that since their immediate area has never been struck by a tornado, hurricane, flood, or earthquake, it never will. This despite the fact that they may live in a belt which is potentially subject to one or more disasters of these types.

An even greater number of people believe that the continental limits of this country will never be subjected to nuclear attack. We all of course hope that this is true. However, current world tensions and technological developments by potentially hostile world powers tend to make such a belief unrealistic in the next decade.

Civil defense is primarily concerned with the protection of the civil population in the event of such a disaster. On August 1 of this year the Department of Defense assumed new responsibilities in this field.

In a statement before the Military Operations Subcommittee of the House Committee on Government Operations, Secretary of Defense, Robert S. McNamara, said in part:

"Defending the civilian population of the United States against the dangers of thermonuclear attack is not in itself a new responsibility for the department. Our primary reliance is on U. S. military forces as a deterrent against attack. But if miscalculations, intentionally or accidentally, produce an attack against continental United States,

our defensive forces are prepared to meet and engage the attacker.

"Despite the damage that we might inflict on enemy aircraft, some of these aircraft would probably penetrate our defenses far enough to release their weapons. We do not yet have any effective operative defense against ballistic missiles, and some of these missiles would undoubtedly reach targets in the continental United States. In a nuclear attack, several million Americans—perhaps several tens of millions—might be killed."

Many of these casualties would result from the blast and heat resulting from the thermonuclear explosion. There is no financially practical Civil Defense program that could save all of these people from the direct effects.

However it is a different story when we consider the secondary or delayed effect of a nuclear attack, particularly radioactive fallout. It is perfectly feasible to provide adequate fallout protection for all survivors of the direct effects.

As you may know, fallout results when a nuclear weapon is detonated close to the ground. Tons of earth and debris are forced up into the familiar mushroom cloud. These particles become contaminated with radioactive materials from the explosion. They are scattered by the winds, especially at high altitudes, and later fall to earth in the form of radiation emitting dust. These particles themselves may or may not be visible, but the radiation they emit cannot be seen. It is damaging to human tissue and can only be detected by use of special instruments.

Two basic protective measures against the hazard of nuclear radiation are distance and shielding. Various hypothetical attack situations have demonstrated that few areas of the country would be completely free from the fallout hazard. Further, distribution patterns will depend upon weather conditions at the time of, and immediately following, a detonation. Thus accurate fallout forecasts cannot be developed very far in advance of actual attack. This, coupled with the lessened expected warning time reduces the potential use of distance, by means of evacuation, as a protective measure.

Shielding against radioactive fallout can be accomplished by placing a large mass of material between individuals and the radiation source. This principle is incorporated

in the design and construction of fallout shelters.

The most competent of the nation's scientific and medical experts have agreed that fallout shelter is one of the most important requirements for survival following nuclear attack. The National Academy of Sciences and the American Medical Association have strongly urged the construction of such shelters. In the Academy's words, "adequate sheltering is the only effective means of preventing radiation casualties," and "there is adequate technical knowledge to permit a program of shelter construction."

Outside the zones of blast damage, fallout may begin in 30 minutes to several hours after the attack depending upon the distance from ground zero and the speed of the winds. Therefore, outside of likely target areas, there may be an adequate period following an attack warning for the children to get home from school and the breadwinner to get home from work. In the United States there are over 100,000,000 people who do not live in or near a likely target area. Their primary requirement for survival is a properly stocked fallout shelter; and in most instances there would be sufficient time for the family to congregate in the home shelter or some type of communal shelter before the arrival of fallout.

In potential target areas, in the developing missile era, the situation is different. Between the issuance of attack warning and the actual attack, there may be only time for movement to shelter. Although a nuclear weapon can destroy the heart of a city, a miss or near-miss must be considered a distinct possibility. Such a miss, up-wind, could also wipe out the city's population, unless the citizens know how to take advantage of the time following warning to seek previously identified and previously prepared fallout shelter. For these situations, two or more shelters are the best solution. This requires not only shelters at home, but shelters at school, shelters within industry as well as community-type shelters in the downtown or business sections of the city. In target areas, the reunion of the family might be delayed for a period of days.

One other important fact concerning fallout is vitally important from a civil defense standpoint; namely, its radioactivity decreases or decays quite rapidly. Actually, two

weeks after attack the level of radiation will have decayed to 1/1000th of the level that would exist with the fallout on the ground one hour after explosion. It is considered, therefore, that a two-week shelter occupancy will be sufficient for survival. In nearly all cases the majority of shelter occupants will be able to emerge in two or three days, part time at least. Thus the idea advanced in the novel "On The Beach," that the fallout from a nuclear attack would gradually engulf the world and wipe out everybody, is seen to be unfounded.

Obviously this has many implications for the total school program and particularly safety education. The school civil defense or disaster preparedness program should be two-phased. The first is an action program designed to protect students immediately. The second is a curriculum program designed to build citizens who are and will be competent to live in a world in which disaster survival promises to be an important, continuing, and perhaps permanent part of their way of life. These phases are simultaneous programs in the schools and are not necessarily mutually exclusive.

By virtue of his office, the chief school administrator is the responsible authority who sets up school programs to protect lives and property. School board policy should explicitly assign him this responsibility. Oftentimes much of this responsibility is delegated. I'm sure this is not news to those who are specialists in safety education. The point is that someone should have responsibility and authority to establish a disaster protection organization within the system and to take the necessary steps to assure its operational capability.

Disaster protection plans must be developed in consonance with those of the community. Protection measures cannot be effective unless all public agencies cooperate. In event of nuclear attack the decisions regarding protective actions to be taken locally must be made by local authorities. Thus a carefully coordinated plan for all disaster contingencies is imperative. It should be carefully detailed in writing with personnel assignments and alerting diagrams.

One of the first requirements is to determine the extent and quality of available fallout shelter within each school building. Obviously many of the recently constructed

buildings will have little if any suitable protection. Basement areas of older structures may provide a surprising amount of potential shelter which can be made suitable with a minimum of modification. A building survey might be accomplished by specially trained persons to determine shelter quality in accordance with established standards.

The Department of Defense, at the direction of President Kennedy, is currently embarking on a vast shelter survey program. This is designed to identify, mark and stock available community shelter space in existing buildings throughout the United States. This will provide a large number of shelter spaces at the least cost, and in minimum time.

The shelter space identified and marked under the federal survey program will also be equipped and stocked at federal expense. The stocking will be on an austere basis, including water for two weeks, food for five days, first aid and medical supplies, radiological detection kits, sanitation supplies, and tools for exit in emergencies.

Some schools may be shown by the survey to have acceptable shelter space, particularly buildings with basements. In other cases near-by buildings may have acceptable shelter space which can be used by school populations.

The shelter survey, identification and marking program, will get underway in the very near future, and will be conducted under the supervision of the U. S. Army engineer districts, assisted in certain areas by shore establishments of the navy. Details concerning the survey in your area may be obtained by contacting the local district engineer office.

Should there be no suitable shelter space in the school buildings or in other buildings in the vicinity, the plan to be used should be worked out with the local authorities responsible for the safety and welfare of the people. No one plan will fit all communities.

Since the public shelter as identified and stocked will necessitate austere living therein, school curricula could well include psychological and social pre-conditioning for such an eventuality. The necessity for people to work together and not panic should be stressed.

It should be emphasized that new school construction might well incorporate dual purpose shelter. A school cafeteria below ground

with appropriate shielding qualities makes an excellent day-to-day use of a shelter area. Students generally occupy this facility for only short periods each day, and the normal cafeteria food storage would serve as a good nucleus for the emergency stock. It is worthy of mention that the school system of Artesia, N. M., is currently constructing an elementary school completely underground. Thus the entire building can be used as a fallout shelter to accommodate approximately 2000 people. To the best of my knowledge, this is the first school of this nature in the country.

In addition to shelter provision, an adequate attack warning system for the school should be developed. This must be tied in with the community warning system. The manner in which this warning is received is not as important as that it be quick, accurate and certain. Care must be taken, however, to assure that the civil defense action signals relayed to the students cannot be confused with other signals, such as fire warning, or the dismissal bell.

Within the next year or two it is planned to provide direct warning to homes, schools, offices and factories by means of the "near" system. "Near" stands for "National Emergency Alarm Repeater." Under this system, a special signal is superimposed on the power distribution lines which operate an alarm plugged into a wall outlet. Thus any building or structure wiring for commercial power may, at a cost of \$5 to \$10 each, install the alarm device. Every effort now is being made by the federal government to expedite the installation of the signal equipment at power stations through the nation.

Since attack may come while school is not in session, some school facilities may be destroyed and others in the same system be left relatively undamaged. Therefore, each school system should make provision for preservation of essential records through microfilm stored at an alternate site outside a potential target area, or by other suitable means. Similarly a line of succession should be established among school officials to assure continuity of authority in the event the regularly constituted official or officials are unable to act.

Consideration should also be given to a student identification program. Identification assists in quickly bringing together the in-

jured and their families or at least in transmitting accurate information in their behalf, thereby eliminating much uncertainty and anguish.

Emergency groups should be organized among older students for purposes of fighting small fires, light duty rescue, first aid, and radiological monitoring. Training of such groups for institutional protection purposes can be accomplished under the regular curriculum, but their operational function must be under competent faculty direction.

The foregoing represents a few guidelines that must be considered in developing a school protection program. This very limited treatment serves to point up the complexity of such a program in addition to outlining the basic considerations involved.

The second phase of a school civil defense program is embodied in the curriculum. Civil defense in itself does not encompass a precise body of academic knowledge. It does, however, cut across many curriculum areas.

At the elementary level the principles and concepts introduced must be within the level of understanding of the particular age group. This principle has always been recognized and followed by safety educators and therefore represents no departure from standard practice.

These students should become familiar with the disaster plans of their school and community. They should know the warning signals and what they mean and also the nature of Conelrad (640 or 1240 on the Standard AM radio dial for emergency information). They should understand that shelter affords the best protection against fallout, and where the closest shelter is located. Necessity for stocking certain extra supplies of food, water, etc. in the shelter is a necessary understanding. Elementary first aid is a further practical area of instruction.

In addition to knowing what to do in case of a disaster the educational system must also strive to develop appropriate community attitudes. Many parents exhibit concern that civil defense instruction will develop a fear or panic complex in the minds of youngsters. It is my opinion, however, that many children today are more aware of the realities of nuclear attack than are their parents. I believe therefore, that the subject of nuclear attack can be approached on a calm, objective, basis with the attitude that there is a good

chance to survive. This will assist measurably in avoiding the so-called "scare approach."

Students must also be prepared mentally to depart from their daily routine: to inhabit temporary austere facilities, and to adjust to the many inconveniences, including possible separation from family, that may result from such a major disaster. The concept that students, after saving their own lives, can help look after the needs of others will assist in keeping them busy, thereby focusing their attention away from their own troubled situation.

At the secondary level new and more complex items may be introduced in addition to the safety aspects. I should like therefore to provide a few limited examples for consideration.

Social studies might include the study of ideological differences of governments as a basis for present world tensions; a study of community agencies and how they as a part of government would function in emergency; an exploration of how weather affects fallout distribution patterns; and an examination of population trends and how they affect vulnerability, as well as survival chances.

In science the study of protective measures against chemical, biological, and nuclear warfare is appropriate including effects, detection, monitoring, and decontamination.

Home economics can include a study of a balanced emergency diet, special techniques of emergency mass feeding, emergency sanitation measures, as well as emergency home nursing.

Similar appropriate activities should be carried on in health, language arts, vocational education, and of course throughout the safety education program.

Institutions of higher education can also incorporate even more specialized and technical principles. It is imperative for instance that all future architectural and engineering graduates understand the principles of fallout shelter design and construction. Emergency casualty care poses some difficult problems with which medical and nursing education must contend. Family welfare, control of delinquency, and prevention of criminal acts during periods of emergency are a part of sociology and or public administration. Emotional reactions associated with disaster situations is a suitable subject for psychology.

These few examples serve to point up some of the actions necessary to accomplish the complex task which faces us.

The federal government has provided some assistance in this area. Approximately 15,000 sets of radiological detection instruments with curriculum guides have been distributed to high schools and colleges nationwide. This was designed to provide science teachers with the necessary tools to incorporate radiological defense principles into their curricula. Further it provided a geographic distribution of instruments which enhance a radiological monitoring capability in event of emergency.

A federally subsidized civil defense adult education program is currently operating in 15 states. To participants in this program, a 12-hour course in personal preparedness in the nuclear age is offered through existing adult education facilities without charge.

A number of national professional education organizations have developed, published, and distributed "support" publications for their membership. These publications indicate endorsement of the civil defense education principle by the organizational leadership. They also provide recommendations for participation of local membership to further this effort.

The U. S. Office of Education, Department of Health, Education, and Welfare, is currently preparing civil defense curriculum material for student study in the areas of secondary school science and social studies. These materials should be released shortly.

These are a few representative samples of actions undertaken, but the list is by no means exhaustive.

As you know, President Kennedy has indicated that there is a definite need to strengthen and accelerate the total civil defense effort. His active support and the positive steps he has taken have stimulated national interest immensely. It is expected that considerable additional federal leadership will be evident very soon.

The nuclear age necessitates re-examination of the total educational program in terms of adopted protective measures and additional curriculum concepts. Planning and executing such programs for educational institutions require people with courage, foresight, integrity, and all the other qualities that constitute leadership.

Through this aggressive leadership coupled with proper planning and action, the overall effects of a nuclear attack can be minimized, the majority of the people will be saved and the nation will survive. The schools have a major role in this preparedness for disaster you and I hope will never come.

Following the talk by Mr. Fred Brantlinger the following talk was made by the chairman, Dr. Frank Dennett (in summary):

It is rather interesting to note that when the program was developed a year ago, little did we think of the importance of civil defense and the associated problems. However, we must admit that Dr. Patterson, chairman, and his committee made good use of the "crystal ball" and planned the program, knowing full well that we would have to meet and discuss this very important subject.

For more than thirty years, the philosophy of safety education, as expressed by the late Albert Whitney, related to greater and better adventures for safe living. Today, our philosophy has changed to teaching of safety for survival. This last summer, as a reserve officer, I spent two weeks in Alabama taking a refresher course in chemical, biological, and radiological warfare exercises. With this background, I feel more prepared and confident in trying to explain some of the concepts with respect to fallout that will be mentioned.

We understand from Dr. Clifford Brownell that we must all get accustomed to the fact that life at the present time, and in the future, will always involve risk and insecurity. For a long time people were not concerned because they knew that no one would "leave this world alive." However, with the scientific advances in recent months, Shepard and Grissom have accomplished this feat.

From nuclear bombs we get effects from blasts, heat, radiation and fallout. The effects on buildings, grounds, and population vary according to the height of the target blast area. The Civil Defense Agency has assumed that its greatest contribution can be made to saving of lives and property through preparation and planning in areas outside the direct blast area. This usually includes the area outside of a zone with a radius of 15 to 20 miles. In considering every type of protection, the Civil Defense Agency agreed that it could save the greatest number

of lives, with the smallest expense of money and effort, through the use of fallout shelters. Those in the blast area would be affected immediately by blast, heat, and radiation; and very little could be done for those who are unfortunate enough to be in these target locations. But, outside these areas, where the tremendous blast of the bomb would suck up many thousands of tons of dirt and debris, they would be subjected to radio-active materials which would fall to the ground as tiny particles. The fallout would not occur for at least an hour, depending on distance from the target area, wind direction, speed, weather conditions, etc. With this amount of time, if advance preparations have been made, there is every reason to believe that all could survive.

In planning for the meeting today, I thought I would like to share with you some of the impressions of our people with respect to this important problem. Recently, I clipped statements made by various people when they were surveyed with respect to certain questions pertinent to the problem. Take for example this question: "Has your family discussed a fallout shelter?" The following are the answers given by three or four of those surveyed:

One housewife said: "We've discussed a fallout shelter and come to the agreement that when the warning blast sounds I will take the children to the basement of a school a few blocks away. I wouldn't want to spend two weeks in a shelter by myself."

One man said: "We've talked about fallout shelters, but that's as far as it has gone. I've instructed my family in the event of an attack to keep calm and do what they're told by authorities. Like everyone else, we know we should have a shelter, but by the time we got around to doing something it'd be too late."

One woman said: "To discuss a fallout shelter just never occurred to us. In fact, we don't even like to talk about the possibilities of needing one. We'll never need one, and those who are building shelters are betting we'll have a war, while I'm praying we won't. You know, like an insurance policy."

Another man said: "While I think there's a need for fallout shelters, where can you build one in the city? The people living close and in the city will just have to take their chances; and from what I've read

about fallout and explosive force, even fallout shelters wouldn't do much good."

To a second question—"What would you do if you heard the air-raid sirens wail steadily for 3 to 5 minutes?"—the following answers were given:

One man said: "Well, I tell you what I would do. I'd run. That's what I would do. And no one would see me stop until I hit the nearest corner in the deepest hole of the nearest building. Even with all this publicity civil defense is getting now, people in general still think they can duck a bomb like in the days of World War II. They don't realize that, man, this ain't the same bomb. A little old steel helmet on your head is not going to help you, that's for sure."

Another man replied: "Ha, I've got it all figured out. . . I hope. I live near the Patterson Park swimming pool and the locker rooms there are underground. Pretty good idea? But, then again, I would probably be in the Court House if the sirens started. I've been there for more than 21 years, but I hope I'll never have to use the basement there. Yes, it just seems a shame we even have to think about precautions like this, it really does."

Another person said: "If it happened while I was 10,000 feet up in the air (I'm a stewardess), I suppose I wouldn't even know about it. And maybe it would be better that way. My employer has not given stewardesses any instructions on what to do in case of an attack, as far as I know. But you know, it seems a little strange for civilized people to even talk about how to protect themselves and survive in case of mass extermination of the human race. Who knows? Perhaps we won't have to wait for another Ice Age after all."

Another said: "If I was driving, I would pull over to the side of the road, light a cigarette, and think about the incredible stupidity that brought the whole mess about. Take shelter? Who wants to live in a hysterical world when men start throwing super-bombs around with millions of innocent men, women, and children as targets? Not me. I think some people won't be happy until the bombs start falling anyway. I visited Hiroshima and that grim reminder is a silent gallery of horrifying pictures and exhibits. It makes me sick to my stomach when I think it could happen again."

Another said: "Me? I'd try to get right into a shelter, that's what I'd do. And I wouldn't stop running until I was underground in a basement someplace. I think shelters are a good idea if bombs start flying around, but I guess people will depend upon basements for the most part."

To the question: "In view of the step-up in civil defense education, do you favor civil defense in the city and county schools?" the following answers were received:

One man replied: "Yes, I believe civil defense training is necessary. It might be best given in some additional program in the schools. It should be made impressive, however, so it carries over from the school environment to the time outside school. Civil defense training is a definite necessity especially in times such as these. It is necessary, I think."

Another replied: "Definitely, civil defense should be taught in the schools. Children today need to be taught the things necessary for their protection as soon as they can absorb it. As long as the world situation continues as bad as it is now, children need some sort of instruction in civil defense."

Another replied: "I think it should be part of the child's training, but I don't know that it should be part of the curriculum, as such. It's taught in the classroom it implies that a large number will attend, that it is part of the formal educational program. It might best be implemented as an auxiliary to the regular school program."

One man said: "In these times a program of training for children certainly is needed, if only to enable them to look out for their own safety. It seems to me that the school is the ideal place for civil defense training to be given to children. It could perhaps be made part of outside activities or taught right in the classroom. Some sort of training is definitely needed in any case; if the schools can't or won't do it then it is the duty of parents to do it."

Another replied: "Yes, in this day and age I think civil defense training should be given in the schools. With Khrushchev screaming about a new bomb, every child should at least know what to do in case of attack. It should be taught at least from the high school age up. After all, they are the coming generations of this country."

In the area of civil defense education, at

least, most people seem to agree that our schools should accept this challenge and incorporate civil defense as part of a child's safety education program.

I would also like to share with you a letter that was sent to our superintendent of schools, Dr. George B. Brain, by the president of the Baltimore Teachers' Union. This letter, somehow, was reproduced recently in the Congressional Record by Congressman Ryan of New York because of its interesting point of view. Because of time, I will read only several paragraphs that have interest for us today. The following is quoted:

"Vigilance concerning the welfare of our children is of first importance. How best to protect them is the concern of all citizens. Teachers have perhaps been more zealous than most citizens in cooperating with civil defense in the past. While guiding students in air-raid drill, crawling under cafeteria tables, taking cover on cement corridor floors as in World War II, many teachers have felt the futility of such methods of dealing with the H-bomb."

We teachers, who will share with our pupils the "securitis" of these methods, are convinced that the building of fallout shelters is no improvement.

We call your attention to the statement in his report to Congress of Secretary of Defense McNamara (*The Sun*, August 2, 1961) that fallout shelters are good only for cities which do not suffer direct hits. It is generally agreed that in case of war, Baltimore will be a primary target. The recent articles on civil defense in *The Evening Sun* demonstrated that Baltimore could be completely destroyed by H-bombs with devastation spreading for many miles around. Lethal fallout is equally annihilating. Secretary McNamara in his report stated further that, "A near miss up-wind from a large city would still wipe out the city's whole population, leaving the city undamaged."

"But in the nuclear age, our children's physical safety can no longer be achieved through the physical means of steel and concrete. Knowledge, intellectual ability, and creativity in dealing with the new demands of a new age are the only ways of protecting our children's bodies. It is these capacities of the mind which desperately need

instilling and which cannot be fostered by building bomb shelters."

"Only by achieving quality education for all our children—only by providing adequate classroom space, reduced class size, and fully qualified teachers—can we realistically meet the nuclear challenge. Those who hope to depend on bomb shelters are dreaming in the past."

It is interesting to note that in the area of traffic safety, it is difficult to get people to understand that they might get hit by a car when they cross streets improperly. In fact, you may note that on wet days they do scamper across because they know they can get wet—but the fact that they might get hit by a car—this is considered an impossibility!

You may remember that several years ago, in Connecticut, they had a strong drive, the theme of which was "SLOW DOWN—SAVE YOUR LIFE." The drivers did not slow down, and lives were lost. But, when they changed this to "SLOW DOWN—AND SAVE YOUR LICENSE," this was "for real," and drivers did slow down to save their licenses and also their lives. In the area of nuclear warfare, while most people are certain that they won't be hit by a car, each and every person is convinced that the bomb will blast off directly over his head. We know that there are not enough, at the present time, to strike at all the targets; the enemy would like to "knock out"; yet the hysteria and alarm has reached proportions where each and every person feels that there is a nuclear bomb with his name on it! This leads me to say that "what we don't know can't hurt us!"

We heard earlier that the two important factors in fallout are the concentration of radioactivity and density of barriers. The best means of protection, of course, is "just not to be there." Therefore, every effort is made to have as much material between yourself and the outside world—considering all other hazard factors. We have heard many times that we should be prepared to stay in shelters two weeks. This is a possibility; however, the concentration of radioactivity may be low, or the decay rates may be rapid, so that perhaps ten (10) hours or

48 hours may be all that may be required to stay in shelter areas. Children will not have to stay in the highly protected areas all the time. They can move out to make use of toilet facilities, cafeteria facilities, and others, for short periods of time.

Information will be sent via CONELRAD, giving the amount of radiation and suggesting safety factors so that school authorities may make decisions as to whether children should be dismissed or retained in school; whether they may be permitted to go outside for short periods of time, etc. It may be perfectly reasonable for schools in one part of the state to evacuate, and in another area in the direct path of radiation, children will be kept at school.

This will be our "way of life" for some time ahead. School authorities should prepare and plan a civil defense procedure for their own schools. These plans should be checked with the local civil defense authorities, and then the information should be sent to parents so that they may know the school's procedures, and make the necessary plans for all situations as far as possible.

Those living in large cities or major industrial centers, may take some comfort in knowing that "Mr. Khrushchev and Company" do not have sufficient bombs at this time to "knock out" all good target areas; and therefore it would seem that his first choice would be knocking out our retaliatory capacities. This would include the Strategic Air Command bases, missile bases, and other installations of a similar nature.

Mr. Ronald Patterson, of the Detroit, Mich., public schools, read an outline of the Detroit school disaster plan and then conducted a general audience discussion on school civil defense. Among the topics discussed were: (1) the proper name for a civil defense drill, (2) systems of communication for various alarm signals, (3) what to do when the alert sounds.

Mr. Brantlinger concluded the discussion with this advice: each school should have a disaster plan that is tailored to its special needs; the plan should be designed in close cooperation with local civil defense authorities.

HOW THE SAFETY COUNCIL MANAGER AND SAFETY EDUCATION SUPERVISOR CAN COOPERATE IN THEIR ACTIVITIES

A PANEL DISCUSSION

Remarks of G. Ernest Bourne, manager, Utah Safety Council, Salt Lake City, Utah.

Cooperation, as our dictionaries and thesauruses tell us, means, among other things—partnership. Certainly you and I are partners in our mutual objectives. As such, there is a deep obligation for us to share our ideas, resources, and information.

To do this we need two-way communication with each other. All too often the safety education supervisor and safety council manager don't even know each other exist! I can't tell you, for example, who, if there is one, is the safety education supervisor in the San Juan school district down in the southeast part of my state. By the same token, he probably does not know me. And that's too bad, both ways.

But from a professional standpoint, we are both missing the boat, and I will explain why.

First, he is missing out in maintaining possession of much valuable local safety information and access to safety educational resource materials and training aids that could be put to good use.

Secondly, I am missing out in failing to secure optimum outlets for the safety education program of my organization.

These two failures, involve a great many things too numerous to elaborate upon, but by the two of us getting together, we could discuss them in considerable detail.

One of these things that would be proper to discuss when the two of us got together would be elements of system thinking and methods, and the timing of certain projects or activities. One can save a lot of wheel-spinning by doing so. In this business of safety there are many complexities which involve inter-agency cooperation and use of varied resources. This interlace of interests and knowledge of who is best equipped to do or assist with a project is often familiar to the safety council manager. He is therefore a useful man with whom to work.

By membership in the National Safety Council, the safety education supervisor has access to, or should have, the outlines and teaching guides and other materials we council managers find in our Chapter Libraries. These contain excellent suggestions and ideas to incorporate into classroom teaching. Failure to use them for reference purposes would simply be playing the old ostrich trick again.

Close liaison should also be maintained with the local or regional PTA safety chairman. They in turn are usually in touch with the local or state safety council. With this chain of communication added participation in the National Safety Council Honor Roll program could be stimulated. Frankly, I think this is one of the finest and most appealing contributions in the entire safety program relating to the schools. As a council manager, I will not be satisfied until all the schools in my state are enrolled because of the many things this program embraces and means. The safety education supervisor can and should make a real effort and contribution in this. The safety council manager is ready and eager to be of help to him.

Closely related to this is the need and value of gathering accident data involving school children. This is done by use of the standard student accident report forms and summaries. Far too many schools, in my observations, fail to use these forms. The result is often poorly directed safety programs that miss priority targets. Because of this, it is only natural that some school officials are cool to otherwise needed safety programs in the school. Your safety council manager would be glad to help here, too. Once the routine of setting up the accident gathering program is accomplished, it is not an undue burden. Overcoming inertia to get it started is the problem, it seems. But this is a fundamentally important part, it would appear to me, of a safety educator's job.

The schools, and particularly the safety education supervisors, should make it their business to find out what the priority needs in their area are relating to traffic safety. This can be done by asking city officials what findings and recommendations relating to the schools are contained in the Annual Inventory of Traffic Safety Activities for his city. If the city is not participating in this program, help get it to do so. After ascertaining what the priority needs are, offer assistance and cooperation to the city officials in carrying out the inventory recommendations.

The safety council manager, on the other hand, can spur his organization to take the leadership to sponsor, or assist in the development of, regional and statewide youth safety conferences and seminars. These provide opportunities for the students to develop interests and activities that have broad chain-reaction effects. They also identify problems, projects, and programs that can have community-wide impact.

These conferences and seminars will suggest and assist in development of student safety committees or councils that have many worthy objectives and possibilities. The safety council manager should always have on hand a supply of the National Safety Council student safety kits. These can then be issued to a school, on request. We only issue them in this manner because first we do not wish to force anything upon anyone, and secondly we couldn't afford promiscuous distribution of that kind.

These student safety committees would then, in turn, find it useful and desirable to affiliate with or form a statewide youth safety association, and the national association sponsored by the National Commission for Safety Education.

So much has been written and said about the driver education program that I am going to pass over this area with but one comment. See that your school's training cars are equipped with seat belts and that the students use them. It's a good habit to get them addicted to! High-school students are not the only ones needing driver education. So if there is a move on for adult driver education, cooperate and assist in such an undertaking. There is much to be done in this area of need.

We have had considerable experience in

developing and promoting safety legislation. Frequently we have observed that school people will unilaterally propose and try to get bills of a school safety nature through the legislature. Usually such efforts fall flat on their face. We saw this happen at this year's session, and in other years.

The reason is not necessarily that the proposals themselves are faulty, indeed some of them are good. But legislators are often prone to view with a jaundiced eye proposals coming directly from school people. Our legislature, at least, sometimes is that way, as they have trouble enough with school financing problems.

On the other hand, measures that are proposed and supported by the state safety organization and the Governor's Official Traffic Safety Coordinating Committee have a considerably better record of success.

Thus, if school safety educators and officials would review their safety legislation needs with the safety council and other similar agencies well in advance of the legislative session, more success would be possible. Not only that, sometimes even the original proposals could be improved upon so as to enhance not only their chances but avoid mistakes that, if enacted, would have to be corrected at the next session. We have seen that happen, too!

As a close observer of the total accident problem, I am acutely conscious of the urgent need for reducing and eliminating accidents in the home and its immediate environment. As driver education has a carry-over effect upon the parents, so too can home safety stimuli brought home from school by the child. This, of course, can be done in many ways. One of the most helpful techniques is to provide the student with a simple home safety check-list. The safety council can provide such a check-list. This should be taken home, with instructions on how to get the parents help in completing it, and bringing it back to school for summarizing and brief class discussion.

I am not suggesting that this is primarily a school responsibility because it is not. But I do mean that the school can not close its eyes or mind to things outside the classroom, or areas not directly related to it. We are told that safety is a way of life

and certainly the school is one of the main-springs in developing this.

But equally important, in the same manner that an employer wants his worker on the job every day, so does the teacher want his student in class. Students are all too frequently prevented from such regular attendance because of the stupid but preventable mishaps that occur in the home and its surroundings.

The sight of an eight-year-old boy in bare feet or tennis shoes steering a rotary power mower around the lawn never fails

to chill me. This, and hundreds of other hazards that attention could be attracted to could prevent mishaps that would save thousands of child-hours in the classroom over a school term, I am sure.

In closing, I reiterate that a close working partnership between us can and will produce more success in our mutual objectives. We cannot delegate to other vaguely-identified people our chores and responsibilities. By each contributing his part the end-product will be better schools, a better community, and certainly a happier and more profitable life for all of us.

LOCAL SAFETY COUNCILS

By HAROLD COX

Mr. Howard Cox, of the Detroit, Mich., Traffic Safety Association, briefly outlined the Detroit program. The Detroit Association works closely with the schools and the local police. The schools have an extensive safety education program, with a patrol group in every elementary and junior high school and the largest high school driver education program in the nation. The Traffic Safety Association supplies some safety education instructional material to the schools, and works closely with the street and highway department to plan safe routes to and from schools.

In addition, the Detroit Traffic Safety Association brings the safety message to the general public through the use of communications media. Mr. Cox played a tape of "Showcase," a radio program on safety that is regularly aired by station WGRK.

Mr. Cox concluded his presentation with a short question and answer period where specific problems were discussed.

Mr. W. J. Danforth, manager of the Fort Worth, Texas, Safety Council described their school program as a "coordinated effort to prevent and reduce accidents. Each school has a safety committee that regularly inspects areas such as school crossings and lunchrooms for accident hazards, as part of a "Green Cross for Safety" program. Every six weeks, each school reports to the safety council. After 10 suc-

cessive safe periods a gold cup is awarded to the school.

To aid in school safety education programs, the safety council and local organizations have supplied over 150,000 pieces of material to the schools, including appropriate visual aids.

In conclusion, Mr. Danforth commented on the program's success. He says that it has resulted in a carry over of safety practices into the home and community. Last year, the school system reported only 230 student accidents and 869 days lost due to accidental injuries.

Mr. Forrest Gaines, managing director of the Greater Baton Rouge, La., Safety Council, opened his talk by stating that a program of proper cooperation between the schools and the local safety council is of major importance to a full scale community safety effort. A school-safety council cooperative program that is conducted in the proper manner can have the greatest single impact on the total safety of the community. It is important that the council be informed of school policy and that the council abide by it in all association with the safety supervisor. Through cooperative planning, the supervisor can define major needs and indicate the types of assistance which the safety council can render to the schools.

In discussing the Baton Rouge program, Mr. Danforth emphasized that all plans

are made cooperatively. For instance, when one school principal mentioned that patrols needed more recognition, the safety council promoted a plan whereby on Monday and Thursday of every week, one school patrol group appears on a local television program. Among other activities, the council also supplies the schools with safety lesson outlines for the teachers, and has set up a cooperative plan for promoting the National School Safety Honor Roll.

Opening his remarks, Mr. Albert Phillips, executive director of the Greater New Haven, Conn., Safety Council, stated that the New Haven council has a particularly difficult job because the city school system has no coordinator charged with responsibility for safety education. To compensate

for this lack of supervision, the council has worked with a committee of principals in formulating plans for safety education programs.

At present, no school in the state of Connecticut has a coordinated program. In New Haven, the council has been working to convince schools of the need for safety learning. Although the schools do have patrols, fire prevention programs, and some participation in the National School Safety Honor Roll, they have done no work in accident reporting. The council has participated in formulating a system-wide curriculum change that will include safety education as part of class work, and is working with the schools to set up a complete program of accident reporting.

HOW THE SAFETY EDUCATION SUPERVISOR AND THE LOCAL SAFETY COUNCIL CAN COOPERATE IN THEIR ACTIVITIES

By HAROLD F. LILLIE

Dir.-Secy., Safety Council of Greater Lansing, Mich.

Since its organization in 1939, the policy of the Safety Council of Greater Lansing has been to support the official agencies of government, responsible for the safety of our citizens, through public education programs.

We would like to present two significant examples of the cooperation between our council and our schools, that has resulted in the knowledge that "we have one of the finest school and child safety education programs in this nation."

Back in the early days of the organization of our council, we offered our cooperation to the local boards of education and found that safety education materials and teaching aids would be welcomed in all of our public and parochial schools and would be used in every way possible, if the safety council was willing to buy or produce this material.

At that time we did not have a safety director or supervisor as such in our local system; however, a local high school faculty

member was acting as safety supervisor for the schools, and doubled in brass for the safety council as chairman of our School Safety Division. This gentleman was eventually given full departmental status and made director of safety for the Lansing Public Schools and is still chairman of our School Safety Division. Probably many of you have heard of him or worked with him in the national School and College Section programs. I refer, of course, to Lewis E. Clark.

Because of Lew's work in the public schools in Lansing as safety director and his interest in the total child and school safety programs which involve all of the public and parochial schools in Lansing, East Lansing and Ingham County, in the School Safety Division of the safety council, much has been accomplished in our service area.

So great is the value of the safety education materials available from the National Safety Council—both as a teaching aid in

the schools and as it is carried home from the schools—that, at the present time, our council purchases and distributes, each month, to 126 schools administrators, departmental directors, and to teachers, the following quantities of N.S.C. school and college safety education materials:

- 135 subscriptions monthly to *Safety Education* magazine
- 2,350 Lower Elementary and 1,550 Upper Elementary Safety Lesson Units, monthly
- 140 Secondary Safety Lesson Units, monthly
- 685 Elementary and 90 Secondary Posters, monthly
- 10 subscriptions monthly of the *Safe Driver* magazine for driver education instructors

It has been our policy also, outside of the materials mentioned above, to supply on request additional materials that are asked for by departmental directors for use in special programs. Some of these are: school safety fire packets, fall proof pamphlets, safety education reprints shop safety, school shop safety poster packets, food service safety check lists and safety education data sheets such as *Safety in the School Lunch Room*.

We know the value of the wide-spread use of this material, and can report to you that business, industry and government who support the Safety Council of Greater Lansing, are only too happy when we report on the expenditures we make from our budget, for the school safety education materials that have proven of such worth in our area.

Another valuable example of the cooperation between the official education agencies of government and our council, comes about through the programs designed by the School Safety Division, chaired by our school safety director.

This division, made up of public and parochial school administration, departmental heads, elementary and secondary faculty members, and enforcement officials from Lansing, East Lansing and Ingham County, plans and designs and writes pamphlets, booklets, flyers and brochures. These publications are not only used in our schools

as teaching aids, but are distributed through the schools, P.T.A.'s and other club groups through our Women's Division, and are carried into some 50,000 homes in our service area.

This type of material is printed and produced in the safety council office and is specifically designed to meet the needs of our citizens wherever a potential accident hazard is apparent, or wherever a need for greater safety education in a specific field is felt.

As an example, in our City of Lansing, we have some 8,000 licensed bicycles—We believe there must be a like number of unlicensed bikes—There was much concern on the part of parents, teachers and enforcement officials over the bicycle problem in our area. The result was the writing and production of 100,000 pamphlets "What Every Bike Rider Should Know," which has been used during the past three or four years in the schools and homes of our community.

Some of the others that have resulted from this program, and made similar use of, are: *Wise Walking Pamphlets*, *Hunting Safety Blotters and Bookmarks*, *A Message of Importance To Parents on Rainy Day Safety*, *Safety Hints for Christmas* (Reprints from N.S.C. pamphlet), *Winter Fun Pamphlets*, *The Child In Lansing Traffic Book* (annual edition), *Lansing Traffic Rules* (for driver education classes), *City of East Lansing Traffic Law Digest* (for driver education), *The Talking Bike Scripts*, *What Every Operator of a Power Lawn Mower Should Know*, *A Guide for Elementary Teachers* (safety education book), *Squirm the Safety Bookworm*, *Traffic Safety Placemats*, *Green Pennant Posters*, *Stop-Look-Wait-Walk* (screen door stickers).

Both Lansing and East Lansing have been three time winners of the America's Safest City Award. We are unable to evaluate how much the cooperation of the safety education supervisor with our local safety council has helped us in gaining this recognition, but by all standards, we know, we are doing everything possible to assure the greatest degree of safety for our youngsters in the schools and in public places, and to give them a strong background of safety education to meet their needs for the future.

STATE LAWS FOR SAFETY EDUCATION

By JAMES F. NIHAN

Dir. of Safety Education, State University of New York, Albany, N. Y.

The purpose of this study was to evaluate existing safety education laws and regulations and to make recommendations for their improvement. The laws were compiled from official statutes. The regulations were abstracted from state education department publications.

Forty-eight states have legislation and 19 have regulations affecting at least one major phase of safety education. None have legislation or regulations pertaining to all phases. Several state education departments use the laws in lieu of regulations. Evacuation drills are covered by law in 34 states, by regulations in nine. Twenty-four states have laws regarding driver education; 15 have regulations. General safety education is included in the laws of 23 states, in the regulations of 14. Fire prevention education is legislated in 18 states but covered by regulations in only one state. School safety patrols are provided for by law in 12 states, by regulations in four. Statutes providing for traffic safety education were found in 11 states, regulations in only three. Civil defense education is affected by legislation in three states, by regulations in five. Six states have laws dealing with education in firearms safety.

Many laws fail to provide flexibility for local initiative and adaptability. There are conflicting standards among the states and within states. Many codes are ambiguous as to authority and responsibility. Several states' regulations are hortatory rather than regulatory.

The laws and regulations identified were abridged and the major provisions refined into separate evaluation instruments. A panel of seven state education administrators

evaluated the provisions in the instruments and applied to each item a qualitative rating of Excellent, Good, Fair or Poor. The judges favored existing regulations over laws. They accepted more prescriptive details in the regulation, but consistently criticized excessively prescriptive or inordinately permissive items.

A quantitative value was applied to each of the four evaluation terms. To be recommended, an item required two-thirds of the maximum value attainable. The following recommendations reflect the fundamental principles contained in the 26 legislative and 49 regulatory items which qualified. Safety education laws should: 1) require all schools to offer instruction in the several phases of safety; 2) authorize state education departments to regulate the details of such instructions; 3) authorize the expenditure of school funds for safety instruction; 4) avoid prescribing the details of safety instruction; 5) not mandate that non-educational agencies participate in, regulate or control education functions; 6) refrain from providing special financial support for certain phases of safety instruction and, 7) not involve the schools, directly or indirectly, in the granting of licenses or permits.

Safety education regulations should: 1) establish the basic framework within which school districts may adapt safety instruction and, 2) provide uniform minimum standards relative to granting credit for safety courses, time devoted to safety instruction, distribution of safety education funds, grade levels for such courses, and the extent of participation by non-educational agencies.

THE SAFETY EDUCATION PROGRAM OF THE PHILADELPHIA PUBLIC SCHOOLS

By DALIBOR W. KRALOVEC

Dir., Div. of Safety Education, School District of Philadelphia, Philadelphia, Pa.

The Problem and Its Scope

The main purpose of this study was to describe and analyze the safety education program of the Philadelphia public schools. This involved four problems: 1. to trace the early development of safety education in the Philadelphia public schools, 2. to determine the present status of the program, 3. to develop an evaluation questionnaire for Philadelphia based on national, state, and local recommendations and standards, and 4. to evaluate according to the evaluation questionnaire the present status of the safety education program of the Philadelphia public schools.

This study dealt primarily with the instructional program of safety education in the Philadelphia public schools. Emphasis is placed on the organization and administrative phases of the program. Evaluation of the program is based on the evaluation questionnaire for Philadelphia developed in connection with this study from national, state, and local recommendations and standards.

The need for safety education in the modern world is everywhere apparent if one reads the newspaper accounts and pictures of mishaps in traffic congestion and other hazardous conditions; and in the statistics of accidental deaths and injuries in the home, at school, in play and recreation; with fire, in work, and in numerous other situations. The critical need for safety education in a large metropolitan city such as Philadelphia is especially acute because of the extent of exposure to hazards.

Stack and Elkow point out that "In a world of constant change, objectives cannot be set for all time." There was need, therefore, to study the safety education program of the Philadelphia public schools to see that it was attuned to the facts and the times. No recent comprehensive study or analysis of the program has been made.

The need for a study of the type projected here was evident from a review of previous research studies in safety education. These studies are primarily of a broad survey

nature. The present study is designed to give a detailed analysis of the comprehensive safety education program of the Philadelphia public schools. It may be, in addition, a means of stimulation and inspiration to other communities in the organization and administration of vital and adequate safety education programs.

The safety education program of the Philadelphia public schools has evolved over a considerable period of time. There appears to be a need to ascertain direction and present status of the program. This study, in addition, should be of considerable value to the improvement of the safety education program of the Philadelphia public schools.

Method of Investigation

General references in the area of research methods and techniques and specific safety research references and studies indicated in the bibliography were consulted. Special attention was devoted to doctoral studies in the field of safety education. Background for this study was developed over many years through a study of the literature of safety education and long-time service in safety work.

Historical Aspects of the Study

Chapter IV of this dissertation, "A History of Safety Education in the Philadelphia Public Schools from 1818 to 1960," was written almost exclusively from primary source materials. A study to discover references to safety and safety education was made, and statistical reports from the superintendent's office were culled for references to safety and safety education. Locally published educational magazines were consulted. Additional sources of information were early manuals, courses of study, reports, bulletins and letters contained in the files of the safety office of the school district of Philadelphia. Personal interviews with leaders in the safety movement in Philadelphia helped to fill in gaps in the printed material. Careful notes were made from sources of materials indicated. The data

were arranged in a chronological sequence to give the story of the development of safety education in the Philadelphia public schools.

The evaluation questionnaire for Philadelphia was specifically developed for use in this study to serve as an evaluative instrument for the safety education program of the schools and as an administrative device to stimulate thought and activity in the school.

In 1949 the safety committee of the Philadelphia public schools prepared a short survey check list intended for distribution to principals throughout the Philadelphia public schools. It was called "School Safety Diagnosis for the Principal and His Staff." This questionnaire was never distributed to the schools. It was used in this study as a starting point and basis for the development of the evaluation questionnaire.

The first plan for the evaluation questionnaire for Philadelphia consisted actually in the development of four questionnaires along the lines of the original "School Safety Diagnosis for the Principal and His Staff." The four questionnaires were designed to ascertain the reaction of administrators, teachers, parents and pupils to safety and to the safety education program of the Philadelphia public schools. An attempt was made to have all four questionnaires similar in construction and in general items in order that reactions of the four groups could be compared and summarized in a significant manner.

Several months were spent in the development of these questionnaires, but they were eliminated from the study because they attempted too much and they were too general in nature. It was decided to concentrate on one questionnaire directed to the principal and the administrator of the school. A single comprehensive questionnaire seemed to have possibilities for coverage of a variety of safety areas in a much more detailed, specific and objective manner.

The evaluation questionnaire for Philadelphia, then, followed the general plan of the original "School Safety Diagnosis for the Principal and His Staff." The questionnaire developed for this study, however, was considerably enlarged and was made more specific and objective than the original questionnaire. The questionnaire was aug-

mented and changed to include elements from national, state and local standards for safety education together with numerous items which seemed particularly appropriate to the Philadelphia situation. The questionnaire considered five areas, namely:

1. General organization and administration.
2. School plant and grounds.
3. Instructional program in safety.
4. Community relationships.
5. Evaluation.

The questionnaire was revised a number of times in the light of suggestions made by the sponsoring committee and a jury of experts in safety education and by an informal pre-test of the questionnaire by a limited number of selected principals.

In early April, 1959, the questionnaire was mailed in duplicate to all Philadelphia public school principals with a covering letter from the superintendent. Responses were checked against the distribution list for completeness of the returns which were requested to be returned by May 15, 1949. In view of the official nature of the questionnaire and its covering letter, little difficulty was encountered in securing a one hundred per cent return.

The principal and his staff were requested to answer the questions in terms of "No," "Partly," or "Yes," or "Slightly," "Moderately" or "Extensively," and they were encouraged to make explanatory remarks on any part of the questionnaire. In view of these directions several methods of tabulation were considered. It was decided that a hand rather than a machine tabulation would meet the needs of this study, since only a part of the questionnaire response was numerical in character.

As a first step, the questionnaires were sorted for ease of handling them into the eight administrative districts from which they came. Returns from elementary schools, junior high schools, and senior high schools, including vocational-technical schools, were separated within the district returns.

Blank questionnaires with a "No Response" column added served as forms to tabulate the numerical returns from the questionnaires. Explanatory remarks were taken verbatim from the questionnaires returned from each of the administrative districts

and these were organized in terms of the five major areas covered in the questionnaire. The handbook of the school district of Philadelphia for 1960 listed the following school units as of September 1959:

TABLE I NUMBER OF DAY SCHOOL UNITS	
Senior High Schools	16
Senior-Junior High Schools	2
Vocational-Technical Schools	3
Junior High Schools	28
Elementary Schools	158
Residential Schools	1
	248

In addition, twenty-two elementary school annexes were maintained and attached organizationally to other schools. Six of these annexes were considered by the principal to be sufficiently different from the parent school to have questionnaires submitted separately for them. A total of two hundred fifty-four questionnaires were returned and used in this study.

The conclusions consisted of interpretations of the most important findings presented in the summary. Recommendations were offered for improvement of the safety education program of the Philadelphia public schools based on the findings of this study, in terms of the possibility and desirability of constructive practical application to actual situations of at least some of the conclusions, and in terms of the need for further research or study.

Summary of Historical Development of Safety Education in the Philadelphia Public Schools.

1. Twenty-five important communications were found in the early journals of the Board of Education concerning general "physical hazards" between the years 1875 and 1908.
2. Twenty-five important communications were found in the early journals of the Board of Education concerning specific "fire escape" needs between the years 1875 and 1907.
3. Safety patrols were established in Philadelphia in 1914 by the Philadelphia Rapid Transit Co. Safety patrols were officially approved as an integral part of the plan of instruction in February, 1925.
4. Safety patrol operation, except duties on school grounds, was suspended from 1929 to 1931. In May, 1931, the superintendent of schools was authorized and directed to organize school safety patrols in accordance with section 510 of the school laws of Pennsylvania. Safety patrols have operated continuously since that time, from 1931 to the present time.

5. Safety education became an established part of the curriculum of the Philadelphia Public Schools in 1932 with the issuance of a "Syllabus in Safety Education."

6. The Philadelphia public school defense committee which was organized in 1941 immediately after Pearl Harbor became the forerunner of committee organization for safety in the Philadelphia public schools.

7. The driver education program was instituted in the Philadelphia Public Schools in September, 1950 by the Board of Public Education.

8. The safety office in the division of physical and health education of the Philadelphia public schools was established by official action of the Board of Public Education on July 10, 1951.

9. Safety education was centered in the safety office, division of physical and health education, from 1951 to 1960.

10. The division of safety education was established by action of the Board of Public Education at its meeting on July 12, 1960.

11. The division of safety education began its official operation on September 1, 1960.

Summary of Present Status of the Safety Education Program

1. In 1960, there were more than 6,000 safety patrol boys serving in the public schools.
2. In 1960, a new safety patrol manual was issued for pilot study in a number of schools throughout the school system.
3. In 1960, there were 34 full-time teachers in the driver education program teaching approximately 4,000 students to drive in a fully approved state-standardized program.
4. A new course called "Resource Unit Outlines for Safety Education in the Elementary Schools" was issued for pilot study in 1959.
5. No independent time allotment was provided for safety education at the elementary or secondary school level in the Philadelphia public schools, except in driver education.

6. Approximately 30 written safety communications were issued to the schools each year.

7. At least one original safety flyer was developed by the Philadelphia public schools each year to carry a significant safety message in attractive way to students and parents.

8. All Philadelphia public schools received each month of *Safety Education* magazine of the National Safety Council.

9. The traffic safety program of the Philadelphia public schools was supplemented by the full-time services of six traffic officers from the Philadelphia police department.

10. Philadelphia had a force of 720 firemen school crossing guards.

11. Bicycle safety was a regular part of the safety education program.

12. Railroad safety programs were offered by the major railroads serving Philadelphia.

13. Fire safety regulations were spelled out in Administrative Bulletin No. 1 entitled "Fire Safety in Schools."

14. The fire safety program of the Philadelphia public schools was supplemented by the full-time service of three firemen from the Philadelphia fire department.

15. Safety in the home received emphasis in the school program.

16. The playground safety program utilized many of the safety personnel and services offered during the regular school year safety program; the safety patrol supervisor; six police officers assigned to the pedestrian safety education program; three firemen assigned to the schools; and the services of numerous community agencies, including the automobile clubs.

17. The schools were active in the civil defense program.

18. Supplementary-type programs included safe handling of dogs, kite flying, soliciting rides, and port tours.

19. Safety conferences such as teen-age conferences, bus driver's safety institutes, and coordinator's conferences were held as a regular feature of the safety education program.

Summary of the Evaluation Questionnaire

1. Teachers and/or safety patrol sponsors were designated as safety coordinators in

most Philadelphia public schools. Vice principals were given this responsibility in a number of secondary schools.

2. A committee comprised of the safety coordinator and other staff members assisted with the school safety education program in 76 per cent of the schools.

3. Schools achieved balance in the safety education program in more than 94 per cent of the schools by including safety in all areas of the curriculum, using a variety of generally-recognized valid methods and appropriate aids and involving all personnel.

4. Approximately 97 per cent of the schools declared that they eliminate safety hazards by encouraging cooperative group action, reporting hazards to proper authorities, executing an appropriate inspection plan, and following up on complaints and suggestions.

5. Eighty-nine per cent of the schools checked with the staff each school term on the rules and regulations contained in Administrative Bulletin No. 1, "Fire Safety in Schools," safety information and suggestions contained in the safety file and directions to the custodians.

6. Ninety-three per cent of the schools made known fire and defense procedures to faculty, children and parents through such means as oral communications, written communications, and drill exercises.

7. Ninety-one per cent of the schools disseminated information contained in safety communications from the Central Office through such means as assemblies, faculty meetings, special communications to parents, suggestions to the coordinator, bulletin boards, special safety projects, and through evaluation of the program.

8. Seventy-eight per cent of all the schools had the "Course of Study in Safety Education—Grades One to Six" available for teachers' use. Ninety-two per cent of the schools reported that they have safety pamphlets, booklets, or books available for use. Ninety-six per cent indicated that audio-visual aids are available for teachers' use.

9. Eighty-nine per cent of the schools declared that they had organized a school-wide system for the use of Form FHV 51, Record and Report of Accident, and 82 per cent said they have organized a school-wide system for the use of Form M 98, Record

of illness and/or injury. Eighty-eight per cent asserted that they followed up accident reports.

10. Student safety groups were organized in the schools as follows: 33 per cent had school safety councils; 80 per cent had school safety patrols; 87 per cent had indoor safety guides; 26 per cent had junior fire patrols or departments; 38 per cent had civil defense messenger service groups; and 74 per cent had sanitation or good housekeeping squads.

11. Schools claimed that they checked regularly on the proper functioning of student safety groups as follows: on the street, 90 per cent; in the playground, 89 per cent; on the school bus, 44 per cent; and within the school building, 94 per cent.

12. Seventy-six per cent of the schools stated that they used the literature and services of recognized safety agencies in organizing and planning the safety program of the school. Approximately 90 per cent used the booklets, pamphlets, posters, flyers, and magazines of such agencies.

13. Eighty-eight per cent of the schools made use of Safety Education magazine by circulating the magazine among faculty members; over 60 per cent reviewed articles and used the lesson outlines; 12 per cent claimed to write for the magazine.

14. Schools generally reported moderate provision of in-service safety education for staff members. Approximately 80 per cent of the schools reported the use of resource persons and participation in safety meetings and discussions.

15. Eighty-nine per cent of the schools reported moderate to extensive provisions for acquainting new teachers in the school organization with the safety education program of the school.

16. Ninety-seven per cent of the Philadelphia public schools reported that they instructed the staff and students to live in a safe environment.

17. Ninety-five per cent of the schools indicated inspections of the school plant and grounds in order to eliminate hazards such as slippery surfaces, loose plaster, unsafe furniture and equipment, broken glass, defective pavements, steps, and blocked passageways.

18. Ninety-seven per cent of the schools

declared that they took precautions to see that all exit doors are unlocked and unobstructed during school hours.

19. Approximately 96 per cent of the schools revealed proper use of "built in" safety features of the school building such as panic bolts, fire doors, handrails, and alarm systems.

20. Sixty-seven per cent of the schools noted that they have studied the traffic layout on stairways and in corridors.

21. Schools reported on the question of taking special precautions to insure safety in special areas as follows: 41 per cent, in shops; 39 per cent, in home economic rooms; 33 per cent, in science laboratories; 42 per cent, in cafeterias; 75 per cent, in auditoriums and stages; and 92 per cent, in gymnasiums and playgrounds.

22. Ninety per cent of the schools showed that they checked with the custodian to see that an adequate inspection for fire and other hazards was made of the building and grounds at the close of each day.

23. Eighty-six per cent of the schools reported that they have made plans and safeguards to meet common neighborhood hazards.

24. Over 94 per cent of the schools reported that teachers and parents observe children for unsafe behavior so that they may improve planning, instruction, supervision, and environment factors in safety.

25. Approximately 85 per cent of the schools indicated that they have diagnosed moderately or extensively, the school accident report to determine what can be done to reduce accidents by improving the safety factors in school activities, curriculum, supervision, and environment.

26. Eighty-two per cent of the schools felt that they developed the judgment and maturity in their pupils which would enable the students to arrive at the wisest way to deal with the safety factors in any situation.

27. Over 80 per cent of the schools stated that they instructed pupils in the safe routes home. Fifteen per cent of the schools reported that they do not instruct pupils on the safest way home.

28. Approximately 84 per cent of the schools reported moderate or extensive opportunities for pupils in the safety program to assist in the purposing, planning, organ-

izing, administering, practicing, and surveying of the program.

29. Eighty-five per cent of the schools gave evidence of teacher use of a wide variety of safety activities in terms of pupil levels appropriate to the developmental level of the child.

30. Schools declared that teachers encouraged children to participate creatively as follows: 81 per cent by initiating projects of their own; 82 per cent by writing original safety plays, stories, and poems; 94 per cent by drawing or painting posters; and 62 per cent by conducting needed surveys.

31. Over 80 per cent of the schools declared that their safety programs afforded opportunities for integrating safety activities in the subject matter areas.

32. Approximately 90 per cent of the schools asserted that their safety programs included traffic, school, home, playground, fire, seasonal, and civil defense safety.

33. Over 90 per cent of the schools affirmed that they took advantage of the opportunities offered by special events such as holidays, emergencies, vacations, and special drives.

34. A high percentage of schools used a variety of media in the safety program. Ninety-nine per cent used posters, 84 per cent used dramatics, 72 per cent used original writings, 97 per cent used assembly programs, 90 per cent used safety patrol activities, 88 per cent used bulletin boards, and 84 per cent used slogans. Twenty per cent of the schools revealed that they have not used original safety writings.

35. Schools reported that they plan for safety with the staff and community in a cooperative effort. Sixty-eight per cent hold safety meetings and discussions, 76 per cent hold home and school meetings, and 82 per cent use community resources and agencies. Fifty-six per cent cooperated in and/or sponsored conferences and campaigns.

36. Approximately 90 per cent of the schools indicated that they did not sponsor such community activities as courses, forums, and debates. Approximately 50 per cent revealed that they did not sponsor discussions and plays on safety.

37. Over 90 per cent of the schools promoted an instructional program of pedestrian safety which included observation of traffic

controls, obedience to traffic control personnel, use of pavements, and alertness for turning cars. Eighty per cent of the schools had pedestrian safety instruction on safest routes home.

38. Approximately 60 per cent of the schools made systematic attempts to inform parents of pre-school as well as school age children of safety habits through special meetings, written communications, distribution of safety materials, and information on available safety services.

39. Approximately 75 per cent of the schools declared that they promoted a program on home or out of school safety by means of written communications, meetings and discussions, and distribution of safety literature and provision of speakers.

40. Approximately 50 per cent of the schools affirmed that they informed parents of regulations governing automobile loading and unloading and request parental cooperation.

41. Eighty-four per cent of the schools recorded that they cooperated with community efforts to prevent accidents during holidays and vacations by making playground space available.

42. Approximately 90 per cent of the schools asserted that they fostered the building of informed public opinion and the development of public support for programs designed to make the community safe for children and adults.

43. Ninety-one per cent of the schools reported that there are fewer accidents.

44. Eighty-eight per cent indicated that accidents are less serious as the result of the safety program.

45. Eighty-four per cent felt that there were fewer near accidents.

46. Ninety-one per cent evidenced safe behavior on the part of the children.

47. Ninety-one per cent of the schools asserted that they cooperated with other groups in safety programs.

48. Eighty-five per cent of the schools stated that fewer complaints are received.

49. Seventy-nine per cent of the schools believed that more commendations are received for safe practices.

50. Sixty-five per cent of the schools reported that they are listed in the National Safety Council School Honor Roll.

Conclusions

1. While much attention was given to the physical structure and condition of school buildings, according to the early journals of the Board of Education, the matter of inadequate fire escape facilities appeared to dominate the evidence.
2. Safety patrols have played a significant part in the safety education program of the Philadelphia public schools since 1914.
3. The instructional program in safety in the Philadelphia public schools made its first steps as an organized program with the issuance in 1932 of a "Syllabus in Safety Education."
4. World War II gave considerable impetus to the safety education program of the Philadelphia public schools.
5. The driver education program which was started in 1950 has expanded considerably.
6. Guides and/or courses of study in the Philadelphia public schools made use of special techniques such as integration in the various subject areas to provide time for safety education in the school curriculum.
7. Many safety communications, safety materials, safety services and resources were furnished to the schools.
8. The safety education program of the Philadelphia public schools featured a wide variety of safety activities.
9. A number of school-year safety education programs were carried over into the summer playground program.
10. Safety conferences formed a significant phase of the in-service education of teachers and other school personnel.
11. Safety Patrol sponsors, safety coordinators in each building, and driver education teachers were key persons in the safety education program of the Philadelphia public schools.
12. As a result of the safety education program, significant effort was made to eliminate safety hazards.
13. Considerable emphasis was placed on fire and defense procedures.
14. A high percentage of use was made of safety communications, instructional material and services and resources furnished to the schools.
15. Accident reporting constituted a sound basis of the safety education program.
16. Student safety activities played an important part in the program.
17. The Philadelphia public schools gave a high degree of attention to the safe use of school plants and grounds.
18. The instructional program in safety appeared to be comprehensive and used a wide variety of approaches.
19. The evaluation questionnaire for Philadelphia seemed to indicate only moderate individual school efforts in community relations in safety.
20. School personnel generally felt that the safety education program was achieving its purpose.

Recommendations

As a result of the findings and conclusions drawn from the body of this study, the following recommendations are made:

1. Complete files of historical materials in safety education should be kept so that these materials may be readily available for subsequent reference and research.
2. The safety patrol manual, issued in 1960 for pilot study in a number of schools, should be revised in the light of suggestions received and should be prepared for printing.
3. Driver education should be continued and expanded in order to reach all students of legal driving age.
4. The new course called "Resource Unit Outlines for Safety Education in the Elementary Schools" issued for pilot study in 1959 should be revised in the light of suggestions offered by the schools and should be prepared for printing.
5. Time allotment for safety education in the curriculum should be considered for elementary and secondary schools.
6. Additional financial resources should be sought to support the distribution of original safety flyers which meet the needs of the Philadelphia situation.
7. The safety education program of the Philadelphia public schools should be continued and expanded to meet growing safety needs. A study should be made of staff needs in order to implement an expansion of the program.
8. Safety conferences such as the teen-age traffic safety conferences, school bus driver's

safety institutes, and school safety coordinator's conferences meet a real need and should be continued.

9. Items from the evaluation questionnaire for Philadelphia developed for use in this study should be examined one by one by those responsible for the safety education program in the Philadelphia public schools to ascertain possible areas for improvement in the program.

10. School personnel should be encouraged to contribute to safety education magazines and other media of public information.

11. Research of the informal and formal types in safety education should continue to be encouraged. A few research projects for future consideration might include:

Development of improved curriculum guides in the many areas of safety educa-

tion including driver education, vocational safety education and science;

Creation of new approaches and materials in safety education with special emphasis at the junior high school level;

Study of the influence of safety education on the lives of students in terms of the development of safety attitudes and the meeting of civic responsibility;

Development of an employee accident prevention program to a greater degree than is presently in operation;

Determination of the direction of the future development of the safety education program of the Philadelphia public schools as a whole or in its various facets to include new developments such as air safety, boat safety and other safety needs as they arise.

CASE STUDIES OF ONE-CAR ACCIDENTS INVOLVING YOUNG DRIVERS

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The purpose of this study was to determine *who* was being involved in one car accidents, *how* and *why* they were being involved, and *what* implications the findings had for driver education and improvement. To accomplish this general purpose the investigator worked through the following specific problems: 1) to prepare case studies of selected one-car accidents involving young drivers, 2) to determine common characteristics or combinations of behavior, conditions, and biographical factors in these case studies, and 3) to develop educational content and technique based on an analysis of the individual case studies and the cases viewed collectively.

The population studied consisted of drivers under 30 years of age involved in one-car accidents in three central Michigan counties during a three month period in 1959. Information about the accidents and the drivers was obtained from police accident reports, interviews with the drivers, visits to the accident scenes, state driver license records,

and school records. Aid from one college and two high schools was obtained to help determine effective procedures for using traffic accident case study analysis to achieve driver education objectives.

One hundred twenty-four drivers were interviewed out of a possible 135 drivers involved in the type of accident being investigated. Interviews with eleven drivers could not be obtained because the driver lived too far away or refused to be interviewed. Five interview cases were eliminated when the information supplied by the driver proved to be unreliable. So 119 cases were ultimately used in the study. With few exceptions these 119 interviewees were cooperative and seemingly uninhibited in discussing the accident.

Common Characteristics and Combinations of Factors Related to the Accident

Each individual case included from 2 to 12 factors which appeared to relate to the accident. Most individual cases included

driver, vehicle, and environmental factors. In only one case did the driver seem to be a victim of circumstances.

The accidents tended to occur within six miles of the driver's residence (67 per cent); at night (69 per cent); in open country (65 per cent); on a straight road (60 per cent); on highways of asphalt or concrete construction (77 per cent). Subsequent information will show other environmental factors related to the accidents.

The ratio of men to women involved in the accidents is 4 to 1 which is identical to the male-female ratio for all accidents in Michigan during 1959. This ratio is not consistent with the male-female ratio of Michigan drivers under 30 years of age which is 1.8 to 1. However, these figures do not consider the driving exposure rates for the sexes. Women reported fewer miles driven than men in this study, but the information appeared to be too unreliable for any accurate comparison.

Forty-four per cent of the subjects completed a high school driver education course. Two-thirds of this group were under 20 years of age while only two of them were in the 25-30 age group. This condition made it pointless to compare the driver education group with the others.

Analysis of driving records revealed: 1) that the subjects reported to the interviewer an average of 200 accidents while the official records showed a 1.76 average; 2) twenty-six per cent of the subjects, all men, had accumulated from 5 to 20 violations, or at least 3 within the last year; 3) forty-one per cent of the drivers had no previous accidents, but none of these were men in the 25-29 age group.

A study by Siebrecht and others² concluded that 1 out of 14 women drivers and 6 out of 10 men drivers under 30 years of age have an accident record. In this investigation more than 1 out of 3 women and 2 out of 3 men had an accident record before being involved in the one-car accident investigated.

Numerous factors combined to create each of the traffic accidents in this study, and frequently one of these factors stood out as an obvious cause. For example, the driver "fell asleep," "reached for a cigarette," or "exceeded the critical speed on a curve." However, when one looks for

underlying factors which prompted the "trigger" event, speculation replaces certainty. Alcohol, worry, fatigue, or poor attitude may be present as a circumstance, but the condition may or may not be a cause. The biases of the investigator toward accident causation further complicate the process of trying to identify objectively and accurately the factors which contributed to the accident. This study was not exempt from the problems and limitations expressed here.

As planned, each accident was studied as a "whole." Case studies were prepared from a view of the interacting driver, vehicle, and environmental factors. An accounting system was developed to determine how frequently each of the accident factors occurred. A subsequent step revealed the most common combinations of factors. Each accident was classified according to the following prominent human errors which directly precipitated the accident:

1. Asleep or blackout—18 cases.
2. Distraction—36 cases.
3. Perception—judgment error—60 cases.
4. Passenger fell from vehicle—4 cases.
5. Lack of skill in backing—1 case.

The distraction cases were further classified under pre-occupation, passenger distraction, and distraction within or outside the vehicle (non-passenger). Specific errors under the perception-judgment category include misjudging approach or critical speed to curve, misjudging surface and skill error, misjudging critical speed on straight slippery surface, overdriving perception distance, and misjudging position of vehicle. Three of the passengers who fell from the vehicle were children, and the fourth was a teenager attempting to ride on the hood of the vehicle.

Underlying human factors, vehicle defects, and highway and traffic engineering deficiencies were related to the direct cause described in the preceding paragraph.

Human factors which appeared in at least 20 per cent of the cases reviewed were: 1) alcohol; 2) unsafe attitude toward speed; 3) emotionally upset or excited; 4) fatigue; 5) in-a-hurry; and 6) poor corrective action.

The only vehicle defect appearing in more than 5 cases was "smooth tires." How much this deficiency contributed to the accident is highly speculative.

Accident Analysis Try-Out in Driver Education Classes

Representative cases were selected to use in two high school driver education programs. Top priority was given to those cases best demonstrating that the accident could have been avoided if the driver had possessed accurate information, different attitudes, better control of his emotions, or improved skill. Furthermore, the cases selected involved drivers near the age level of those who were to analyze them.

The two high school teachers involved did not use the same technique in presenting the cases to the students. Teacher A divided his class into small groups and gave each group a different case. The students analyzed the case within their group for causes and preventative measures, and then each group reported its composite and individual conclusions to the class. Eight cases were analyzed in one period. Teacher B requested the students individually to analyze each of eight cases and write their conclusions. This required more than two class periods. The same evaluation form was administered in each school.

Both students and teachers responded favorably to the accident case study analysis as a learning experience in their driver education classes. The specific learnings mentioned most frequently, and those the students felt would help them become better drivers were: 1) the importance of attend-

Highway and traffic engineering defects appeared in 44 per cent of the cases, with "defective surface" accounting for almost one-half of these defects. Other engineering defects were: 1) inadequate or defective shoulder, 2) curve poorly designed or marked, and 3) exceptionally narrow road or bridge.

Table I shows the number of times each of the underlying factors appeared with more direct causes of the accidents. Fatigue and alcohol appear prominently in the "asleep" accidents, and emotional factors show up in 22 of the 36 "distraction" cases. The most certain conclusion seems to be that alcohol, attitudes, emotions, fatigue, etc., can contribute to almost any direct cause.

The interview data were reviewed for background attitudes and emotional problems which seemed to relate to the individual's driving behavior. Attitudes which appeared most frequently were:

1. Fatalistic attitude toward chances of accident involvement—33 per cent of the cases.
2. Unrealistic attitude toward own driving ability—22 per cent of the cases.
3. Hostility toward traffic law enforcement—13 per cent of the cases.

Twenty-six drivers had a history of nervous disorders or emotional instability, and 19 of these subjects were emotionally upset just prior to the accident.

TABLE I
Direct Causes of the Accidents and Frequency of Related Underlying Factors
(Based on interview data and visits to the accident scenes)

Direct Causes	No. of Cases	Alcohol	Attitude (fatalistic)	Attitude (unrealistic)	Emotions	Fatigue	In-a-hurry	Poor judgment	Poor corrective action	Vehicle defect	Hostile or U. S. Aggr. Driver
Asleep	18	8	5	4	4	14	2	5	7	2	1
Black out	3	0	0	0	1	1	2	0	0	1	0
Distraction (non-passenger)	14	4	3	2	7	5	1	0	6	4	4
Distraction—passenger	13	0	0	0	8	1	1	1	7	0	5
Preoccupied	9	1	1	3	7	8	5	1	7	5	7
Misjudged speed—curve	17	6	4	7	4	6	2	0	11	6	8
Misjudged surface—skill error	16	2	0	3	8	4	3	0	16	6	7
Misjudged speed—straight	12	2	2	7	3	2	4	0	7	4	8
Overdrove perception distance	10	1	2	5	2	1	3	1	5	2	7
Misjudged position	5	2	1	3	1	1	0	1	3	2	4
Passenger fell from vehicle	4	0	0	0	0	0	1	0	2	2	1
Improper backing	1	0	0	0	1	0	0	0	0	0	0
Total cases	119	27	18	37	46	40	25	9	64	36	52
(% of total cases)	(100%)	(23%)	(15%)	(31%)	(39%)	(34%)	(21%)	(8%)	(55%)	(30%)	(44%)

ing and adjusting to road and weather conditions, 2) the importance of avoiding distractions which take a driver's eyes off the road, 3) an understanding of driver errors in emergency situations, such as skidding, driving on the shoulder, etc., 4) the need for intelligent interpretation and judgment in operating a vehicle, and 5) the danger of driving when emotionally upset. These factors happened to be highlighted in the selected cases. If the teacher desired to stress the effects of fatigue and alcohol or other factors, he would choose cases in which these factors were involved.

The students permitted to analyze the cases in small groups and then report their findings to the entire class rated the accident analysis technique higher than the students who wrote their individual analyses of each case.

General Benefits suggested by the Try-Out of Accident Analysis in Driver Education Classes

1. Studying actual accident cases focuses student attention on the "crucial learnings" needed by drivers to operate safely and efficiently on the highway.
2. An accident case may involve important concepts from all the traditional units of driver education instruction. Integrating and relating the concepts around a focal point, the accident, tends to establish a meaningful learning experience.
3. Students learn that most accidents involve more than a single cause, and that none of the factors are trivial if they were needed to create the accident.
4. Teachers discovered that accident cases "triggered" group discussion which helped students to clarify their beliefs, attitudes and understandings of concepts involved in the accident.
5. Students felt that the accident analysis experience helped them develop the ability and desire to recognize accident-producing situations and adjust accordingly.
6. Accident analysis shows promise as a way to modify and evaluate the interests, attitudes, knowledge, and thinking habits of students.
7. Based on student reactions, one of the greatest values in using accident case studies for analysis appears to be in preparing drivers to react correctly in emergency driving situations.

8. In summary, this technique seems to integrate content in a meaningful, vital and interesting way; placing emphasis on crucial learnings needed to survive on the modern highway.

Selected Accident Report Data on One-Car Accidents in Two Different Three-Month Periods

A comparison was made between the three month period of this study (October-December, 1959) and the preceding three months (July-September, 1959) to discover similarities and differences. Since no interview data were available from the July-September period, only police accident report data were used for this comparison. This is a collateral phase to the study designed to identify different results one might expect if another three month period were used.

Little, if any, difference was found between the two three-month periods in the following:

1. Ratio of drivers under 30 years of age to those over 30 involved in one car accidents—3 to 2 ratio in each period.
2. The mean age of the drivers under 30—mean of 21.62 in July-September, and mean of 20.71 in October-December.
3. The male-female ratio—4 to 1 ratio in each period.
4. Locality of the accident—approximately 61 per cent in open country, 27 per cent in a residential area, and 12 per cent in a shopping or business district, in each three month period.
5. Road characteristics—exactly 49.6 per cent happened on a straight and level road in each time period.

Considerable difference was found when comparing:

1. Frequency by light conditions—accidents during darkness 16.4 per cent higher in the October-December period.
2. Surfaces and weather conditions—twice as many dry road accidents happened in July-September compared to October-December, and it was snowing in 12 per cent of the October-December accidents compared to no snow in July-September.
3. Road construction—a higher percentage happened on gravel roads in the July-September period.

A comparison between the actual frequency of accidents for the combined period (July-December, 1959) in three age groups—under 20, 20-24, and 25-29—and the expected frequency, if the accidents were in direct proportion to the percentage of drivers in each age group, revealed that the under 20 drivers had 1.76 times the expected number, and the 25-29 group had .45 of the expected number.

Implications of the Findings for Research

When convinced they will be anonymous, young drivers involved in a one-car accident will consent to an interview and freely discuss the causes as they see them. They will also reveal their driving records more completely than the official record. Since this is true and since a review of 246 one-car accidents over a six month period involving drivers under 30 indicated a highly disproportionate number under 20 years of age, a study of this group alone seems appropriate. The project should aim to determine the intellectual, physical, physiological, social and emotional differences between teen-age drivers with an accident and violation-free record and those with repeated violations and accidents.

If studied now, all the drivers in this group would have completed a state ap-

proved driver education course due to the Michigan driver education law which became effective in February, 1967. This fact would permit the investigator to evaluate and suggest improvements for driver education, in addition to discovering information on teen-age traffic violations and accidents.

Furthermore, findings of this study suggest the need for research into the following areas:

1. To determine the differences between men and women in the human factors related to accident causation, so that appropriate educational efforts can be designed to meet these differences.
2. To compare the case study method suggested in this study to other teaching methods with respect to their potential for imparting knowledge, modifying attitudes and affecting driving behavior.

NOTES

1. Gerald F. King, *The Age Characteristics of Michigan Drivers*, East Lansing, Michigan, Highway Traffic Safety Center, Michigan State University, 1958.
2. E. B. Siebrecht, C. F. Schumacher, and A. R. Lauer, "Accident Characteristics of Drivers at Various Age Levels," *Traffic Safety Research Review*, 36 (December, 1959), pp. 25-32.

A SURVEY OF GENERAL SAFETY EDUCATION COURSES

By JOHN E. CORBALLY

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Preface

At the 1960 annual meeting in Chicago, of the College Safety Education Division of the National Safety Council's Higher Education Section, a work project was approved that would have as its purposes (1) collecting of various course and curriculum outlines in safety education, (2) analyzing such course outlines, and (3) recommending a "model" course outline that might be used as a guide for colleges and universities which are offering safety education for the first time. Out of such a study it was hoped that there would be found many common

elements in basic college courses in general safety education.

A committee was appointed in January, 1961, to evaluate such college courses. Members were Lillian C. Schwenk, Iowa State University, Ames, Iowa; Dr. William A. Stebbins, State University College of Education, Brockport, New York; Dr. Robert T. Bowers, Jr., The University of Georgia, Athens, Ga.; and Dr. John E. Corbally, University of Washington, Seattle, Washington, as chairman.

This study would not have been possible without the help of Dr. James F. Nihon,

director of safety education of the State University of New York, and Dr. Bernard I. Loft, Associate Professor of Health and Safety at Indiana University, and members of his classes. Dr. Nihon prepared and distributed the inquiry form used in the study, and Dr. Loft and his students summarized the raw data. Members of the committee made specific suggestions which have been incorporated in the final report.

Introduction—Those who have taught a general basic course in safety education recognize that there are many topics that might and should be included, that there is great variation in time that might be devoted to each topic, that various methods can be used effectively, that many resource persons are available, that the field is rich in audio-visual aids, and that all age groups need instruction in safety. How to prepare prospective teachers so that they will be equipped to teach and practice safety in the school environment is a continuing problem in teacher education. Not all teacher training institutions provide a course or courses in this field, nor do all teachers recognize their legal responsibility for the safety of their pupils. A basic course should be developed in such a way to be of value to all teachers—elementary or secondary. It also should have in mind school administrators and prospective college teachers in this area. Such a course, too, might have an occasional appeal to college students in areas other than teacher training as an elective.

Not only is there a need for more higher institutions to offer work in safety, but it is important that there be some uniformity in a basic course as a means of up-grading teacher preparation in safety education. Teachers who receive their training in one state may teach in another, and to facilitate transfer or acceptability of credit there needs to be comparability and equivalency of course offering to make such transfer possible.

Many other reasons could be advanced for such a study, but to those working in this area it is obvious that a start such as this one should stimulate further curricular research and provide an incentive for re-evaluating one's own offering using the suggested course outline developed from the data obtained.

Procedure—Early in March, 1960 a letter

was sent to various colleges and universities throughout the United States asking them to forward outlines of their basic courses in general safety education. Respondents were asked to indicate (1) total credit hours for the course; (2) total clock hours; (3) number of minutes devoted to each major topic or subject area; (4) textbook preferred for the course; (5) recommended references; and (6) teaching techniques and audio-visual aids used. These schools were selected not only by geographical location, but also by the reputation of each institution for having a valid general or basic course in safety education.

Forty-six colleges and universities sent course outlines and supplied the supplementary information requested. Since two failed to give sufficient information, the data used came from 44 higher education institutions. These were well distributed geographically, and included public and private teachers' colleges, and other colleges and universities. It seems fair to assume that this represents a valid sampling for the purposes of this study.

Analysis of the Data

Total credit hours for the course. Of the 44 schools reporting, 26, or 60 per cent allowed three semester hours of college credit toward graduation. Eleven schools granted two semester hours; two allowed one and one-half semester hours, and one allowed one semester hour credit. The most common practice was to make this a three semester or five quarter hour credit course.

Total clock hours. There was a wide variation in practice as to the total clock hours devoted to the course and credit allowed. This is shown in Table I.

TABLE I

Total Clock Hours Devoted to the Course in Safety Education		
Number of Schools	Clock Hours	Semester Credits
1	60	3
13	50-59	3
11	40-49	3
3	30-39	3
7	20-29	2
2	20-29	2
2	20-29	1½
1	10-19	2
1	10-19	1
1	15	2

The range in hours for three semester credits was from 30 to 60. For two credits the range was from 15 to 39. Three schools gave three credits for 30-39 clock hours, while seven gave only two credits.

Number of clock hours devoted to each major topic or subject area. Twenty-three of the 44 reporting schools supplied information for this part of the study. This time was broken down into the following general areas: introduction, farm and home safety, fire safety, industrial safety, bicycle safety, pedestrian safety, traffic safety, sports safety, school safety, civil defense, legal responsibility, and evaluation. The range in time is shown in Table II.

TABLE II
Number of Clock Hours Devoted to Each Major Topic or Subject Area

Topic or Area	Range in time	Average
1. Introduction	1-31	7½
2. Farm and Home Safety	1-18	4
3. Fire Safety	1-6	3
4. Industrial Safety	1-9	2
5. Bicycle Safety	1-9	2
6. Pedestrian Safety	1-9	2
7. Traffic Safety	1-18	4
8. Sports Safety	1-9	2
9. School Safety	1-12	4½
10. Civil Defense	1-9	2
11. Legal Responsibility	1-9	2
12. Evaluation	1-9	2

More time was spent in introducing the course than on any other topic. The average

Audio-visual aids and recommended references. Audio-visual aids used to assist in teaching were many and varied. Those most widely used by the respondents were: flannel board, posters and charts, display boards, puppets and models, magnetic boards, tape

time was almost twice as much as in the areas of school safety, farm and home safety, and traffic safety.

Textbooks preferred for the course. Only four different texts were used by the 36 institutions replying to this question. Twenty-two preferred Stack and Ekow, *Education for Safe Living*; nine used Florio and Starnford, *Safety Education*; three selected Brady and Stack, *Highway Safety and Driver Education*; while one institution used the American Automobile Association text, *Sportsmanlike Driving*.

Teaching Techniques. The lecture method was found to be predominant throughout those institutions which reported on teaching procedures. Other methods used, usually to supplement the lecture method, and the number of institutions using these are shown in Table III.

TABLE III
Teaching Methods and Frequency of Use in Classes in Safety Education

Method	Number of Institutions
1. Group Method	10
2. Oral Reports	9
3. Guest Speaker	8
4. Class Discussion	8
5. Outside Written Reports	8
6. Field Trips	5
7. Panel Discussion	3
8. Demonstration	2

recorders, projectors, slides, psycho-physical testing devices, testing for alcohol consumption, auto stimulators, brake reaction detector test devices, and film.

Films preferred by the reporting schools included:

Film Title	Source
School Safety Patrol	Dept. of the Army, Chief of Chaplains Washington 25, D. C.
Anyone At All	Cuyahoga Falls Police Dept., City Hall Cuyahoga Falls, Ohio
Pattern for Survival	Daisy Mfg. Co., Rogers, Ark.
How to Have an Accident in the Home	The Coca-Cola Co., P. O. Drawer 1734 Atlanta 1, Ga.
Safety Doesn't Happen	National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

(Continued on next page)

1961 National Safety Congress

Film Title	Source
Mias the Killer	Bureau of Public Roads, Photographic Section, Washington 25, D. C.
Coal Gas	Cleveland Automobile Club, 2605 Euclid Ave., Cleveland, Ohio
Danger Sleuths	Convair Motion Picture Section, Dept. 98-80, P. O. Box 1950, San Diego, Calif.
Fire Exit Drill at Our School	Dept. of Attorney General Parliament Building, Toronto, Ont.
Industrial Arts: a Safe Shop	Dept. of the Army, Deputy Cts for Personnel, Safety Division, Washington 25, D. C.
Let's be Safe at Home	City of New York Department of Water Supply, Gas and Electric, Room 2317 Municipal Bldg., New York 36, N. Y.
Let's Stop and Go Safely	Calvin Co., 1105 Truman Road, Kansas City 6, Mo.
Plan to Live	Audio Productions, Inc., Film Center Bldg., 630 9th Ave., New York 36, N. Y.
When You are a Pedestrian	Calvin Co., 1105 Truman Road, Kansas City 6, Mo.

Some excellent reference materials were listed. According to their frequency of selection, they were:

1. American Automobile Association, *Sportsmanlike Driving*, McGraw-Hill Book Company, Inc., New York, 1955, 480 pp.
2. Florio, A. E. and G. T. Stafford, *Safety Education*, McGraw-Hill Book Company, Inc., New York, 1956, 327 pp.
3. Brody, Leon, and Herbert Stack, *Highway Safety and Driver Education*, Prentice-Hall, Inc., New Jersey.
4. American Red Cross.
5. Stack, H. J., and J. D. Elkow, *Education for Safe Living*, Prentice-Hall, Inc., New Jersey, 1959.
6. National Safety Council, "Accident Facts," *The Council* (Current Issue), Chicago.
7. Halsey, *The New Let's Drive Right*, Chicago, Scott, Foresman, 1958.
8. *Journal of Health, Physical Education and Recreation*, by American Association of Health and Physical Education.
9. *Today's Health*, by American Mental Association.
10. *The Casualty and Surety Journal*.
11. Seaton, Don C., *Safety in Sports*, Prentice-Hall, Inc., 1948.
12. American Association of School Ad-

ministration, *Safety Education*, N.E.A., Washington, D. C. (18th Yearbook.)

13. Heinrich, *Industrial Accident Prevention*.
14. Tysor, H. J., *The Fundamental Principles of Driving*, Banks Upshaw and Company, Dallas, 1953.
15. *Driver Education*, New York University.
16. *Who is Liable for Pupil Injuries*, by National Education Association.

Conclusion—From the information obtained from the 44 colleges and universities, and from an analysis and evaluation of the courses of study submitted, a typical or representative basic course in Safety Education is submitted for consideration.

A Suggested Basic Course of Study in Safety Education

1. Total credit hours for the course—3 semester hours.
2. Total clock hours—three class meetings per week, 18 weeks, or 54 class meetings of 50 minutes each or equivalent.
3. Textbooks mentioned most frequently for the course:
 - a. Stack, H. J. and J. D. Elkow, *Education for Safe Living*, Prentice-Hall, Inc., New Jersey, 1959.
 - b. Florio, A. E., and G. T. Stafford.

Safety Education, McGraw-Hill Book Company, New York, 1956.

4 Content:

- I. Introduction (Lecture) 7 clock hours

- A. Need for safety education

- B. Nature and scope of the accident picture
 1. Motor vehicle
 2. Occupational
 3. Public, home, farm, recreation

- C. The accident problem—philosophy and principles of prevention

- II Home and Farm Safety (Lecture, oral reports) 4 clock hours

- A. Home accidents
 1. Annual deaths and injuries
 2. Falls cause most fatal home accidents
 3. Burns, poisons, firearms rank next in order
 4. Causes and related factors

- B. Farm accidents
 1. Machinery and equipment
 2. Animals and plants
 3. Insecticides and pesticides
 4. Flammables and explosives

- C. Preventing home and farm accidents

- D. First aid (See footnote at end of outline)

- III Fire Safety (Lecture, guest speaker) 5 clock hours

- A. Nature of fire problem
 1. Loss of life; injuries
 2. High economic cost
 3. Decreasing earning power; increased taxes
 4. Causes

- B. Fire prevention
 - a. Classes of fire; fire extinguishers
 - b. Learning and understanding
 - i. Chemistry of combustion
 - ii. Correct use of matches; smoking habits
 - iii. Care of defective and overheated chimneys and flues
 - iv. Spontaneous combustion; housekeeping
 - v. Use and maintenance of electrical appliances
 - vi. Holiday precautions

- C. First aid

School and College Sessions

- IV. Occupational Safety (Guest speaker, written reports, field trips) 4 clock hours

- A. Overview of occupational hazards

- B. Elements in a complete plant program
 1. Machine guards
 2. Personal protection
 3. Instruction in safe practices

- C. Home shops

- D. First aid

- V. Traffic Safety (Guest speaker, class and panel discussion) 8 clock hours

- A. Nature of traffic problem
 1. Rural and urban motor vehicle accidents
 2. Pedestrian problem
 3. Relationship of alcohol
 4. Accident factors: age, vision, speed, vehicle defects, weather, and the like
 5. Bicycles, motor scooters, go-karts

- B. Driver education

- C. First aid

- VI. Pedestrian Safety (Guest speaker, demonstration) 4 clock hours

- A. School child
 1. Community-parent responsibility
 2. School responsibility for safety education
 3. Some guiding principles

- B. Student aids
 1. School patrol
 2. Safety council
 3. School parking problem

- C. First aid

- VII. Safety in Swimming and Recreation (Lecture, class discussion) 4 clock hours

- A. Physical education; interscholastic competition

- B. Water activities
 1. Swimming
 2. Skiing
 3. Boating
 4. Fishing

- C. Individual sports
 - D. Hunting
 - E. Camping
 - F. Vacation Safety
 - G. First aid

- VIII School Safety (Guest speaker, lecture, group method) 6 clock hours
- A. Plant
 1. Buildings and facilities
 2. Grounds
 3. Inspection and follow-up
 - B. To and from school
 1. Pedestrian
 2. Vehicular
 - a. Motor scooter
 - b. Bicycle
 - c. Auto
 - d. Buses
 - C. Student activities
 1. Field trips
 2. Surveys
 - D. School shops and laboratories
 - E. Relation to community program
 - F. First aid
- IX Legal Responsibility (Lecture, guest speaker, written reports) 4 clock hours
- A. Liability
 1. Teacher
 2. School
 - B. Negligence
 - C. Legal defenses
 - D. First aid protection
1. Insurance
 2. School board
 - E. Student insurance
 - F. Workmen's compensation
- X. Disaster Preparedness and Civil Defense (Lecture, panel discussion) 4 clock hours
- A. National emergency
 - B. Riots; demonstrations
 - C. Fire
 - D. Natural disasters
 - E. First aid
- XI. Evaluation 4 clock hours
- A. Class participation
 - B. Projects, panel, survey
 - C. Special assignments
 - D. Mid-term examination
 - E. Final examination
5. Bibliography. To be built around local, state and regional problems.
6. Audio-visual aids, as available.

Note: First aid considerations in the course (e.g., II-D and in other places in the outline) do not constitute complete first aid instruction but rather highlights of injuries commonly incurred in the area under discussion or unique to the area of discussion.

Where students in the course have been drawn from a particular area of specialization, opportunity should be provided for discussion of safety problems and their prevention in that area.

STUDENT PROJECTS IN COLLEGE SAFETY EDUCATION COURSES

By C. FRAZIER DAMRON

Dir., Research, and Teacher Preparation in Safety Education
University of Wisconsin, Madison

Student projects, carefully conceived and selected, provide an excellent opportunity for supplementing the instruction and learning involved in regular class procedures. They also provide a motivational environment for the specific needs and interests of the student. Both factors are vital when it is recognized that one college course in safety allows a very limited amount of time for teaching content alone, much less the time to provide experiences that will motivate students to be actively involved in developing good safety programs wherever they are.

It is fortunate, and necessary, that we lean heavily upon the students' previous educational backgrounds and experiences for the general qualities involved in a good teacher. However, when it comes to teaching them specifically how to teach safety, the thinking, planning, and design of our courses must take into account two major problems. We must insure that students know and continue to plan and demonstrate good instructional techniques. We must be certain that we teach, thoroughly, course content and all that this implies.

A project, to provide optimum learning

opportunities, should be selected and assigned on the basis of three general criteria:

(1) It is a specific task involving a scholarly investigation.

(2) It is an educational experience that requires initiative on the part of the student.

(3) It supplements or extends beyond the basic course content discussed in class.

Other questions to be considered when projects are being selected and assigned are:

1. Does it provide opportunities of learning something that for the student is worth knowing, something to stimulate him to be a better teacher and leader in safety? A few suggestions of projects of this type are: plan and develop a filing system for safety education, plan a safety program for a particular school, community, or organization, identify organizations (local, state, or national) that are involved in safety activities and describe their contributions, develop a plan for integrating safety into selected subjects in the total school curriculum.

2. Is the project activity of general interest to the student and is it related closely to the common activities in which they are or will be engaged? For example, an industrial arts major may prefer to do a project relating to shop safety, while a history major might be interested in developing the history of the safety program in his school or state.

3. Does the activity pertain to the kind of experiences teachers will have both on and off the job. Projects of this type could include: the planning and demonstration of a TV program on the values of a good safety program, an outline of the functions and values of safety committees in the school or community, or a series of five-minute speeches planned for groups such as the I.T.A., civic clubs, school faculty, or teenage clubs.

4. Does the project provide an opportunity for students to select, develop, and demonstrate real or simulated learning situations such as: how to conduct skill tests

in driver education or bicycle safety, develop a role playing situation in which a safety program is planned by the school faculty, or design and construct an off-street driving area for driver education.

5. Does the project activity have an application on integration potential with other areas of knowledge? Examples: identify and describe the safety implications in teaching a particular subject, i.e., science, math, physics, civics, physical education, etc.; debate the issue of "subject matter integration versus special courses" in safety at the elementary and secondary levels.

6. Does the project activity lend itself to creative thinking and original ideas? This is one of the most valuable points to consider. Projects which promote new thinking about how to teach for safe behavior are a fruitful frontier endeavor. Examples: construct and design a teaching machine with tests for use in safety instruction; plan and develop a new series of bulletin board materials for classroom use; plan and develop a series of attractive safety exhibits for promoting safety in a school.

7. Does the project activity lend itself to the building of the safety profession? Examples: develop plans for building the state safety and driver education associations, list and evaluate selected free and inexpensive materials in safety education, outline a series of ten newsletters for members of the Safety and Driver Education Association, or design a brochure that describes how to get safety legislation passed in your state.

Any project assignment should provide specific opportunities for students to explore and think through as many important safe behavior concepts as possible. They should be encouraged to apply these concepts in behavior patterns that apply to their own everyday activities and teaching responsibilities.

In essence, this means that those of us who are responsible for preparing teachers in safety education should be very concerned that our students have such basic knowledge of safe behavior that it is a definite example to those they are to teach.

COLLEGE AND UNIVERSITY ADVANCED COURSES IN SAFETY EDUCATION

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"The opinions expressed by the writer are his own and reflect only from experience his professional identification as a Visiting Associate Professor of Education, Center for Safety Education, New York University, nor do they indicate acceptance or endorsement of these remarks by that fine institution."

Our small town newspaper, *The New York Times*, editorialized last week on a shocking fact: "... half the operations performed in American hospitals are done by physicians 'unqualified' to perform in accordance with the standards of the American College of Surgeons." Equally shocking is the fact that safety education functions are carried on by persons who, at the time of their initial appointment or in some instances individuals currently functioning or about to function, are unqualified to meet the vital functions of preparing youth for safe living in our complex environment.

Comparatively few areas within our nation have established standards for the initial appointment of safety educators that meet even the recommendations of the Third National Conference on Driver Education, or the consistent exhortations of national leaders in the field of safety education. This profession of safety education does desperately need a national conference on the professional preparation of safety educators. Such a conference would establish current standards and give direction to future professional growth.

The safety educator has need for many competencies. He gains them from many sources: his early exposure to safety experiences; his academic and pre-professional curriculum preparation; his laboratory and field work along with practice teaching; his in-service training; his convention and conference participations; his certification for competency within his state, and like experiences.

It is the concern of this brief report to identify the course work that may be made available in the development of the

safety educator—more specifically the advanced course work. To further delimit the scope only credit course preparation is to be considered.

In the fine publication, *Safety Education*, September, 1960, a listing of "College Safety Education Credit Courses" was published. At 156 colleges and universities in 43 states 338 courses are offered. No doubt some had escaped inclusion. The listing identifies basic and advanced courses of varying credits and accreditation at undergraduate and/or graduate levels. More careful count reveals the following distribution:

Safety Education Courses	
Advanced	78
Basic	175
Advanced and Basic	10
Undergraduate	201
Graduate	37
Undergraduate and graduate	85

The identification of basic or advanced was left to the mental agility of the individual reporting his courses to the National Safety Council. Significantly courses called basic at one institution were labelled advanced at another and vice versa.

To set the stage—for the purpose of more leisurely and lively review later—there follows a listing of basic, intermediate and advanced courses labelled by this writer:

Title

Basic	
Safety Education (or General Safety Education)	
Safety and First Aid	
Driver Education (or Driver Education & Traffic Safety)	
Intermediate	
Advanced Driver Education	
Civil Defense and Disaster Control for Safety Education	
Community Organization for Safety	

Communication Media and Public Relations in Safety Education
Industrial Applications of Safety Education

Organization, Administration and Supervision of Safety

Psychology of Safety Education and Accident Prevention Education

Traffic Engineering for Safety and Driver Education

Traffic Enforcement for Safety and Driver Education

Driver Improvement Programs and Techniques

Workshop in Safety Education

Advanced

Current Literature and Research in Safety Education and Accident Prevention

Field Experiences for the Specialist in Safety Education and Accident Prevention

Professional Seminars in Safety and Accident Prevention

Thesis Seminar in Safety Education

You may well see that through capricious judgment (25 years of professional experience) the task of identifying advanced work is here simplified. The above does require much review and revision. Of that there is no doubt. It would best be achieved by group discussions. Admittedly intermediate is more advanced than basic but time is too short to comment more fully on any but the advanced.

To discuss and describe a few of the advanced courses is the next task: there are singled out for elaboration three courses that are offered, in this instance, at New York University.

Field Experiences for the Specialist in Safety Education and Accident Prevention. 120 hours, 6 credits. Two semesters. (Required of all full-time students—exclusive of summer sessions). The course description follows: Directed group investigations of educational, governmental, private, community and industrial agencies and organizations concerned with safety; critical evaluation of safety education programs.

Within this program guided visitations are made to 30 agencies each semester. Studied are facts of size, personnel, func-

tions, purpose, accident experience, safety programming, budgeting, program emphasis, special safety problems, measurement of program effectiveness, publications, and, cooperation with other agencies.

It might be added that the proximity of large industry in the New York City area to the university materially enhances opportunities for rich experiences. This would be true as to other large urban centers. Written reports, compilation of collected materials, ten independent visitations with critical reviews are required of all students at part of the course work. Students who have taken this program have been simply thrilled and the instructors rewarded not only with the wealth of integrative safety experiences but in knowing more fully the scope of the safety movement.

The second advanced course:

Current Literature and Research in Safety Education and Accident Prevention. 3 hours, 3 credits. One semester. (Graduate) The course description: Directed readings and class discussion of current literature, critical analysis of research in safety education and accident prevention; steps involved in problem solving. (Outline appended but subject to current revision).

The last mentioned course has been conducted by Drs. Cutter and Elkow. Distinguished resource personnel lecture to students and discuss their research and publications after students have studied the materials under investigation. Students also study various advanced texts, research in the field, and prepare critical reviews of publications assigned them after individual counseling. They report the course to be intellectually stimulating to an advanced degree and highly motivating to them for initiating their own research and writing.

Thesis Seminar in Safety Education is the third advanced-level course. Obviously it is close to the final level of achievement of doctoral candidates and needs no further comment here.

For a report of this type a summary would be too time consuming. But a few recommendations might well be in order:

... that there be established, perhaps under the aegis of the Higher Education Section, a committee of leading safety educators to develop acceptable, concise terminology for advanced course titles, con-

tent and accreditation, as well as acceptance into the many colleges and universities.

... that perhaps under the College Safety Education Section a similar effort in relation to undergraduate foundation courses in safety education be initiated.

... that there be conducted a professional preparation conference to achieve fuller identification of the needs for courses, levels of attainment in the safety education field.

... that scholarships and fellowships be made more readily available by private and governmental sources to aid in the preparation of persons with advanced competencies in this field.

... that recognition of advanced preparation lead to improved professional standards—even licensing within a professional area of safety education.

... that recognition of advanced preparation and improved compensations of a financial nature be more fully publicized.

... that each of us recruit keen mind-for a service in safety education that requires devotion, dedication, long and arduous work, inadequate compensation (tentative)—until the millennium when—through working together to advance our profession greater safety and adventure will be the heritage of all our youth, all of the inhabitants of this universe.

THE COLLEGE-UNIVERSITY HIGHWAY TRAFFIC AND SAFETY PROJECT

By S. A. ABERCROMBIE

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There are two good times to talk about a research project. One is before the project is initiated, when one can speak in glowing terms about the new knowledge which will be forthcoming from it, and of how the findings will redound to the benefit of all mankind.

The other good time is after the project is completed. Then one has at hand the specifics that related to the doing of the project—including the unforeseen problems encountered along the way—as well as the outcomes that have finally been set forth in black and white.

On this occasion I fear that the report is being given at a different and somewhat awkward time—after the project has been initiated, but before it has been concluded. Fortunately, my assignment is to talk about the purposes and procedures of the college-university highway traffic and safety project. This gives me the opportunity to review with you the nature of the project, who is involved, how it was initiated, how it is being pursued, and what may be expected to result from it.

First, some background information lead-

ing up to the project. In the late 1940's a group of five organizations interested in traffic safety joined forces to sponsor the first national institute for traffic safety training. Seven other organizations with similar interests cooperated. This first institute, held at the University of Michigan during two weeks of August, 1948, was attended by 142 persons who enrolled in six different one-week courses and participated in ten general meetings devoted to such traffic safety topics as the car, the road, the driver, accident records, public information, etc.

Over the next dozen years, national institutes for traffic training were held annually on college and university campuses throughout the United States. One purpose of these institutes was to provide in-service training for personnel employed in position-carrying responsibility for one aspect or another of traffic safety. Another purpose was to broaden and strengthen the traffic safety activities of the several institutions which had or were considering offerings in traffic safety. A third purpose and hope of these institutes was that of fostering the development of additional specialized

college and university centers, bureaus, or institutes that would provide education, research, and service in highway traffic safety.

In 1948 the NEA Commission on Safety Education published a report on a questionnaire of "College and University Activities in Safety." The survey sought information about the existence of bureaus or institutes, courses, extension service activities, campus safety, and the coordination of safety activities inside the institution and liaison with outside agencies. Of 259 colleges and universities surveyed, 199 reported one or more activities in or related to safety. The activities reported ranged from the mere provision of a safe college environment in 35 institutions to impressive lists of activities in all five areas of inquiry reported by 20 institutions.

In 1949 the NEA Commission on Safety Education published "College and University Traffic Training," a 12-page statement developed in a workshop on college and university traffic training held in 1948 at Northwestern University. The report dealt with specialized in-service training, specialized pre-service training, integration of safety content in undergraduate courses, and public safety institute type programs.

In 1950 the commission administered the national conference on safety by colleges and universities which was attended by 233 persons. The published conference report treated safety in relation to agricultural education, engineering education, liberal arts education, teacher education, university extension services, and campus safety.

In 1951 Michigan State College (now University) undertook a study under the auspices of the Association of Land-grant Colleges and Universities to determine whether a land-grant college or university could be of substantial assistance to the people responsible for highway traffic administration within its state, to judge the appropriateness of an educational institution devoting some of its resources to that type of service, and to ascertain specifically what it could do to help. A 97-page report entitled "What Can Colleges Do About the Traffic Problem" resulted from this study late in 1953. In his letter of transmittal addressed to members of the Association of Land-grant Colleges and Universities, Michigan State president John A. Hannah

said: I suggest that you regard this report . . . as a fairly applicable analysis of the traffic problem and what your college or university can do to help solve it."

In 1958 the commission and the U. S. Office of Education published the findings of a joint survey of 1,933 colleges and universities, conducted to determine the extent of college and university offerings in highway traffic and highway safety. The survey report showed that 973 offerings were then available in 328 institutions. Some 82 per cent of the offerings were regular courses, the remainder being short courses and conferences. The breakdown of these 973 offerings by areas of major interest was as follows: education, 42 per cent; engineering, 33 per cent; enforcement, 10 per cent; motor vehicle fleet operation, 6 per cent; and specialized offerings (such as accident records seminars and school bus driver institutes), 7 per cent.

This brings us to the report on the purposes and procedures of the college-university highway traffic and safety project, which is now under way. The idea for this project germinated with the American Association of Land-grant Colleges and State Universities. The land-grant group accordingly set up a project committee headed by president Albert N. Jorgensen of the University of Connecticut. Funds became available for the project through a grant from the Automotive Safety Foundation. The NEA National Commission on Safety Education, because of its unique experience in the field to be investigated, was asked to administer the project.

Stated broadly, the purpose of this project is to bring together from selected colleges and universities basic information and experiences related to their work in highway traffic and highway safety that will be of mutual benefit to all land-grant colleges and state universities, and to other institutions as well. It was determined early that the basic information and experiences would be gathered through personal interviews with the presidents and other key persons on the campuses of selected institutions.

Following three-way discussions among the land-grant group's committee, The Automotive Safety Foundation, and Commission on Safety Education staff, a project content and procedures committee was or-

ing what the job opportunities are. It is for these reasons that I have asked to appear with you today.

What is the Army civilian career program for safety management personnel?

Safety management is "the art of planning, organizing, directing and controlling available resources to eliminate accidental losses through safety administration, safety engineering, safety inspection, and other related activities."

Civilian career planning is directed toward the technical, scientific, and managerial development of employees within career fields.

The safety management career program, along with all other career programs in the federal service, had its birth in a recommendation of the Hoover Commission. The commission pointed up the necessity for federal employees to have a planned developmental program not unlike those available to their counterparts in many elements of private enterprise. Accordingly, the Department of the Army, in July of 1957, published Army Regulations 690-5 which prescribed the general plan governing the establishment and operation of civilian career programs within the department. And, in June of this year, the Department of the Army added another "first" to its many pioneering personnel management efforts when it published Civilian Personnel Regulations establishing the Army civilian career program for safety management, the first plan of its type for safety personnel in the federal service.

What are the objectives of the Army civilian career plan?

a. To meet the Army's continuing and future civilian manpower requirements with the highest quality staffing.

b. To provide a system of foreseeable career opportunities and planned programs which will attract, retain, and develop qualified personnel to meet key civilian staffing requirements.

c. To provide an effective means for selection and assignment of qualified employees on the broadest feasible organizational base.

What occupational field does the program embrace?

In the safety management career program of the Army, there are three basic occupa-

tional series; namely: the 018 or the safety management series which includes safety assistants at the GS-3 and the GS-7 levels and safety officers at the GS-9 level and above; the 803 which is the safety engineering series for safety engineers; and the 1820 which is the safety inspection series for safety inspectors.

In addition, the career program includes individuals from several other occupational series who are assigned full-time to support the Army accident prevention effort. These include, but are not limited to, the following occupational series: aviation safety specialists, nuclear weapons safety engineers, microbiologists, bacteriologists, physicians, physicists, and chemists.

The latter group may register in both the safety management career program and in the program for their specific series when such an additional career program has been established and published. In this way, these individuals have an additional opportunity to progress up a career ladder should they desire to do so.

How does one get into the 018, the 803, or the 1820 series?

GS-018's are taken from among federal service entrance examination (FSEE) eligibles. This is an examination which is used to recruit the bulk of college people to government. The FSEE is designed primarily as an avenue through which young people with promise may enter the federal service.

To those who have a college education or equivalent experience, this examination offers many advantages. Persons who qualify are considered for trainee positions at the entrance level in a wide variety of career fields in various federal agencies and geographical locations. Sixty career fields are offered through this one examination. It is, in effect, one application for many employers at the same time.

It is a thorough examination and one which serves as an effective screening instrument. For example, during the 1960-1961 school year, 182,081 persons applied for the examination and 114,200 took it. Of these, 42,702 passed. Upon passing the written examination, the individual's name is placed on the list of eligibles from which many different types of positions are filled, including those of safety assistants.

GS-803's are taken from among those individuals who have established eligibility in appropriate engineering examinations.

GS-1820's are taken from appropriate civil service commission registers.

What kind of a person is the Army looking for to fill its safety management needs?

We are not looking for a man who can fit into the program like the last piece of a jigsaw puzzle, for we know such a man does not exist. We are, however, looking for people who have the intellectual base upon which we can build—hence, the requirement that GS-018's come from among federal service entrance examination eligibles.

Once we have a man with this intellectual base, we are prepared to develop him by scheduling him for a series of training and work assignments. Moreover, if the individual performs satisfactorily and can grasp the training provided for him, he may advance rapidly at the lower grade levels. For example, a young man who has passed the FSEE may start as a GS-018-5 (safety assistant) and, after six months of satisfactory on-the-job performance, may be promoted to a GS-018-7.

And, after an additional twelve months of satisfactory performance, he becomes eligible for a rating at grade GS-9 as a safety officer. This is the extent of command training and promotion agreements with the U. S. Civil Service Commission. Upon reaching the grade GS-9 level, an individual's rise is dependent solely upon his performance, his willingness to accept a variety of assignments in any area of the free world, and his demonstration of a willingness to develop himself through correspondence study, evening courses and other self-developmental exercises and activities.

What of employment opportunities?

Within the next five years, we will lose through retirement, disability, death and other causes, some thirty per cent of the some 700 safety management personnel whom we now have in our inventory. Within the next ten years, we will lose more than half of our people to these same causes. At the present time, in fact, there are openings for some thirty persons in the Army program.

What are the elements of the safety man-

agement career program? I shall comment briefly upon each of the following five elements:

- Inventory and referral service.
- Recruitment and selection.
- Entrance-level training.
- Appraisal and counseling.
- Progressive developmental opportunities.

Which of these elements are of special interest to colleges and universities? Actually, all of them. However, I should like to highlight two, recruitment and selection, and progressive developmental opportunities.

In doing so, I should like to state my views on some current thinking regarding the type of training the "safety man" should have. The best bet for a successful accident prevention specialist is that individual who already has had professional training in a specific discipline or one who has a very good liberal arts background upon which to build. Accordingly, our recruiting is directed toward quality college graduates who have passed the FSEE. Once we have men of this caliber, it is not difficult to develop them in accordance with the plan outlined in the career program.

It would help the cause considerably if colleges and universities could offer a *fundamentals*, a *survey* or an *introductory* course in accident prevention doctrine for majors in various fields of study. In this way, some of these individuals might be inspired to apply their talents to the control of accidental loss and make it their career. To illustrate this point, I should like to relate a recent happening in the Army.

A young mechanical engineer joined the safety staff of one of the Army's technical services. From his record, it was apparent that he could have made out equally well with any one of several employers and in any number of vocations. Curious as to why he had chosen to come with the Army for development as a safety specialist, I discussed this with his supervisor. I was told that the individual reported that he hadn't thought of a career in accident prevention until one day during his senior year when a guest lecturer pointed up the many contributions he could make to society by applying his talents to the field of loss control.

THE LITTLE RED CAR AND WHERE IT WENT

By DIXIE A. THARP

Mill Creek School, Jefferson County Public Schools, Louisville, Ky.

The story of the little red car began in the fall of 1956 soon after the school term started at Mill Creek School, Louisville, Ky. One of the students in my third grade classroom suffered a broken arm in an automobile accident as she was riding with her mother. With this close-at-hand example, I felt that the thirty-one third-graders would accept safety instruction if I made it interesting for them.

The year before in art class, we had constructed a school bus from a large refrigerator box for the purpose of emphasizing safety on the school bus. This had appealed to the children very much since it was large enough for a driver and three or four riders. Remembering the enthusiasm of the children and after discussing it with my husband, who would be called upon for the basic construction, we decided to build a mock car to use as the motivating device.

Since parents of several children were employed by an automobile plant, the third-graders accepted the idea of assembly line construction for our car. The chassis, which was made from the running gear of a coaster wagon that had been acquired with trading stamps, was built in my husband's workshop at our home. It was large enough for the driver and a rider. The car's body was made of cardboard and the steering wheel was donated from a garage. It was then moved to school and the art period was used for painting the little car a bright red and for adding other equipment.

The car was used for teaching common-sense rules of automobile riding, safe walking, bus riding and bicycle riding. Safety instruction became the main theme of other activities in the classroom for the enthusiastic group of children. The teacher gained many new ideas but the school term ended before these could be carried out. However, note was taken and plans made for later and more extensive use.

During the following summer, my husband decided to rebuild the car and to use wood for the body to make it more durable

for our activities in the classroom. Since dual headlights appeared on current car models, we needed the change.

This time, the little car rolled about on ten-inch wheels with rubber tires and white side walls. The steering mechanism was attached to the front wheels so that the wheels turned in the same manner as a conventional car. The steering wheel from the previous model was used. The body which was six feet in length and almost three feet in width was again painted bright red. The interior received upholstery of red plastic.

The trunk at the rear was a convenient storage space for other teaching aids. Bumpers were made from slats of Venetian window blinds and painted with aluminum paint. When taken to school, the new group of thirty-four children were very excited as they had seen and heard much of the little red car. They added refinements that they considered necessary such as the license plate.

They also installed a speedometer, a clock and an AAA emblem. Many said that from a distance, the car might easily be mistaken for a foreign import. Although the children propelled themselves by "walking" as they rode, they were very happy to receive a turn as driver or rider during instructional periods.

Expression of gratitude is due Mrs. Leona Guterthum, the principal of Mill Creek School, for her enthusiasm and encouragement in our "Aim for Safety Around the Clock."

Miss Virginia Wheeler, supervisor of safety and the school lunch program of Jefferson County schools, offered many helpful suggestions and lists of available materials for the teacher. Her visits were enjoyed by the children since she always complied with the request, "Come ride with me."

Since an alert and courteous attitude is important to safe living, the class adopted, "Always Alert, Nobody Hurt," as their motto. After discussion of good citizenship,

the class worked on key words for a bulletin board in the hall just outside our classroom. The words selected were "For my school, I promise to listen, learn, cooperate, respect, exert best efforts to keep M.C. proud of me."

We arranged the words so that the name of the school, "Mill Creek," was obvious. Patriotic colors of red, white, and blue were used. A figure representing our school drum and bugle corps, plus the drum major and a gold key of safety placed above our motto completed the picture.

Other keys to good citizenship such as self-control, responsibility, courtesy, duty, thoughtfulness, and sportsmanship proved effective in building correct attitudes for safe living at all times. The words were posted in the room, also combined into a class dictionary for the children.

In traveling to and from our school, the great majority of the children must ride the school buses. U. S. Highway 31W, which is four lanes and very dangerous, leads to the school. The little red car then must of necessity go to the bus stop and help teach the children to ride safely. After ideas were suggested, they were illustrated with posters by the children for the bulletin board.

When these were removed to make room for other posters, they were made into a booklet with an attractive cover. Each area of safety studied was combined into a large scrapbook that was presented by a parent. Members of the school Safety Patrol became our honor guests. They came to the room regularly to talk to the children and inspect Mill Creek's safety car.

New words were added daily to speaking vocabularies and these primary children were surprised to find themselves known as "pedestrians." Comic drawings of pedestrians proved amusing but convinced the children that they should be "smart pedestrians." A miniature traffic light used with the car emphasized proper walking habits. Twin brothers in the room became known as the stop and go twins. They dressed in red and green shirts to play the role. Parents helped map the safest route to school.

Living at school safely was another problem. Teaching what to do in the classroom, the halls, the lunchroom, and on the playground was important. Ideas for safe play

were carried home to younger brothers and sisters. The car was a valuable aid in teaching the children their responsibility while playing near traffic and parked cars. One eight year old organized a neighborhood safety club of playmates "to teach them to do what was right."

It was convenient during the arithmetic lesson of circles, rectangles, and triangles to call attention to the road markers. The pupils learned to identify all types of road signs. These lessons were enthusiastically carried to the homes. One parent stated that while driving on the expressway he was cautioned by his nine year old son: "Daddy, slow down. There's a yellow diamond shaped sign."

Since every child in the room wanted to drive a car some day, hand signals were popular. This practice would lead to the next part in the program for the little red car.

The hand signals were important in the teaching of bicycle safety. The children made a survey of the number of bicycles owned by Mill Creek pupils. Eight hundred ninety six children were contacted. We found that seven hundred sixty six had bicycles that they rode regularly. Riders numbered about the same in each grade from one through six. Booklets on tips for the safe rider were distributed. An inspection by police was conducted on Saturday at the Shively Park. Each member of our class wore a badge proclaiming this as "Bicycle Safety Week." One of the group won a third place award in the AAA annual poster contest. A child in another third grade won honorable mention.

Holidays presented different problems. Suggestions for trick-or-treaters were written and taken home at Halloween. At Christmas time, the third grades were invited to present a play for the P.T.A. This involved our class and three others. An original play, "Santa's Safetyland Parade," was written. The little red car figured prominently in the presentation. Every child was given a part and their costumes received the safety touch. There were the pedestrians, the drivers, the road signs, the traffic lights, the bicycles, the toys, and of course Mr. and Mrs. Santa arrived at Mill Creek from Safetyland in the red car. Our theme song, "Safety First," was written to the tune of "Jingle Bells."

Our Junior Red Cross project included a tree made from an umbrella frame, covered with poultry wire and painted gold. Red and green ribbons fastened candy canes and lollipops of many colors. The mock trip to the Children's Hospital was made in the little car and Christmas tree safety was learned on the way.

Home safety and fire prevention were combined. The children found many hazards when the check list was completed. A large doll house was used to focus attention on home. Ribbon banners ran from the bulletin board signs to different areas. Each child made an interesting booklet to carry home.

Four years prior to this project, the principal had asked the sixth grade classes to think of something that would appeal to the younger children and encourage better safety habits. Thoughtful Tim was created. When children obeyed safety rules, Tim displayed his smiling face. When they disobeyed, Tim was sad and embarrassed and the reverse side was shown. Each classroom had a small version of the figure which was placed by the door to report accidents with his red face. Now, we found that Thoughtful Tim was an excellent helper with the little red car. We worked hard to keep him smiling.

How did these activities fit into the basic program? The children were given many opportunities for reading. They now searched for stories concerning safety. The book, "In Storm and Sunshine" of The Road to Safety series by Buckley, White, Adams and Silvernale, which is published by American Book Company, was most helpful. Several copies were purchased by our P.T.A. The children collected new words from highway markers and other sources. These were printed on tagboard and inserted in the card holder to be learned. They later were transferred to a large envelope and used by the pupils for a check-up on word recognition.

The Social Studies program also was correlated with safety teaching. Studies of other lands included winter safety with Norway, bicycle with England, water safety with Brittany, strange animals with Spain, and sun exposure with Africa. Film strips were shown and the children were asked such questions as, "Are there stop signs? Any cars? Any bicycles?" "How are po-

licemen like the ones in our own country?" "Can you read some of the signs?"

The map study included activities of charting vacation trips with string. Canceled postmarks located capital cities. Children helped parents plan trips to travel safely. Scrapbooks of interesting places to visit were made. At one time, we had in our classroom a book for each of the fifty states.

Letter writing, important in English lessons, was made interesting with a small post office constructed in the room. Letters written to parents concerning safety gave writing and spelling a real purpose. Many parents sent replies to school along with their suggestions. Newspaper items were exchanged here, also.

Safety talks and dramatization were much more effective with the use of a play microphone.

The art period was a good time for preparing posters and signs. A very attractive mobile of safety items and messages was hung in the hall window. Each day a group of children were looking to discover what the third graders had added.

The pupils loved to sing safety songs and to create original ones to fit familiar tunes.

There was no "special" time set aside just to teach safety. It was interwoven with every activity and every subject.

As a follow-up for the class, a fourth grade teacher found that when the group studied transportation, they wanted to include train safety.

A fifth grade used clippings for a hall board.

In grade six, our special art teacher stated that this group produced many ideas for safety bulletin boards and posters.

Of the original group of thirty-four children, twenty-six finished with the sixth grade of our school last June. Twenty-two of those served on the Safety Patrol. Enrollment at Mill Creek School totals over one thousand pupils. One hundred sixty-five were in grade six. The patrol had thirty-five members. We found one minor home accident reported that resulted in loss of one day from school.

Parents reported that safety habits of the children were greatly improved. Relating classroom lessons to safe living at

home proved an effective technique in securing cooperation from parents. They were eager to help the children apply ways of safe living to their everyday activities.

The project also had effect upon parents. Neither mother or father dared make a mistake while driving with a "safety-conscious" child sitting by his side.

Helping these youngsters get a start on becoming good traffic citizens is a real challenge for any instructor. Words are inadequate to describe the project. It has when one walks on a street and sees a group of happy children who

quels of red roses, their surprise way of saving to the teacher, "Thank you for the little red car."

ACKNOWLEDGMENTS

I am indebted to a number of people for ideas, suggestions, and encouragement. I find it impossible four years later to furnish an accurate bibliography since materials were from so many sources and used to accompany our special need.

I am very grateful to Mill Creek School, the Jefferson County Board of Education, Louisville Safety Council, and the Louisville Automobile Club for materials.

I wish to thank the National Safety Council Program Committee of the Elementary school for giving me the opportunity to report on this project.

VALIDITY, EFFECTIVENESS OF VARIOUS SAFETY EDUCATION TEACHING TECHNIQUES (A GROUP STUDY)

Led by: JAMES W. MANN, Professor of Elementary Education, Roosevelt University, Chicago, Illinois.

With the assistance of: LUCILLE CAVANAUGH, Representing Association for Childhood Education, Homewood, Illinois; CLARISSA HUG, Representing Council for Exceptional Children, Chicago, Illinois; WALTER H. SCOTT, Principal, George G. Meade School, Philadelphia, Pennsylvania; RICHARD TOLSMAN, Representing National Union of Christian Schools, Cicero, Illinois.

Recorded by: HELEN MAE SMITH, Illinois Conference of Seventh-Day Adventists, Brookfield, Illinois.

Criteria for determining the validity and effectiveness of safety education techniques by the group were:

1. In launching a program of safety education, the interest of the children must be captured. Children must be a part of the planning if experiences are to be educational.

2. To make safety education more effective, we must involve the parents, enlisting their cooperation and their active participation, even to the point of insisting on better law enforcement if necessary.

3. Good safety education has carry-over value. The following activities are suggested to determine how much value:

a. Send letter with questionnaire to parents to discover trends for purposes of comparison.

b. Check in the ninth grade to ascertain, if possible, the good habits and

practices that have carried over from previous learning (and teaching) of good safety practices.

4. A school safety program to be effective must have the cooperation of all adults in the community. We must help adults to develop better attitudes toward safety by:

a. Parent teacher meetings and letters to parents. We should call on parents to assist in safety education activities including informing the community.

b. Encourage participation by community organizations—safety council, TV, radio, newspapers and so forth—and city departments—police, fire, traffic engineering, recreation and so forth.

In addition it was suggested that inservice education for teachers in safety not be left for summer sessions and that credit be given for such education.

TRAINING DRIVERS TO MEET EMERGENCIES

By ALFRED L. MOSELEY

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A lady from Gloucester left downtown Boston on a very hot August afternoon and headed northeast on Rt. 1 and then on Rt. 128. While driving in the high-speed lane, the right front tire blew. The car went out of control to its right across three lanes of traffic and over the curbing. The driver managed to regain some measure of steering control and, for a small distance, the vehicle went parallel to the curbing and then crossed it again. In the process of regaining the roadway, the vehicle turned violently to its own left, crossed three lanes of traffic again, and then crossed the median. As it emerged in the opposing lane of traffic, it was hit at right-angles by a second vehicle which was in turn hit in the rear by the third.

None of the persons who survived this circumstance, and there were seven who did, were able to give any account at all of what happened. There were some false memories; there were some estimations; there were some guesses; there were some impressions. "It all happened so fast."

When the driver of the first vehicle became aware that something was wrong, the vehicle was moving out of control. There was no evidence of braking at this time. The engineering term "feedback" might well be applied. In this instance the steering control motions of the driver were overcorrected. But the driver did not know quickly enough what the control meant in terms of actual change in the direction of the vehicle. Thus the driver steers too far to the left and is out of control.

The driver in the southbound lane was on his own side of the road minding his own business. He was where he had every right to be, and, in all probability, was within the speed limit. He was on a collision course beyond a point of no return before he had any realization that anything was wrong. Suddenly a missile came out of control across the median and entered the lane of traffic ahead of him. He had time enough to make a very small steering correction and to make the earliest pressure change in the braking system, but these were of no avail because

he had neither time nor distance in which to act, or for his acts to become effective.

The driver of the third vehicle was completely without choice. When the vehicle came to a sudden stop in front of him, his following distance was such that there was no possibility of avoidance. One of the interesting things that came out in this case was the observation that in the third vehicle there was evidence of two head impacts in the windshield. One of these was from the inside out, indicating that a passenger had hit it. The other one was from the outside in, indicating that some human body had been acting as a projectile and had impacted this windshield while in flight. The question was, what is the appropriate identification of this person?

Careful laboratory work established later that the driver of the vehicle which went out of control originally was the one who had impacted the windshield of the third vehicle. It is of interest that in the investigation of this particular case, no note had been made of this unusual circumstance by any of the investigating officers and none of the survivors had any awareness at all that a human body had been hurtling through the air as a missile.

With the orientation which has been raised in your minds on previous occasions, you will naturally be concerned with the degree to which protective devices were in use in this particular circumstance. The answer is very simple. With the exception of those devices which were built into the car by the manufacturers, there were none in use.

This case serves to illustrate: (1) that the time factor involved is very short, (2) that the difficulty of managing a vehicle under conditions of explosive decompression in a tire is great, and (3) that the effects of the driver's control movements and his knowledge of their effects is of fundamental importance. The case may serve well to underline the concept that it is a real tragedy for this driver to have had her first blowout on the last day of her life.

The point to be made in the present discussion is a very simple one. *Emergency training is a feasible concept.* It has been utilized in other areas with considerable effect and with a reduction in the severity of injury and a reduction in the incidence of death under extreme circumstances. In addition, it has provided skills, concepts, attitudes and "presence of mind," so that in situations which were completely unpredictable the basic characteristics of the training come to the aid of the individual in solving the unexpected problem.

In making a plea for consideration of emergency training for driver education, it is necessary to engage in a small amount of criticism of our standard procedures. The criticism is not what you might expect. We know very well that training as a principle is extremely sound in any area and that, where it is properly carried out, it provides a person with information, with habits, with skills, with attitudes, with ideas, with concepts, with emotional orientations which act favorably concerning his capacity to meet the practical requirements of life. Driver education is no different from any other field in these areas and it is successful in accomplishing many of these objectives.

In the various studies which have been conducted to describe the difference between the driver-education-trained-driver and the person who receives his training from a friend or a member of the family, the advantages which one would hope to find on a statistical basis do not appear as consistently as might be wished. A part of this is due to faulty statistical manipulation of the data accumulated. Another part of it is due to the fact that, while driver education accomplished what it set out to do, it did not set out to do enough. The training did not go far enough to prepare the driver for the extreme circumstance.

It is not subject to proof at this time, and I must freely admit it, but I hold the opinion that the reason why our driver-education-trained-students do not show the advantages that we might wish is due to the fact that their training does not go far enough to equip them with skills to meet the practical emergencies of highway travel. Therefore, what I am saying is that policy decisions favoring the addition of emergency training must be made. The goal of this training is

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to provide the student with emergency skills for the occasion of need.

There are several facets to the concept of emergency training which are worth reviewing on this occasion. They are fundamental to any procedure in which emergency skills are to be developed.

Multiple factors.—In every area of man and machine relationships, events occur, sometimes instituted by the man, sometimes initiated by the machine, sometimes originating in the environment around them, which produce the opportunity for errors, or near accidents, or collisions, or accidents. Many of these occur under circumstances in which more than one factor combines to produce a deleterious effect. It is the teaming up of these factors under the conditions of ordinary life that lead one to believe that allowing chance to control the destiny of a person in an emergency is foolhardy.

It is usual to find in the cases we are studying, under a U. S. Public Health Service Grant, that in automobile deaths many important causal factors act simultaneously. For instance, it is perfectly usual to see a person with a strong and important emotional maladjustment history, driving a vehicle with a compromised condition because of lack of maintenance to one or more components.

The person has fallen heir to long periods of work and shows a chronic fatigue; he has now been out for many hours and may be described as being in a fairly acute state of fatigue; he has had alcohol to excess and is operating under conditions of low illumination, when some component in the vehicle, such as a tire, goes flat and the vehicle is out of control.

The principle underlying this description is not an oddity. It is the rule: that multiple negative factors occur simultaneously, compromising the capacity of the human operator to appropriately protect himself by an intelligent course of action. It is entirely possible that the circumstances with which we are concerned as highway emergencies are not predictable as to time and place. It is possible that they are predictable in how they will run their course.

In reasoning from what is known in the treatment of disease, for instance, we might say that a physician might not predict which of his patients will get malaria, but he can,

with fair precision, describe what the course of the disease will be, when the temperature will go up and when it will drop and what the degree of rise and fall will be. He can predict what the probable physiological reactions will be if the person is given no medication and what will happen if he gives him a medication which is specifically for this particular disease. Can we become familiar enough with the course of any given emergency situation so that we can then take its basic nature and utilize it to our educational benefit?

Short time interval—The time interval in which an emergency arises is very short. This means that time is at a premium. I have already mentioned that one may be on a collision course beyond the point of no return before he knows that anything is wrong. In the Grand Canyon accident of two airliners sometime ago, a fraction of a second of warning was about all that anyone had and the possibility of control, when that information was available, was not within the realm of the aerodynamics of the aircraft in flight. The meaning of the inferences concerning the factor of time is clear. If the preparation for that last crucial moment is not completed ahead of time, there is almost nothing to be done about it, short of an act of the Deity.

When you spend a good deal of time interviewing persons who have been involved in injury and death-producing accidents and treat them as witnesses, you find several types of phenomena. Two of these are extremely important. Many of them suffer an amnesia. In some circumstances it is concerned only with the moments of the event. In other circumstances, the memory loss reaches back for a period of several minutes, quite often, and sometimes even a few hours prior to the event. Some of these losses are related to brain injury. Others may be related to emotional trauma. In any event, it means that whatever useful information might have been provided by these persons is completely lost.

The second type of response is from a person who apparently does not exhibit this type of shock reaction, but simply responds with an almost constant, "It happened so fast." Now this means that in spite of all of the careful questioning that can be brought to bear on these people, not only in

the situation immediately following the case, but in days succeeding, no details are described which can be used as anchor points around which to understand the nature of the collision course and what the human operators did. Many of these people fabricate. By this I mean that with their imagination they simply fill in the blanks of their memory and then describe something which they come to believe is true but which objective investigation can show very clearly is not.

First signs of danger—One of the very important factors, now appearing, is that the signs of developing emergencies may be obscure. This means that we find interview evidence, in cases where there has been a blowout, that no explosive sound gave an audible warning to the driver. The term "blowout" itself almost directly implies a sudden sharp sound to go along with the failure of the tire. I find myself using the term "explosive decompression" by way of indicating the rapidity with which the air leaves the tire, hoping by this means to avoid the implication that there is a sound that comes with it.

There may be other clues that a tire is failing. One of these is that the hub cap will go sailing down the highway ahead of the vehicle, or off to the side and attract attention. The second one is that a tread wave is set up as the tire begins going flat and this is felt in the steering wheel as a strange type of road shock. But by the time these things happen, the process of decompression has gone quite far and the problem of control is quite severe. The point is a very fundamental one. If the signs of developing emergencies are obscure, it is all the more certain that intelligent reasoning would lead to experimental investigation of the nature of these circumstances and the development of means by which these can be determined at their earliest time.

Correct response, too slow—In addition to these factors, there are observations made in the course of training for emergencies in other situations which give rise to a very thoughtful concern in the highway field. In the use of the Dehmel trainer in aviation safety, the control operator can set up any warning circumstance so as to teach the pilots how to diagnose difficulties and how to carry out control procedures. Over and over again, the training record shows that,

after basic indoctrination and familiarization, the crews are able to perceive the dangers and decide on the appropriate means by which to manage them.

When this has been accomplished, what do you find in your appraisal of their results? The multiple negative factors are set up in the panel so that the altimeter shows a drop, a wing is low, another prop is feathered, and a fire begins in another engine, then what is the pilot to do? He shows in his training the capacity to do the correct thing. The unfortunate thing is that he does it too late for it to be effective.

Obviously, this clue means that the training has to go far enough to accomplish speed in the recognition of the problem, speed in the accurate decision concerning what to do, and speed in carrying out the decisions with dispatch and with skill. This is what the emergency training procedures are intended to do.

Panic—In an interview with an instructor at Camp Pendleton, California, concerning emergency underwater evacuation from a submerged helicopter, an interesting thing was learned. About one in 100 of the Marine recruits will go through the underwater escape training program panic, though fully aware that the situation is one admitting of considerable control. If this can happen in circumstances where the training is under good control, what might you expect of this panic-stricken person when he is confronted by a horrendous experience? It suggests that the training should go far enough to sort out the limit of the emotional capacities of the trainee. If an individual is to be in control of a situation involving the lives of other people, it is entirely reasonable to wonder if he should not be selected out by some such appropriate process.

The following factors and reasoning apply to the psychology of emergency training:

- Emergencies happen fast.
- Skills cannot be developed when you have only one instant requiring perception of the developing trouble, diagnosis of existing trouble, the need for immediate, accurate decision, the need for accurate remission action.
- To meet this problem, the person exposed to the dangers should be placed in training situations where the educational procedure and the engineering devices have been

carefully structured by appropriate research and which conform closely to the operational characteristics of the real emergency, so that he receives first-hand experience in the diagnosis and management of the emergency situation.

d. The training program should be carried to the point where the student shows his tendency to panic and is eliminated; or shows his incapacity to properly manage the emergency and is eliminated; or develops a skill and capacity to respond to the emergency by doing the correct thing in time for it to be effective.

e. These steps will bring the student to a point where he brings a skill to the occasion of need.

f. The more significant the contribution of the man to the successful performance of the man-machine relationship, the more important it is that the training of the human operator be carried to a degree where he can successfully manage all types of problems which arise. We are dealing here with the attempt to reduce a situation fraught with danger to a point of control and to provide a skill which will act under conditions of imminent danger.

g. Since many primary variables may affect the operational control of a vehicle in emergency training to a considerable degree, consideration of these variables must be taken into account in the training. This will mean that if there is a qualitative change in how a given kind of factor is managed as a function of velocity, then the student will be given an ample amount of indoctrination concerning this change under operational conditions.

h. Emergency training is by no means a guarantee that the details and the training and the procedure, though followed through with accuracy and speed, will produce no injury and no death. There are significant data in aviation presented by Jones, in a paper concerning 850 emergency bailouts in the U. S. Navy indicating that in most of these bailouts, the pilot had little choice but to abandon the aircraft. Eighty-five per cent of the bailouts were successful in that the lives were saved and in 50 per cent there was no injury at all. This is certainly a marked advance and accomplishment over what might have been the case and what certainly would have been the case other-

wise. These data represent a marked improvement in survival but not a complete solution.

i. Sound emergency training must include more than procedures and their successful accomplishment during the training program. It is necessary also to indoctrinate students on the nature of the various components in the physical system and their maintenance. Practice should be extended, not only to the area of maintenance of the emergency skills, but also to the maintenance of the system concerned with their successful completion. Attitudinal orientations are also very important.

j. In real life situations, individual factors of an emergency nature do not happen one at a time. One, two, three, five, seven, nine team up and they operate simultaneously. This means that perception time and comprehension time may be extended, because of the nature of the complexity of the various factors and the effect of the combination of factors in obscuring the clear symptom of the beginning of the emergency problem, to whatever extent this can be taken into account in training.

k. Once emergency training has been accomplished and people with this training are carried into practical situations, there must be an automatic means by which to feed back their observations of these conditions to the training program so that the emotional factors, details and training procedures and modifications of technique, both in training and in engineering, can be accomplished for increasing the success of the program in the future.

l. The nature of habit systems must be taken carefully into account in emergency training. Under stress a person tends to fall back on the oldest and most highly developed habit system that he has. It is necessary that these matters be taken firmly into account in setting up the system, not only in evaluating previous experience in driving a vehicle, but in evaluating habit systems coming from other circumstances which may come in to play here. For instance, if a person is in the habit of scratching his nose, when a horrendous experience begins developing on the highway he will first scratch his nose before he does anything else. The nature of these habit trends must be taken carefully into account in setting up the basic system.

In military and civil aviation, many problems developed because of the shift from one type of aircraft to another. There was no standardization of the nature of mechanical operation of a component nor its designation. A crank that turns clockwise on the right-hand side of the cockpit might, in one craft, lower the flaps and, in another craft, lower the wheels. Very accomplished pilots then demonstrated the capacity to make a landing with the wheels up instead of down. This type of error simply means that whatever emergency training is carried out should be done on the basis of a habit system not dependent on the vehicle in which it is applied. Standardization of the controls and their location and operation can go far in solving this problem.

The following examples of emergency training applications are given by way of giving support to the principle that emergency training is a well-established procedure. Appropriate administrative decisions concerning this type of training have been made on many occasions. Feasibility has been established. Training programs have achieved successes which have modified the expectancy of injuries and deaths which otherwise would have been proven true. Emergency training has proved its worth.

Bailouts in naval aircraft—Jones¹ has described an analysis of 850 bailouts from fighter attack, trainer and other types of naval aircraft which occurred during a five-year period beginning July 1, 1944, through June 30, 1949. All of these were emergency bailouts. Several of the descriptions which Jones has given are pertinent to the problems under consideration here.

He describes as follows: "One pilot was involved in a rather severe mid-air collision in which the tail surfaces of his plane were badly damaged. However, he was able to climb to 10,000 feet to test the stall characteristics of the aircraft. He determined that it was not possible to make a carrier or watered landing with the plane damaged as it was. He jettisoned the canopy and trimmed the plane as much as possible. However, as soon as the controls were released, the aircraft went into a nose-down spiral at about 200 knots. The pilot experienced some difficulty getting out and had to climb back over the fuselage to get completely clear. By this time he had lost

about 2,000 feet. In spite of all these difficulties, his only injuries were minor abrasions. . . . This is an interesting example of how basic emergency training prepares a person for a situation involving some unpredicted difficulties.

Air transport drill—Jones describes how one Navy squadron illustrated a necessity for emergency training practice in large transport planes. The captain had 27 passengers aboard, all of whom, because of their duties either as flight engineers or orderlies, had some understanding and familiarity with safety equipment and safety procedures. Without any prior warning, the pilot shouted, "This is a drill. The right wing is on fire. Put on your parachute and get out as quickly as possible. Get out." It took the first man in this plane two minutes and 20 seconds to evacuate. The 26th man was out of the plane in four minutes and 20 seconds. The 27th man never got out.

The officer in charge of the flight lined the men up outside the plane and inspected them to see how well they had carried out the emergency evacuation procedure. He found that five of these persons had their chutes on upside down. Five of them had the harness wrong side out. Several others had attached the buckles of the harness to the wrong component and several others had attached the harness so loosely as to fall out of it in the air when the rip cord was pulled. Following this, some detailed instruction was given about how to attach the parachute and fasten and adjust it under these conditions and how to evacuate the plane. The drill was then repeated with the following results: The first man was out of the plane in 8 seconds. The 27th man was out of the plane in 20 seconds and, in every case, the gear was properly attached.

The disaster—In any circumstance in which there is a new type of procedure, theoretical calculations can be made on the basis of previous operational, clinical and experimental evidence and very sound estimates of how to meet the predicted circumstances can be made. These are occasionally substantiated to a large degree by succeeding events, some of an experimental nature and some essentially accidental.

In the case of high altitude bailouts in

the Air Force, it was expected that because of the decreased density of the atmosphere at high altitude, there would be no severe opening shock. This line of reasoning did not take into account the possibility that the rarity of the atmosphere would serve to increase the rate of initial acceleration because of a diminished drag, and that therefore there would be opening shock. It was expected that the jump would require prolonged use of oxygen because it would take a fair period to get down to where the oxygen pressure would be sufficient to maintain normal respiration.

Colonel W. R. Lovelace, II, MC, U.S. Air Force, made an experimental jump to study these conditions from 40,000 feet on June 24, 1943.² "He suffered an extremely hard opening shock which rendered him unconscious and caused him to lose both gloves from the left hand. When he recovered, he had a frozen left hand and was suffering from shock. The nylon glove retained on the right hand served to protect it from frostbite."

On July 3, 1943, Major P. J. Ritchie made an emergency jump without oxygen from 32,000 feet. "He delayed pulling the rip cord until he was about to lose consciousness. He remembered a terrific opening shock as his chute opened, and he lost consciousness shortly afterward. Examination showed he had a dislocation of a lumbar vertebrae." Another Air Force officer in August 1944 was given permission to conduct an experimental free fall jump from 42,000 feet to take into account the tests and predictions that had been made in the above cited information.

He chose to use no automatic parachute opening device and proceeded to carry out the experiment. He fell 42,000 feet and landed in the desert sand, fracturing every bone in his body. In all probability, he was dead before he hit. The death would be attributed to lack of oxygen. The objective evidence indicated that he had made no attempt to pull the rip cord. The literature does not make a clear description of the degree to which dissent played a part in this particular instance, but the objective material reported strongly favors the circumstance with dissent, to the point that even secondary protective apparatus was not included.

If this has any meaning for emergency training in the highway field, it is simply that the dissenter, who chooses to "fly by the seat of his own pants," will disregard the accumulated knowledge, results of experiment, and descriptions of the variables, to his own destruction. Steps must be taken to identify him and to understand him, so that compliance with the requirements of the problem can be accomplished.

Escape by parachute—In one of Da Vinci's drawings, there is a picture of a parachute. When the Wright brothers flight-tested their aircraft at Kitty Hawk, they made no provision for getting down independently if something went wrong. As experience with aircraft developed, it became clear that something was necessary to make it possible for the pilot to escape from the plane under certain conditions. Parachute training developed in remarkable steps after basic designs were completed. We have a high degree of sophistication in this field in the military areas.

In Jones' study of bailouts, he makes the point that bailouts, under relatively controlled conditions, are generally safe. They become hazardous, at best, when the plane is on fire, or plummeting out of control, or after a mid-air collision. No matter what the circumstance otherwise, the pilot may make matters worse, no matter how badly off he was to start with, if he (1) waits too long, (2) loses altitude so that the craft is too low, (3) stands up in the seat so that he is swept away into the tail section, (4) opens the chute too soon and becomes entangled with the plane so that he is dragged down to his doom with the aircraft.

The reasons for bailouts in primary categories involve mid-air collisions, power failure, fire, loss of visibility, traveling in inclement weather and being lost, a normal spin, an inverted spin, loss of fuel, structural failure and also the category in which the circumstances are unknown.

In order to underwrite the whole process of emergency escape from a plane in flight, one of the steps taken by the U.S. Navy was the development of a bailout trainer for practice on the ground. This is accomplished by tying the plane down with the tail elevated in a flight position; with the engines running, the slip stream of the

plane's propellers enable the student to simulate the jump at air speed and the student lands in a net along side. Under these conditions he is able to learn correct techniques, and especially the kinds of things not to do. One of the important advantages of this training is that it reduces the time required to clear the cockpit in an emergency escape.

As the speed of aircraft became higher, and the maneuverability of the planes changed, and as dual rudders were developed, the problem of bailing out became a very different one. In order to properly manage escape from an aircraft under these conditions, it became necessary to consider how to propel the pilot from the plane by some automatic means. Automatic ejection seemed to be an answer.

Ejection—It might seem that the problem of ejection could be handled very simply by some means of getting the pilot out of the seat so that he would clear the craft, but many other factors get involved in it. Commander Webster² describes the main hazards in escape from high speed and high altitude aircraft as follows: 1) separation from the structure of the plane, 2) aerobolism, 3) opening shock of the parachute, 4) anoxia, and 5) frostbite.

Mr. Richard Frost³ looking at the problem of ejecting a pilot from high performance aircraft describes them as follows: 1) decision to abandon the aircraft, 2) operation of emergency controls, 3) removal of obstructions to egress, 4) egress from the crew station, 5) avoidance of airplane structure after egress, 6) prevention of injury caused by impact, pressure, temperature, deceleration, and/or tumbling, 7) prevention of injury caused by ambient pressure and/or temperature, 8) retention and protection of life-saving and survival equipment until use, 9) operation of life-saving equipment, 10) prevention of injury during landing considering both vertical and horizontal velocities and type of surface encountered, 11) counter-acting effects of surface environment, including hunger and thirst, 12) facilitating search and recovery operations by friends and avoiding these operations by enemy, and 13) training in the operation and maintenance of the system.

It is clear in viewing the Frost list of engineering problems here that once the

ejection from the plane is accomplished, a host of brand new problems enter the picture, which must be dealt with in advance and carefully planned for. Some of these problems require that the means by which they are managed be carried along with the pilot on his way down. It is interesting to see that the solution to a problem often brings on other problems which are very difficult to manage.

Colonel H. G. Moseley⁴, of the USAF, has described 757 known ejections from high performance aircraft. Five-hundred eighty-four or 77 per cent of these were nonfatal. One-hundred seventy-three or 20 per cent were fatal. In the nonfatal cases, 215 were without any injury; 158 had only minor injury; and 110 or 15 per cent had major injury. In analyzing these circumstances, Moseley found that mechanical ejection was clearly the answer to the removal of the crew from high performance aircraft.

He found in analyzing the cases that there were difficulties in initiating the escape procedures and that special training and engineering design had to go into this phase of the operation. He found that there were difficulties, related to 87 deaths, in separating from the seat once the seat had been ejected from the aircraft. He also found that there were difficulties in deploying the parachute.

It is very interesting to see that the choice of the altitude and the entering velocity in ejection have much to do with the success of the ejection from high-speed and high-altitude. If the chute is deployed too quickly, the opening shock may be so great as to rip the harness in two so that the parachute and the aviator fall separately. If the person does not fall for some distance and is not carrying oxygen with him from high altitudes, he may suffer an anoxic death before he reaches the area where the oxygen-partial pressure is sufficient to maintain normal respiration.

One of the benefits derived from the study of the unsuccessful ejections is that if the body is allowed to go through a free-fall for a distance, it actually slows down so that the rate of fall is not as great in velocity as the initial velocity was in leaving the aircraft. This means that the person accomplishes a moderately

high-speed descent into areas where the oxygen-partial pressure is considerably more favorable, that he leaves the area where extremely low temperatures are unfavorable, and that he slows down sufficiently so that the opening shock of the parachute will not be so great as to tear it apart.

In experimental and operational studies of high altitude bailouts, Mazza⁵ describes his test in which a free-fall drop from high altitude was carried out. "In the first free-fall drop from 37,066 feet, the subject free-fell 80 seconds prior to automatic opening of the parachute. In the second drop from 41,586 feet, the subject free-fell 90 seconds. Ground personnel tracking the drops by radar, estimated the openings to occur at approximately 15,000 feet above sea level."

These data give some indication of what the time factor is in the problems of low oxygen pressure at high altitudes. If you had the experience recently of having the pilot of a jet airliner give the temperature, you have probably been surprised to hear him say that you were travelling at 25,000 feet and the temperature outside was 40 and then, with a pause, add "below zero."

In the drop experiments oxygen equipment consisted of a mask connected to a bailout bottle; a second bailout bottle with a simple pipe system was utilized in case the primary system should fail. Both of these were checked by actual use prior to the jump to be sure that they were properly functioning. In addition, each of the subjects in the experiments wore a stop watch and an altimeter sewed to the sleeve of his outer garment and a knife sewed to the trouser leg so that he would have information concerning the length of time involved in the fall and the altitude, and means by which to take care of problems which came up in flight.

Aircraft accident analysis—Zeller⁶ has analyzed the information developed in the investigation of 536 Century series fighter aircraft accidents in the period January 1, 1953 to June 30, 1957, inclusive. His data are carefully managed from many standpoints and some of his comments are apropos. "The role which the knowledge of emergency procedures played was considerable. Study of the accident reports indicated that in 148 accidents, some type of emer-

gency procedure was necessary. In 133 instances, some emergency procedure was used. Of these, the incorrect procedure was applied in over half of the cases.

It is noted that Century series experience apparently has little effect on whether or not the correct procedure is accomplished. This finding is not unreasonable because emergency procedures are ordinarily of use only when an emergency occurs. Whether the pilot experiences the emergency during the first five hours or the several hundredth hour of flight time has little bearing on the knowledge of these procedures if he has not specifically practiced them in the meantime.

"The high number of incorrect emergency responses suggests that controlled use of simulators and trainers which permit practice of emergency operations should result in a decrease in accidents caused by the pilot having an inadequate knowledge of these procedures." This point is very similar to the one made earlier in which it was mentioned that some procedure was necessary for the maintenance of emergency skills in the highway field once they had been developed.

Helicopter accidents—At Camp Pendleton, California, a helicopter dunking device was employed in order to teach military personnel how to escape from a submerged helicopter after falling into the sea due to the loss of a rotor blade. The machine is so designed that an instructor and nine men can sit in the passenger compartment of the helicopter as it is dunked. In a controlled procedure, into 15 feet of water. The procedure, as described by Sgt. Edward A. Roberts and Lt. Colonel W. T. Shafer, is as follows: In the first experiment, the recruits are given a basic description of what is to occur, where they are to sit and how they are to manage the problem of getting out of the aircraft. They go through a minimum of two immersions.

In the first instance, the machine is dropped into the water and stopped at chin height. Here they are given a description of how to take a last breath as the water forces air into compression in the upper part of the fuselage. Men are equipped in this circumstance with full field equipment. This means normal arms, rifle, a light pack, helmet, an ammunition belt and full combat clothing, including boots.

In the second experiment, the machine is dropped to the bottom. They follow the procedure of waiting until the wheels touch and until the motor gives signs of stopping to take their last breath. If they wait until the water is up around shoulder height and take their last breath, they finish it just as the water comes up over their chin. They remove helmet and place it underneath the seat because the chin straps may get caught in the corrugated floor. The other personal gear which they are carrying is removed and put under the seat.

The recruits hold onto the seat with one hand during this operation so that they will maintain a stable position and not interfere with the motion of other people around them. While still holding onto the seat, they trip the buckles of their seat belts and leave in designated order. As they go through the door, it is necessary to grab the door and force themselves down in order to avoid some of the hoist mechanism gear which is attached to the fuselage at a point above the door. It seems necessary to exhale a small amount of the air which has been taken in in the last breath because it is, in fact, compressed. The rest of the procedure is to swim to the surface of the water.

This has been a successful program. It has turned up the interesting finding on panic, already mentioned. "It is important," says Sgt. Roberts, "if you are going to panic, you do it here where you can get away with it."

Flying civilian aircraft as a private pilot—It is an interesting experience to take the position of a student pilot and begin to learn from actual experience in flight what the various structures in aircraft mean and how they perform their functions in flight. The meaning of trim, aileron, stabilizer, pitch, roll, yaw, the reading of instruments, and the reliance upon them is enhanced by the procedure of becoming a student. The concepts undergo important changes as the student sees the structures in use in flight.

In interviews with student pilots and with instructors, one gets the impression that in learning to fly, much of the understanding of the nature of aircraft and flight is accomplished by deliberately doing the wrong thing. This means that you accumulate experience under relatively controlled conditions. You come to understand what

meaning your action has on the capacity of the plane to perform. You learn what the symptoms of these types of problems are as they begin, so that this information can be utilized when it is critical for your safety.

The pilots who operated as bush pilots many years ago and, who will do, report that they find themselves almost constantly busy while in flight looking for a place where they could land it, at this moment, they were to lose their power or if they were to run out of fuel. The process of estimating a glide path and estimating the means by which one would get to a place where an emergency landing could be made is a tremendously interesting phenomenon to observe from experience.

Putting a plane into an altitude where it stalls at 6,000 feet, knowing a spin would be the inevitable result if it were not controlled, gives you a very sound idea of what has to be done to protect the plane from going into a vertical or an inverted spin. When you anticipate that the rate of fall here would be roughly 32 feet per second from the altitude, plus the initial entering velocity, it is very important that the characteristics of the stall and the spin and the management of this problem be clearly understood and the control reactions be very quick.

The reliance upon instruments as the means by which to get information is critical. The psychological responses to the attitudes of the plane under conditions of instrument flight lead you to believe that your capacity to judge what is going on by the means of your sense organs is not only incorrect, but is misleading to the point of being dangerous.

Shafer describes some of the false sensations that result from the stimulation of the otolith organs in the internal ear as a result of acceleration. "For example, in the absence of visual cues, G forces which are present in various maneuvers do not give adequate stimulus to differentiate the type of maneuver; consequently, the pilot may interpret the G forces of one maneuver as originating from an entirely different maneuver."

"1. Sensation of climbing while banking: the resultant G forces of a coordinated turn may produce the sensation of climbing.

2. Sensation of diving while recovering from a turn: The reduction of G forces noticed on recovery from a turn produce the same sensation as reduction of G forces noted in a dive and may be interpreted as such.

3. Sensation of diving following recovery from a dive: in the pull-out from a dive certain G forces are imposed on the body which are reduced following the pull-out. This reduction tends to give the same sensations as are experienced in a dive and consequently may be interpreted as originating from a dive.

4. Sensation of opposite tilt during a skid: Bergin states that in a perfect turn, where the ground or horizon cannot be seen, the angle of bank cannot be sensed because the resultant of gravity and centrifugal force must fall at right angles to the transverse axis. In blind flying, the deviation of the resultant, and, with it, of the angle of turn indicator, may be sensed as an inclination of the aircraft to the side of the deviation. If, in blind flying, the aircraft skids during a turn on account of it not having been given adequate bank, then the resultant no longer falls at right angles to the transverse axis. Thus, the sensation is that of tilt of the aircraft as opposed to the true one."

Flight simulation—At the United Air Lines Flight Training Center in Denver can be seen one of the most interesting simulation centers in civil aviation. Proficiency training, check flights, and practice in emergency procedures are the business of the day. Here are simulators for the CV 340, DC 6, DC 7, B 720, DC 8 and Caravelle. Training programs are designed to meet federal requirements, indoctrinate and provide practice in new aircraft, and make training use of the vast experience accumulated in scheduled passenger operations.

What procedures are included? Maneuvers such as authorized maximum gross take-off weight with failure of a critical engine; maximum weight landing in four engine aircraft with most critical engines at zero thrust; pull out from maximum landing weight with critical engine inoperative. The lesson plans for emergencies include problems such as fire and smoke, emergency descent, power plant malfunction,

hydraulic failure, electrical system failure, and wheel and gear trouble.

It was an interesting experience to watch the progress of a simulated flight. In the procedure to land, the co-pilot radioed for instructions. He was advised to maintain altitude to the outer marker and then descend to 7,000 feet. The flight engineer began the approach descent procedure and reported the first six items on the check list were complete. The tower called United 820 and said, "Cleared to land, runway 126." The check list continued: landing gross weight — 175 M; threshold speed — 121; ejectors — extended; seat belt light — on; anti-skid — armed. The captain called for a weather report and found the ceiling to be 350 feet.

The flight engineer abruptly reported a flame-out in No. one engine. The crew attempted a normal, in-flight re-start while continuing the approach. The engine failed to start. The crew positioned the fuel shut-off lever to "off" and continued the approach to land. The tower was advised of the engine flame-out with a request for standby equipment.

On passing the inner marker at 500 feet altitude, scud clouds rolled over the field blacking out the runway, and the captain elected to go around. The tower was advised and United 820 was re-sequenced to the outer marker for a second ILS approach. On turning inbound at the outer marker, the fire warning light came on, with the alarm indicating an engine fire in the No. two (left inbound) engine.

The captain pushed the master fire warning light to "reset." The crew checked the No. two engine instruments, noting a high exhaust gas temperature. The captain pulled the fire shut-off lever full forward and positioned the fuel shut-off lever to "off." He asked the co-pilot to pull the fire agent discharge handle and check for low pressure indicating light "on." The co-pilot reported fire agent discharge. The captain requested the crew to complete the engine fire control procedure.

The flight engineer moved the generator drive disconnect lever to "disengage" position and positioned the No. two hydraulic pump to "by-pass," and checked the No. three pump to "on." By this time the fire light was out on No. two and the co-pilot

advised the captain, "Fire light is out." The captain requested the co-pilot to advise the tower of the condition and ask for emergency equipment to stand by. He also requested a precision radar assist.

The flight continued down the glide slope, crossing the inner marker, with continuous advice from ground radar. The plane settled in a normal landing without incident.

The above description shows how the flight simulator and the flight check serve to maintain the emergency skills developed in thousands of hours of flying. These procedures are an intimate part of how the aviation industry carries out its efficiency and skill maintenance programs. The air line may carry passengers with full confidence that skills to meet the occasion of need are "built in" each one of the flight personnel.

Suggested emergency training — Some steps in emergency training can be taken now. These are steps that most driver training instructors know or could work out for themselves.

1. **The soft fire.** It is easy enough to set up a simple situation in which one of the tires either on the front or the rear of the vehicle has 10 pounds of air in it and allow the driver to travel at low speeds to get the feel of the situation. Obviously, much driving of this sort is going to damage the tire, so a special one should be used for the purpose and watched carefully for evidence of failure.

2. **Brake pedal loss.** Under some conditions the brake pedal shows a sign of a slow brake loss. You have experienced a mushy and spongy pedal where you have low fluid in the system or a leak in a wheel cylinder. This happens also when the adjustment of brakes is not up to standard. One of the important things here is to teach the person how to recognize that the feel of the pedal itself is not right. This is not to suggest that the person should be asked to operate a vehicle with defective brakes. The point is to teach him how to recognize, by applying pressure to the brake-pedal, that something is wrong with the braking system.

It is recommended that the person be taught how to stop the vehicle with the use of the hand brake. Under conditions of

massive brake failure which occurs while the vehicle is in motion, the possibility of stopping is dependent upon the hand brake and upon having a clear area ahead. The hand brake is certainly going to operate at something less than half braking efficiency in many conditions. If the hand braking system is not in good condition, then the driver is in terrible trouble. To think of the hand brake as a way out requires much practice. To teach the driver from the beginning how to use the hand brake as a means of stopping the vehicle is to provide him with a skill which is extremely important.

3. **Ignition loss.** On some occasions the operator of a vehicle will lose the ignition while in transit. This can be simulated very easily. While the student is driving in a normal fashion, the instructor can shut off the ignition switch. The task for the driver would be to determine that this had happened and to leave the travelled part of the roadway as quickly as possible in order to avoid obstructing traffic, and exposing himself to collision.

4. **Protecting the scene.** Protecting the scene of an accident means giving warning to vehicle operators coming in both directions that there is trouble in the road ahead and that it should be approached with extreme care. Staking out the vehicle with flares, fuses, flashers or flags is required. Distance from the vehicle must take speed into account. The standards of the Interstate Commerce Commission for vehicles transporting cargo and passengers across state lines would appear to be basic standards for the teaching program. Protecting the scene has to do both with an accident and with the condition of vehicle failure.

5. **Sign reading.** Sign reading is a far more important matter for many circumstances than is generally realized. A great deal has been done on legibility, and on minimizing the language and the number of ideas presented to the driver at one time. The traffic engineering profession has contributed a lot to these matters. The accomplishments are occasionally completely lost when a piece of roadway is either in construction or in reconstruction. Temporary signs, signals and markers are put out. Learning how to interpret these changes and how to make sensible judgments

based upon them is a very important matter to the driver.

6. **Inspecting the vehicle.** One of the most important basic areas in which sound and practical training can be given is on procedures for inspecting the vehicle.

In the highway field we assume that human failure is the nearly complete problem and we do not look at the rest of the situation. Our published reports in this field are accurate insofar as data are reported, but they are completely inadequate because systematic investigation of the vehicle is not carried out by any public agency in any state automobile accidents. Therefore, it is extremely important in principle to teach students how to look at each component in the steering system and test it for adequacy. Students should learn where the weak parts are, where connecting mechanisms that can become loosened or disconnected are located, which parts are fragile in design and subject to failure. Tires are extremely important. Each component in the exhaust system, from the manifold all the way to the end of the tailpipe, needs to be inspected regularly.

7. **Deceleration protection.** We have estimated in our cases at the Harvard Medical School that a large number of persons who are killed are on the receiving end of missiles which go out of control and cross into the driver's path.

In one of our recent cases three persons were travelling northbound on a four-lane divided highway. They were all sitting in the front seat. Without warning the vehicle went out of control, crossed the median, and then entered the southbound lanes. The driver of a heavy vehicle going in the opposite direction observed the vehicle while it was in the median and realized that it was coming into the lane. The driver hit his brake and left skid marks for a very short distance, while making a very slight turning movement of avoidance. His reactions appeared to be excellent under these conditions. He was on a collision course beyond a point of no return before he knew that anything was going wrong. In spite of all that he did, there was no possibility of avoidance.

None of the persons killed in this accident were using seat belts. When other drivers go out of control, or other vehicles fail

while in motion, whoever is in the immediate vicinity is in extreme danger. In such cases, the only help possible is that given by deceleration protection. The term deceleration protection here is intended to mean door locks that resist opening, padded foam on the visors, padded foam on the dashboard, a recessed-post type steering wheel and seat belts for each separate occupant in the vehicle. This is a minimum.

Research—Some of the types of emergency training that could be suggested cannot be readily carried from the stage of concept to the stage of teaching activity. Some of these items require detailed operations research. Some of them require engineering design work to devise and manufacture devices to help. The following list is presented, without attempting detailed description at this time, to indicate some of the teaching procedures which should be available in the future. They are:

1. **The panic stop.** This has been mentioned before. You might easily argue that this term should have been in the first list. While this is a defensible position, it is also true that under some panic-stop conditions, secondary emergency problems arise. Until these have been worked out, the panic stop should not be added to the teaching routine.

2. **Sudden brake loss or sudden brake failure.** At Harvard we see the circumstance of having lacerated brake hoses or disconnected lines. We see the results of the vibration of the metallic line against another metallic structure so that the fluid leaks out. Without any prior warning the car is without brakes. Controls are limited. We do not yet know how serious this problem is, statistically.

3. **Sudden power steering loss.** This refers to the type of thing that happens when you are going along in a perfectly orderly fashion, and the power steering fails and you don't know it. You start to steer and during that first moment your hands simply slip across the steering wheel. You have to recover, move back again, grip the steering and then start a recovery movement with added strength. It is during this critical period of finding the failure and developing the strength to override the power steering mechanism that jeopardy occurs.

4. **Returning to shoulder.** In many parts

of the country we have shoulders along the highway made of sand or soil or stone. The shoulder surface may be two inches or three inches below that of the pavement. When the new driver runs over the edge of this, he may have a great deal of difficulty in getting back. Teaching him how to do this without running the risk of putting the vehicle out of control is important. One possible means is to decelerate without braking, and gain the roadway at low speed.

5. **Explosive decompression.** Explosive decompression in a tire is a term used in preference to the term blowouts, in an attempt to indicate the extreme rapidity with which the air loss is accomplished. We have demonstrated in our clinical work that to put your foot on the brake for a massive deceleration under the conditions of a blow-out is asking for death, because whatever steering problem you have as a result of the tire failure will be magnified many times by the hard application of the brakes. Procedures for managing the deceleration and the steering control need to be worked out experimentally.

6. **Vehicle control.** What should the passenger do when the driver of his vehicle obviously loses control? We have one case in which the passenger was obviously trying to give aid. The vehicle continued out of control and hit a tree and the passenger was killed. What his action should be under conditions of fainting, seizure or sleep is a complete unknown.

7. **Skidding.** The vehicle which goes into a skid is in a serious situation. Sometimes a person can go into a controlled skid and avoid some other type of problem by its use. This takes a degree of skill which is beyond the range of most of us. What about the ordinary situation when you lose traction on a wet road? Or when you think you can stop on ice or snow and you find you can't, what do you do? These procedures are being tackled by the Committee on Winter Driving Hazards of the National Safety Council and very soon they will have some recommendations to make. One of the important things here, of course, is careful evaluation of the type of equipment in use on the vehicle respecting winter driving hazards.

8. **Misfires.** What about the situation in which the other driver shows signs of being on the collision course, but you don't know

what to do about it? Assume that he is intoxicated or asleep. Procedures need to be worked out to adequately handle this matter.

The idea of clicking your lights up and down could hardly be more foolish. If a driver has gone to sleep at the wheel with his own car all around him and his own engine and headlights going, it is almost certain that your headlights are not going to wake him up. It is suggested that the horn be used in an attempt to wake him up. In the meantime, pulling over to your own side of the road protects your liability interests. Other work on this problem needs to be done.

9. **Pedestrians.** A short time ago a newspaper writer phoned and asked my opinion about the appropriate action of a driver when a dog runs into the street in front of him. His question included the comment that he had checked with the local safety council. The advice given was that they did not recommend that the driver make any attempt to avoid the dog.

Reaction to this was very simple. This is a useful training ground. We have an important pedestrian death problem in this country. Nearly 8,000 pedestrians are killed by automobiles in the course of the year. When a dog runs into the street, you have an opportunity to use the situation as a training ground for avoiding the pedestrian. The actions of the dog and the pedestrian are probably equally unpredictable, and this gives you a chance to develop emergency skills. If you can avoid the dog, you can also very probably avoid the child.

This statement of principle is not a solution to the problem of how a driver should behave with respect to pedestrian deceleration, but until experimental work is accomplished to set up the means by which the pedestrian avoidance procedure can be established, this philosophy is certainly a useful one. At the present time we don't even use a horn to warn a pedestrian of a collision course. The principles of protection applied for occupants ought to be extended to design work for pedestrian protection also.

Problems of emergency training.—There are several problem areas which need to be looked at rather carefully in looking forward to adding emergency training to the driver education procedure. It is not necessary to go into great detail on these, but some of them are of basic concern.

The first of these is to justify the research which is necessary to develop the training procedures and to devise the engineering devices. There will be some who will find no possible justification for a training procedure which may have an element of danger in it.

We get in the habit of "jay walking" in the point that the very success of this activity leads us to believe there is no danger in it. We drive automobiles under all kinds of conditions, including the most severe weather, with hardly a thought that anything will go wrong which will lead us to injury. The traffic casualty statistics are accumulating at such a rate that the probability of involvements of any of us gets greater and greater as time goes along, as traffic density increases and the number of miles traveled increases.

It behooves us, then, to look into the areas where we know unsolved problems exist and to take firm and intelligent and thoughtful steps in order to manage these circumstances. We cannot prove how many persons die due to blowout conditions. We can document that existing emergency procedures in other areas find their extreme problems amenable to both engineering and educational methods. It behooves us to take the steps necessary to add these methods to the highway safety field.

Research in this field is a fundamental necessity. Research which is basic in an attempt to describe the variables, to properly develop training procedures, and to create sound engineering devices to support safe training. Research must be carried to such a point that we will achieve an almost fool-proof system of training in each of the several areas where emergency training procedures are justified. No amount of effort and money should be spared to successfully accomplish this degree of perfection.

When these several matters have been settled by appropriate research, there are other problems which need to be taken into account.

What should be the level of skill development reached by the student at the time he begins to learn an emergency skill? This requires special study. It is a special instance of learning readiness.

What are the physiological responses to stress which are well known to occur under

other circumstances that will become involved in this type of training? What happens to the adrenals and to the autonomic nervous system? What is the shift in the general adaptation syndrome in the human body? What is the effect of these observed physiological changes in a student who possesses a given disease or pathology? These are matters which need to be explored under experimental conditions with sound medical scientists carrying out the studies.

What can be done to devise an automobile to be used for this type of training? The dual-control cars which are presently in use all over the country have served well for the circumstances for which they were designed. For the type of training which is being described here, complete duplicate controls will be necessary in order to guarantee that the safety of the occupants during the training period will be assured. The engineering genius of the automobile industry can certainly accomplish this objective in line with their long-standing policy of giving sound support to the driver education field.

In many educational jurisdictions, there are existing policy decisions on record indicating that the student cannot under any conditions be placed in a situation of danger while in driver education. We may be quibbling with a language problem to raise this one, but it may be a very real problem. Whatever steps are taken to accomplish emergency training, it is important that all interested parties participate in the developments from the very beginning so that the accumulated experience of public officials in every field can be utilized to accomplish a sound training program. School board personnel should be participants in the development of the program.

What legal requirements should there be for instructors who take on the tasks that we are suggesting? Should they have first aid training? Should they have special indoctrination concerning the mechanics of vehicles? Should they have teacher training preparation with an appropriate stamp of approval by the State Department of Education? Should they have some additional qualification as certified by the department concerned with driver licenses? These several matters must be taken into account so that problems which might arise in the application of the materials can be handled in advance.

What emotional problems develop in the circumstance of training that can be detrimental to the health of the student or detrimental to his safety in the condition of the emergency training? Preoccupation, lapses which come by virtue of illusions, fascination and marked degrees of imagination concerning the lessons must be considered. What of the emotional responses which lead to nausea and vomiting? What is the effect of the training on his sleep? Does unsuccessful activity deleteriously affect what happens in classroom studies in other areas?

These many matters need to be looked at one at a time and very carefully. The road set is one which requires exhaustive preparation and very fundamental research activity.

1. It is the argument of this paper that a policy decision should be made in each of the several jurisdictions concerning it that emergency training in automobile safety is a step which we should take.

2. All interested parties should sit in conference and explore the many steps to be taken for a sound program for developing emergency training areas, training techniques, training materials and engineering devices, and teaching personnel.

3. Steps should be taken to obtain enabling legislation or administrative decisions, where it can be done by decree, to give support to the development of emergency training for highways.

4. The emergency training programs which are developed should be subjected to exhaustive testing prior to use. Experimental comparisons should also be carried out to assess the value of the training under controlled conditions.

This author recommended several years ago that successful completion of an authorized driver education course be required before the license examination for an original license to drive. This does not mean the first license in California, then the first license in Nevada. This means the first license to drive an automobile. Three states have adopted some such provision in the meantime and some others are considering it presently. It is necessary to repeat this recommendation and urge its adoption. We know that the procedure is a sound one and that it contributes significantly to the long-

run successful operation of the vehicle by the student.

Consider along with this some other recommendations which you will agree are very radical. These are not offered individually but should be appraised as a group—which, in fact, cannot be accomplished at the moment. The original license to drive for any driver should carry a restriction permitting the person to drive a vehicle for a period of one year, but at no time with any passengers aboard. During this period he could carry with him an instructor, and the instructor would aid him in the preparation for a re-examination which would follow.

It is not possible to give a complete statistical support for the no-passenger restriction at this time. However, the National Safety Council has provided data, from 13 states in 1957 and 10 states in 1958, which indicate that for each of these years the accident problem for the persons with less than one year of experience is approximately as follows: accidents 16,945; deaths 163. Projecting this to the entire country, it suggests 270,000 accidents, of which 10 per cent would involve personal injury, and 300-1,000 would result in death.

The other justification is that it is a very personal matter to sacrifice one's life when a fire has no traction and the vehicle skids. No state is free of this problem, nor is any vehicle. Is it really morally right that a person should be given a license which exposes him to death by skidding, without ever having had the first word of teaching and demonstration of how to stay alive by regaining control? It is expected and assumed and should be provided that an instructor who is qualified could be aboard for purposes of teaching at any time.

If tabulations were made of the number of rollover deaths, pedestrian deaths, one-car accidents and fixed-object collisions, both fatal and nonfatal, occurring to people during the first year of being licensed, considerable data could be amassed to indicate that with inexperience comes hazard. We have seen in our studies several instances of deaths occurring in and by an automobile before the driver's license is a year old. We have seen one particular tragic instance of a death when a driver's license was one hour old. It is particularly important that this type of problem be avoided.

The next recommendation is that a re-examination be given at some time appropriate in terms of experience and accomplishment in training. The driver would be required to demonstrate his skill at managing a car under certain emergency conditions before the no-passenger restriction was removed from his driver's license. Anyone allowed to continue with a license for a second year would at least have to demonstrate the skill in avoidance of pedestrians.

Summary

In the foregoing materials, an attempt has been made to describe the concept of emergency training as applied to any circumstance in which emergencies are a normal by-product of man-machine relationships. The psychology of emergency training has also been described. A number of examples have been given in which emergency training has been carried out in other fields with strong evidence of success.

Examples of emergency training deemed necessary in the driver education field have been given. Some problems concerning their development and application have been indicated and some recommendations made for application of these materials when the appropriate educational and engineering researches have been completed. It is sincerely hoped that policy decisions favorable to the development of emergency training for automobiles will be carried out with all haste, and with all soundness.

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THE DRIVER EDUCATION TEACHER AND TEACHING MACHINES

By CHARLES H. HARTMAN

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Within the past several years there has been considerable attention given to discussions centering about what are commonly known as teaching machines. In fact, the previous school year has been described in some quarters as the year when these various teaching machines moved out of the psychological laboratories and into classrooms en masse.

Although a great deal has been said and written on this topic it would appear that there exists both among professional and lay groups a somewhat vague notion of (1) what constitutes a teaching machine, and (2) what such devices can and can not contribute to the development of a quality instructional program.

In this brief presentation an attempt will be made to clarify certain aspects pertaining to teaching machines. Recommendations for the consideration and possible use of these devices in the teaching of driver education will form a second part of the presentation.

First it seems essential to clarify what is meant by a teaching machine. Although it is only within recent years that we have heard so much about "teaching machines," viewed in the broadest sense teachers have had available and have used all sorts of machines in their teaching for many years. A film projector or tape recorder would represent but two examples of this type of machine.

In some quarters, the charts, projects, models and other instructional aids which many of us find opportunity to use in our classes on a nearly everyday basis—both the commercially manufactured models and the models and projects prepared by students and teachers—these instructional aids are also known as teaching machines.

If I may inject a personal reference that is pertinent, it can be reported that earlier this year it was my good fortune to have a brief article published in *Safety Education* which described the preparation and

utilization of a variety of teaching aids, models, and projects prepared by students enrolled in the teacher preparation program in driver and safety education at Illinois State Normal University. Grateful as I am for the publication of the article and convinced as I am of the value of engaging high school and college students in project and survey work such as that described in the article, I cannot refrain from taking exception to the title which was somehow given this article as it went to press. The title appearing with this article was "They Make Their Own Teaching Machines." Unless the broadest possible latitude is allowed, the aids described in the article cannot be considered to be "teaching machines" and the title, therefore, is a misnomer.

Lawrence M. Stolorow defines a teaching machine in his monograph, *Teaching by Machine*, as "a mechanism that presents information to a student and controls his behavior in a predetermined interacting relationship." Interested persons are referred to Stolorow's publication which has been useful in the preparation of this presentation.

Under this definition neither the projects and aids described above, nor "machines" such as the film projector and tape recorder can be properly classified as teaching machines. Driver education teachers may be prone to regard the several simulated devices available in this field (e.g., the Aema Drivotrainer) as teaching machines, particularly since these devices are so machine-like in appearance. Depending upon how such devices are actually used and depending upon how strictly or loosely one interprets the definition of teaching machines, these simulator devices may or may not be properly regarded to be within this category. Under a strict interpretation of the definition it is likely that they would not be considered to be teaching machines.

Perhaps this tendency to lump into the teaching machine category such a wide

variety of instructional aids, might be minimized if the synonymous term auto-instructional device were more commonly employed.

Central to the discussion to use any auto-instructional device is the problem of whether such a device is to be used at the sole source of instruction or as one factor in a total instructional effort. There are research findings available that indicate the effectiveness of each of these procedures in particular circumstances. It would seem that the nature of the skill, knowledge, and attitudinal factors involved in the teaching of driver education suggests that if the use of auto-instructional devices in this field is to be attempted, utilization might well take the form of one factor in a total instructional effort rather than the sole source of instruction. This is, of course, a supposition that the one procedure would be more effective than the other, and can be borne out only through adequate research.

Excluding the possibility that some of the several simulated devices commonly associated with driving instruction are actually auto-instructional devices, it can be said without much fear of contradiction that there has been no great rush to design and use auto-instructional devices in the teaching of driver education. If any such programs have been designed and used there has been a paucity of information made available concerning this innovation.

Are not we as driver educators as seriously in need of the development, testing, and utilization of effective auto-instructional devices as are our colleagues in other fields? Many of us feel the pressures of an all-too-short thirty clock-hours of instruction in the classroom phase and six clock hours of instruction behind-the-wheel forcing us to provide less than a truly complete and comprehensive course. Some of us are facing classroom sessions that grow larger and larger with each passing year. Many of us are constantly forced to justify the relatively high instructional costs of driver education programs. All of us as driver educators, convinced of the value of high school driver education, are seeking support for plans that will make driver education available to all eligible students. Do not these factors, as well as others, combine to form a convincing need to seek

an ever-increasing efficiency and effectiveness for the total driver education program?

If the answers to these questions are in the affirmative it behooves us to initiate actions which will lead us toward a greater understanding of the possible use we might make of auto-instructional devices in driver education. This is not to suggest that we in driver education "jump on the bandwagon" with regard to auto-instructional devices. There is probably little room left on the bandwagon anyhow as it appears that so many have already made their jump.

For this we need have no regrets for despite the attention given auto-instructional devices during the past few years the research reported thus far seems more provocative than definitive, more argumentative than conclusive. Until some important questions can be answered it would seem advisable to use auto-instructional devices in an experimental framework rather than in routine instructional situations. We should not, however, sit back and let the other fellow do it. Consideration and study of the potential uses of these devices in driver education is worthy of our attention at this time.

It is not necessary to promote the idea that we should give time and attention to a study of these devices as they might relate to driver education. Consciously or subconsciously many teachers fear these "machines;" they view these mechanized models as supplanters of the teacher. Those holding to this view will need to be persuaded that their view runs contrary to the facts. Auto-instructional devices are not devices which will eliminate the teacher; rather they are a means of emancipation for the teacher for they can free him from the more routine aspects of his work and thereby give him more time for thoughtful planning of instructional programs, and for gaining more knowledge about his subject and his students.

In summary it should be reiterated that auto-instructional devices or "teaching machines" do not embrace as many instructional aids and classroom "machines" as is perhaps supposed. Further, driver education teachers need to initiate actions which will lead to a competent consideration and study of the possible uses of auto-instructional devices in driver education. This needs to

be done both for enrollment and cost considerations, and for the more important reason that such consideration and study could lead to an increased effectiveness in

the teaching of driver education. Finally, the time to initiate such actions is this year, not next; the persons to initiate it are "we," not "they."

INCENTIVE AND YARDSTICK — NATIONAL COLLEGE AND UNIVERSITY SAFETY AWARDS

By LOWELL L. CARVER

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Although the campus safety group of the National Safety Council has been in existence only since 1949, it has always recognized the need for an evaluation and award program which would both give recognition to those colleges and universities which are taking measures to reduce campus accidents, and at the same time would serve as a stimulant to higher education institutions to initiate or strengthen such programs.

When the campus safety committee became a formal part of the school and college conference structure in 1957, as part of the higher education section, it appointed a committee on recognition of campus safety programs to study and recommend for adoption a standard recognition program similar in intent and scope to the honor roll program.

After considerable research, experimenting, consulting and try-out the committee, with the assistance of Daniel Webster, men in the field and National Safety Council personnel, a proposed plan for citation of colleges and universities has been developed. In accordance with the general policy of the National Safety Council, the school and college conference has established a recognition program for outstanding achievements of colleges and universities in safety.

The four levels of awards provided are: Award of Honor, Award of Merit, Certificate of Commendation, and President's Letter.

The awards will be determined by using an evaluation check-list developed by the committee, containing 58 items, each item has an assigned maximum numerical value, varying in weight from two to three, and totaling 150 points.

The awards are noncompetitive and are conferred on colleges and universities achieving a level of accomplishment as established by the awards committee of the higher education section and approved by the school and college conference. Any college in the United States or Canada is eligible if it is a member of the National Safety Council and if it is an accredited higher education institution.

Two committees will be appointed to function in the program.

The awards committee will consist of five members appointed by the school and college conference (submitted by the section) from the field of education and local safety councils. This committee will determine policies and procedures in the program.

The judges committee will consist of five members, likewise appointed by the school and college conference, from industry, a national organization, a state department of education, the NSC board of directors, and the school and college conference. The latter two members may be the vice president for schools and colleges, and the chairman of the school and college conference. The function of this committee will be to review the entries in the program, checking tabulations of scores, and participate to such extent as they can in award presentations.

Other program details are too numerous to mention at this time and will be subject to some variance from one higher education institution to another; however, reasonable uniformity of achievement is assured through meeting the standards set for each award level by the awards committee. At the same time the selection of those col-

leges and universities which receive recognition, as compared with those which do not, provides a limited element of competition. This, in combination with the institution's desire to maintain or to improve its award level, constitutes a challenge or incentive to make programs worthy of recognition.

Program Objectives

1. To improve the environment and related factors of the college campus in reducing accidental injuries to students, faculty and staff members, and the public using the facilities.

2. To promote the sponsorship and conduct of safety research by higher education institutions for application in all phases of human endeavor.

3. To improve and expand the teaching of safety in regular courses of instruction and through special courses for the preparation of safety educators and specialists.

4. To assist in determining those desirable standards for a college in achieving a well-balanced safety program.

5. To give recognition to colleges and universities in educational effectiveness for greater safety.

Evaluation of Achievement

The following criteria are offered to guide colleges and universities in planning and evaluating their safety efforts. They also serve as the main headings for the evaluation check list.

1. Administrative leadership, including responsibility and authority for the conduct of a coordinated program and its implementation.

2. Safety organization, including the designation of a qualified person to coordinate and direct the program; safety committees, boards, and councils.

3. Standardized procedures for reporting all injuries incurred in college-jurisdiction accidents; periodic analyses and summarization of accident causation and related factors.

4. Placement and training of new faculty, staff members, and students, including orientation, physical examination, and in-service training programs.

5. Provision of a safe environment for living, working, and for recreation through

a system of inspections, adherence to legal and recommended standards, and the elimination of physical hazards.

6. An emergency and disaster-preparedness program to control and reduce the possibility of death and injury in the event of accidents, or other incidents with disaster potentials.

7. Promotion of interest in safety through recognized promotional media and educational publications.

8. A continuing program of research and safety education for staff members and students, and the provision of special safety education courses for students preparing to become safety educators or safety specialists.

Many times we have heard the statement, "that unless top management is sold on safety it will be difficult to carry out an effective program." This is just as important in an educational institution as it is in industry. It is essential that a written policy be prepared by the top administration of a given college or university indicating interest in and support of a safety program. It is further important that the administration place responsibility and delegate authority for the prevention of accidents and that the policy of accident prevention and safety be known to staff members and students alike. Staff members and students should be invited to participate and contribute to the program.

It is highly desirable that the head of the college or university appoint a qualified person who will function in a staff capacity, and serve in a full-time or collateral role as safety coordinator, supervisor or other suitable title. This individual should have high interest in safety and time to spend on safety education and accident prevention.

His functions should include the preparation of a master plan of safety programming including unit safety organization, inspections, student and public accidents, fire prevention and control, safety promotion, preparation of rules and regulations, and encouragement of safety education and training. This individual should also endeavor to work with staff members and organizations within the college or university in attaining safety objectives. He should periodically keep the college or university administration advised concerning progress.

the student body. Yet these personnel, and college facilities, in total comprise one of America's greatest challenges to those who would destroy our democratic heritage and way of life.

Although the number of colleges which have activated balanced safety programs over recent years has shown a significant increase, the status of our accident-prevention efforts points up the need for redoubling our efforts if campus safety is to be a fundamental and respected function of administration. We must convey the idea that campus safety activities contribute to the abilities of colleges and universities to perform their stated missions, whether they be in the training of technical or professional workers, or in the preparation of teachers of our future generations. Campus safety is a means of conserving our human and material resources.

Possibly the lack of a "packaged" program, and inadequate communications, are responsible for the failure of many college administrators to recognize the important values of campus safety as an organized and continuing activity. Campus safety is not unique in its slow acceptance, for we have seen the same shortcoming in numerous aspects of college safety.

Records show, for example, that the first verified motor vehicle traffic fatality in the United States occurred in New York City in 1899. Yet it was not until 1923, just short of a quarter-century later, that driver education with behind-the-wheel instruction was first offered as a high school subject.¹ It was not until another 13 years had passed that any college accepted the fact that the automobile, and its attendant fatalities and casualties was here to stay, and that higher education institutions could contribute through the adequate preparation of teachers in this field.² It already was late—in the meantime over one-half million Americans had lost their lives from accidents involving the automobile, the greatest of all killers.³

No influence is intended that colleges have not been making any efforts to create cam-

pus which are safe for work and study, living, and recreation. Early information is fragmentary, but it is known that as early as 1915 the University of Illinois had a student group known as the "Life and Limb Club," devoted to the prevention of accidents in college shops.

It is also known that most of the initial college endeavors in practical safety, on an organized basis, were patterned after industrial safety programs, and as such were oriented to the safety of employees, and the engineering approach to accident prevention through environmental controls. Many of these broadened into programs which also considered the student body, and the activities carried on within the institution. The earliest of these, with full-time leadership, was probably that initiated by Lorin J. Elder at Pennsylvania State University (then Pennsylvania State College), in 1936.

If we were to compare staff and students in colleges with their counterparts in industry, we might imagine that at least half of our institutions of higher education now have organized safety programs. The logic of this belief might rest on the facts that industries of comparable sizes generally have well-defined safety programs, and since colleges have all the accident exposures normally encountered in industry—and many more in view of recreational and athletic, housing and food services, and research activities—they should be out in front in the promotion of safe practices. Unfortunately the Campus Safety Association has conjectured that this is not true, on the basis of its membership. It seems that although colleges virtually are communities in themselves and have all the attendant exposures to accidents found in most small cities, it has not been until some catastrophe has occurred, or there has been an awakening to the extent of the accident problem through liability suits or insurance claims, that administrators have become aware of the problem.

Aside from difficulty in understanding this lack of college effort in accident prevention, when viewed in terms of billions of dollars invested in installations and facilities, irreplaceable faculty members, potential of research efforts, and the worth of students to the future of the nation, the question has been raised, "Is campus safety a form of education in itself?" Do students ac-

quire safety knowledge, attitudes and skills from their observations of the campus and the examples of safe practices set by staff and faculty members? Industry feels that they do, and as in the case of the chemical industries, sometimes wonder why colleges don't do a better job in preparing students for productive roles as technicians or professional workers. Fortunately, the educational values of effective campus safety programs are being given increasing emphasis.

The organizational status of campus safety programs, and the duties of assigned personnel, has been largely a matter of conjecture. Questions have been raised as to the most appropriate place in the administrative structure for safety coordination and stimulation. In some instances, concern for individual prestige or security has been expressed. We have found ourselves stumbling over questions such as, "Is health a part of safety, or is safety a part of health?"

Some insight into the extent and nature of campus safety programs may be derived from a survey conducted in the spring, 1961 for the National Safety Council's Campus Safety Association.

At that time a simple questionnaire was mailed to each of approximately 1,970 colleges and universities in the continental United States. Admittedly, the instrument was not designed to give a comprehensive picture of campus safety programs; rather, through check and completion items, to elicit as complete a response as possible.

The purposes of the survey were to determine:

—if patterns of safety organization exist for institutions of various size.

—where responsibility for safety programming most frequently is placed.

—accident-prevention and other activities of assigned safety personnel.

Information was sought in regard to eight items:

1. Identification of the college or university.

2. 1960-1961 enrollment.

3. Person responsible for coordination and direction of college-wide safety program.

4. Percentage of time he devotes to practical problems of campus safety.

5. His major accident-prevention activities in sequence of time spent.

6. His major activities other than accident prevention.

7. Existence of safety committee or counterpart for recommending of policy and program.

8. Consideration for employment of full-time safety personnel, if such are not presently employed.

A total of 190 questionnaires were returned, representing 90 per cent of all colleges and universities. The number of students which these colleges enrolled, 885,066, however, represented 24.5 per cent of the total enrollment of all colleges for the 1960-1961 academic year.⁴

In treating the data, it was recognized that the varying sizes of institutions could be expected to influence the extent and nature of campus safety programs, and the time spent in different activities. For example, it was assumed that many of the smaller institutions might assign safety coordination duties on a collateral basis with other duties. For this reason, the 190 questionnaires returned were tabulated by four enrollment groups, as well as for all colleges as a whole.

1. Enrollment for the 1960-1961 academic year for 1,970 colleges of degree-credit students was estimated at 3,879,611 by the Office of Education, United States Department of Health, Education and Welfare.

TABLE I
Respondents According to Numbers and Sizes of Institutions

	Under 1,000	1,000 to 5,000	5,000 to 10,000	Over 10,000	Total
Total Colleges	1,842	587	109	71	1,970
Respondents	43	77	38	23	190
Per cent Responded	2.3	13.0	35.0	32.0	3.6
Enrollment	32,481	171,245	195,800	465,800	885,066
Average Enrollment ...	594	2,922	1,900	21,100	

1. Gilbert, Minnesota.
2. Pennsylvania State College, 1936.
3. Estimated at \$14,870 from National Safety Council figures.

Safety Titles

"Safety" or an equivalent term was used in the title of the person designated to head the accident-prevention program at 40, or 22 per cent, of the responding colleges. Assignment of the responsibility to a designated individual was indicated by 149, or 78 per cent, of the reporting institutions.

Place in Organization

Of the 190 reporting institutions, 149, or 78 per cent, indicated that responsibility for the safety program had been delegated to one individual. Departments in which these coordinators or directors most frequently were assigned were buildings and grounds and central administration.

Administrative Supervision

At more than a third (38 per cent) of the colleges which indicated a delegated responsibility for the program, the designated person reported to the president. Others frequently reported to a dean or director in central administration or to the business manager.

TABLE II		Place in Organization and Administrative Supervision	
Place in Organization		Administrative Supervision	
Buildings and Grounds	37	President	52
Central Administration	34	Dean, Dir. Central Admin.	22
Business Office	33	Business Manager	18
Dept. Fire Prev., Safety Security	20	Dir. Bldgs. Grounds, Plant	18
Dept. Health, P. E. & R.	18	Dir. Health & P. E.	10
Academic Dept.	14	Vice Pres. Administration	7
Health Service	1	Head, Academic Dept.	6
Residence Halls	1	Dir. Health Service	5
Total	149	Total	136

Time Spent in Accident Prevention

At those colleges where the safety responsibility had been assigned for coordination by one individual, time spent in safety work was usually less than 10 per cent. Of the 141 responses, 88, or 60 per cent, of the individuals indicated less than 10 per cent spent on safety; 18 spent 11 to 20 per cent of their time, and eighteen spent up to 60 per cent of time on accident prevention. Seventeen of the respondents indicated full-time, or equivalent, was devoted to the campus safety program.

Safety Activities

The activities in safety in which assigned personnel were involved, and the time spent in various safety duties, showed a close correlation. Most frequently men-

TABLE III	
Time Spent on Safety Activities	
Per cent of Times	Number
1-10	88
11-20	18
21-30	7
31-40	6
41-50	3
51-60	2
61-70	1
71-80	1
81-90	1
91-100	17

tioned were inspections, fire prevention and protection, accident reporting, maintenance of buildings and grounds, and organization and administration.

Other Duties

The most complete answers to this question were provided by the larger institutions, where it appeared that safety duties were augmented by activities in security and protection, maintenance of facilities, instruction including safety and driver education.

TABLE IV		Safety Activities by Frequency and Time Spent	
Frequency		Time Spent	
Inspections	180	68	68
Fire Prev., Prot.	118	73	73
Accident Reporting	102	44	44
Maint. Bldgs. Gnds.	101	49	49
Org. and Admin.	97	61	61
Student Housing	97	35	35
First Aid	87	31	31
Traffic, Fleet, Parking	86	21	21
Student Activities	85	28	28
Employee Safety	81	40	40
Athletics, P. E. & R.	80	29	29
Civ. Def., Dis. Prep.	78	18	18
Laboratory and Chemistry	78	30	30
Shop, Mech. Guarding	70	18	18
Protective Equipment	60	4	4
Industrial Hygiene	58	7	7
Radiological	36	7	7

Of the 86 questionnaires in which answers were given, the following were indicated as the most frequent assignments:

TABLE V		Frequency of Other Duties	
Security and Protection	17	Security and Protection	17
Buildings and Grounds	14	Buildings and Grounds	14
Academic Subjects	12	Academic Subjects	12
Instr. Safety and Driver Ed.	12	Instr. Safety and Driver Ed.	12
Instr. Health and P. E.	8	Instr. Health and P. E.	8
Enr. Health and Sanitation	8	Enr. Health and Sanitation	8
Administration	6	Administration	6
Supr. Non-Academic Pers.	5	Supr. Non-Academic Pers.	5
Student Counseling	2	Student Counseling	2
Insurance and Retirement	1	Insurance and Retirement	1

Safety Committees

Over half, 98, of the reporting colleges indicated the existence of safety committees, colleges without committees numbered 7, and 15 of the 190 institutions failed to answer the question. There was apparently a relationship between size of institution and the organization of a safety committee.

TABLE VI		Safety Committees by Size of College			
		Under 1,000	1,000-5,000	5,000-10,000	Over 10,000
Colleges Reporting	62	77	28	23	190
With Safety Committees	19	45	18	18	99
Per cent	30.6	58.7	64.3	78.3	51.6
Without Committees	37	47	8	5	77
Not Indicated	6	5	2	2	15

Of the 18 colleges employing full-time safety personnel, 16 had safety committees.

Employment Plans

Of the 169 responses to this question, 129 colleges indicated no immediate plans for the appointment of full-time safety personnel. Seventeen colleges stated that one or more full-time persons already were employed, and in 23 institutions there are plans for such appointments.

TABLE VII		Employment of Full-Time Safety Personnel			
		Under 1,000	1,000-5,000	5,000-10,000	Over 10,000
Presently Employed	2	11	5	5	17
Employment Planned	2	11	5	5	23
No Immediate Plans	86	64	14	5	128
Not Indicated	4	2	4	4	21

Twenty-three colleges with enrollments ranging from 11,500 to 87,000 completed the survey form. Total enrollments for this

1. The enrollment figure of 87,000 was for the State University of New York, which has a centralized safety program for all its colleges.

group were 485,500 or an average of 21,100 per institution. These colleges represented 32 per cent of the total of 71 colleges in this enrollment range.

Safety Titles

Of the 23 reporting colleges, 15 had assigned coordinating or directing responsibilities to staff members whose official designation carried the term "safety" or equivalent in their titles. All of the colleges indicated that responsibility had been assigned to some individual.

Place in Organization

The department in which the coordinating or directing responsibility was most frequently placed was fire prevention, safety, and environmental health (10), central administration (4), buildings and grounds or physical plant (3). At two colleges each,

the program was conducted from the department of health, physical education and recreation; or an academic department. At two other institutions, the responsibility was placed in the housing office and the business office.

Administrative Supervision

Most frequently (7) the person to whom the supervisor or coordinator of the campus

safety program reported was a high officer of central administration, such as a vice president for business administration, central administration, comptroller. In three higher education institutions each, the director of health service, business manager, director of physical plant or buildings and grounds, was

the responsible administrator. Responsibility at 13 of the 23 institutions was to a member of central administration, to the head of a service or operations department at seven colleges, and to an academic department head at four institutions.

Safety Activities

Seventeen primary activities were listed on the questionnaire. The 23 respondents indicated a wide range of time spent in these activities in their routine operations.

TABLE VIII

Place in Organization and Administrative Supervision	
Place in Organization	Administrative Supervision
Fire Prev. Safety, Env. Health.....	10
Bldgs. and Gnds., Phys. Plant.....	3
Central Administration.....	3
Health, Phys. Ed. Recreation.....	2
Residence Halls.....	1
Chemistry.....	1
Business Office.....	1
Special Services.....	1
Nuclear Research Center.....	1
Total.....	23

Time Devoted to Safety and Accident Prevention

In this enrollment group of colleges, there was a significant difference in the amount of time spent in accident-prevention activities. At nine institutions, the person assigned responsibility for coordinating the safety program spent full-time in this capacity. At the other extreme, seven colleges indicated that the amount of time spent was between one and ten per cent. Nevertheless, average time spent was about fifty per cent. Considering safety-related duties of security, radiation protection, and environmental health, fifteen institutions have staff spending virtually full time in health and safety activities.

Irrespective of time spent, accident reporting and inspections were the most frequently checked responsibilities (21 each), followed by fire prevention and protection and employee safety (each 19). Although traffic control, fleet safety and parking, and radiological safety were less frequently indicated as a primary duty, notations on a number of reports pointed up that in these special areas other college personnel frequently were assigned these specific responsibilities.

In the table which follows, it will be noted that overall involvement of safety personnel in specific activities contrasts considerably with the amount of time spent in the activities.

TABLE IX

Safety Activities by Frequency and Time Spent

Activity	Number Involved in Activity	Rank of Activity in Time Spent			Rank not Indicated
		1-5	6-10	11-17	
Accident Reporting.....	21	9	6	7	3
Traffic, Fleet, Park.....	15	3	2	3	4
Inspections.....	21	14	3	3	4
Fire Prev. & Prot.....	19	11	1	1	1
Employee Safety.....	19	12	1	1	1
Program Org. and Adm.....	17	13	1	1	1
Civ. Def. and Dis. Prep.....	17	4	1	1	1
First Aid.....	17	1	1	1	1
Laboratory and Chem.....	17	6	1	1	1
Protective Equip.....	16	1	1	1	1
Shop, Mech. Guarding.....	16	1	1	1	1
Student Housing.....	16	9	1	1	1
Indust. Hygiene.....	16	1	1	1	1
Student Activities.....	16	4	1	1	1
Bldgs. Gnds. Maint.....	16	4	1	1	1
Adv. R. E. & R.....	14	4	1	1	1
Radiological.....	14	4	1	1	1

Other Duties

Safety-related activities were most frequently reported as additional duties, such as teaching of safety and driver education; environmental health and sanitation, and security and protection, each reported four times. No added duties were reported three times, while other academic responsibilities and supervision of buildings and grounds activities each were reported twice. Insurance and retirement, and supervision of all non-academic personnel were each reported once.

Safety Committees

Even in those colleges with full-time safety personnel, the assistance of a safety committee as a means of implementing the program was found to be a common practice. Of the 23 colleges, 16 indicated they had safety committees; five stated that such committees were not in existence, and two failed to answer the question.

Employment Plans

Five of the 14 colleges presently without full-time safety personnel indicated plans to add such personnel for direction and coordination of the safety program. More

than half of the colleges with full-time safety personnel stated that more than one full-time person is assigned safety responsibilities, and that future plans provide for staff additions.

Of the 100 colleges with enrollment of 5,000 to 10,000 as listed by the U. S. Office of Education, responses were received from 28 colleges, or 28 per cent of the colleges of this size. The responding colleges represented a total enrollment of 195,800, and ranged between 3,000 and 9,000 students, with an average of 7,000 per institution.

Safety Titles

At 10 of the colleges, coordinating and directing responsibilities were assigned to a staff member with safety or its equivalent in his title.

Place in Organization

At all but five of the 23 colleges, the responsibility for campus safety had been assigned to a designated individual. The departments in which the responsibility was assigned, and the staff or faculty member providing administrative supervision, is shown in the following table.

TABLE X

Place in Organization and Administrative Supervision	
Place in Organization	Administrative Supervision
Bldgs. Gnds. Maint. or Equivalent.....	10
Administration.....	4
Traffic, Fire Prot., Saf. Engr.....	4
Health and Physical Education.....	2
Health Service.....	1
Business and Finance.....	1
Construction Technology.....	1
Total.....	28

Time Spent in Accident Prevention

In colleges of this size, the person designated the responsibility for safety coordination or direction tended either to spend very little time in these duties, or virtually all of his time. Time spent in accident prevention was indicated as one to ten per cent at 11 institutions, whereas 91 to 100 per cent of the responsible person's time was spent at five institutions. At the other seven colleges, one did not indicate time spent, and five estimated percentage of time in safety duties of 11 to 60 per cent. The average time spent on safety for the designated individuals was 40 per cent.

Safety Activities

Activities in which assigned safety personnel were involved, irrespective of time spent, were in order of frequency: program organization and administration, inspections, fire prevention and protection, and maintenance of buildings and grounds. The six activities most frequently mentioned on the basis of time spent were: organization and administration, fire prevention and protection, employee safety, maintenance of buildings and grounds, first aid and accident reporting.

Place in Organization

The question as to placement of responsibility for coordinating the safety program was left blank by two reporting colleges, and 19 institutions added comments that no person had been designated to carry out this responsibility. Where responsibility was indicated, most frequently it was placed in the business office or treasurer (13), office of dean of students (10), or physical plant (8).

Administrative Supervision

In 26 of the 38 replies to this question, the person who coordinated the safety effort was responsible to the president. Others included: dean of instruction (4), business manager and director of plant (each 3), and hospital director and director of health, physical education and recreation (each one). Replies were not given by the other colleges in this group.

TABLE XIV

Place in Organization	Administrative Supervision
Business or treasury office	13
Office of Dean of Students	10
Phys. and Gen. Serv. Plant	3
Health Services, Physical Ed.	3
Central Administration	4
Academic Department	1
President	26
Dean of Instruction	4
Director of Plant	3
Business Manager	3
Hospital Admin.	1
Dir. of Health, P. E.	1

Time Spent in Accident Prevention

Nineteen institutions did not answer this question. Of the 41 responses, 34 indicated that time spent on safety activities was less than 10 per cent; six stated that 11 to 20 per cent of the designated person's time was spent on accident prevention. At one institution the responsible person spent 21 to 30 per cent of his time in safety activities.

Safety Activities

Activities most frequently listed included student housing, fire prevention and protection, inspections, buildings and grounds and maintenance, accident reporting, student activities, traffic and parking, and activities related to physical education. By time devoted to various duties, these also were most frequently mentioned.

TABLE XV
Safety Activities by Frequency, and Time Spent

Activity	Number Having Activity	Rank in Time Spent			Rank not Indicated
		1-5	6-10	11-17	
Student Housing	35	14	8	1	18
Fire Prev. & Prot.	34	19	5	1	10
Inspections	31	18	2	1	11
Build. and Gnd. Maint.	29	18	2	1	11
Accident Reporting	28	11	10	1	2
Student Activities	27	7	10	1	12
Traff. Fleet, Park.	27	10	4	2	11
Alb. P. E. & R.	26	11	6	1	10
First Aid	25	9	3	1	9
Civ. Def. Dis. Prep.	19	3	3	1	8
Laboratory, Chem.	18	3	3	1	8
Org. and Admin.	18	8	3	1	10
Employee Safety	16	4	2	2	8
Shop, Mech. Guard.	16	4	2	2	8
Prot. Equip.	11	1	3	2	7
Indust. Hygiene	8	1	1	2	5
Radiological	8	1	1	1	5

supplemented with time in safety related student enrollments presently employ full-time staff members for safety. Two colleges indicated plans for the future, while the majority (56) which replied to the question stated that no plans are being made.

Conclusions

1. Although it cannot be assumed that all of the 1780 colleges which did not return the questionnaire were without organized campus safety programs, it is likely that the lack of programs was related to failure to return the survey form in a great many cases.

2. The 149 institutions which indicated that they had organized programs demonstrated a significant increase over the seven colleges with programs which were represented in a meeting in Chicago in 1949 for the interchange of information in campus safety. The actual number of colleges with organized programs, or with full-time safety personnel is probably considerably greater than that indicated in the survey, on the basis of membership in the Campus Safety Association.¹

3. The greatest need for the activation of organized programs is in the smaller higher education institutions, which probably have as wide a variety of exposures to accidents as do large universities, but do not have budgets permitting them to employ safety specialists.

4. There is no single pattern of safety organization. However, the most common practice is to place safety as a staff responsibility in central administration. In particular, this practice was prevalent in smaller institutions, where buildings and grounds or physical plant departments were indicated as the second most frequent department. Many larger institutions placed the responsibility in a department of safety or equivalent.

5. Administrative supervision was vested directly under the college president, vice president, dean or other high administrative officer, at about two-thirds of the institutions.

6. Although time spent in safety activities by the person delegated or assigned

the responsibility for coordination was often activities such as security and environmental health, in the majority of reporting institutions this individual spent less than 20 per cent of his time in safety operations, usually less than ten per cent. At the large universities which reported, the full-time of one or more specialists was devoted to safety in most instances.

7. The most frequent safety activities in which assigned personnel for coordination were involved was fairly consistent for each group of colleges by size, and for all reporting colleges as a whole. All groups indicated primary activity in inspections and fire prevention and protection; three of the four groups indicated activity in accident reporting and buildings and grounds maintenance, and two in organization and administration. In contrast, institutions of over 10,000 enrollment showed employee safety as a primary function, and activities in housing safety were most frequently indicated in colleges of less than 100 enrollment. Provision of protective equipment, industrial hygiene, and radiological safety were the activities least mentioned for all colleges as a whole, and all groups except colleges with enrollments over 10,000, which showed least activity in traffic safety, radiological, and in athletics and physical education.

8. Although security and protection, buildings and grounds maintenance or supervision, and teaching of academic subjects were most frequently reported as supplementary duties for all colleges, no consistency was found among colleges of various sizes.

9. The use of safety committees is an accepted means of implementing the safety program, and in some colleges is the only coordinating and stimulating force. A number of colleges commented that committees could be useful but as presently organized were ineffective. A majority of larger colleges and universities with full-time safety personnel also make use of a safety committee structure.

10. The majority of colleges presently without full-time safety personnel stated that there were no immediate plans for such employment, or that the matter had not been considered. The number of colleges planning such personnel additions was greater than the number presently employing safety specialists full-time.

¹ Association members in October, 1961, numbered 875, and included representatives from about 200 colleges and universities.

Recommendations

1. Regardless of the size of a college, it is desirable that an organized program of accident prevention and safety education be developed as a means of conserving the resources of the institution, and making for maximum effectiveness and accomplishment in meeting its stated objective.

2. At each institution, a qualified and interested staff or faculty member should be designated to coordinate the safety program. Such appointment may be on a collateral basis in smaller colleges, however it seems desirable that colleges with enrollments over 5,000 appoint professional personnel on a full-time basis, or at smaller colleges with high accident potentials.

3. It is preferable that the safety coordination function be placed within central administration, reporting directly to the president or other high level administrator, as a means of stressing the importance given to the accident prevention effort, and for acceptance of the program by all operational and academic departments and staff members, as well as the student body.

4. It is not reasonable to expect that basic functions of inspections, fire prevention and protection, accident analysis, maintenance of facilities and the many other duties common to the safety coordinator can be performed in any degree of completeness if only 10 per cent of his time is allocated to the function. It is urged that colleges assess their total accident-prevention needs, and on this basis determine the activities in which the safety coordinator should be involved, and the amount of time essential to the adequate performance of these duties.

5. Safety committees are a desirable means of implementing individual efforts in accident prevention and making maximum use of the college resources. Safety committees, to be effective however, must be carefully selected, and should represent the major activities and facilities of the college at a high staff level. They must meet regularly and report findings and recommendations to the administrative head in an advisory capacity.

A MODEL BICYCLE CONTROL PROGRAM

By JOHN A. MEARS

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As college enrollments increase on our college and university campuses, we are sometimes faced with a bicycle or motor scooter problem. Where the problem already exists, it will become intensified in the ensuing years. In some instances, it has apparently reached major proportions.

What are some of the typical problems? First, the increasing potential conflicts between pedestrians and vehicles and between the vehicles themselves. Second, controlling the routing of these vehicles. And third, the ever-present parking problem.

Recently, the bicycle and motor scooter problem on the University of Washington campus became of sufficient concern to Professor Ed O. Kanz, manager of the Safety Division, that he checked with other colleges and universities to compare notes only to discover that there was a dearth of fact-

ual data available on the subject. This venture led to a survey conducted by Kanz in co-operation with the Campus Safety Association to develop statistical data on the operation of bicycles and scooters on college campuses.

Based on the survey of Professor Kanz and Lee Sweum, traffic technician at the University of Washington, a model bicycle control program was set up. In their survey, questionnaires were sent to 75 colleges and universities in the Spring of 1961 to determine the extent to which bicycles and motor scooters were used on their campuses during the two academic years from 1958-1960. Forty-four replies were received, but only 34 were used in compiling the statistical data. Ten of the replies were not tabulated for various reasons.

Of the schools surveyed nine had enroll-

ments of less than 2000; 11, from two to ten thousand; and fourteen, more than ten thousand. It is worth noting that the total enrollment increased more than four per cent in one year. At the same time the number of bicycles per thousand students increased 11 per cent, and the number of motor scooters increased almost 50 per cent during the same period. However, no statistical trend in the ratio of the number of two-wheeled vehicles to the increase in college enrollment could be noted after all the data had been summarized. Kanz has suggested that more surveys of this nature be conducted to see whether a trend does evolve.

Even though the tabulated results of the survey indicated less than one per cent of the two-wheeled vehicles are involved in accidents, Kanz pointed out that the data did not give a complete picture of the problem. Some of the comments made on the questionnaires disclosed that records were not kept for bicycle and motor scooter accidents. Kanz also pointed out that minor accidents involving bicycles many times go unreported.

During the two years surveyed, 13 accidents were reported the first year with 15 for the second. Of these 28 accidents, 22 were classified as minor and six as disabling. Of these six, one was classified as permanently disabling. Other problems brought out by the survey were:

1. Inadequate parking facilities.
2. Lack of printed rules and regulations governing the use of bicycles and scooters. According to the survey only ten of the 34 schools contacted issued such rules, and of these ten, six issued them only for scooters.
3. Lack of bicycle registration. Only three schools required students to register their bicycles, but more than half of the schools required permits for motor scooters.
4. Inadequate enforcement procedures. More than two-thirds of the schools contacted had inadequate enforcement procedures to deal with bicycle operators.

What are the steps that must be taken to implement an effective bicycle control program on our college and university campuses? Let us assume first that a traffic

problem does exist. How can we work towards a solution to the problem? I should like to emphasize that there is no one way to organize a university community for the purpose of developing an effective bicycle control program. However, there are certain essential steps to be taken in all effective programs. These are:

1. Support of the administration
2. Appointment of a coordinator
3. Setting up an adequate accident records and reporting system
4. Establishment of legislation
5. Setting up a licensing program

I shall discuss these in this order. If any safety program is to be effective, it must first have the support of top management—in this case, the board of trustees and the president. Of course, you can have a safety program without their support, but I believe that general acceptance of the program will be somewhat passive without their support. It is their responsibility to provide a safe environment for the faculty, staff, students, other personnel, and those who use the facilities of the university community. This in itself is good public relations because the university will be helping to create a favorable attitude among its many publics by letting them know that it is interested in their general welfare. If the administration shows interest, then this interest will usually permeate the campus.

In our next step, the administration should delegate some individual to assume the responsibility of serving as coordinator for the program. His job would be to organize a safety committee made up of representatives from the faculty, staff, dean of faculties, dean of students, head of the safety division, medical officer, student government, fraternities, and superintendent of buildings and grounds. The coordinator, of course, would have access to the president's office and serve in a capacity.

In selecting the coordinator, the particular circumstances will help determine who would be the best man for the position. In some cases it might be a safety education teacher, whereas in other cases it might be the dean of students or head of the safety division. Since the main job of the coordinator will be to develop public support for the safety program, I cannot overemphasize the im-

importance of selecting the best man available for the task. Needless to say the coordinator should be able to work with people and have more than a passive interest in safety. If he should happen to have a good knowledge of sound safety practices, so much the better.

The president should attend the first meeting of the newly organized safety committee to lend support to the program. At this meeting the coordinator should outline the responsibilities of each member of the group and with their help develop plans for making a survey to determine the extent of the bicycle problem, that is, the extent of accidents and congestion. It goes without saying that we must have the facts to determine what needs to be done. When the survey is completed, the committee should discuss their findings, concentrating on the weakest spots first. For example, circumstances or conditions contributing to congestion, such as inadequate parking facilities, should receive major consideration.

Once the committee has determined the extent of the bicycle problem and has agreed upon priorities, its next step is to make its findings known and to explain its aims and planned procedures to the university community. This is one of the better methods to gain acceptance of the program, for if people do not know or understand what the program is, they certainly will not support it.

With the completion of its survey and publication of its findings, the next step the committee must take is setting up an adequate accident records and reporting system. In the replies that Kams received some of the respondents indicated that no records were kept of the two-wheeled vehicle operation. It is impossible without accident facts to plan an effective safety program, for the program will be based on guesswork or opinion. Past experience has indicated that there is a direct relationship between an effective accident prevention program and a good accident records system. The only way to obtain the information needed to formulate an effective program is to require the reporting of all personal injury and property damage accidents. Since this is not easy to accomplish, I should suggest therefore that reports be required in all property damage accidents in excess

of \$10.00.

After the facts have been compiled, they must be analyzed to determine the types and causes of the most frequently reported accidents and the time and location of such accidents. Data of this type will help the safety committee plan more effective programs. Establishing a centralized location for reporting accidents has also proved efficient. Accident reports should be filed by location to be readily available for analysis of accident causes at specific locations. For example, in planning your program you might want to know what the accident experience is at a given location. It would be a simple matter to remove all the reports from the file pertaining to a certain location to obtain a complete accident picture. The establishment of a driver record file would make possible a quick summary of the violation and accident experience of the individual driver. These summaries should be prepared periodically.

This leads us to our next step—the establishment of legislation. In establishing rules and regulations governing bicycle operation, it is essential that they do not conflict with the state law. Before the safety committee drafts any legislation, it should study the state statute governing bicycle operation and check with the local police department to determine whether the Model Traffic Ordinance has been adopted by the community. It is well recognized that non-uniform laws contribute to accidents, cause congestion, and inconvenience motorists and pedestrians. If the Model Traffic Ordinance is in effect, then appropriate sections of it should be adopted in drafting legislation governing the operation of bicycles on campus. (Section XII of the Ordinance is devoted to bicycle regulations.) Even though a community has an ordinance, the safety committee can still set up its own rules and regulations governing the operation of bicycles on campus. However, these regulations should not conflict with the local ordinance, if possible.

One of the most important phases of the safety program is licensing. If bicycle tests have already been developed by the local police department, then the college or university should take advantage of this service. This will avoid duplication of effort. Everyone should be required to complete successfully the bicycle tests before being

granted the privilege of operating a bicycle on campus. We must realize that some of the faculty, staff, and students have never been exposed to any form of safety instruction and that some of them have just started to take up the bicycle habit. Arrangements might be made with the administration to include during orientation week some safety instruction, such as a film teaching the safe operation of a bicycle. During this period it would be well to explain the procedures for registering bicycles. Pamphlets should be distributed explaining the rules and regulations and safe practices. The student government is in an excellent position to assume this entire responsibility.

If the local police department has not developed bicycle tests, then it is up to the college or university to provide such tests. Several organizations, such as the National Safety Council, the Bicycle Institute of America, Inc., National Commission on Safety Education, and the American Automobile Association have available upon request information on how to conduct such

tests and inspection. To those who may question the necessity for administering bicycle tests, let me point out that studies have revealed that two of three bicyclists are violating one or more traffic laws when they become involved in a collision with an automobile. Moreover, approximately 20 per cent of the bicycles involved in motor vehicle accidents had some mechanical defect.

What are some of the benefits that can be expected from an effective bicycle program? I believe that such a program will make the campus a safer place, will help create the proper attitude toward traffic safety, will reduce accidents, decrease congestion, and discourage bicycle thefts. Finally, many of our future leaders are now enrolled in our colleges and universities. The attitudes they develop toward traffic safety will influence them to react positively toward similar safety programs in years to come when they assume parental responsibilities and positions of leadership in their communities.

IMPLICATIONS FOR TV IN DRIVER EDUCATION—EFFECTIVENESS OF TOTAL PROGRAM

By EDWARD WILLIAMSON

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Although the data has been collected for a study that will assess the effectiveness of television in the teaching of driver education, tabulation and statistical treatment yet remains to be done. Until these are completed no valid conclusion can be reached as to general effectiveness of teaching driver education by television.

On the other hand, it is possible to form some judgment on the basis of experience, and through use of proven facts, that helps us reach some conclusion regarding future use of this new medium.

Let us consider these points categorically.

1. Since research has shown that one of the most effective ways for developing favorable attitudes is through group discussion, and since driver educators are seri-

ously concerned with this phase of learning, we do not believe that all of the time devoted to teaching of the classroom phase should be used with television instruction. The reason for this is obvious, as no method of conducting group discussion with audiences of 10,000 to 12,000 has yet been discovered.

On the other hand, television used properly, with cooperation between the studio teacher and the classroom teachers, may present material that will set the stage for group discussion under the guidance of the regular classroom teacher. In fact, this has been one of the richest rewards of the program.

2. We know that through television, experiences can be provided to large groups

that might never be possible otherwise. As an example the television camera might be taken into a traffic court or to a congested intersection, or to other places where enriching experiences occur and provide first-hand knowledge to hundreds. Think of the administrative problems that would have to be overcome if this mass of people were actually to visit these places in person. Also think of the use that can come of such experiences for discussion purposes.

3. A studio teacher has one major responsibility, that of preparing his telecast which may be of only fifteen minutes duration several days per week. He has at his disposal every known teaching aid, models, maps, charts, diagrams, film and the services of a wide variety of consultants and resource people. He spends the majority of his day in preparing for his next program. You recognize the impossibility of classroom teachers ever being in such a favorable position for doing a masterful job of teaching.

4. When open circuit television is used for the telecast there is the additional possibility that many non-school citizens are viewing. If this happens what a wonderful public information device this is. There is also an outside chance that these viewers may learn something about safe driving, or some of their faulty attitudes may even be changed.

5. Within the school system itself, under the plan used in our state, Florida, a large number of the faculty are involved because each homeroom teacher, whether a driver education teacher or not, is a viewer because of monitoring responsibilities for students assigned them. From observation, the belief is strengthened that there is greater appreciation of driver education among these

teachers than among those without this opportunity.

Some will contend that everything that can be done with television can also be done through use of films. Even though this reasoning has merit, absence of research in this area leaves the question of relative cost unanswered. Video tape may turn out to be the compromise.

Those planning to institute television programs might profit by the experience of those who have experimented with this medium. There is often a tendency to stress skill development on telecast programs when the time might be used more advantageously in presentations that would strengthen attitudes. This is especially appropriate when open circuit is used, because of the additional benefit to be derived by adult viewers.

I have mentioned some of the observable benefits that the teaching of driver education by television might provide. Doubtless, there are others that have been omitted.

The preceding speaker has described the reduction in cost brought about by limited use of television. So far nothing has been presented that would justify a stampede to abandon traditional programs in favor of television. The criteria for selection of any method or combination of methods of instruction must relate to achievement of the desired educational outcomes. Reduced cost of instruction is not a valid criteria if the quality of the program is appreciably reduced. When the study, which I now have underway, is completed some indication of the effectiveness of teaching by television will be available. Until we have more evidence, let us proceed cautiously, with an open mind that will allow the use of educational television to assume its proper role in the driver education program.

IMPLICATIONS FOR TV IN DRIVER EDUCATION

By W. K. STREIT

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An airplane flying 23,000 feet above Montpelier, Ind., recently broadcast instruction in 17 subjects to about 500,000 students in schools and colleges in a six-state area

of the Midwest. This \$½ million dollar airborne program financed chiefly by the Ford Foundation uses specially equipped DC-6 planes with the antenna pointing

down instead of up, telecasts elementary school programs of 20 minutes and secondary and college programs of 30 minutes duration, all on video tape in series of 60 to 128 lessons. Five more subjects will be added in January.

There are now 54 ETV stations on the air and 19 more under construction. Two hundred programs are broadcast by educational TV—cultural and informative. Today, almost every course in the school and college curriculum from first grade arithmetic to college zoology is being taught somewhere over TV. It is estimated that 2,000 elementary and secondary pupils in 250 schools are receiving some part of their education by television. More than 20,000 college students are receiving some courses via TV in 250 colleges and universities. Of the millions who have watched the National Classroom, over 8,000 students have been enrolled in 300 schools and colleges for credit.

The exciting growth of educational television throughout the country to date is the result of active interest and support of many philanthropic, educational, civic, and business organizations, as well as by thousands of enthusiastic individuals. Given continued support of this kind, education television should become one of the nation's most valuable educational assets.

In 1952, the Federal Communications Commission set aside television channels for noncommercial educational stations. When it was realized that educational television was more than a dream, the Cincinnati Public Schools became interested in its potential for teaching boys and girls. In October, 1954, the first educational television programs were telecast to Cincinnati schools over channel 48, WCET, the local UHF station. WCET obtained the first license for an educational television station in the United States and was the sixth station to begin operation. The 1950-51 school year showed a total of 918 telecasts, more than 50 per cent of which are live direct teaching programs where the viewing is required.

During the first year and a half, the telecasts were primarily enrichment programs, with a few in the area of direct teaching. Because the latter was a controversial matter, more evidence was needed.

In 1956, a seven-week experimental program in chemistry was telecast. In 1957, a one-semester driver education program for five schools was put on the air.

Both were evaluated carefully to determine the effectiveness of instruction. The findings indicated that, as measured by performance and achievement tests, pupils learned at least as well by television as in conventional classroom situations.

The next year, control classes of students who were not exposed to the television program were set up to match experimental television classes of 175-200 students in a single room. A test was designed to measure the results of both types of instruction. Here are the findings in two sentences:

Achievement of students in driver education, as measured by objective tests, was superior in those classes which received instruction by television. The differences favoring television instruction were statistically significant with pupils of above average ability but lacked significance for pupils of below average ability.

In March, 1958, the National Commission on Safety Education, NEA appointed a national advisory committee on the Driver Education Kinescope Project to prepare outlines, supply materials, offer suggestions and criticisms, review each kinescope and approve the final product. This top level committee was composed of Clara Stratemeyer, chairman; John Eales, J. Duke Elkow, Lonnie Gilliland, Robert Marshall, Amos Neyhart, Leslie Silvernale, Benjamin Tinnel and Norman Key, secretary. The project was completed one year later and the kinescopes are now available through NET Film Service, Audio-Visual Center, Indiana University, Bloomington. The 29 kinescopes of 30 minutes each are suitable for use in secondary schools or for adults. A kinescope may be shown from a motion picture projector or telecast from the studio.

The big advantage of education television is that a gifted teacher can reach thousands of students simultaneously. The big drawback is the loss of personal give and take between teacher and student. This is partially overcome in a 55 minute class period by utilizing 20-25 minutes for discussion following the telecast.

There are many problems to be solved such as, adjusting the programs to the school schedule, coordination between the studio and classroom teacher, gaining the interest of teachers, tendency toward standardization, adjusting to individual differences, and the big problem of quality.

What can you do by television? You can bring top resource people and a great variety of materials to the students which would not be available to the average teacher. You can present a great variety of visuals to reinforce instruction. Each child has a front row seat. The good TV teacher talks to every student all of the time. TV gives careful thought to scope and sequence so that nothing important in the course is omitted. There is no chance of the course going off at a tangent because of a particular bent of the teacher or on the insistence of some class members.

The classroom teacher is one of the team. We don't refer to the "master teacher" on TV but rather think of one complementing and supplementing the other. The classroom teacher gets the students ready, she motivates them and furnishes the enthusiasm for the course. She moves about the room during the telecast and picks up points that need clarification and emphasis. There is immediate follow-up to clear misunderstandings, if any. She does not rehash or reteach the telecast but rather conducts a good discussion on essential points.

Following are some suggestions given to teachers of large TV classes:

1. *The Need for Good Orientation*
Discuss with the students such things as:

1. The need for concentration.
2. The need for carefully prepared homework including the reading assignments in the textbook.
3. Check to see if texts have been read in advance.
4. The need for some discussion on notetaking:
How to take notes
What not to write
5. TV will probably require more independent work on their part. Prepare students for this. Teacher leaves open-ended questions.

II. Physical Arrangements

1. Be sure students can see and hear. If possible, assign every other seat so that students are not huddled together.

2. Check vision—Be sure students with faulty vision or hearing are seated in the front of the room.

3. Give close supervision during telecast to see that students are not sleeping, annoying others, or studying other subjects.

NOTE: It is desirable to place books on the floor under the seat.

4. Time following telecast should be used for following up the kinoscopes before introducing new materials or proceeding with pupil reports or other driver education assignments. *Never* use this time as a study period.

III. Equipment

1. Be sure sets are always in good adjustment.

2. If possible, train students to assist with the mechanics of moving or adjusting sets.

3. Report set difficulties to the assistant principal or person designated in school.

4. Traffic board and blackboard should be ready for use at each session.

After five years of experimenting with the use of television in direct instruction in chemistry, biology, driver education, elementary science, and mathematics in the Cincinnati Public Schools, the following generalizations may be drawn:

1. Neither television nor conventional instruction tends to be consistently more or less effective for all pupils and for all courses.
2. When subject matter achievement tests are used as criteria, there is a trend for televised instruction to be more effective than conventional instruction for older pupils at higher grade levels. Conversely, conventional instruction tends to be more effective with younger pupils at lower grade levels.

3. Television instruction tends to be more effective than conventional instruction with above average ability students unless deliberate efforts are made to direct instruction to less able pupils. Conventional instruction tends to be more effective with less able students as long as deliberate efforts are made to direct instruction to pupils at a below average ability level.

4. There is a negative relationship between preference for television and pupil ability level; that is, the more able pupils tend to prefer conventional instruction while their less able peers tend to prefer television instruction.

5. There is a negative relationship between preference toward television and educational grade level; that is, pupils in higher grade levels tend to prefer conventional instruction while pupils in lower grade levels tend to prefer television instruction.

6. Teachers generally tend to look upon television instruction as an asset to education and feel that being a classroom teacher in a

television situation is a valuable experience. They are evenly divided on issues such as personal satisfaction, amount learned by pupils and whether they would like to engage another class in television instruction.

7. There is some evidence to show that reducing the length of the telecast may result in the telecast being more effective for the less able pupil.

Conditions surrounding the use of television in any given school system may be unique and thereby invalidate the generalization in any single school system. The quality of instruction will differ as will the general support given to educational television and the socio-economic characteristics of the community. Such factors suggest that it is imperative for each community to conduct its own studies relative to the use of television instruction.

Just over the edge of time is world-wide television by the development of satellite relay transmitters. Then a billion people can watch a program simultaneously. Will educators be ready for this day when it comes? Only the future knows the answer, but education had better start getting ready.

NEW DEVELOPMENTS IN TELEVISION AND THEIR IMPLICATIONS FOR DRIVER EDUCATION

By C. FRAZIER DAMRON

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It is interesting to note that only a few times in the history of the world have new methods of communication been developed. The late Charles E. Wilson has stated in one of his last speeches that, "Not since the invention of the printing press has a new means of communication been created that offers the opportunities for advancing education that educational television holds forth."

In a new publication of the department of audio-visual instruction of the NEA

titled, "And TV Too," we are told there is no longer any doubt that educational television can provide unique learning opportunities. It states there is no doubt that educational television can provide unique learning opportunities, and also that there is no doubt that classroom teachers must play two key roles if educational TV is to achieve its maximum potential as a teaching tool: the teacher must be a member of the professional team which plans the content of TV presentations, and must under-

stand its uses and be prepared to capitalize on its contributions to learning.

This has direct implications for the driver education teacher and his profession which desperately needs to find a means by which it can speed and at the same time broaden the basic driver education of our youth and adults.

There have been many reports on research and experimentation with educational television over the last decade. Many of them have been favorable; some have indicated shortcomings of various types; a few have cast doubt as to what television can do; and some have indicated great expectations for its future.

Few would argue that a great deal more is to be learned about this modern communications medium, and that it is essential that we explore its many relationships to the teacher-learning process.

In reviewing the implications of television for driver education, we must realize that it is not the facilities that determine the educational value of television, but what is transmitted, i.e., the programs themselves. We must also remember that educational television is a radically new concept, so new that we are prone to compare it with commercial telecasting whenever educational programming and costs are discussed.

They should no more be compared than should a paper-back cowboy story be compared to a textbook, just because both make use of the same medium.

Educational television provides an opportunity for a fresh approach, for a new consideration of the appeal to the eye as well as the ear, and perhaps even for a revision of teaching methods.

As you may know, the educational experience may be communicated over commercial stations, educational stations, or over closed-circuit installations. The two broad types of programs are instructional and enrichment television.

This report is concerned only with instructional television which consists of broadcasts deliberately designed to aid instruction and to develop further the attainment of educational objectives. These broadcasts are presented in an orderly and sequential arrangement, one building upon another, as the learner achieves increased competence. There are four types being used

in American schools and colleges. The type that is used should depend on what makes sense in a particular situation in view of curriculum needs, teacher competencies, pupil enrollment, and television facilities.

One type is total television teaching in which the only instructional help given is that included in the television series. Other necessary learning experiences must be provided by the learner himself, who consequently must be highly motivated to want to learn and be sufficiently mature to carry out the rest of the regimen that the course requires. Most credit or non-credit telecourses offered to adults are of this type. Implications are here for the teaching of adult drivers and perhaps the advanced course in driver education for teachers, supplemented perhaps by correspondence tutelage through university supervision.

The second type of instructional television is major resource teaching. The Midwest Program on Airborne Television Instruction is mostly of this type. The broadcasts carry the main burden of formal course presentation, but learning is facilitated by other experiences under the guidance of the classroom teacher. A great deal of present instructional television on both school and college levels is of this type. Such a plan, it would seem, could be applied to almost any phase of instruction in driver education, with the exception of practice driving experiences in a dual-control car.

The third type is supplementary television teaching, in which the television programs supplement the instruction which takes place in the classroom. Television in this case follows a course of study in a broad way, but adds to it the kinds of fruitful experiences which individual teachers find difficult if not impossible to provide. This type of television program is wide spread throughout the nation and merits serious consideration for use in driver education.

The fourth type of instructional television is observational and a small closed-circuit system is used solely because it provides a better class view of important phenomena. This could be done very well in a laboratory school to facilitate learning in teacher preparation classes by allowing students to observe driver behavior of teenage drivers and demonstration teaching in either class or road instruction.

In summary, I would like to point out that although systematic research is somewhat limited due largely to the newness of television, considerable trial and error experimentation by many schools has pointed up several contributions which television makes to the educational program. There are some things we now know that television can do to improve the quality of teaching and learning when designed, planned, and used for a purpose. All of the following demonstrated contributions of television to education have important implications for driver education:

1. Television stimulates learning. It serves as a springboard for many worthwhile learning opportunities.

2. Television provides resources often unavailable to classrooms. This contribution is one most frequently mentioned by those using television most extensively. It includes the sharing of resource persons, materials, facilities, and outstanding teaching personnel.

3. Television serves as a source of new ideas for the teacher. In this respect, new dimensions have been opened up in both service and in-service teacher education. Teachers can better keep abreast of new developments, new resources, new teaching aids, and methods.

4. Television presents factual content to many students at one time. It communicates content quickly with great emotional impact to a large number of students.

5. Television reiterates minimum essentials for all students. Schools using television in their instructional programs are indicating that the use of television is serving an unexpected function in insuring a higher quality of instruction without limit-

ing the ceiling for students. It is doing this by underlining basic ideas and reinforcing learnings.

6. Television shares student activities. In many localities, schools have used television as a means of sharing the good things which go on in one school with other schools. For example, in driver education, student projects could be brought to the attention of pupils in other schools. Television thus places a premium on individual initiative and creativity.

Despite the numerous positive findings attesting to television's capacity to improving the quality of instruction, it is a matter of concern to note that the majority of schools throughout the nation are still not using television in any facet of their educational programs, nor are they even considering seriously its use. There can be little doubt that the profession as a whole is unaware of the contributions which the television medium can make to the educational program.

The future, therefore, lies in the ability of the educator, or why not driver educator, to initiate and put this advanced system of communication to use. How else will we be able to instruct all eligible teenagers in driver education classes? How else will we be able to provide adult refresher courses to all who need such instruction? How else can we better inform the public about the need and value of driver education? How else can we more effectively upgrade teacher qualifications than through in-service training that could be provided by educational television? How else are we going to meet teacher shortages? And how else are we going to drastically reduce the costs of driver education?

IMPLICATIONS GROWING OUT OF CHANGE TO SAFETY

(Summary of talk by Walter Freeman, Director of Research Division of Community Development and Services, Michigan State University, East Lansing, Mich.)

Mr. Freeman, in discussing the question of mobility in connection with safety, said this is not as much of a problem as it

seems to be. The problem of mobility involves families that move into a new neighborhood during a school year or just be-

ture, making it difficult for the children to adjust to the new school and life in the community.

He said the first thing to do for children moving into a new community is to make them welcome. He pointed out that some transients seem to carry stability with them when moving into a new community and adjustment is no problem. But, particularly when large groups of people move into a community, such as those who go from place to place in their line of work, overcrowding is sometimes a problem.

He said pre-school children often lack proper education if the mother works. But he explained that the quality of relationship between mother and child determines the kind of education rather than simply whether or not the mother works. This factor often is considered a particular safety problem as well as that of the broken home.

However, Mr. Freeman said he does not believe this is really as serious as it might seem to be. He said he doesn't think that the family is breaking up because of more activities and more freedom from work, either. In fact, he thinks the family is just as close as it ever was.

In the discussion period, a question was asked if there are certain techniques that

can be used to make youngsters self-reliant at an earlier age. The answer was that parents should accept the ideas of growing youngsters and recognize that their responsibilities do exist; this way, they will mature faster and accept them.

Another question was on how to build safety attitudes in children. The answer was to teach safety attitudes that leave room for child trust. For example, don't tell the child not to drive more than 50 m.p.h. and then let him see you drive at 60. Also teach the child the proper safety attitudes, to respect laws and those who enforce them.

Those participating in the questions and answers session were: Irma Fricke, R.N., representing American School Health Association, Evanston, Ill.; Harry Lodge, representing General Conference of Seventh-Day Adventists, Brookfield, Ill.; John Tibbett, National College of Education; Arnetta Wallace, National Conference of Colored Parents and Teachers; John V. Fridlund, graduate student, Northwestern University, Itasca, Ill.; Lillian Gilliland, teacher, Andrew Johnson Elementary School, Oklahoma City; and Grace Ellen Sules, assistant professor, Department of Education and Psychology, University of Rhode Island, Kingston, R. I.

IMPLICATIONS FOR ELEMENTARY SAFETY EDUCATION

By EVA M. DRATZ

Professor of Elementary Education, Keuka College, Keuka Park, N. Y.

The formal goal of the educators is to educate children. Our first step is to develop a clear understanding of the groups, concepts, purposes, values and problem-solving practices. In an atmosphere of mutual acceptance, respect and desire to understand and to help each other, communication and change can occur. Teachers must evaluate their techniques in helping pupils to develop attitudes and practices of good citizenship so effectively and to demonstrate their results in behavior so clearly that there will be a united effort in safety.

Learning is improved when the instructional program is based on an understanding of each child's capabilities, interests, and background; when experiences have satisfying emotional overtones for children and they apply the learnings which grow out of vital and stimulating experiences, when children actively engage in solving problems that are significant and purposeful; and, when consideration is given to the child's developing self concept.

Variations in individual growth patterns, ideals, past experiences and home life cause

children to learn in their own ways. Individual needs should be met through this use of such procedures as varying activities, giving individual help, using community resources, and group planning for units in safety. At all times, we must realize that elementary children remember and apply the learnings which grow out of vital and stimulating experiences in which pupils clarify problems, plan ways of attacking them and achieve success in solving them.

When I was teaching in elementary school, I had the privilege of working with a group which wished to organize a health and safety council. The class elected officers and decided on a basic program for the year. Two representatives from each class in the building were invited to attend the Friday afternoon meetings. During the winter, the problem of snowballing was discussed. Folds were suggested, targets were constructed, and penalties were proposed. During the following three weeks, the complaints mounted in number. I questioned the reasons and procedures. The president turned to the group and said, "What will we do?" A first grade representative said, "Just stop!" These pupils realized the values of cooperation, of working relationships, of self reliance, and of desirable attitudes for there were no more criticisms in this area.

Other factors must be considered if learnings are to have upbuilding emotional overtones for children. The applications of skills and information to plans of action of concern to pupils is effective. Opportunities

which help children to realize values of a safety program must be developed. Motivation is brought to a high level when pupils participate in planning. When purposes are clear and the problem is defined, the successes are real and significant to the learner. Evidences of safety understandings are observed in the gymnasium, in craft classes, in the classroom, in the hall, and to and from school.

As the pupil views himself as a competent person in group activities, he will become interested. If he feels that he can be a leader of his peers when he is a successful patrol officer, or president of the safety council, he will approach new problems with a positive manner. The pupil's self-concept changes as he has new experiences in helping to meet the needs of his classmates. As children mature, they develop more realistic attitudes of self acceptance. The teacher must realize that attitudes are deep-seated learnings based on meaningful experiences and are a part of the pupil's self concept. Children learn many attitudes from association with people they respect.

Experiences in which the pupils can earn prestige, feel secure and cooperate with others will provide a foundation for safe living. Continuous emphasis upon and commendation of positive expression of attitudes toward others is imperative. Participation is fundamental for it makes the pupil personally responsible for his own safety and relates his own safety performance to that of others.

AN EVALUATION OF SOME ASPECTS OF THE DRIVER TRAINING PROGRAM IN THE LOS ANGELES CITY SCHOOLS

By CECIL G. ZAUN

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Los Angeles City Board of Education, Los Angeles, Calif.

In May, 1960, the Los Angeles City Board of Education voted to continue driver training for the 1960-61 school year, but to evaluate the program in light of its placement in the curriculum.

The evaluation and research section of the Los Angeles schools was authorized by the board to conduct a survey pertinent in driver training, and from the study results the board would determine the future of the

behind-the-wheel phase of the total traffic education program.

The study dealt with the following questions:

1. Does the present system of selecting pupils to take driver training result in any differences in ability and/or achievement levels between pupils who take driver training and those who do not?

2. What happens to the school marks (grades) of pupils who take driver training, and in what ways do their marks differ from the marks of those who do not take it?

3. What do the various interested groups—school administrators, A-12 pupils, their parents, and the voters of the community—believe and desire with respect to the function of the high school in preparing pupils for driving?

4. To what extent are these groups willing to express themselves with respect to the financial implications of driver training?

By means of a systematic referral to test data on file in the evaluation and research section and to pupil personnel records maintained by schools, a random sample of 3168 A-12 pupils from 37 high schools was obtained, of whom 519 had taken driver training and 849 had not. The two groups were compared to see if there was any evidence of selectivity in the scheduling of pupils to take driver training.

The second project was to investigate school marks earned by driver training pupils and progressive changes in their marks, if any. To do this, a sample of the pupils previously described was matched carefully with a similar sample of non-driver training pupils, using I. Q. as the criterion. The grade point averages of driver training pupils before, during, and after their driver training semester were compared with grade point averages of the non-driver training matched controls for the corresponding periods in each one's high school career.

The third requirement of the study was to sample, by questionnaire, the experiences, attitudes, and beliefs relating to driver training of five groups of individuals, as follows:

A random sample of 1217 A-12's of 38 high schools, both driver training and non-driver training.

A random sample of 683 parents of A-12's of 37 high schools, both driver training and non-driver training.

A random sample of 456 voters representing the proper proportions of all areas of the Los Angeles City High School District, including, of course, parents and non-parents.

Thirty-eight principals of senior high schools.

Thirty-eight head counselors of senior high schools.

The evidence from this study of driver training in high schools of the Los Angeles City High School District indicates that:

1. Pupils selected for driver training instruction within Los Angeles City high schools were not random samples of the school population, but tended to be higher than average in both I. Q. and achievement.

2. School marks of pupils taking driver training did not differ from marks of pupils not taking the course, did not drop during the course, and did not drop after completion of the course.

3. A majority of respondents believed that it would be highly desirable to make completion of an approved driver training course a prerequisite to the granting of a driver's license to young people.

4. A majority of respondents believed that, although the high school might have other more important responsibilities, it is the logical, and perhaps under the circumstances the only, suitable agency to administer a driver training program. In this sense it is the "business" of the schools to teach it.

5. A high preponderance of all respondents have shown their readiness to support the driver training program, even though it is more costly than other elements of the school program.

6. Of A-12 pupils, their parents, and school administrators, few felt that a driver training course had any appreciable effect upon a pupil's school work.

7. Most respondents believed that the most unsatisfactory element of the present driver training program is the fact that many who wish to take it are unable to be accommodated. Minimum facilities should assure enrollment to all qualified applicants.

8. Pupils wished to enroll in driver

training for a variety of reasons, but the most compelling to both pupils and parents appears to have been the prospect of getting lower insurance premium rates.

9. Not only pupils, parents, and school personnel, but also voters in general, are genuinely interested in Los Angeles schools,

and welcomed the opportunity to express themselves on a matter of deep importance—driver training. Their comments and suggestions were carefully prepared, and seemed to reflect a sincere appreciation of the problems and accomplishments of the schools.

SUMMARY AND EVALUATION OF NEW METHODS OF DRIVER EDUCATION AS APPLIED IN LARGE AND SMALL SCHOOLS

By DWIGHT M. DAVIS
Supt. of Schools, Moline, Ill.

By WILLIAM C. HARRIS
Supt. of Schools, Allen Park, Mich.

I. We evaluate our program by asking:
A. What was attempted?
B. How did it work?

II. We should include opinions from our staff, parents, students and other adults.

III. Always include a follow-up study.

IV. The community is entitled to a good program.

V. Ways to insure a good program:

A. Plan well for your individual needs—a program which is good for one area of the country is not necessarily good for another.

B. Work driver education in with the total school program—carefully work out scheduling problems.

C. We must have outstanding teachers.

D. Public relations must be well represented—understanding by others will make sure they like us.

Allen Park, Michigan is a community of 38,000 population with a total public school enrollment of 6,894. It is located in the southern suburb of Detroit and is a part of the Metropolitan Detroit Community.

This community has offered driver educa-

tion to its high school students since 1950. The driver education program has grown from one car and one instructor, to a year around program with 16 teachers, who teach driver education along with art, chemistry, auto shop, speech, business studies and elementary education. They use 5 automobiles of which one is loaned, 3 leased and one purchased. Four of their cars are equipped with automatic transmissions, and one has the standard transmission. All of the behind the wheel instruction is conducted on the street.

In 1950 when driver education was first introduced in Allen Park, this school was confronted with the same problems that most schools must solve. The only classroom available for teaching this subject was a small storage room, adjacent to the gym. The students who enrolled were in the twelfth grade, and were for the most part girls.

Through administrative and community support, the program was located in its logical position in the tenth grade, and boys, as well as girls, enrolled in the course. Because driver education is recognized in this school system as contributing to the general objectives of education, this subject area was considered a part of the school curriculum when the new high school was planned in 1952.

The architects designed driver education into the building just as science, physical education, industrial arts, and other subject areas are planned into a sound education unit.

The driver education facilities were placed in an area adjacent to the school's parking lot and next to the auto shop. It included a classroom to house 30 students, a storage room for testing devices, visual aids, and motion picture projectors. The classroom has access to the auto shop and a parking area which is reserved for the 5 driver education cars. The auto shop facilities are used to maintain and service the driver education cars.

Questions Asked After the Presentation

1. What are the certification requirements for teachers in driver education in your states?

Harris: 15 hours in safety education, but we are trying to raise this to a full minor.

Davis: We don't have a minor re-

quired yet, but are working toward it.

2. Is there any opposition in your area to giving instruction to non-public school students?

Harris: No, all are encouraged to come and are welcome, although there are scheduling difficulties.

Davis: No, they are entitled to come under the state aid law. Many come during the summer.

3. Should we go on record as favoring car-marked taxes for driver education?

Davis: It is difficult to get a driver education program off the ground without state aid. However, we should not expect our program to go on forever that way. It should be continued on its own merits if possible.

Harris: It is a good foundation for a start, but the program should be on its own in the community eventually.

TECHNIQUE FOR RESEARCH

By DR. F. R. NOFFSINGER

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Once upon a time, in the dim history of the past, there lived in a remote region of China, a peasant whose name was Ho-ti. He lived in a straw hut at the edge of a village with his son, Bo-bo, and his prized possession, a sow with a new litter of pigs. One day, as was his usual custom, Ho-ti went into the woods in search of food for his sow, leaving Bo-bo to watch the homestead.

Bo-bo was not too bright, but he had the usual curiosity of boys. During his father's absence he began to play with fire in the area outside the hut. By chance some sparks fell on the dried straw of the hut and set the hut on fire. Bo-bo stood by helplessly, fascinated by the fire.

After the fire died down and in spite of his excitement, there came to Bo-bo some slight glimmering of the plight of the sow

and her litter. So he began to sift through the ashes hoping to uncover and rescue the pigs. As he brushed the ashes away, his fingers touched the roasted body of one of the pigs. By instinct he put his finger to his mouth to relieve the pain of the burn. And he was greatly pleased with the taste that came from the roast pig.

Eagerly he put his fingers into the ashes and on the roast pig to gain more of this new taste. Soon he was tearing the pig apart and gorging himself with the delicious repast.

In the midst of this orgy, Ho-ti, the father, came out of the woods and with dismay saw what had happened to his hut. Immediately he began strapping his son. But Bo-bo paid no attention. He continued to dig into the ashes in search of roast pig. Finally Ho-ti saw the ineffectiveness of his

efforts and became curious about Bo-bo's action. Soon he too was searching for other roast pigs of the litter.

When every last bit of the delicious food had been devoured, he cautioned Bo-bo not to say a word about what had happened to any of their neighbors.

Ho-ti rebuilt his hut, and soon another sow had a litter. Ho-ti could not help recalling the haunting taste of roast pig. And so late one night his hut burned to the ground again and Ho-ti and Bo-bo had another feast.

Neighbors began to wonder when periodically Ho-ti's hut burned in the middle of the night. Spring, they caught Ho-ti setting fire to his hut and brought him into court. His case was all but lost when Ho-ti suggested that they place a sow with a litter in a hut, burn it, and let the judge taste the roast pig, and then decide the case.

This was done and Ho-ti was acquitted. Soon throughout the country hut fires blazed the landscape.

Now this kind of discovery of truth or of the solution to a problem is purely accidental. Eating meat raw posed no problem to Ho-ti and Bo-bo. They had never tasted meat that had been cooked. Bo-bo didn't purposefully burn down the hut just in order to roast the pig. Even then it was only by accident that he discovered the taste of roast pig.

About many things we are no different than Ho-ti and Bo-bo. There was a time when we looked upon traffic accidents as a visit from God—the natural result of driving an automobile—the unavoidable penalty inherent in the act of driving.

At an earlier date yellow fever was accepted as a visitation of Divine Providence and therefore looked upon as a matter of course.

Can it be that in some of our high school driver education classrooms today we can find methods and techniques in use that were discovered in the same way that Bo-bo discovered how to roast pig? Can it be that some of these methods and techniques are as crude as burning down a hut to roast a pig? Can it be that these methods and techniques, once accidentally discovered, are accepted as a matter of course and used over and over again? Can it be that in our

teacher training institutions they are also accepted as a matter of course and handed down unchanged and unchallenged to generations of new teachers?

Don't we find that some concepts are difficult to transmit to our driver education students? Is it possible that the difficulty arises from the fact that in such cases our methods and techniques may be crude—may have been accidentally discovered—may have not been tailored properly to achieve our objective? An old Chinese proverb reads:

If you are finding a thing hard to do, you are doing it the wrong way.

Historic does not tell us how long Ho-ti and his neighbors, and their descendants, burned down their huts to roast pig. It may have been as much as a hundred years. But it is quite evident to us today that at some memorable point in history someone got tired of having to rebuild his hut every time the family wanted a feast of roast pig. He became dissatisfied with conditions as they were and he began to think of how nice it would be if he could have roast pig without burning down the hut. He became conscious of the difference between *what is* and *what might be*.

Now, and only now, did a problem emerge. How could this problem be solved? He knew fire was one of the essentials for roasting pig. But did it need to be his hut? Could it just as well be a pile of brush? He would experiment. It worked! The problem of having to rebuild his hut was solved.

A farmer had in one of his fields a large rock area. It had been there for years, for as long as he had owned the farm. Each year he plowed around the rock, making curved and irregular furrows. One day he sold the farm. The new owner noted the rock area in the field and was unhappy about it for he had trouble in plowing long straight furrows. He thought what a nice field this would be if only the rock were not there. He became dissatisfied with *what is* and dreamed about *what might be*. He had a problem. He investigated. He found that the rock was very brittle—that it could be broken by a stout blow from a sledge hammer. In less than a day he had broken up the rock, loaded it on his wagon, and hauled it away. His desire for a straight furrow could now be achieved.

Some 35 years ago, in a little town in Michigan, Dorothy, a young housewife was busily engaged in her kitchen mashing cooked fruits and vegetables and running them through a strainer. She was preparing food for the couple's first baby. It was a tedious, time-consuming daily task. And now there was a second baby and more of this hard work in prospect. Wouldn't it be nice if by some means or other she and many other members in the community could be relieved of this arduous job. She was thoroughly dissatisfied with conditions as they were. How many other things she could accomplish if only she didn't have to spend so much time each day preparing food for the baby. She became aware of what might be. Out of her recognition of an unsatisfactory condition came the problem of what to do about it.

That night she talked about the problem with her husband Dan who was assistant manager of a small cannery in the town. He was somewhat skeptical about how much time this mashing and straining job took. The next day he went into his office, closed the door and with a big spoon began mashing a pint of cooked peas through a kitchen strainer. After this experience he was convinced that it took considerable time, and since it did, he was convinced mothers would buy prepared baby foods. To check his conviction he made a small survey of mothers in the community and found that they would welcome prepared baby foods if they were priced reasonably and could be bought in a grocery store. This small sideline of the little cannery in the first year sold 500,000 cans, in the second year 4 million cans. Today, well over 3 million cans, jars and packages of Dan Gerber's prepared baby food are sold each day.

Analyzing these illustrations we can readily see that for progress to be achieved in any given situation there are three prerequisites which must be met:

1. A condition must be unsatisfactory. There must be some kind of discontent, some kind of unhappiness with things as they are, some need that is not being adequately satisfied.

Someone disliked rebuilding the hut every time he had roast pig, the farmer disliked crooked furrows, the housewife didn't like

to spend so much time preparing baby food, someone thought it was terrible so many people died from yellow fever, someone was appalled at the number of fatalities from traffic accidents. In each case, there was dissatisfaction, unhappiness, discontent.

2. You must be conscious of the difference between what is and what might be. There must be recognition or visualization of an improved condition—an improvement that removes from the condition that which makes for discontent, unhappiness, dissatisfaction, difficulty.

Someone had to visualize how much easier life would be if for every feast of roast pig there was no hut to rebuild, the farmer had to visualize the possibility of a straight furrow across his field, the housewife had to see herself satisfying other desires in the time it had been taking her to prepare baby food, someone had to visualize how much more pleasant life would be without yellow fever, someone had to visualize driving his car without the constant fear of damage to his car or of injury or death for himself. In each case, there came a consciousness of the difference between what is and what might be.

3. There must be study, investigation, experimentation, the results of which are used as a tool to get yourself out of a difficult or unsatisfactory or unhappy or disconcerting situation.

Ho-ti's descendant was faced with the problem of how to get roast pig without burning down the hut—he had to reason that fire was an essential—maybe the hut wasn't—how would he find out—he'd try an experiment with a brush fire—if it worked he had proven that the hut was not an essential—and he would have his problem solved. The farmer was faced with a problem—how to get rid of the rock—he had to investigate—how big was the rock—could it be broken—he'd have to test that—if it worked he would have his problem solved—he could reduce the rock to small pieces and haul them away.

The housewife had a problem—how to get baby food without taking a lot of her time to do it. Her husband tackled the problem—could he make baby food easily in his cannery—would housewives buy it—he investigated—he found they would welcome the innovation on condition that—

could be met their condition—he could sell it at a reasonable price. But would the geriatrics carry his line—he tried this out—they would—he had solved the problem.

Those interested in the elimination of yellow fever had a problem—they set up a theory—they said maybe invisible particles (which they named "fomites") were given off by the sick—they tested this theory—it didn't always work—they discarded it and formed another—Maybe mosquitos carried the germ—they tested the theory—it worked—they found no cases in which a mosquito was not involved. But there was another difficulty—not all situations where mosquitos were involved developed yellow fever. Was it a particular species of mosquito? They experimented long and carefully. That was it—only one kind of mosquito was involved. The problem was solved—they now knew what carried yellow fever. But a new problem arose—how to eliminate that kind of mosquito—eventually that problem too was solved.

The traffic accident problem—well, that's not solved yet—we're all working on it. It's not a simple problem—it's a very complex one, one that must be broken down into many, many minor problems, each of which requires the application of the same careful systematic scientific method for a solution.

Let's go back now to those three prerequisites. How many of you driver education instructors go home at the end of each day happy and contented with the progress each of your students has made that day toward being a good driver? How many of you college instructors leave your office each evening completely satisfied that you have done the best that could be done that day in the training of each teacher to teach driver education effectively? If any of you here have such feeling of contentment and satisfaction—then you are probably using methods and techniques accepted as a matter of course and discovered in the same accidental way that Bo-bo discovered how to roast pig.

Can any teacher, high school or college, and without wracking your brain to think about it, quickly mention one method—one technique—one device—you are now using

that doesn't seem to be getting the kind of result with some particular student that you would like to get? Are you dissatisfied with the results produced? Are you unhappy about it? Do you carry it home with you at night? Does it worry you—like for example the rock worried the farmer, or the rebuilding of the hut worried the descendant of Ho-ti? If it doesn't worry you, then you have no problem. There is no dissatisfaction and therefore no visualization of the difference between what is and what might be. And there will be no progress in the improvement of methods or techniques or devices used in your teaching.

But even if you are dissatisfied and discontented—even if you do worry—there still can be no progress toward improvement unless you follow through on the third prerequisite. You have a problem but you have not yet taken the steps necessary to its solution. You must study the problem, you must investigate, you must set up a theory and another and another until you find one that works. And then you use the result of your study, your investigation, your experimentation as a tool to remove the worry, the dissatisfaction, the discontent, the difficulty that the situation presented.

You want "research" results that you can use to help improve the driving record of your students—that is "research". This is real down-to-earth, do-it-yourself research that you can use in the classroom, in the laboratory, in the car on the street. This is research that will get results.

Give it a try. Start now by compiling a list of every situation in your teaching day that you believe can be improved, every activity that seems more difficult or time-consuming than it should, every method that does not seem to produce as effective a result as you would like to see. And then get irritated about each of these, one at a time, to the point where you will follow through on that third prerequisite—study, investigate, experiment until you have found the solution to each of your problems. And next year when I see you at the Congress you will be able to say, "I've found a dozen or more new things to do to improve the traffic behavior of the students in my driver education classes."

IMAGES OF DRIVER EDUCATION IN THE '60's

By ROBERT D. BOND

Supvr., Driver Education, Traffic Safety Dept., Ford Motor Co., Dearborn, Mich.

The subject of my remarks—images of driver education in the 1960's—gives me an opportunity to cover a wide variety of matters, some of which have great promise in the years ahead:

Everything's so advanced. Take medicine, for instance. Did you know that by 1970 Americans will be spending more than 18 billion dollars on medical care? And it's really doing the job too for by then it's expected that every doctor will have gotten well.

In looking into the coming decade, I hope I have discretion as well as the discernment to take a sufficiently broad look into the crystal ball. There was, I admit, a temptation as a member of the automobile industry to talk about all the exciting changes in cars that are coming. Instead, I have attempted to keep the automobile in proper perspective along with the driver, the highway and the changing face of America.

It is also necessary to admit that this business of getting properly oriented with future trends is a tricky undertaking, and one that is full of pitfalls; so I don't for a moment imply that my brief and limited comments here this morning do more than touch upon some of the more important developments and innovations which may take place during the next ten years or so.

In examining the first image of what could be, let me attempt a wide-angle view of the situation. It would be a poor crystal ball indeed which did not show the viewer a panorama of a bubbling and boiling America that from shore to shore was busy turning out more cars, building more highways, and producing more drivers to use them than ever before. By 1980 it is estimated that three quarters of our people will live in urban centers with more than 100 million of them in the 200 major metropolitan areas and half of the anticipated 245 million population will live in suburbs.

In terms of cars I see an increase of nearly 25 million by 1970, from some 74 million to nearly 100 million.

In terms of drivers, an increase of about 16 million, from 87 million to over 100 million is anticipated.

The total of miles driven is rising at a rate that will bring it to one trillion miles per year by 1970.

And tragically, the total number of fatalities is destined to increase to more than 40,000 a year.

All this at a cost of some 8.5 billion dollars per year, up from the 6.5 we now must pay annually for our automobile accidents and related costs.

Now, let us rub the ball again and take a somewhat more detailed glance at the situation as it applies to driver education specifically. One of the most prominent things to be noted is that in 1970 there will be 4 million young people reaching the driving age each year as opposed to 2½ million now achieving this status. This is 11,000 a day; a significant figure for all of us who are concerned with the problems of improving driver education.

As I see it, some noteworthy changes will have occurred in the public school systems in the direction of increased ability to give more students better training. For example, the number of high schools offering complete courses—classroom and practice driving will increase 12 to 15 per cent, and the number of students receiving complete instruction will rise sharply from the present figure of 39 per cent to around 60 per cent by 1970.

Another important increase will be a doubling in the number of states providing financial aid to schools (from 18 to about 35); and a significant figure will be the rise from 5 to 15 in the number of states requiring driver education before licensing young drivers.

Looking ahead ten years convinces me that the number of driver education teachers will continue to grow. More important, there will be a marked improvement in the background, training and experience of a great many of them so that the quality of

instruction they give will be of a considerably higher order than it is today.

On the other hand, I see a number of teachers who are teaching driving today who will fall by the way. There will be a multitude of reasons for this fallout. Among these are: the decision by more and more smart administrators to strengthen their driving program by eliminating the unenthusiastic, incompetent teacher (as far as DE is concerned, that is) who was just looking for an extra job weekends or summers; the realization by more school officials that driver education would be supported by the community over the long haul only if the results in terms of well-trained students justified it; the effect the various associations and conventions—such as this one—will have in raising the standards of acceptable competency; and by the increasingly close scrutiny which will be given to the driving course by special community civic groups whose leadership has recognized the need for improving the quality of the driving courses.

What I have just said can be applied to the professional driving school teacher or operator just as well as the high school teacher. In fact, it is my contention that over the coming years these two groups will exert a beneficial influence over each other as a result of their competitive efforts. Leadership on both sides of the picture are coming to realize the dangers of the sniping situation that in the past has too often existed. Both groups must work more harmoniously together while they are also striving to improve their individual level of operations.

Without question more of us in this business are going to awaken to the fact that driver education extends far beyond the high school. We are going to learn to adopt the approach that driver education must be made available and desirable to the 85 million drivers already on our highways. And who in the community is the natural and logical leader in such a movement? Right! The driver education teacher. The one, that is, who has sufficient vision to project his concept of his job beyond the narrow confines of the high school where he now teaches.

Like the average duffer on the golf course or the 20-year bowler who still has

a 150 average, all but about 3 per cent of the licensed drivers on the road have a great deal to learn about the field of advanced driving techniques. It is just not the kind of thing most people learn by experience. For example, how to space properly, or correct use of the rear view mirror is still a mystery to most people. We must find effective means of communicating the necessary additional skills and attitudes to the millions of motorists. The smart driving teachers are going to find new opportunities that are personally productive for them as far as their pocket book is concerned, and beneficial for the community through improved traffic safety.

And now, what about the situation in our colleges and universities? Teacher training institutions offering sound basic and advanced courses for driver education teachers are expected during the next ten years to increase in number, to be better situated geographically, to possess considerably more equipment than is standard today, to have staffs whose quality is markedly higher, with curriculum standards which will be broader, stronger, and better integrated, and with more students attending them each year than is now the case.

I believe these things because of the figures and indications which point to the need for them are irrefragable, as I have tried to point out in my introduction—11,000 students a day of driving age by 1970, etc. I believe these things because I have read a little about the history of the American people, and I know that they have usually, somehow, seemed to recognize certain basic situations and have managed to preserve the worthwhile things in spite of seemingly insurmountable obstacles. And, too, I have talked personally with many people in many states, and they have convinced me of their acceptance of sound driver education as a vital and continuing part of our secondary school system. I believe that colleges and universities will have these advances in their courses because of continually growing pressure to do so. It is my opinion that they will rise to this challenge.

Another factor which can be added to the foregoing ones to account for the significant expansion in driver education during the 1960's is the growing public pressure for some kind of mass preparation of

average teacher to take an active part in such new research. Perhaps not in the major studies, which will be handled under the direction of skilled professionals in surveying techniques, but rather in building smaller studies through their local, state and regional associations and societies.

There is nothing that prevents any teacher from being a better salesman in his particular community for the results of both types of surveys mentioned. In fact, one of the points which in my opinion will be revealed is the need for safety education teachers to take a more active part in community safety affairs than has been the case in the past decade. This is not as difficult or complicated as it sounds. Breaking the ice and becoming involved is the most difficult part, and once the start is made it will be discovered that there is great opportunity for the individual to take part in such a way that both he and the community will benefit. For example, an instructor who started a student group under the aegis of the NEA national student traffic safety program would soon find more profitable activities than he could handle, and many of them could be of the kind that provided information suitable for background reports to the local community.

In the years immediately ahead there is unquestionably going to be a new concentration on programmed learning and the teaching machine. We at Ford have just completed our first draft of a programmed course in driver education. I have no doubt that this short course on passing will look pretty crude in three years, to say nothing of 10, but for the moment it's the latest thing, and the first of its kind made for use in a teaching machine that I know about. Since this technique holds promise of helping the teacher on the spot do a better job with less time and money spent, I suggest that many of you will want to at least look up the basic literature on the subject of programmed learning to determine its possible use in your school.

Incidentally, we are going to have to initiate some new teaching techniques in order to prepare our students for driving conditions they will face during the coming 10 years. Sustained speeds of 90 miles per hour on cross-country highways will not be out of the question during the late '60's. Pre-

paring the student for this range of speed will require a whole new concept of emergency procedure instruction for most teachers, as will the requirements for safely handling a car at these speeds. Do you give high-speed demonstrations, tire failure simulations, panic stops from top highway speed? A recent survey by a magazine indicated that the average man in the street anticipates cars that can be driven at speeds of 100 miles per hour by 1970. All I can say is that we would be well advised to all take the latest police pursuit courses in high speed driving that are just now beginning to be available in a couple of states.

The network of freeways being built as a result of the 1956 Federal-Aid Highway Act will by 1972 span the nation and ultimately serve one-fifth of all motor vehicle travel. We are going to be in an era of high-speed, long-distance travel which was unknown in past years. Our drivers as well as our cars must be up to the job if we are to realize the improved safe driving engineered into these roads.

The conclusion is inescapable that regulatory measures will be modified and improved to an extent that will affect course content and methods now used in teaching driving students. I anticipate significant advances in state licensing laws, which in many cases will mean that there will be reasonably tough tests of knowledge and skills as well as physical abilities before the first license will be given. Good sound licensing procedures are a boon to driver education and the passing of the best possible regulations for the particular state should be one of the important goals of each state teacher association.

One area which every teacher of driving should consistently urge and support is that of uniform traffic laws and ordinances. The Uniform Vehicle Code should be on the desk of every one of us and be used as a guide for classroom discussions, as well as the source of recommendations to the community whenever matters of this nature come up for consideration.

I see, too, the use of driving simulators really coming into its own during the next decade. These devices will vary considerably in capacity ranging from a complicated multi-million dollar one sponsored by the

federal government to simple devices that can reproduce with reasonable accuracy a single function. The demands of the new fast cruise cross country driving will require such equipment be put to its maximum use. Safe testing of new drivers and re-checking of experienced drivers will make far greater use of simulators to duplicate conditions which are too dangerous to try under actual conditions. The new Aetna Drivotron for duplicating realistically certain driving situations is a case in point.

One factor which appears likely to strengthen the hand of the driver education advocate is the continued emphasis by insurance companies through reductions in rates for insurance to young drivers who have successfully passed an approved driving course. We must all continue to encourage these discounts for young drivers as they probably are the single most effective means of gaining recognition and acceptance for driver education. I would go further and suggest that we should undertake to each to put the pressure on the insurance companies to increase the amount of the discount to make them more in line with the figures they quote on the reduction in accident figures of the youngsters who have had instruction.

An area that has been vastly influential in the success of the driving program is that dealing with the cooperation of civic and business groups and organizations. A great many of them have declared themselves on the side of driver education. As an example, the recent decision by the auto industry to double the rebate allowance to teachers who loaned cars to schools for use

in driving classes, is most encouraging. It indicates to me that a very important and substantial element has unequivocally declared itself as an ally in the fight to achieve acceptance of driver education.

The adult driver who is in difficulty for one reason or another in regard to his driving practices could in the past only atone by paying a fine or going to jail. The advent of the driver improvement school will offer an intelligent method of handling the problem driver. Here is a great challenge to both the professional and the public school teacher; here is a most satisfying and lucrative opportunity for them, here is a way to substitute a constructive program based upon building increased knowledge and skill for a negative program based upon punishment. I have every confidence that this challenge will be met and the driver improvement school will become an important fixture in every major community.

And now the crystal ball becomes opaque and I can no longer make out what it shows. I am not naive enough to suggest that all, or for that matter, any significant portion of the advancements I have mentioned will take place without a great struggle on the part of each one of us. I do believe that collectively many of us have been on a plateau, building experience for the climb ahead; and now that we have reached the hill we will make the climb to the next level, even though it strains all our gears in the process. The next time we are given a look into the crystal ball we shall find that many of these predicted goals have, through our own efforts, come true.

TEACHER COMPETENCIES IN SAFETY

By HOMER ALLEN

Chairman, Committee on Teacher Competencies in Safety
Elementary School and Higher Education Section, NSC;
Professor, Physical Education for Men, Purdue University, Lafayette, Ind.

Two years ago a joint committee of the Higher Education Section and the Elementary School Section of the School and College Division of the National Safety Council agreed to investigate the training in safety

education received by grade school teachers. During the following year some attempt was made by various members of the committee to compose a list of competencies which any grade school teacher should pos-

ness in order to best promote safety education in her grade. It became evident that such a list was not suitable for the purposes needed.

Last year the writer volunteered to conduct a survey in the two grade schools in West Lafayette, Ind., in an effort to determine the competencies and training of the various teachers. The attached report is the summary of this survey.

Grace Allen Stiles and Harold A. Seekamp each indicated some desire to conduct similar surveys in their respective communities, and the writer supplied them with the preliminary material which he had prepared. Copies of their reports are available from the staff representative of the elementary school section, Dr. Vivian Weedon.

It is evident from these reports that much work needs to be done along the lines of training prospective grade school teachers in the safety education competencies which will enable them:

- A. To recognize hazards.
- B. To eliminate as many hazards as possible.
- C. To train pupils to live safely with those hazards which cannot be eliminated.

A Survey of the Hazards, Accidents and Injuries in Two Grade Schools in West Lafayette, Ind.

This study was initiated in 1960 primarily to try to determine the safety education background and interests of the elementary school teachers in Morton and Burtisfield Schools. Mr. Carmen Fabian, principal of Morton School, assured the investigator that he was interested in the study and would cooperate to the best of his ability in having his teachers and the teachers in Burtisfield School assist in the investigation.

Mr. Fabian estimated that about 50 teachers and others would engage in the survey. The investigator purchased covered notebooks, hereafter referred to as "LOG" books, and he also prepared a personal information sheet to go with each log book as it was distributed to each teacher. The following instructions were attached to the log book:

Things to Include in the Log Book

1. Any hazards in the school building which might affect the pupils in my room.

2. Any hazard on the school grounds which might affect the pupils in my class.

3. Any new hazards which appear either inside or outside in activities of my pupils.

4. Any conditions which I recognize for the first time as a potential hazard.

5. Any accidents and/or injuries which occur to any of my pupils.

6. Any accident or injury that I could have prevented by anticipating trouble.

The following personal information sheet was distributed to each teacher:

1. Did you have a safety education course in college?

2. What was the nature of the course?

3. If you did not have a safety course in college, are you aware of any lack of safety consciousness?

4. Are you aware of the natural hazards in and around your school?

5. Are you able to guide your children away from hazards?

6. Can you train your children to cope with hazards which cannot be eliminated?

7. Have you been involved in any kind of accident in the past year? Describe it briefly.

8. Would a training course in safety education have helped you not to have an accident?

9. Would an in-service training course in safety education aid you in protecting your children?

10. What are your main safety problems in the school?

The material was distributed to the teachers early in the fall of 1960 and was collected in May of 1961. A rather disappointing total of only 14 persons returned the log books, which in itself may lead to at least one conclusion. Of those who returned the logs 11 were female teachers, 1 a school nurse, and 2 were male teachers.

The personal information sheets were fairly well filled out, with the exception of a few which had no answers to questions 8 and 9. There was a distinct lack of entries in most of the log books, and again, this may lead to at least one conclusion.

Summary of Data

I. Personal Information Sheets

- A. Number of teachers responding: 11 female, 2 males, 1 nurse.

- B. Experience: The range of experience among female teachers was from 2 to 35 years, with an average of 12.9 years. The range of experience among the male teachers was from 5 to 9 years, with an average of 7 years. The nurse did not indicate her experience.

- C. Answers to questions on information sheet:

1. YES (Females 3, Males 1). NO (Females 9, Males 1).

2. Health and Safety and/or First Aid.

3. YES (Females 1). NO (Females 5, Males 2). AT TIMES (Females 1).

4. YES (Females 12, Males 2).

5. YES (Females 12, Males 2).

6. YES (Females 11, Males 2).

7. YES (Females 1). NO (Females 11, Males 2). Fell down stairs due to own carelessness.

8. YES (Males 2). NO (Females 3). NOT SURE (Females 4).

9. YES (Females 2, Males 2). NOT SURE (Females 6).

10. Swinging doors

- Ball going into street

- Steps

- Unpredictable element in children

- Running in halls

- Falls

- Traffic

- Feet in aisles

- Pushing

- Playground activities

II. Areas where accidents occurred:

- Playground

- Halls

- Gymnasium

- Streets

- Stairs

- Walks

III. Types of Injuries:

- Wind knocked out

School and College Sessions

Sprained wrist
Skinned hands and knees
Face and head bumps and cuts
Wounds from falls or collisions
Stabbed self with sharp pencils
Mouth and tooth bruises and cuts
Broken arms

IV. Causes of injuries:

Fell from swing
Fell from bicycle
Fell while playing game
Tripped over obstacle
Playground equipment broke
Sharp edged culvert
Broken glass
Ice
Swinging lavatory door
Thrown ball bat
Improper twirling in swing
Slip on tile
Collisions at hall corners
Carrying exposed sharp pencils in pocket
Collisions in gym while playing games
Improper riding of bicycle in traffic
Falls on playground

V. Precautions taken by teachers:

Boy recovering from broken leg not permitted to play game with other children until completely healed
Children not permitted to climb on decorative design on school building
Had janitor remove broken glass from play area
Stopped ball players from grabbing and swinging on swing supports.

VI. Hazards listed by teachers:

School delivery truck driving on playground while children were present
Running across swing areas
Tiles on playground
Rocks on playground
Children playing in teachers' parking lot
Snowballing in school area
Swinging on stomach or standing
Unsupervised play on playground
Bicycles parked in play area
Parking lot is really part of playground—moving cars
Game equipment not removed when activity is finished

Holes on playground
 Scattered loose coal on playground
 Children running across street after alighting from family car
 Glass on school walks and playground
 Chain across drive
 Hot radiators
 Blacktop playground
 Ice and snow on walks
 Wet stairs during bad weather
 Drivers opening car doors in path of bike riders
 Careless opening of classroom doors into halls
 Waxed floors
 Rolling piano platform in gym
 Dogs on playground
 Green framework at back entrance—small children like to climb it
 Use of folding chairs to stand on
 Child riding bike wearing face mask
 Children running carrying sharp pieces of ice
 Tree trimmers at work near building entrances and play areas
 Girl drinking milk from shattered thermos bottle

VII. Dates of Notations:

September—None	February—2
October—10	March—1
November—5	April—5
December—4	May—None
January—5	

VIII. Questions asked by teachers:

Case of Purdue student forcing indecent exposure on small girl. Do we need to counsel our children concerning such hazards?

IX. Quote of the year:

"No accidents. Just the usual bruised knees from playground activities."

Conclusions

1. A majority of the elementary school teachers in West Lafayette were not interested in compiling "log" books concerning: (1) their own safety background, and (2) the accidents, injuries, and hazards in and around their schools.

2. Most of the teachers who returned the log books showed a woeful lack of

ability to do the job which was asked for. Dates were lacking, as were entries of good safety acts.

3. Most of the elementary school teachers had no safety education courses in their college training program. Hence, one wonders if they knew *how* to keep a log book concerning safety practices.

4. Most of the teachers had complete confidence in their ability to recognize hazards, guide their children away from same, or train their children to cope with them. In view of the accident record, it would appear that this confidence is ill-founded.

5. There is enough uncertainty among the teachers concerning the possible benefits of safety education training courses (collegiate and/or in-service) to permit the assumption that both might be good.

6. We learn nothing new concerning the areas where accidents occurred. These are the same areas in which accidents have always occurred. Likewise the types of injuries and causes are the same as have been listed in past studies. Is it not a good assumption that if these teachers had been trained in safety education, they would have been able to forestall many of the accidents?

7. In connection with the hazards listed by the teachers, there is little indication that anything was done about said hazards. Is this an administrative problem only?

Recommendations

1. This type of survey should be conducted in many representative schools throughout the country.

2. The investigator should personally meet with the teachers, and should make clear to them what is wanted. This is not a particular criticism of the principal. He may think he understands; the investigator may think he understands; but somewhere a link is lost.

3. The personal information sheet should be revised by an expert so as to permit the collection of really pertinent data.

4. The original committee should now review any surveys that have been made to date, and prepare a new master list of competencies which then should be submitted to a large number of elementary school teachers and principals for analysis.

FROM NOW UNTIL THEN

By OLIVE S. BERG

Incoming Chairman, Elementary School Section, NSC;
 Elementary Supervisor, State Dept. of Public Instruction, Pierre, S. D.

I have looked at the safety problem as it affects elementary school children. After all, we are interested in children and their safety.

I believe the following figures on accidents to children are correct:

1. Each year there are approximately 15,000 accidental deaths among children under 15 years of age.
2. Accidents are the leading cause of death among children after the first year of life.
3. Accidents cause almost 17 per cent of all deaths of children, ages 1-14.
4. The most common fatal accidents among children are: motor vehicle, drowning, fire, explosion and poisons. Together they cause more than half of the accident toll.

The National Health Survey estimates that 16½ million children are injured each year. These children are 36.5 per cent of all persons injured. 16 per cent of these injuries occur in and about the home. Among the school age groups, one child in ten is hospitalized as an in-patient as the result of injuries received in an accident.

62 per cent occur in the school plant.
 5 per cent occur going to and from school.
 16 per cent occur at home.
 17 per cent occur in public places.

Death rate—1950-1959: deaths, 934,000; approximate cost, \$100,000,000,000.

According to the U. S. Office of Education, there are 861,035 elementary teachers in the United States. What an army to move toward safety! The safety needs, as they affect elementary schools, fall into several categories. These are: (1) a full knowledge of school safety problems, (2) an opportunity to put into practice the knowledge learned, (3) skill in safety practices, and, (4) change of attitudes of teachers.

These are four basic steps in "safety-proofing" teachers. These four basic steps could be applied to either children or adults.

It is from these basic steps in "safety-proofing" that the safety program should proceed.

The principle preventive methods in the past decade concentrated on eliminating the environmental hazards where children worked, lived, traveled and played. Results have been gained in reducing accidents, but, since it is now known that 80 per cent of accidental deaths are largely under control of individuals, greater emphasis must be placed upon the human factors as they influence accidents. Three steps seem to be appropriate:

1. Selection — This deals with better screening of individuals for job and activity placement.

2. Included is medical and psychological testing as a screening device for better guidance of children in safety.

3. There is need for a modification of behavior through supervision and education. This is the point at which the teacher is the key person in the safety program. It is through change of safety attitudes that progress is made. The change in attitudes depends upon motivation, liability involved, economic considerations, administration and organizational policies, constraint and enforcement of rules and laws.

There must be opportunity for putting into practice the safety rules and laws. Teachers must have more knowledge of safety, both practically or psychologically. Skills in safety must be used by the teacher in her work with children in creating better attitudes. Let it be assumed that by safety attitudes is meant "a predisposition to react in a certain way to a given situation."

Attitudes may be expressed through a degree of alertness. Teachers need to educate children to be alert. This would include observation of the environments in which children find themselves. The observation element draws in precaution on the part of the individual. Precaution may foster apprehension of what may follow in safety procedures.

standing of the elementary rudiments of driving a motor vehicle.

Even today we have those school officials, I am sorry to say, who do not accept the fact that selecting a school bus driver should demand relatively as much time and attention as the selection of any other member of the school staff including the classroom teacher. It would be incomprehensible to most school officials to think of hiring the first person who walked into their office and asked to be hired as a teacher without first checking his credentials, previous experience, and qualifications.

In hiring a school bus driver, however, we are too often guilty of hiring the first available applicant in spite of the fact that we realize no school bus is safe in the hands of a driver who is physically and emotionally unfit, or who fails to follow sound driving practices; and, as a result, school bus drivers are in many cases ill-suited for their responsibility.

There appear to be two major aspects to the problem, apart from the continuing and competent supervision, of providing the best possible school bus drivers, (1) the recruitment and selection of qualified people; and (2) providing adequate training programs specifically designed to prepare these people for the job to be done. Although recruitment, selection, supervision, and training are in a sense inseparable, I will attempt in as far as possible to confine myself to speak to us on recruitment and school bus driver training programs.

Securing responsible and qualified drivers is not necessarily a new problem in the field of school transportation. Even before the advent of motorized transportation in this country when horse-drawn carriages and wagons were the conveyances commonly used to transport pupils to school, both the personal qualities of the driver and his control of the pupils being transported as well as his skill in handling his team were matters of concern and as such received attention in certain localities.

You will recognize, I am sure, this concern also agree that the following comments taken from a report by O. J. Kern, superintendent of Winnebago County, Illinois, schools at the turn of the century

has a certain familiar ring. In this report Mr. Kern describes his visit to several newly centralized schools in North Eastern, Ohio.

"So we drove on to North Madison, in Madison Township, where three wagons are used. On our way there we saw the first wagon. We stopped at the farmhouse and talked with the driver. He carried all the children from one district, about twenty in number. His route was five miles long. That is to say, starting at the first home to pick up a child until he arrived at the central school was five miles. Then he drove back home after delivering the children, thus covering ten miles in the morning. Of course he traveled the same ground after school, thus making 20 miles in all. He got \$1.50 a day for his work. We asked him if he made any money at it. He said he did, as he was working a small farm that did not require all the time and labor of himself and team. We asked him if he had any trouble with the children and replied none. He said he was employed by the township board of education, who put him under bond to be careful with the children; to have a safe team; to provide a suitable wagon, covered and provided with curtains, and containing soapstones and tap robes for the worst weather. We asked what objections the parents along the route had to the new plan. His reply was that the only objection was on the part of two or three at the beginning of the route, as they had to get their children ready somewhat earlier than they used to when they went to this district school. Of course the children had to be ready when the wagon came. He aimed to start at 7:30 and arrive at the building not later than 8:45. Thus there were no children tardy; none came with wet feet or clothing; the attendance was greatly increased and much more regular. The driver believed the movement had come to stay; that the people would not consent to go back to the old way."

Kern goes on to describe school transportation during that period at another school district he visited on this trip:

"The wagons are provided with curtains, tap robes, soapstones, etc., for severe weather. The board of education exercised as much care in the selection of drivers as they do in teachers. The contract for each route is let out to the lowest responsible bidder, who is under bond to fulfill his obligations. The drivers are required to have children on the school grounds at 8:45 a.m., which does away with tardiness, and to leave for home at 3:45 p.m. The wagons call at every farmhouse where there are school children, the children thus stepping into the wagons at the roadside and are set down upon the school grounds. There is no tramping through the snow and mud and the attendance is much increased and far more regular. With the driver, there is no opportunity for vicious conversation or the terrorizing of the little ones by some bully as they trudge homeward through the snow and mud from the district school."

This account of pupil transportation in Ohio at the turn of the century would indicate that many of our current problems in school transportation such as securing

well-qualified drivers are by no means new ones, but rather in one form or another have been with us for over 70 years.

The seriousness of the problem of securing well-qualified school bus drivers has been compounded in recent years, however, as a result of two developments. (1) The rapid growth of school transportation in this country (for example, in 1923 approximately 800,000 pupils were transported in the United States as against about 7 million in 1950 and more than 13 million this year with an estimated 15 million by 1965), and (2) the increased complexity of our transportation technology today, along with the side effects of this technological development in terms of the complexity of the vehicle itself, increased speeds, and our innumerable and varied traffic and highway problems.

There is no doubt about it—the job of driving a school bus today calls for physical, mental, and emotional capabilities of the very highest order. In order to secure qualified school bus drivers possessing these capabilities, it is necessary as an initial step to (1) establish adequate standards that all drivers are required to meet prior to employment, and (2) rigidly adhere to these standards.

The major responsibility for selecting drivers rests, of course, as it should upon the local school authorities. It is conceded, however, that the states have a major responsibility in exercising a reasonable degree of leadership, authority, and control in this area, and that adequate general standards and regulations must be promulgated by the states, preferably through the state education agency, to guide local school boards in this important function. It is recognized, of course, that local initiative should be constantly encouraged to exceed state requirements whenever possible.

The fact that school bus drivers in all of the states are now required to meet at least some standards indicates that the states do recognize this responsibility. Although there are wide variations between the states, both as to the specific items covered and the extent these items are covered in state standards, there does appear to be a definite trend to require that drivers meet more rigid standards.

The following excerpt taken from a recent

School Transportation Sessions

report by the Georgia State Department of Education points out the immediate result this has had in one state.

"In 1959, the State Board of Education tightened up its policies regarding physical examinations. The Board ruled that drivers over 65 could not be employed; nor could a driver with a physical handicap. These newer and more stringent regulations were adopted in order to insure greater safety for the 436,078 Georgia children who get on 4,327 school buses each day to ride to school and home again. When the new regulations were put into effect and more rigid tests required, 222 previously employed drivers failed because of such physical defects as missing limbs, eye or ear handicaps, heart ailments or other disabilities. As a result of the rigid new requirements, school bus accidents in Georgia involving the drivers' judgment were reduced from 18 per cent to 18 per cent."

Generally speaking the standards for school bus drivers in a majority of the states include the following elements: age, physical condition, experience, and character, among others.

Age Requirements

Minimum Age. In 1960, 16 states¹ required their school bus drivers to be at least 21. One state, Rhode Island, required drivers to be at least 25, while in South Dakota, a 15 year old could legally drive a school bus.

In 10 states,² 16 year olds could legally drive a school bus, 5 states³ allowed 17 year olds to drive school buses, and 15 states⁴ allowed 18 year olds to be employed as drivers. One state⁵ required school bus drivers to be at least 19, while Hawaii required all school bus drivers to be at least 20.

Maximum Age. In regard to maximum age requirements, the 1960 survey indicated that 39 states have no specific maximum age limit for school bus drivers. One state⁶

1. Arizona, Delaware, Illinois, Indiana, Maryland, Massachusetts, Michigan, Missouri, New Jersey, New York, Ohio, Pennsylvania, Tennessee, Utah, West Virginia, and Wisconsin.
2. Alabama, Iowa, Kansas, Maine, Nebraska, Nevada, North Carolina, Oklahoma, South Carolina, and Virginia.
3. Arkansas, Colorado, Florida, Mississippi, and Texas.
4. Alaska, California, Connecticut, Georgia, Idaho, Kentucky, Louisiana, Minnesota, New Hampshire, New Mexico, North Dakota, Oregon, Vermont, Washington, and Wyoming.
5. Montana.
6. Delaware.

and accidents due to negligence. If we firmly believe driving a school bus requires special skills and information, then the answer is, of course, on-the-job experience and training for new drivers prior to assignment.

I would like to touch very briefly on only two of a number of other important considerations in school bus driver selection.

(1) Few school employees are in as unique a position as the school bus driver to influence the community's confidence and respect in its school system. A school bus driver's personal conduct and daily performance as observed by the pupils, parents, and the taxpayers of the community can have a serious impact one way or another on the school's public relations in the community.

(2) A school bus driver can have either a positive or negative influence on the young minds which are under his charge for a considerable portion of the school day: his attitude toward promptness, the manner in which he drives his bus, his respect for laws and regulations during the daily run, the manner in which he handles discipline, his personal habits of speech and dress, his self-control and emotional stability, all can have considerable, immediate, and perhaps even a lasting influence on the attitudes and behavior patterns in this particular age group.

As Walter M. Gorden, head of one of the nation's largest school bus operations with 42,000 riders, Baltimore County, Maryland, aptly and humorously put it:

"What we are looking for in a school bus driver is a paragon, a diplomat, a public relations man, a nursemaid, a Prussian general for discipline. He must be able to keep both eyes on the road, watch for traffic situations with considerably more care than the average motorist, and at the same time control 50 or more squirming, yelling, energetic, hell-bent kids who are behind his back."

And I might add, we want his services for only a few hours per day at a salary often in no way commensurate with his responsibility.

A report by G. I. Fletcher, an agent for the Massachusetts State Board of Education in 1898, on the quality of the drivers in that state in 1898 might well be used, with certain modification, to sum up the situation as it exists today in regard to the quality of our school bus drivers across the Nation.

"Nearly all of the drivers are reported to be trustworthy. Some are said to be as good as we can get. Some are of doubtful qualifications. All committees and superintendents regard trustworthiness and fitness in the driver as of the highest importance. One committee says: 'Only such persons should be employed as we would trust with the care of our own children.' A few committees say that they have to watch drivers of convalescents and hold them to strict account. Some complain that children are not under proper control in the carriages; but upon the whole, there seems to be a good degree of satisfaction with such vehicles and drivers as have been employed."

A HYPOTHESIS ON LICENSING THE SCHOOL BUS DRIVER

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From its beginnings in 1840 in one school district in Massachusetts, transportation for students to and from school has grown into the massive enterprise of today. A 1960 publication reports that although only one in every four students relies upon school sponsored transportation, there are nearly 11 million young people riding school buses each day.

Elaboration on the need for safety in school bus programs is certainly unnecessary. There is no question but that the prevention of accidents should be a high priority goal. However, it would appear that adequate measures are not being taken toward this end. As clear evidence of this, national statistics with only 42 states reporting in 1960, concerning school bus accidents,

show more than 2000 injured and 177 killed in a total of 8900 accidents. In Illinois for example, the average accident rate per vehicle in 1958 was greater for school buses than for all other commercial vehicles!

Recognizing the extensiveness of school bus programs throughout the country, and with the evidence of a great number of accidents and injuries occurring, it is clear there is a need for a concerted effort toward maximizing safety within these programs. However, it would appear that in most instances, greater attention is paid to the mechanical condition of the vehicle than to the driving skills of the operator. Federal and state laws exist pertaining to the physical characteristics of the vehicle. Only limited regulations exist concerning the adequacy of the driver.

The annual cost in 1959 of operating the many school bus systems in the nation was over 400 million dollars. The separate school bus systems, functioning within the unit of the school district, are, in most cases, maintained and financed by the local board of education in cooperation with various state agencies. In fulfilling their responsibility of adequately maintaining these programs, several states have established screening, training, and refresher programs for their drivers. There is a noticeable lack of any such preventive measures in the majority of states, however.

Corrective or punitive measures taken against drivers after the occurrence of accidents do serve as a form of preventive action against future accidents. However, it is the thesis of this paper that the more positive approach of taking preventive measures prior to any traffic offenses or accidents represents a far superior method. Thus, the general hypothesis is that a strict and comprehensive licensing examination will reduce school bus accidents.

Hiring and Screening

As was true in the case of national statistics on the number and severity of accidents in which school buses were involved, information concerning the screening and training procedures for school bus drivers, as they exist in the various states, is quite difficult to obtain. Those states which now have, or which are presently establishing extensive programs in this area do report on their efforts and findings. However, the majority

of states in which programs of wide scope do not exist, report limited data concerning the procedures they employ.

The hours for school bus drivers are typically not those of the usual nine to five working day. They are shorter and are divided over the day according to the arrival and dismissal time of the schools. The salaries paid to these drivers must be expected to be concomitant with these limited hours. It is safe to assume that few adults could support themselves and their families on school bus driver salaries. To supplement the salary, the driver may either be employed in some additional capacity by the school district, or he may hold another part-time job. In any case, due to the nature of the job and its obvious disadvantages, a large proportion of school bus driver applicants tend to be retired persons, students, housewives, or persons seeking only short-term employment. These applicants are not likely to be the best safety risks.

One problem which is highlighted by these conditions is that a good many of the older persons who have been retired from full-time employment and who now serve as school bus drivers are no longer in their physical prime. Unfortunately, attention becomes focused upon this issue only on the occasions when tragedy occurs as a result of the sudden physical incapacitation of the driver. While the question of physical fitness is especially pertinent with reference to the older driver, it is also of serious importance for all drivers. Illinois, for instance, requires not only a doctor's certification of the applicant's physical fitness but also yearly examination during the term of employment.

Part of the screening procedures in both New York and Oregon include careful physical examinations. Of course these examinations are usually designed only to detect gross physical deficiencies such as a serious heart condition which would make the individual a risk on the road. Such check-ups in all probability, seldom determine those psychophysical capacities of a driver (reaction time, depth perception, and field of vision) which are equally important to the safety of the vehicle and its passengers.

As one way of meeting this salient problem of the lack of qualified and physically fit drivers, North Carolina has inaugurated a program of hiring and training students

as drivers. At present, over 90 per cent of the school bus drivers in the state are high school students. The training program for the prospective drivers include 12 hours of classroom work as well as a minimum of six hours of actual road training. This instruction is beyond the ten hours of training required for all driver education students in the state. Such a program as this has obvious benefits in providing the opportunity for close supervision of drivers, quick availability of substitute drivers, and greater selectivity in the hiring of personnel.

Initiated by a safety specialist for a local General Electric plant transportation system, another program involving student participation rather than student drivers, was instituted in the school districts in at least one county in Indiana. Two or more students on each bus are trained to provide assistance to the driver in emergencies. This precaution is, of course, taken to avert the disasters which can occur when the driver is unable to handle or maintain discipline with all of his passengers, or to maintain control of this vehicle in a critical situation or when he becomes physically incapacitated.

West Virginia focuses upon the technical ability of the driver and submits each of its applicants to a six hour training program. This is followed by a written examination and an on-the-road test of the applicant's skill in handling the bus. All training and examinations are supervised by the state police force.

In-Service Training and Testing

In Michigan, the in-service training program consists of a 12-hour intensive instruction program held for all school bus drivers in the state. Small subsistence monies are paid to those drivers in attendance for the two day program. The instructors for the training sessions, each of whom have been trained in highway safety measures, are brought in from several of the colleges and universities in the state.

A somewhat similar program has been established in New Mexico. It is reported that each year 700 to 800 drivers attend the Annual School Bus Drivers' Institute for training in safety techniques. Refresher courses of the same nature are also carried on during the year in areas where accidents or violations are reported.

A program in Oregon was instituted by the State Department of Education in co-operation with the Division of Motor Vehicles. The essentials of this program are similar to the elements noted above. Oregon requires special school bus driver licenses. A team of trained inspectors review safe methods of school bus operation and traffic laws and regulations with the drivers. Satisfactory fulfillment of the training sessions as well as certification of physical fitness are required before the license is granted by the state.

As evidence of the efficiency of a screening program, after all school bus drivers in Georgia were tested, the rate of accidents due to errors on the part of the driver were reported to be "cut in half." Furthermore a total of 252 drivers were disqualified from operating school buses as a result of the tests.

There have been numerous reports in the past several years which contain recommendations for national and/or local school bus driver screening, training, and supervision programs. Most of these include mandatory yearly physical examinations as well as some form of training for the driver in safety precautions to be taken on the road. A recent report recommends, beyond the physical qualifications, requirements for high standards of moral character, emotional stability, knowledge of traffic laws and regulations, skill requirements in the handling of the school bus, and experience in driving. Although such a program would indeed be of great value, careful research must precede its establishment. New Jersey, continually active in the general field of accident prevention, is now in the process of doing such research and establishing such a program.

New Jersey Program

In building a comprehensive program in highway safety, the state of New Jersey recognized the need for rehabilitative (corrective and preventive) supplements to its punitive (law enforcement) measures. In 1952, the first Accident Prevention Clinic was established with Drivers Safety Service acting as technical consultants. Since then, the program has grown to comprise eight clinics located throughout the state. The multiple purposes of these clinics include determining those psychophysical and psy-

chological characteristics of the driver which tend to be related to accident involvement, informing the driver of whatever psychophysical deficiencies exist, advising him of how to compensate for or correct limitations, and imparting to him through counseling, more positive attitudes toward law enforcement, traffic regulations, and safety precautions.

In general, drivers who had more than two reportable accidents or who have accumulated a given number of violation points, or who have been convicted of driving while intoxicated, are required by the state to participate in the program. Each subject is given a thorough psychophysical examination, including tests of visual acuity, field of vision, reaction time, depth perception, night vision, color vision, and glare recovery.

Two psychological examinations are also administered to each subject, although at present, the results of these tests are used for research purposes only. Based upon a comparison between the subjects' scores on each of the psychophysical tests and minimum standards which have been established as the basic requirements for safe driving, recommendations are made to each driver as to what he should do to compensate for whatever deficiencies may exist. This processing, including an initial interview and a final counseling session, usually takes about two hours. In cases of extreme psychophysical inadequacies, the driver is referred back to one of the state licensing centers for re-examination and possible action on suspension of his license unless corrective steps can be taken.

Of the 28,834 drivers processed by the Accident Prevention Clinics from September 1952 through June 30, 1959, only 2,469 have continued to reoffend; that is, he involved in either accidents or violations. This represents reoffenses for only 8.5 per cent of the total group of subjects. As a further check on the efficiency of the Accident Prevention Clinics, research is currently underway to determine the reoffense rate of a control group of drivers, who, though "eligible" for action, were not exposed to Accident Prevention Clinic processing.

New Jersey has had a limited examination program for school bus drivers for some years. Until November, 1960, the following procedure was used in school bus

driver licensing in New Jersey: Together with the initial application form, the subject submitted a medical report stating that his physical condition was satisfactory. He also had to satisfactorily complete a test measuring his knowledge of traffic laws. Visual acuity and other psychophysical tests were then administered to the applicant (Porto-Clinic). The final step was a road test on which the driver had to demonstrate his skill in operating a school bus.

In November 1960, however, Drivers Safety Service was asked to cooperate in setting up a new testing program for school bus drivers. At present therefore, applicants are required to go through the complete Accident Prevention Clinic processing. Any subject who falls below the established minimum standards on any three psychophysical examinations is unlikely to be granted a license.

One of the basic problems in establishing a research program within such a practical setting is meeting the needs of the various agencies connected with the program. The Division of Motor Vehicles and the Department of Education, both agreed on the need for psychophysical test minimums as part of the criteria for school bus drivers. However, although comprehensive recommendations have been prepared by Drivers Safety Service, no standard has, as yet, been set on the psychological or emotional qualifications of these applicants. There is now, in progress, a psychological test program as part of the school bus driver screening.

The tests currently used in the program were originally developed by Drivers Safety Service for use in a rehabilitation program which is supported, in part, by a Public Health Grant (RG-6296 (R1)). The program concerns itself with the rehabilitation of that 8.5 per cent who continued to reoffend following their Accident Prevention Clinic processing. The results of these test administrations to school bus drivers will be used initially for research purposes. As indicated, no applicant is currently denied a license on the basis of these psychological tests.

Table I indicates the extent of yearly accidents, injuries, and death in school buses since 1953. The information has been assembled in such a manner that individual bits of information can become meaningful. For example, Column Three (number of ac-

TABLE I
Accidents, Injuries, and Deaths in School Buses

Year	No. of States Reporting	No. of Accidents	Per Cent of Increase	No. of Injuries	Per Cent of Increase	No. Killed	Per Cent of Increase
1953	30	2,941		701		4	
1954	34	4,346	47.77	983	40.22	8	100
1955	36	5,144	18.36	1,306	34.87	18	125
1956	38	5,809	12.92	1,398	6.61	6	-72.22
1957	37	5,953	2.47	1,171	9.07	7	40.0
1958	40	7,136	20.71	1,580	34.92	29	314.28
1959	39	7,152	-1.47	2,039	28.64	53	127.15
1960	42	8,908	24.55	2,067	1.32	19	-64.15

idents) shows a steady climb in accidents—1960 has almost three times the number of reported accidents as 1953. The number of injuries has also increased at the same rate for this period.

Although it is obvious from the above table that the number of accidents and injuries has increased, the number of people killed each year has fluctuated, so that no pattern is discernable. This is hardly any consolation to those families affected by this tragedy.

We note from this table that:

1. There are still no uniform or complete statistics available on school bus accidents.

2. The number of deaths and injuries incurred in school bus accidents does not follow any pattern other than a steady increase—thus suggesting that more intensive research efforts are needed with an emphasis on the vehicle operator.

The following table compares accident and injuries of New Jersey and national statistics. No tabular presentation is needed for the number killed during this period since school bus deaths in New Jersey for this same period totaled only three. What is particularly interesting in this table is that the number of school bus accidents and injuries have increased at approximately the same rate as the national figures.

TABLE II
A Comparison of National and New Jersey School Bus Accidents and Injuries

Year	No. in N. J.	ACCIDENTS		No. in N. J.	INJURIES	
		Per Cent of Increase	National		Per Cent of Increase	National
1953	46	2.22	47.77	23	52.08	40.22
1954	56	21.72	18.36	33	43.47	24.81
1955	54	3.57	12.92	61	84.84	0.61
1956	73	23.35	2.47	89	45.90	9.07
1957	101	38.35	20.71	69	22.47	34.92
1958	78	22.77	0.47	34	50.72	29.06
1959	123	65.38	24.55	103	202.94	1.32

In terms of percents, it would seem that New Jersey statistics are even more erratic than the national figures. The above comparison will only become meaningful when the licensees under the new program have had sufficient driving exposure to allow for meaningful statistics. Since the new licensing program has gone into effect, the school bus drivers who were processed under this system have had a total of four school bus accidents and only one private car accident, while at the same time, these same drivers have been ticketed for only five moving violations, with none of these

on a school bus. Thus, it seems likely that some aspect of clinic processing is having the desired effect. It would also appear the bulk of the school bus accidents are being contributed to by the drivers who received school bus licenses before the new procedure was put into effect.

One cannot yet draw any final conclusions since sufficient time has not elapsed for these newly licensed drivers to have had sufficient exposure. However, we hope that they will follow a pattern similar to other Accident Prevention Clinic processed subjects.

TABLE III
An Age Comparison of the Accidents and Violations of Three Groups of Drivers

Age	Per Cent of Sample			Per Cent of Violations			Per Cent of Accidents		
	New Jersey	Accid. Prev. Clinic	School Bus Drivers	New Jersey	Accid. Prev. Clinic	School Bus Drivers	New Jersey	Accid. Prev. Clinic	School Bus Drivers
17	1.2	0	0	3.7	0	0	2.9	0	0
18	1.6	2.2	0	3.2	0	0	4.6	1.7	0
19	1.6	4.8	0	2.8	2.3	0	4.8	4.2	0
20-24	8.7	17.0	12.7	12.9	15.2	18.57	18.2	25.9	22.93
25-34	22.9	24.6	22.4	26.9	43.4	45.57	27.6	34.7	28.16
35-44	26.1	22.2	30.2	23.0	28	21.43	20.9	22.9	24
45-54	19.4	10.1	17.1	15.2	6.3	12.14	12.9	3.9	11.24
55-64	11.4	6.3	6.0	8.7	2.9	2.86	6.2	3.9	2.4
65 plus	6.1	1.8	1.6	2.9	1.2	1.4	2.0	.8	.4

Table III is designed to show the accident and violation behavior, in terms of age, of three groups of New Jersey drivers. Columns two, five and eight represent a sample of 303,144 drivers selected randomly from the total population of two and one-half million licensed drivers in New Jersey. Columns three, six and nine represent 1,304 drivers—a sample of the 30,000 Accident Prevention Clinic processed subjects. Columns four, seven and ten deal with the total number of new school bus drivers processed up to October of this year.

No results are recorded for the "under 17" age group—the minimum age for a school bus license in New Jersey is age 21. It is interesting to note that the age range 20-34 of school bus drivers has more accidents and violations than either Accident Prevention Clinic subjects or a sample of all New Jersey Drivers. These facts suggest that:

1. Drivers between the ages of 20-34 ought to be excluded from operating school buses, or

2. More detailed attention should be paid to the past accident and violation history of all applicants, especially 20-34 year olds.

It should be noted that the records recorded for the school bus driver population are for their pre-processing behavior—that is before they received a school bus driver's permit.

The next table presents the pre-licensing records of the newly processed school bus drivers and their post-processing behavior. Table IV indicates, with limitations, a decrease in both accidents and violations. However, we should not be misled by these re-

sults. The time interval between their processing date and the search of their records for post-processing behavior has not been long enough to draw any positive conclusions.

TABLE IV
The Accident and Violation Records of School Bus Drivers: Pre- and Post-Processing
N = 221

ACCIDENTS	
Pre-Processing	46
Post-Processing	8
VIOLATIONS	
Pre-Processing	164
Post-Processing	16

The following four tables compare by per cent of failure, three groups of drivers, on various psychophysical tests. In Tables V (A, B, C, and D) the New Jersey or control group were accident and violation free for a period of three years, before being processed. The Accident Prevention Clinic subjects are a sample of those usually processed for accident involvement. The school bus driver group represents the total number processed, to date.

Each table may be read in the same manner. For example, in Table V A, for subjects aged 36 plus, the controls and school bus drivers had no visual acuity failures, whereas ten per cent of the Accident Prevention Clinic subjects failed on left eye acuity.

The four tables provide some interesting data concerning New Jersey school bus drivers. In terms of visual acuity, field of vision and complex reaction time, the school bus drivers have fewer failures than either of the other two groups. Day depth perception is the one area they fall below the controls and "accident repeaters."

TABLE V A
A Comparison, by Per Cent of Failure, on Visual Acuity, of Three Driver Groups

Age	LEFT EYE			RIGHT EYE		
	Controls	Accident Prevention Clinic	School Bus Driver	Controls	Accident Prevention Clinic	School Bus Driver
18-25	0	0	0	0	0	0
26-34	0	3.12	0	0	3.12	0
35-41	0	1.56	1.25	1.68	2.17	2.5
42-49	0	3.03	0	1.81	4.54	1.44
50-57	0	2.22	2.45	3.22	8.06	0
58 plus	0	10	0	0	3.33	0

TABLE V B
A Comparison, by Per Cent of Failure, of the Field of Vision of Three Driver Groups

Age	LEFT EYE			RIGHT EYE		
	Controls	Accident Prevention Clinic	School Bus Driver	Controls	Accident Prevention Clinic	School Bus Driver
18-25	0	0	0	0	0	0
26-33	1.66	1.66	0	1.54	3.12	0
34-41	.79	1.19	0	1.54	4.34	0
42-48	1.61	4.52	0	1.81	6.43	0
50-57	0	16.32	0	0	16.33	0
58 plus	2.33	12.66	9.09	3.33	11.66	0

TABLE V C
A Comparison, by Per Cent of Failure, of the Complex Reaction Time of Three Driver Groups

Age	Controls	Accident Prevention Clinic	School Bus Driver
18-25	12.50	0	0
26-33	4.6	10.15	2.56
34-41	7.92	12.30	0
42-49	9.09	16.66	1.44
50-57	17.74	24.19	0
58 plus	43.33	46.66	0

TABLE V D
A Comparison, by Per Cent of Failure, of the Day Depth Perception of Three Driver Groups

Age	Controls	Accident Prevention Clinic	School Bus Driver
18-25	0	37.5	39.22
26-33	3.12	34.5	44.87
34-41	7.9	43.65	51.35
42-49	9.09	43.18	62.90
50-57	29.03	38.70	55.17
58 plus	13.33	66.66	54.55

What we may be able to say, if the school bus driver offends at an expected rate, is that their psychophysical characteristics, excluding depth perception, are not necessarily related to their driving behavior. So far, of the over 320 school bus drivers tested and screened, only one has been denied the license on the basis of his failure to meet minimum psychophysical requirements. Therefore, it may be that criteria are either

too low or that only basic psychophysical capabilities are, in fact, necessary.

However, it is more likely a matter of previous screening. Under the new procedure, an applicant has had at least two screenings before receiving his clinic processing. All applicants must first have gone through the usual driver licensing screening and received an operators license. When he or she applies for a school bus driver

permit, he is given a second screening and receives a provisional license for one month; only then does he get the full Accident Prevention Clinic processing.

Conclusions and Hypotheses for Continued Research

It has been generally accepted that there is need for more stringent licensing procedures for school bus drivers. Obviously, if we can prevent applicants who are the greatest risks from operating school buses our accident, injury and death figures should improve. It is also obvious that, in many cases, psychophysical test results give useful information concerning this group of drivers. The need for a high degree of physical fitness is certainly needed. What makes this all the more meaningful, however, is that even with limited pre-licensing counseling, violations and accidents tend to decrease. Thus, we have some basis or logic for *Hypothesis Number One*:

A driver who learns about his psychophysical capabilities and is counseled on the compensatory behavior for any defect tends to have fewer accidents and violations.

As indicated earlier, a start in psychological testing in this area has been made. As yet the number of applicants who have taken these tests is too small for any, even preliminary, analysis. Yet, there is considerable evidence from other studies, that measurement of the psychological and emotional components of a driver provide the best hope for identifying "safety risks." In addition, those applicants who are emotionally disturbed should be screened out since they are operating in an extremely sensitive area. Therefore, *Hypothesis Number Two*:

The inclusion of standardized or custom built psychological instruments in a school bus licensing program has merit, in terms of identifying accident "risks," as well as emotionally unstable applicants.

Although these two hypotheses may seem rather general, their testing holds the key toward reducing school bus accidents.

While the New Jersey research is still in its early stages, it is hoped that studies can be soon initiated to test the above hypotheses and resolve a variety of problems too complicated to deal with in this preliminary paper.

A STRAIGHT LINE ON SAFE DRIVER AWARDS AND INCENTIVES

By E. J. SLINGERLAND
Safety Director, Seattle Transit System, Seattle, Wash.

I think it is safe to assume that every one of us works because he gets paid for it—and no one who works for wages is likely to admit to any other reason. It might seem contradictory, then, to talk about safe driver awards as an incentive for employees when we have already admitted that it is money that talks. Those of you who have tried to sell your management on a driver award program will undoubtedly have met with this argument. What I have been asked to do is discuss some of the criticisms of incentive awards, to see if they are really valid.

When we first suggested a program of driver awards for our operators, we were

met almost instantly with the question "Why should we give a driver a medal for doing the job we hired him to do in the first place?" That may sound like a fairly reasonable argument, but I don't think it will stand much scrutiny. While it is true that when we hire a driver, we make every effort to hire one who will be safe, very few companies can boast that all their drivers are perfect. The latest edition of *Accident Facts* verifies this imperfection by recording over 2,000,000 accidents in 1960 involving commercial vehicles.

So I think that we all recognize that while we might have had high hopes, some of our drivers turn out less than perfect, and will

be involved in accidents. We also know that Tom, the driver who has one or two minor accidents each year, costs us more money, yet draws the same wages as George, who has a perfect record. Is there any reason why we shouldn't publicly recognize George's excellent performance, and at the same time provide an incentive for Tom to improve his record? Though we are all working for money, there are some of us who don't appreciate recognition of a job well done. In the motor transport industry, I believe there is no better recognition than that provided by a safe driver award.

Other critics of our program said "What good is a safe driver award? Only the good drivers will get them, and they won't have any effect on the driver who has the accidents and really needs the help." I wonder if this same critic would refuse to buy fire insurance because when the salesman called, his house wasn't on fire? The inference is the same. Actually, one of the recommendations of a program such as the Council provides is the fact that the benefits reach every driver, good or not so good.

Even the good drivers need a reminder now and then that they are good because they put forth the necessary effort, and not because of luck. Each month we send a letter and booklet or other material to the driver's home, where not only he, but his family as well, reads it. I'm sure that in many cases, the driver's wife has just as much influence on his driving as his company supervisors. One driver told me that after he read the driver-letter, he forwarded it to his son at college, where it was posted on the fraternity bulletin board.

There is another way that the benefits of our program reach nearly every driver. With very few exceptions, the man who has a permanent place on our payroll takes a certain amount of pride in being a good driver. No matter what we're doing, there's a certain competitive spirit that makes us want to be a little bit better than the fellow next to us. If that fellow happens to be wearing a safe driver pin or a shoulder patch, and I'm not, I'm likely to try a little bit harder to get one too. It's possible that I'd never admit it to anyone, but the competition is still there.

This brings up another criticism of incentive awards. Many opponents insist that

incentives for safe driving records, whether they may be in the form of additional pay, merchandise, or a lapel pin, will increase the number of "blind" or "no-report" accidents. I agree that there could be a tendency toward this, but it has been no particular problem to us. Our operators are well aware that while we can possibly excuse an accident, failure to report one is a serious offense which will result in disciplinary action. Last year less than two per cent of our traffic accidents were blind reports.

Some people have told me that an incentive award program requires too much in the way of records—that all I'm doing is making more work for myself. But there is another way of looking at it. No matter what your safety program is, to be effective, it must be based on complete and accurate records. Whether you certify a driver for an award makes very little difference in the amount of work involved; and for any extra work there might be, you are repaid by having available a complete record of each driver's performance. This is essential for any program that produces results in accident prevention.

Of course, the \$64 question, (if such a term can be used) is the one asked by the boss: "How much will it cost?" Unless we are prepared to show that we can save more than the program will cost, we don't stand much chance of selling it. It's easy to calculate the direct expenses, and not much more difficult to add up the indirect costs. There will be the cost per driver in purchasing the material, whether we are giving prizes or shoulder patches. There is the mailing expense if you enter a program that includes such material for the operator.

Some companies pay their drivers for attendance at safety meetings, so these direct expenses would vary according to individual plans, and can usually be figured quite accurately. It is a little more difficult to calculate the money that is saved by such a program. Who can accurately determine the cost of an accident that didn't happen? The best that can be done here is an educated guess, based on your own previous record and the experience of others who have gone into an incentive program. Possibly a few of the facts concerning our own experience in Seattle might be appropriate.

Before we decided to try an award program, we had what we thought was a pretty fair record. Our traffic accident rate was a little better than the national average for comparable properties, and our ratio of claims expense to total revenue had been quite favorable. Our accident frequency rate was more or less stationary, but the cost of accidents was rising rapidly, due to the inflation of claims. In one year alone we had to set aside over \$425,000 for injuries and damages. We felt that if we could reduce our accident costs by as little as one per cent we would save money, as the incentive program that we were considering would cost only about half that amount.

I wish that I could report that immediately after signing up for the Council's driver award program that our accident rate started down, but unfortunately it didn't happen quite that way. It took some time for the program to show effects, and even some of our operators didn't like it at first. However, it wasn't long until even these drivers were showing more enthusiasm for the plan, which they indicated in several ways. More drivers came in to check their records, and ask when their next award was due. Management also took a closer look at these driving records, and we were able to give more attention to the drivers who really needed it. The operators also began to show more concern over their accidents, coming in more frequently to discuss those that were charged preventable. We were always ready to go over these reports with them, using the opportunity to point out the reasons they were considered preventable.

In this way we found the driver award program gave us an excellent opportunity to talk about defensive driving and it seemed

to go over better than when we had to ask the driver to come in.

The driver awards are, of course, only one part of our safety program. We continue to put a great deal of emphasis on training and re-checking. When an operator seems to require it, he is given an additional training period in an effort to help him eliminate any poor driving techniques he may have developed. It is not possible, nor would it be accurate, to say that the incentive awards are solely responsible for the fact that last year we enjoyed the lowest traffic accident rate in the history of our company. Certainly a good portion of the credit for this record, and for the resulting reduction in accident costs is due to this program. It would be hard to find anyone in authority in our company who would not agree that our annual cost of less than \$2000 for the incentive program has not been saved many times over.

In 1960, our cost for injuries and damages was only 40 per cent as high as in 1957, and over the four-year period, the savings were in the neighborhood of half a million dollars. We are not alone in our experience, either. A local trucking concern which introduced an incentive award program reported a 25 per cent reduction in accidents by the second year, and a number of other commercial vehicle operators have made similar reports to our local safety council.

Certainly no one contends that a safe driver award program is a gimmick that will do away with accidents forever, but you will find an increasing number of people who believe that it should be made a part of any well rounded safety program.

A-ROUND THE SCHOOL BUS ROUTE

By WILLIAM B. WOLFE

Asst. Supr. of Transportation, Ohio Department of Education, Columbus, Ohio

It appears that the nation's schools are experiencing such a rapid expansion of pupil transportation today, that schoolmen everywhere are looking for methods of management and control of this growing responsibility.

Pupil transportation is no longer an auxiliary service, but a necessary and important part of the total educational program. Transportation is essential for the operation of most school systems today.

School transportation can be expensive, and it is becoming more so in an increasing amount annually. Many factors are helping to increase the cost of pupil transportation today. School district reorganization and consolidation have expanded this service to a vast number of students who now attend schools in areas far from their homes.

The migration of large masses of city people to the suburbs has increased the number of students transported. Mechanization of the farm has reduced farm population resulting in more sparsely populated farm areas. This, in turn, has caused an increase in the size of rural school attendance areas. The steady increase in our population, coupled with the fact that students attend school more years than in the past, has added to the burden of pupil transportation.

As the size and cost of pupil transportation has grown, so have the number of school bus accidents. In Ohio during the eight year period from 1952 to 1960, school bus accidents increased by 186 per cent. This is a shocking statistic when viewed independent of other facts. During this same eight year period, the number of vehicles transporting school children increased from 7,032 to 8,458, an increase of over 1,000 vehicles. The annual mileage of school vehicles increased by 14,763,516 miles, the number of pupils involved increased by 282,100 during this period. If we consider the growth in all other traffic on our highways during this same period, we can see how the school bus accident problem has been compounded.

It is amazing to note that deaths as a result of school bus accidents increased from two in the 1952-53 school year to five in 1959-60. Injuries, during this same period increased from 65 in 1952-53 to 174 in 1954-55, then declined to 80 in 1959-60.

When one considers the number of buses, pupils, and drivers involved, plus the road, weather, and traffic conditions under which school buses operate, he is surprised that deaths and injuries from school bus accidents, in Ohio, are as low as reported. Even this number is too high; we must work constantly to reduce school bus accidents. The purpose of education is to improve the lives of children, and none of these lives are expendable.

We cannot maintain even one point to a good record. Every parent expects his child to be safely transported to and from school each day. The child should be and can be transported safely. It is the grave responsibility of school officials to provide the people with the safest and most efficient system of school transportation possible for every tax dollar expended.

There are many areas of school transportation in which improvements can be made to add safety and efficiency to the program. We can improve equipment, maintenance, supervision, driver training, and many other facets of the operation of school buses, but the area of concern for this speaker is routing. It is my firm belief that in the area of school bus routing, great strides can be made toward safety and efficiency.

This possibility was recognized by the Ohio Department of Education, and in September of 1960 I began my work as routing consultant and assistant to John Parsons, supervisor of transportation, Ohio Department of Education.

Upon written request from the board of education of any Ohio public school our services are available to help make a survey of the routing plan of the requesting district. It is the purpose of the survey (1) to analyze the routing plan in use at that

time, in light of the four general objectives of safety, adequacy, efficiency, and economy; (2) to determine the needs of the district regarding routing of pupil transportation, being guided by the previously mentioned objectives; and (3) to propose a definite routing plan for pupil transportation that would contribute to the safe, efficient, and economical organization of the school district.

The data for these surveys are drawn from such sources as: the office of the county board of education, county highway department, files of the superintendent or local executive head, building principals, and bus drivers. These data are collected by the superintendent, or the local executive head or their designated assistant, and each district is responsible for the accuracy of its own data.

The information collected and procedure for these surveys involve securing detailed maps of the school district, trip sheets or bus time schedules of the present system, definition of attendance areas, equipment inventory, and school board policy for transportation, if any exists. The existing bus routes are plotted on the map, the school sites are located, boundaries are defined, and students are located along the routes by use of colored map pins, coded to the vertical organization of the school system.

The services of our department are given in the route reorganization process, which involves inspection of roads, route construction, mileage measurement, location of pick-up points, shake-down runs, and driver and/or board of education conferences.

After the survey has been completed, a very detailed report is filed with the local board of education, the county superintendent and one copy is retained by our department. This report contains a complete analysis of the routes of the system in use and those of the plan proposed as a result of the survey. The report also contains a comparison of these two routing plans, plus conclusions drawn from the survey and recommendations for improvement.

Since September, 1960, we have completed some twenty odd surveys in Ohio schools. Most of these have been in districts that have had recent consolidations of rural territory. Although, the local board of education is not obligated to follow the recom-

mendations of our surveys, we have been quite well pleased with the number of districts that have indicated their intention to adopt our proposals this school year. A follow-up of these districts should give some indication of the success of our efforts next year and aid in evaluation of our methods.

You may be interested in the results of these surveys, and I will now present the most numerous conclusions consistently drawn from our studies.

1. The complete lack of board of education policy on school bus routing contributes to the inefficient and uneconomical organization of the present transportation system. This lack of policy also makes the administration of the system difficult and inadequate to meet the needs of the future.

2. The number of buses used in many districts at the present is excessive, and due to the reorganization of the school district, it should be possible to reduce this number by several methods that will be mentioned later.

3. The amount of backtracking on school bus routes can be reduced by proper routing at a considerable savings to the board of education.

4. The number of side spurs to the main bus routes should be reduced in order to save travel time and cost. This would extend the range of the bus and contribute to the safety of all pupils by eliminating some turn-arounds and pick-up stops.

5. The number of pick-up stops should be reduced. This would decrease travel time, extend the range of the bus, and reduce operational cost of fuel and maintenance.

6. Single-trip routing should be eliminated, and double or multi-trip routing used wherever possible to decrease operational cost of drivers and equipment. This would increase the efficiency of equipment used and decrease the number of buses needed.

7. The exclusive use of loop routes limits the range of the buses. They can only pick up pupils within an area limited by one-half the travel time of the route, since they must pick up pupils during the whole travel time. A shoestring route does not pick up on the way out, therefore, it saves travel time and can range farther from school. Not all situations lend themselves to both types of

routes mentioned, and it should be remembered that the loop route can reduce dead-head mileage and should be used wherever possible.

8. Unsafe turn-arounds and stops should be eliminated.

9. The length of routes should be equalized as much as possible to properly utilize drivers and equipment. This may also eliminate some routes altogether, thereby, reducing the number of buses needed.

10. Overloading and underloading could be prevented by constant route revision.

11. Proper assignment of pupils to school and bus route can prevent overloading and underloading, and help equalize length of routes.

12. Small-capacity buses necessitate short routes that are expensive because the number of buses needed increases. When purchasing new buses, larger buses should be considered.

13. When planning routes, dead-head mileage should be eliminated except in cases where shortening routes are needed to extend the range of the bus for scheduling purposes.

14. Travel time on the bus should be equalized for all routes as much as possible. This time should not exceed over one hour for high school pupils and forty-five minutes for elementary students.

15. The long elementary school day caused by transporting the high school and elementary pupils on the same bus should be eliminated. When transporting high school pupils to a different building than the elementary site, dual routing should be used. This decreases the number of buses and drivers needed, and increases the efficiency of equipment.

16. The traditional routing practices and restrictions of the old system should be ignored. New route planning should consider the school district as a whole, and routes and pupil assignment should be made for efficiency of operation.

17. Route revision should be made constantly, and administrator-bus driver conferences should be held periodically.

18. Express routes should be used where possible, especially for high school students. This would decrease travel time, eliminate

pick-up stops, and extend the range of the bus.

19. Feeder cars should be used in areas where the regular route would be too long or an extra route would be underloaded. The feeder car could eliminate unsafe turn-arounds, and long side spurs. The feeder car would also be an aid in scheduling.

20. The average number of pupils transported by a bus in a day should be increased to reduce per pupil cost.

21. Average trips per bus per day should be increased to eliminate the low average mentioned above.

22. Average one-way trip should be lengthened by eliminating excessive stops, side spurs, and turn-arounds.

23. Travel time should be decreased for elementary students and increased for high school students in some cases.

24. Average daily mileage of the buses should be increased to give a lower per mile cost and per pupil cost because of the use of less buses.

25. The extreme range in the composition of the bus load, travel time, and pick-up stops contributes to discipline problems for the drivers and principals and safety hazards for the students.

26. The extreme range in the bus load, stops, and daily mileage contributes to the inefficient use of equipment and driver's time.

27. The use of more buses than needed requires more capital outlay for new bus purchase during the depreciation period of the fleet.

28. The use of more drivers than necessary requires more supervision and salary outlay each year.

29. Maintenance costs should be spread over the smallest fleet necessary.

We do not intend to generalize upon these conclusions at this time, but we believe that another year of such investigation will point the way in which school bus routing should move in the future.

It may be interesting to you to know that in every survey conducted to date, our cost estimates have indicated that a decrease in either the per pupil cost or the per mile cost or both may be expected, as a result of route reorganization. Coupled with this

reduced operational estimate, is another cost reduction in capital outlay for bus purchase because of a reduction in fleet size. The estimated savings in annual operating cost have been as high as \$20,000 in one instance, and the capital outlay savings in this case estimated at \$50,000.

More important than cost have been the indications of improvement in safety such as reduction in stops for a given age group, less or bus. A reduction in side spurs and turn-arounds improves safety, as does the separation of age groups, decreased travel time, and elimination of waiting periods in many cases.

The administrative changes made possible in many cases indicate a better organization of the school day, the curriculum and staff time.

If, after such limited study of the routing situation in only one state, I were asked to state the most urgent needs of school bus routing today, I would suggest the following areas as most important:

Boards of education should consider, write and adopt policy to guide the administration of pupil transportation. This policy should at least be concerned with the following basic questions:

1. The maximum travel time for high school and elementary pupils on school buses.

2. The maximum speed at which buses will be permitted to operate.

3. The maximum time that transported pupils arrive at school before it opens or wait for a bus after school is dismissed.

4. How far normal pupils must live from school in order to be entitled to transportation.

5. The types of physically handicapped pupils entitled to transportation.

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6. How far pupils are required to walk to the main bus line from side roads.

7. Whether the bus will stop in front of each pupil's home on the main route, or only at spaced stops, limited in number by a required minimum distance between stops. It is not suggested that the policies are all-inclusive or that they meet all the needs of all districts. They are presented as essential statements for providing safe, economical, and adequate service.

Boards of education should provide for supervision of pupil transportation in the person of someone other than the head administrator. The problems of pupil transportation today require more time than the head administrator can devote to the job.

Boards of education should adopt the dual routing system for pupil transportation. The high school pupils are transported on separate routes from the elementary pupils. This procedure will free the elementary school from the restrictions of the high school schedule. Dual routing also will reduce the number of buses needed because some of them can be used for more than one route. This is a simple matter of scheduling the start of the high school first in the morning, and elementary school last; this is a matter of board policy.

Boards of education should provide for a public information program to show the need for change in the transportation system. This program should be started long before the actual change is put into effect to avoid public opposition to quick change.

In the final analysis, let us not lose sight of the fact that the purpose of safety, efficiency, and economy in transportation is to make available the better educational program which, after all, is the basis of our existence.

AN OLD AXIOM — SCHOOL BUS ACCIDENT SUMMARY — 1960

By DOUGLAS M. FERGUSON

Superintendent of Safety—Personal Lines,
Nationwide Mutual Insurance Co., Columbus, Ohio

I'm happy to appear here before you again. It's always a pleasure to talk to the leaders in the field of school transportation safety—even when I have to discuss the statistics of our business.

Statistics is never a popular subject—unless they refer to something "vital" and especially interesting, like 38-24-36.

Sir Thomas Browne, an English author of the 17th century, must have had something "vital" in mind when he wrote: "I have often admired . . . the secret magic of numbers."

More to the majority viewpoint, I think, was one of Sir Thomas's compatriots—a bloke named Shakespeare—who noted in his play, "Much Ado About Nothing," that "comparisons are odorous."

The statistics I'm going to review here today may not be as interesting as 38-24-36, but they're every bit as "vital." They pertain to the safe transportation of our "most important cargo"—our school children.

To get into my subject, I cite an excerpt from a report of the 99th Annual Convention of the National Education Association last June. Meeting in Atlantic City, 10,000 N.E.A. members adopted a resolution on the protection of children. That resolution said:

Safety of school children is among the prime concerns of all educators. Yet, despite continuing efforts of school and community groups to prevent accidents and fires, adequate safety remains a serious problem. The National Education Association urges all members of the education profession to continue to use and to expand the day-to-day opportunities for teaching the principles and practices of safe living which are pertinent to their fields of instruction. The N.E.A. calls upon school boards, teaching staffs, and administrators to intensify their efforts to provide physical settings which protect children, to give meaning to the principles of safety, and to enhance the development of safe behavior.

N.E.A. convention resolutions supplement the N.E.A. platform in two ways: (1) by directing the Association's officers and staff

to take specific actions, and (2) by stating the position of the N.E.A. rank-and-file on matters which are educational in nature, national in scope, and of current importance to the teaching profession.

Two things about this particular N.E.A. policy statement are apparent: (1) its scope is greater than the interest of this group here today, and (2) the need for safely transporting an increasing number of children to and from school is the herculean task challenged by the resolution.

Many people, it seems, no longer believe that they can influence actions in their sections of the world. This apathy—this tendency to "let George do it"—may be due to the great international power struggle and the war threats it involves; it may be due to the mighty scientific advances which are announced almost daily; or it may be caused by the world's population explosion and a feeling that one or two people don't count for much anymore.

But whatever the reason for this lack of "go-power," it's up to us—we in this room—to fight it, overcome it, and to pursue the problems of safe transportation with renewed faith and conviction.

We are the leaders—and the manner and methods by which we lead will largely determine the strength and character of those who will follow us, of how many will follow us, and of how good a job we'll all eventually do.

So it's up to us—you and me—to make school transportation safer.

But as I mentioned in this same setting one year ago, we'll see more darkness before we see daylight. With families migrating en masse to suburban homes and with the resulting increase in consolidated school districts, the problems inherent in school transportation have assumed gigantic proportions—and these problems will continue to get worse, instead of better, unless the trends of recent years are reversed.

This is the challenge I throw to you now

Never before have America's school transportation facilities so badly needed the active support and guidance that you can provide. Your demonstrated leadership and experience are absolutely necessary, if the success we all hope for is ever to be realized. That's why I challenge each and everyone of you—in harmony with our colleagues who are absent today—to assume active roles in promoting a safe school transportation system.

Now accident statistics, by themselves, aren't worth much. They're sometimes nice to know, and they may even be nice to look at—but they do not become meaningful unless they are related to a common denominator or inter-related to themselves. For my purposes today, I'm going to inter-relate some statistics through successive years. By doing this, I think I can chart a trend—a trend that should alarm you as much as it has alarmed me.

First, let's look at the progress that's been made in recent years in securing annual school bus statistics from the various states in the U.S.A. In 1953, such data was furnished by 30 states; last year, 48 reported. That's an encouraging increase . . . but before we become sore from mutual back-slapping, allow me to insert a somber note.

Forty-eight states reported last year. That's a fact. But a number of them *still do not separate* their school bus accidents from the total reported for *all* bus accidents. In other words, any accident or fatality involving a passenger-carrying vehicle is recorded in some states. Thus, we safety people don't get all of the information we should to help us plan our attack against accidents. So (if you haven't already done it), I suggest that you acquaint yourself with your state's reporting format and—if it does not conform to procedures recommended by the National Safety Council—I urge you to launch a campaign to bring about adoption of the Safety Council's recommended reporting in your state.

Now, to more accurately measure the size of our school bus safety problems, let's use the reports from the individual states and see how much of an increase there's been in the number of school buses in operation. In 1953, 30 states had 80,000

school buses running. Last year, the number in 50 states was 176,471. I think you'll agree from this comparison that the size of our school bus operation is challenging enough for anyone.

Looking at another angle of our problems, how is the migration to suburbia proceeding? Well, in 1953 five million pupils were transported to and from schools daily. And by 1960—only eight years later—the number had skyrocketed to nearly 12½ million.

Turning to a third area to get the pulse of a rising tide of urgency, let's examine the accident involvement rate of school buses. The figure stood at 2,941 in 1953—and at 8,908 in 1960.

At this point, some of you may be thinking that these advances in numbers transported and accident involvements are not too bad when compared with the increase in school bus usage.

I ask you, though, to please withhold judgment until I make some additional analyses. Because again—this time in the area of school bus accident involvement—some states do not delineate between school buses and public carriers in their annual safety reports. And I don't mean to minimize the tragedy of commercial bus accidents when I indict those states which fail to attach sufficient importance to school bus mishaps to warrant separate accident-reporting data.

When we have accidents, of course, we can anticipate personal injuries. That's as sure as summer and winter, day and night, or flies at a picnic. Statistically, 701 students were hurt in school bus accidents in 1953, and the number had almost tripled by 1960, when 2,067 pupils were injured.

I admit that we might be inclined to look favorably upon these injury figures as they relate to previous data, but again I warn you that such a conclusion will be premature and possibly erroneous.

As long as we have an increasing number of school buses in operation, an increasing number of school children-riders, and an increasing number of injury-producing accidents, we must also expect more fatalities. In 1953, 13 boys and girls were killed while engaged in activities incidental to riding on school buses. In 1960, the number of dead was 50—or approximately four times what it was eight years previously.

My research indicates that previous speakers have given separate treatment to student fatalities which occur on buses and to those which take place while students are going to or from school buses. This separation of information has led to an idea that injuries and deaths occurring while pupils are boarding or dismounting somehow differ from those which take place while the loaded bus is actually moving and transporting its young charges.

I, personally, cannot agree—either with the arbitrary separation of reports of accidents on and accidents off our school buses or with the conclusion that such separation seems to support.

For reasons beyond the intended limits of my presentation, I submit that injuries and fatalities occurring both on and off school buses should be reported together as part of the buses' total operation. I strongly believe this—and I'm exercising the prerogatives of that belief in presenting this accident summary material to you today.

If we now draw the component parts of our problems into one picture, we see what I believe to be a significant, shocking truth. In the period between 1952 and 1961, inclusive, the number of states submitting school bus statistics (but still with some discrepancy), has increased 60 per cent; the number of pupils transported has increased 150 per cent; the number of buses operated has increased 119 per cent; the

number of school bus accidents has increased 203 per cent, and the number of pupils killed has increased 285 per cent.

Now: to those people who have lost confidence in their ability to influence actions in their parts of the world, I ask—what would this school bus safety problem have looked like if every school board could have prevented only one accident or only one injury? How would it look if every state had been able to prevent only one fatality? You know the answers to those questions. But you have to get the questions and the answers to others—and then take them and help us act to solve all of the problems.

Since my assignment is to review the reported school bus statistics for 1960, I can't conclude without going through some more figures. But since you have the same state-by-state data as I (and if you don't, you can get it from the National Safety Council), I'll spare you the agony of a more lengthy report.

Guided by the ancient adage that "the mind can absorb only what the seat can endure," I'm cutting short my part of the program with a tabulation of school bus facts by region. I hope these figures—when compared with the statistics of your state and your neighboring states—will be of interest and value.

In making my tabulation, I have divided the United States into nine regions.

Region	Number of Buses	Number of Accidents	Number of Pupils Transported Daily	Number of Injuries	Number of Fatalities
NEW ENGLAND (Me., N.H., Vt., Mass., R.I., Conn.)	8,351	163	642,543	67	0
MIDDLE ATLANTIC (N.Y., Pa., N.J.)	22,868	1,048	1,971,182	376	7
EAST NORTH CENTRAL (Ohio, Ind., Mich., Ill., Wis.)	32,422	1,079	2,303,890	148	6
WEST NORTH CENTRAL (I.D., S.D., Neb., Kan., Minn., Ia., Mo.)	28,944	1,076	1,041,236	358	2
SOUTH ATLANTIC (Del., Md., W. Va., Va., N.C., S.C., Ga., Fla.)	30,766	2,858	2,453,917	698	14
EAST SOUTH CENTRAL (Ky., Tenn., Miss., Ala.)	18,096	740	1,330,254	160	16
WEST SOUTH CENTRAL (Okla., Tex., Ark., La.)	19,283	414	1,131,216	128	4
MOUNTAIN (Mont., Idaho, Wyo., Nev., Utah, Colo., Ariz., N.M.)	8,502	347	437,948	53	6
PACIFIC (Ore., Wash., Calif.)	12,620	1,186	1,179,190	148	1
CONTINENTAL U.S.	176,471	8,368	12,280,474	2,067	50

In closing, let me say that the picture I've tried to present here today is not a pretty one. I deliberately refrained from using "honey-coated" words or phrases in my presentation with the hope that my words would arouse you—and that you, in turn, would arouse your neighbors and the people of your communities—and that finally all of the citizens and officials of our nation would be awakened—before it is too late.

Active leadership is needed now! Progress is not automatic. The world grows better—not because people wish that it can—but because they know that it can and pitch in and take steps so it can be made better. And we've all got to push and shove and make it better if we're ever going to have the safest transportation possible for school children—"our most priceless cargo."

PUTTING THE RIGHT ANGLE INTO DRIVER SAFETY MEETINGS

By HOWARD R. CHEEK

Supvr. of Transportation, Board of Education of Harford County, Bel Air, Md.

Good safety meetings do not just happen. As a matter of fact, there are far too many school districts in the United States where safety meetings for bus drivers are nonexistent. There are far too many school districts which do not have an organized safety program of any kind in the area of pupil transportation. This is true, not because the administrators in these districts are not concerned about the safe transportation of their pupils, but because this problem gets lost in the multiplicity of problems which cross their desks daily. It is true because they are understaffed and overworked. It is a situation which will continue to exist until the problem is put in its proper perspective and corrective action is taken.

The prevention of accidents is primary among safety considerations and it is my hope that it will not take a series of tragic bus accidents across the nation to impress the people that proper supervision of the bus operation is a vital necessity.

This is exactly what happened in the state in which I live, Maryland. The schools in Maryland are organized on a county system. Since there are 23 counties and Baltimore City, which is a separate political subdivision, in the state there are only 24 school systems. Up until two years ago, one of the county Boards of Education had appointed supervisors of transportation

and some had not. No state aid was made available to help toward the payment of the salary of such a person, and many counties felt that they could not afford such a "luxury."

This situation existed for a number of years, until one morning a train hit a school bus which had stalled on the tracks. Seven high school pupils were killed. Several committees investigated the circumstances surrounding this accident, one of which was appointed by the Governor.

As a result, the Attorney General ruled that expenditures for adequate supervision of school transportation was a legitimate expenditure of state funds. The state Department of Education recommended that each county Board of Education appoint a full-time supervisor of transportation, and one assistant supervisor for each 100 buses in use in the particular county. A full-time state supervisor of transportation was appointed.

A full summer session, yielding six semester hours of credit in the field of pupil transportation, was offered last summer by the University of Maryland. Mr. Wesley Pickle of Tennessee and Mr. Mike Haggerty of Minnesota were obtained as instructors for the two courses offered. I feel that a giant step forward has been taken to assure the safest possible transportation of the school children of Maryland. I deeply

regret, however, that this step was not taken five years ago, and that it had to be purchased with the lives of seven children.

A great deal of time must be spent by someone in planning, organizing, and conducting training programs and safety meetings for bus drivers in school districts from one end of our country to the other. It is just as necessary in Oregon as it is in Virginia. The lives of the pupils in small school districts are just as precious as the lives of pupils in large districts. The first step that must be taken in many school districts is the delegation of the responsibility for pupil transportation to a specific person. The person to whom the responsibility is assigned must have a realistic amount of time to devote to this area.

In my opinion, safety meetings cannot be considered except as a part of the overall safety program for bus drivers. The person whose responsibility this program is must clearly understand what his objectives are and what part the safety meeting plays in meeting these objectives.

Let us consider a total safety program for a few moments. What are our concerns? What do we hope to accomplish? How are we going to go about achieving our objectives?

We are concerned, of course, with the safe transportation of pupils to and from school. That is our objective. We are told by the people who investigate accidents and compile statistics that over 90 per cent of all accidents are the result of driver error. We are, therefore, concerned with the elimination of driving errors by our bus drivers.

I think it axiomatic that the person responsible for the transportation of pupils must select bus drivers with great care. You do not hire someone to drive a school bus whose driving record is loaded with traffic violations.

After the driver is hired, he must be impressed with his responsibility and the urgent need for safe driving at all times. After the first impression, he must be constantly reminded. He must be made "safety conscious." We must change the "it can't happen to me" attitude which all drivers have. The driver must realize that, unless proper precautions are constantly observed, it can happen to him. He must also realize

that whatever happens to him also happens to everyone that is on his bus and who is dependent upon his driving. In essence, we must develop and constantly re-enforce a desirable safety attitude.

The safety meeting is one means of developing and enforcing this attitude. It is not the only means. There are many other things which can be done which will help to achieve this objective.

A safety meeting, however, should not be planned and conducted to develop this desirable attitude. The attitude of which I speak will be developed as a result of the total safety program, which should have a cumulative effect upon the driver.

Safety meetings should be specific in nature, and should treat one topic in detail. It is essential that drivers understand the need for the presentation of the particular topic covered in the meeting. The driver must be properly motivated if he is going to derive any lasting benefit from the meeting.

For instance, suppose a review of your accident reports indicates that several accidents involving school buses have occurred at intersections. Here is a specific problem, which presently exists in your school district, which can effectively be made the topic of a good safety meeting. A presentation of the problem, indicating that 15 per cent, or 20 per cent, or whatever the percentage actually is, of the accidents involving school buses so far this year have occurred at intersections should convince drivers that intersections are dangerous places.

Once the driver has accepted the fact that a dangerous situation does actually exist, he is ready to pay close attention to learning some techniques which will help him to stay out of trouble at intersections. Do not attempt to cover "tail gating" or adjusting to changing weather conditions at the same meeting. These are appropriate subjects for safety meetings on their own. Stick to the one topic which has been selected for presentation and do a good job on that topic.

A poor presentation on the selected topic, or the presentation of a topic which bus drivers do not consider important, can be detrimental to your entire safety program. Bus drivers who attend safety meetings

are attending at a time when they would ordinarily be doing something else. Housewives would be home taking care of their domestic obligations. Service station attendants would be working at their primary job. If they regard safety meetings as important, informative, and helpful they will willingly attend. If they do not, they will not. A poorly organized and conducted safety meeting can be worse than no safety meeting at all.

In organizing safety meetings, careful consideration should be given to the physical arrangements. The time and the place of the meeting should be carefully selected, as these factors will, in part, determine how many of your drivers will be able to attend. Some school districts obtain excellent results by having safety meetings in the evening. I find that, in my own situation, it is best to schedule safety meetings immediately after the morning bus runs, and to schedule them at schools where the majority of the drivers finish their morning runs.

This means that a good number of the drivers scheduled to attend this particular meeting are automatically at the meeting place at the appointed time. It requires less effort for them to stay and attend than it would if they had to make a special trip from their homes at some other time. There is also the advantage of having the educational facilities of the school, such as film projector, motion picture machines, tape recorders, etc., immediately available for use in the meeting. The environment is an educational one and will have some impact upon the drivers.

Careful consideration should be given to which drivers and how many of them attend any given meeting. The meeting will be much more effective if drivers freely participate in an expression of views and/or an exchange of ideas. This will not occur if the number of drivers at the meeting is too large, or if the drivers do not know each other.

In systems which require a large number of drivers, it will be necessary to hold the same meeting a number of times. These meetings should be held in different geographical areas of the system, and should be planned to include not more than about 30 drivers. From the discussions which oc-

cur during the meeting, the conductor of the meeting can often spot misconceptions which drivers have. This will sometimes indicate the need for a meeting devoted specifically to correcting an expressed misconception!

One of the major problems which must be faced in the establishment of a series of safety meetings is that of driver attendance. Bus drivers are just like any other kind of driver, in that they consider themselves considerably better than the average. Many of them have been driving school buses for some period of time, and will not have been involved in an accident of any kind. They consider themselves to be safe drivers, and there is a certain amount of resentment generated when they are asked to attend a safety meeting. The "what can they teach me about driving" attitude must be faced and overcome if safety meetings are going to play an important part in the total safety program.

How do we attack the problem of driver attendance? One way is to make it compulsory. I am sure that this is not the best way. The old adage that "you can drive a horse to water but you can't make him drink" applies to this situation. I think that compulsory in-service training may have some benefits, but I think they are very limited.

Drivers must see that the safety meetings are going to be of some benefit to them if they are to attend willingly. Your job is to make them want to come.

One method of applying gentle pressure in this direction is establishing attendance at safety meetings as one of the requirements for obtaining safe driver awards. This means that drivers who attend safety meetings are recognized on a higher level than those who do not. Drivers like to receive safe driving pins in recognition of the good job they have done. This technique will help to get them to the meetings originally. Whether they return or not depends upon their impression of the actual meetings. If they are helpful, interesting, and informative, they will come back.

The supervisor of transportation in one of the counties of Maryland recently informed me that he had solved the problem of driver attendance. I was rather skeptical, until he explained his problem

and solution. He had been interested in having all bus drivers trained in rudimentary first aid. He was able to obtain a qualified instructor from the regular teaching staff of the county. She was 22 years old, red headed, and had very complimentary measurements. The meetings were held in the evening, and he reported that, not only did the drivers show up, but he sometimes had considerable difficulty getting them to leave. I think his first step in organizing a safety meeting now is to train the red head so that she can be the instructor.

In planning safety meetings, please do not overlook the wealth of expert assistance which is immediately available to you. Be sure, however, that the person that you ask to help you is really qualified in the area in which you need help.

I have never been refused help from people who are knowledgeable in areas which I wish to cover in safety meetings. People throughout the country are concerned with safety on school buses, and will contribute whatever they can toward furthering it if they are asked to do so.

Insurance companies have field safety engineers who are experts in the field. They are more than willing to help, not only from a humanitarian viewpoint, but also because reduced accidents means better business for their employers.

State police are available everywhere and are anxious to help. The American Red Cross welcomes the opportunity to work with drivers in the area of first aid. Safety engineers employed by the government and by private industry have much to offer and are willing to help.

These human resources exist in nearly all communities throughout the country. Not to make use of their talents is a great waste.

Care should be exercised by the person who is responsible for safe transportation, however, that personal contact with bus drivers is not lost. Even when the problem to which the meeting is devoted is being discussed and treated by an appropriate resource person, the supervisor of transportation, if that be his title, should be in attendance at the meeting to introduce the resource person. He should remain throughout the meeting and help to get the discussion and exchange of ideas started.

He should be available after the meeting to talk with the one or two drivers who always have some question which they wish to direct to the supervisor. His presence indicates that the entire school system endorses and approves of the meeting and the concept of an organized safety program. Just as it is hard to visualize an effective faculty meeting without the principal, or an effective board meeting without the president of the board, it is hard to visualize an effective safety meeting without the person responsible for safe transportation in attendance.

There are two cautions to be observed in conducting safety meetings. The person conducting the meeting must realize that he is presenting the topic to a very heterogeneous group. In the group he will have housewives, farmers, retired army officers, service station attendants, and men who work the night shift at a local industrial firm. He will be confronted with educational levels ranging from completion of the third or fourth grade through graduation from college. The members of the group will have vastly different backgrounds. All of these factors must be recognized, and the material must be presented in such a way that it is understandable to everyone. It is always good to use visual aids as much as possible. Such aids might include motion pictures, film strips, overhead projector, and the use of flannel boards or magnetic boards. The last two are particularly valuable for setting up actual and hypothetical traffic situations. Remember that you are after understanding. More understanding will result if the presentation is on a level which is easily understandable by those making up the group. It is not necessary to impress them with our scholarship.

The second caution to be observed concerns the length of the meeting. When the objective of the meeting has been accomplished, stop! Just because the meeting is scheduled to last one hour is not sufficient reason to drag it out. When the appropriate understandings have been developed, everything else is superfluous. Interest will wane quickly, and drivers, when they are finally dismissed, will leave with a bad taste in their mouths. There is nothing sacred about one hour. A good 40-minute meeting is more to be desired than a half dozen poor one-hour ones. As I have stated before, drivers

will not willingly return to be subjected to poorly planned and conducted meetings.

In brief summary, the following must receive careful consideration in organizing and conducting effective safety meetings:

1. Some one person must be delegated the responsibility for school bus safety. This person must have sufficient time to devote to doing this job.
2. Time and place should be selected carefully so that it is easy for drivers to attend.
3. Number of drivers attending each meeting should be controlled so that meetings are not too large.
4. The safety meeting must be specific in nature. The objectives must be clearly defined.
5. The drivers who attend the meeting must be convinced that the topic of the meeting is an important one—one in which they are interested.
6. The presentation must be informative,

interesting, and geared to a level that is readily understood by the members of the group. Human resources in the community should be utilized.

7. Visual and auditory aids should be employed wherever possible.

8. The meeting should be adjourned when the objectives of the meeting have been accomplished.

9. Drivers who regularly attend safety meetings should be rewarded on a higher level than those who do not.

I would again urge that school districts across the nation take the necessary steps to improve the safe operation of their transportation system. I do not mean to imply that travel by school bus is presently extremely hazardous. It is far from it. I do think, however, that increased safety and increased economy can be realized if qualified, trained personnel are appointed to administer this phase of the school program. Do not wait until the horse has been stolen. The time to act is now.

ENCOMPASSING CONTRACT BUS OPERATORS IN THE TRAINING PROGRAM

By BENJAMIN W. NELSON

Supvr. of Transportation, Board of Education of Worcester County, Snow Hill, Md.

In the technological age in which we are living much attention has been focused upon the school system and imploring eyes are watching all of the supporting services which are linked to the total program.

Since transportation is one of the supporting services and we are involved in this endeavor, it is essential that the major purpose of pupil transportation services be defined:

1. To provide educational opportunities for all children regardless of the distance they may live from an appropriate school center of the proper grade level.
2. To provide educational experiences for children above that which might be obtained in a classroom situation.

With the listing of purpose, one needs to add the objectives that have been proven

necessary in the development of any satisfactory program of pupil transportation service. They are as follows:

1. **Safety**
The first objective is to provide maximum safety for all pupils to be transported and in so doing, the following items should be observed by the Board of Education:
 - a. Provide adequate and safe bus equipment.
 - b. Select drivers who are capable of operating large vehicles.
 - c. Make a thorough study of transportation routes in order to eliminate unnecessary hazards in operation.
 - d. Provide for the adequate supervision of drivers and the maintenance of equipment.

3. Economy

The second objective is to provide transportation services at a low cost. In order to maintain a program of pupil transportation within the available funds, it is necessary for a school system to make constant studies and revisions in order to achieve the best service from the funds available for this purpose.

3. Adequacy

The third objective in the operation of a pupil transportation program is based on adequacy of service. In an effort to provide adequate services for all eligible children within a school system, board of education should consider the following items:

a. A sufficient number of buses to provide transportation services on a system-wide basis for all children within a reasonable time limit.

b. Provide express type transportation services for children living in remote areas. This arrangement for services should be made to eliminate the necessity of children being required to remain on a school bus beyond the limit of one and one-half hours.

4. Efficiency

A fourth objective requires efficiency in operation. Since the efficient operation of a transportation program depends upon the placement of responsibility, it is necessary that the following factors be given careful attention prior to and during the school term by all responsible persons connected with the program:

a. Observance of time schedules on a pre-planned basis in order to eliminate inconveniences to those students meeting or waiting for school buses.

b. Selection of appropriate bus stops so as to minimize the danger of accidents on heavily traveled highways.

c. Provide a sufficient number of buses to prevent overcrowding and lengthy routes.

d. Employ capable drivers within the communities to be served.

e. Maintain adequate maintenance facilities to insure minimum expense and maximum safety in operation.

In order to insure that the philosophy and goals of a transportation program may be realized, it is essential that clearly defined policies be passed by the Board of Education.

It is felt by many that the following should be covered:

1. The general philosophy of the transportation program should be stated.

2. A detailed spelling out of operating procedures is required.

3. Consideration must be given to the type and capacity of the buses to be used.

4. There should be plans for routing and scheduling buses.

5. A specific declaration relating to pupil privileges and responsibilities is necessary.

6. Duties of various personnel must be defined.

7. A realistic system is needed for replacing buses in service.

8. A program of maintenance and repair is needed to keep buses in satisfactory operating condition.

9. Outline procedures for the transportation of pupils for field trips and extra curricular functions are required.

10. Proper training of contract drivers is necessary.

Recognizing the importance of the driver in the total transportation program and the objectives previously stated, our Board of Education put into effect a Pre-Service Driver Training Program.

At the present time the Board of Education will not employ any individual to operate a school bus unless he has successfully completed the program consisting of fifty hours of work.

The course consists of actual classroom work, with tests, plus supervised driver training and then the final check out, by the State Police in a bus over a pre-determined route, taking into account the skills learned in the training program.

Enclosed is an outline of the material covered in the course

Pre-Service Course for Bus Drivers, 1960-61

I. Content of course

A. Transportation

1. Importance of training program
2. Importance of transportation in school system

B. Responsibilities and regulations of school bus operation

1. State and county responsibilities for transportation

2. Contractor
3. Driver
4. School bus law
5. School Board regulations

C. The school bus

1. Bus care and maintenance
 - a. Driver's daily checks
 - b. Emergency equipment
2. Bus housekeeping

D. School bus operation—policies and procedures

1. Schedule
2. Loading and unloading
3. Railroad crossings
4. Stops and blinkers
5. Pupil discipline

- a. Types of bus problems
- b. The Principal and bus discipline
- c. Discipline on the bus
- d. School bus rules
- e. The Supervisor and bus discipline

6. Bus drills

- a. Front door
- b. Back door
- c. Two door

School Transportation Sessions

7. Accidents and how to prevent them

- a. Types of accidents
- b. What to do in case an accident happens

8. First aid

- a. The first aid kit
- b. What first aid should a driver use in his situation

E. Public relations

1. What and why
2. Who and how

F. Fire prevention

1. Causes of vehicle fires
2. Use of extinguisher

II. Driving skills

- A. Individual alertness test
 - Person rides in another bus and observes correct and incorrect skills displayed.
- B. Behind wheel test for each person over a prescribed route checking skills of performance.

III. Written tests

- A. Traffic and driving knowledge
- B. Psycho-physical tests
- C. Essay test on materials covered

A HEXAGONAL PROBLEM — SCHOOL BUS SELECTION

By M. R. LIECHTY

Engineering Consultant, International Harvester Co., Chicago

The selection of school bus vehicles is truly a six-sided problem. And even more than a hexagon, we might call it a revolving hexagon. As the six sides of this hexagon, we have selected (1) vehicle life and dependability, (2) vehicle repairs and replacement, (3) maintenance and operating expense, (4) spare units, (5) purchase price, and (6) vehicle application. And when we say that it is a revolving hexagon, you will notice that as your application of vehicles to the intended service is improved, your operating expense will be reduced. You will find that as the dependability of your vehicles rises you will re-

quire fewer spare units. You will find that as you spend more money on the original purchase price for better equipment, you will usually spend less money on repairs and breakdowns. Let's look at each of these items a little bit closer.

1. Safety

As a representative of the School Bus Chassis Committee of the Automobile Manufacturers Association, I can tell you with confidence that the chassis industry feels that we have come a long way up the safety curve, insofar as new vehicles are concerned. There are always things which

can be done. We constantly strive in the direction of added safety and some of the suggestions which we can make at the present time are these:

(a) *Power.* For many years school buses were built with barely enough power to drag the vehicle from its loading source to the school and back home. While other vehicles have been increasing in the power and performance areas, school buses have long been inadequately powered to keep in step with traffic. The new power formula, which was adopted by the national minimum standards for school buses in Lawrence, Kansas, in 1959, is now coming into full play.

It is a good formula for a minimum power standard. Vehicles which meet these standards will have better acceleration than the older buses and, in turn, will tend to help keep traffic moving, especially in congested areas and on high-speed highways. This power standard is a good minimum, but it does not preclude the chance that there are applications which need even more power for proper ability to accelerate and maneuver in traffic.

(b) *The driver's position.* We in the chassis industry feel that the driver's position, visibility, and driving attitude, has a tremendous impact on the safety of the school bus operation. We are not satisfied with the driver's physical position in the present day conventional school bus. Too often, while the driver can see well enough to operate the bus satisfactorily, he does not have the superb vision which he should have if we are to achieve maximum safety.

We, the chassis people, and our school bus technical committee are actively exchanging ideas with the engineers of the body manufacturers through their association, in order to improve on and eliminate this particular problem. We have already offered and are actively engaged in selling transit type units with the driver mounted in the front part of the bus where he has an excellent view, not only of the road ahead, but also of the pupils who are entering the bus itself.

(c) *Brakes.* It would be improper to talk about vehicle safety and not mention brakes, but it is our opinion that the single largest improvement in brakes is in the area of maintenance rather than with new equip-

ment. There are new things being offered, such as the parking brake, which is spring applied and air released and actuates the rear truck brakes when the air is lost on an air brake equipped vehicle, but the majority of school buses are still using hydraulic brakes.

There is a new split-system on hydraulic brakes which will be offered in the near future by various manufacturers to enable the operator to bring the vehicle to a stop on those occasions where a failure with the present system might cause a complete loss of braking. But the best safety factor in any brake system is still good maintenance—preventative maintenance, prior to failure.

(d) *Weight distribution.* When you select a new bus you should consider weight distribution, which is an important factor in achieving good vehicle balance and stability, but normally we in the industry do this for you by offering only those wheelbases on only those passenger sizes which result in satisfactory distribution.

(e) *Seating capacity.* We are sure you will agree, that in making new vehicle purchases, it is necessary to plan a seat for each youngster and at least 10 per cent more if it is economically possible. Natural population growth often forces some routes to pick up more pupils than can be properly seated, but in making any plans for new vehicle selection you will most certainly want to provide enough seats to accommodate all of the pupils and a few extras.

And, one more thing on accidents—we have attempted, for years and years, to avoid school bus accidents by stopping all traffic. In reality, traffic in this day and age on high-speed highways is safest while it is moving uninterrupted. It is our belief that the eventual long range goal in school bus safety must include a program where the school bus does not interrupt high-speed traffic. This may necessitate pull-off areas on congested routes and other new ways of loading and unloading which will allow traffic to move uninterrupted in both ways.

We think it is imperative that plans be started now to keep the school children completely off high-speed multi-lane highways. The very act of stopping traffic, in many instances, directly contributes to the accident. Today's school bus is much like

the Sunday driver—not a menace of himself, but breeding congestion, ill will, and discontent, all of which are safety menaces.

Now, what are the six sides of this problem?

Vehicle Life and Dependability

Certainly if you have any pride in your transportation organization you must have an excellent degree of dependability. Your buses must maintain accurate time schedules to allow a high degree of conformity on the route and thereby enable Mamma to have Johnny on the corner without making it necessary to wait for long periods of time in adverse weather. It is wonderful, for our purpose, that when we select a unit adequate to do the job in a dependable manner, that we normally also get longer life as an added bonus. There is no better bargain in school transportation than an extra year of dependable service built into a school bus.

Spare Units

Across our rotating hexagon, as life and dependability of the selected vehicles go up, the number of spare units you need to maintain rigid schedules will go down. This is a natural reaction.

Application

But dependability is also very closely related to the application of the vehicle in the intended service. Buses have been getting bigger and bigger for good reason. The population of the various areas has been increasing so as to enable the average school bus route to fill a larger bus in the same time. It is rarely practical to buy a school bus which cannot be loaded in one hour. Consequently, we expect that for many years stabilized communities will cause a sizable demand for 48 and 54 passenger units, but the areas where the population is increasing most rapidly are areas of dense population. In these fast growing densely populated areas, it is natural that we should lean more toward the 60 and 66 passenger units.

Using today's methods, the 66 passenger unit is the longest bus which we can build in a conventional type unit and still stay within the overall length limit of 35 feet. Since this bus will be operated in congested areas, and since it requires 256 inches of

wheelbase to properly distribute the load, it is too cumbersome to maneuver properly in congested areas. Further, in congested areas we can fill a bus of even larger size in a short time and this is where we recommend the transit type unit which can accommodate another row of seats. The transit type unit with the engine in the front, and capable of hauling 72 seated pupils, has only a 208-inch wheelbase of the conventional 66 passenger unit. This shorter wheelbase results in much better maneuverability and the driver is "up front" where he can see.

With the engine mounted in the front, the transit type bus needs a beefed-up front axle and front suspension system to carry the extra load, which is suspended ahead of the front axle. The axle entrance way is less than ideal because of the engine cover which uses up a large portion of the floor area in the front of the chassis. The forward control unit does retain an innate identity with normal truck parts. The engine, transmission, radiator, and shift controls are all in positions similar to normal truck operation, allowing a high degree of standardization with other parts and a reasonable purchase price.

To gain the ultimate in application for congested areas, we suggest the pusher bus with the engine mounted in the rear; this bus includes the advantages of short wheelbase, ideal driver location, flat front floor with unlimited aisle room, and ideal load distribution with the 1/3—2/3 front to back load distribution ratio, which allows each tire to carry its proportionate part of the load.

The price goes up a bit because it is designed as a bus instead of a truck, but the application is ideal. In visiting with school bus people over the years, we have often been faced with the question of compromises between a truck chassis and a bus chassis and have been asked to build a vehicle specifically for bus service. The pusher bus unit is such a unit and is designed from the ground up to haul young people.

Other applications, which we must recognize in order to complete the job of getting the pupils to school, are cases which transport the physically handicapped, requiring special driver attention, and many areas are hauling small loads over long distances.

In still other applications, it is ideal to use small vehicles for feeder buses to congregate more pupils in pick-up areas where the larger units can pick them up fast and then make multiple trips to the school. For such an application, a small vehicle, such as the *Troveland*, is gaining popularity and serves a very important purpose. Directly across our hexagon is maintenance and operating expense.

Maintenance and Operating Expense

When it is possible through good application to use five large units instead of six smaller units, then you can save one driver, the housing and greasing expense, and the driver's supervision that goes along with each separate unit. If the six units should be 60 passenger units and the five units should be 72 passenger units, it would result in exactly the same seating area. It is easy to see that when our application is improved, maintenance and operating expenses will go down. But when we talk about the proper application reducing maintenance expense, let us not talk about shoddy maintenance. We sincerely believe in preventative maintenance in school buses, to tear down and inspect, repair and replace all parts before they have a chance to fail in operation.

Other things enter heavily into the particular application and should be considered when making the school bus selection. Such things as cold climate where additional heater capacity is needed. And even time zones such as an area which uses daylight saving time, might use headlights, clearance lights and other lamps sufficiently to warrant buying larger generators. So the selection of the proper equipment to fit the particular application is directly related to the maintenance and operating expense. And what else must be remembered? Repairs and vehicle replacement.

Repairs and Vehicle Replacement

Maintenance and operating expenses are very closely related to repair expenses. For instance, in making recommendations for the national minimum standards, it was the consensus of that group, that a 12-volt 35-amp low-speed cut-in generator was a satisfactory minimum to be used on school buses nationally. The statement has often been made and we repeat it here, that so

often the minimum becomes the maximum. People who select school bus chassis are too often inclined to select components without sufficient analysis, especially on technical capacity of items such as generators.

This can result in a vehicle with inadequate electrical capacity to replace the current drawn from the battery. When this happens, it can only mean trouble. A battery is exactly like a checking account—you cannot draw out more than you put into it. In order to avoid dead batteries, many states are now setting a minimum of 12-volt 50-amp low-speed cut-in generators and even this size is not adequate for all applications. Always compare your generator capacity with the expected current draw.

The wide-spread use of heavier axles, bigger brakes, larger and more powerful engines, in the same application, will reduce the expense of costly repairs and substantially lengthen the vehicle life.

Purchase Price

And to get back to our hexagon—it is not surprising to see that when you take some definite steps to buy adequate components, reduce repairs, and lengthen vehicle life, then the purchase price goes up. Now the purchase price is very important in the vehicle selection and often is the one outstanding factor which is used in determining what the final selection of vehicle should be. We all know that the purchase price is important, but I contend that the price does not warrant the attention which it receives in making a school bus selection because the best is often cheapest in the long run. But price has been over-emphasized to an extent where our hexagon is out of balance. Prices go too low, repairs go up too high and vehicles are replaced more frequently than necessary.

The transportation industry has concentrated its last ten years in large part to the problems centering on economy of operation—cost per mile of units hauled. In coping with this problem, many facets are involved but I would like to make it appear simple by comparing two typical truck users.

The individual, who owns and drives his own vehicle, often faces his biggest obstacle in purchasing new equipment. He must keep the price low because of the money required to finance the deal and

makes his payments out of proceeds earned by the vehicle. Price is important to him, so he buys a highly stressed vehicle and squeezes out every drop of revenue it can produce. It puts him in business but he is not getting a low cost per mile.

The larger operator or company which has better access to capital funds needed to finance the purchase of ideal equipment, is buying more expensive, low stressed equipment. These operators are rewarded with more dependability, longer life per vehicle, less repair expense, and lower cost per mile of units hauled.

Most school buses have long been in the category of high stressed equipment with short vehicle life because of the emphasis on purchase price. I am happy to see bus users taking a good look at the over-all expense of operation and, therefore, leaning farther over to the side of low-stressed long life equipment as an ideal long range way of reducing the cost per mile per pupil hauled.

So there you have it—a six-sided problem of selecting a school bus, but all revolving around safety and written bid specifications; we must never compromise on safety, and we will always have written bid specifications because most buses are owned by public schools—in fact, our last accurate figures indicated that 64 per cent of all school buses are owned by public schools, 10 per cent by private schools, with the remaining 26 per cent by contract haulers.

I am sure that the 26 per cent of the buses which are owned by contract haulers are selected with all the factors which we have discussed here, carefully considered in the vehicle selection. I am confident that the 10 per cent owned by the private schools are carefully selected, based on all six-sides of the hexagon, but very often the 64 per cent which are selected by the public schools, are selected with the purchase price as the prime factor. When the purchase price is the prime factor in school bus selection, an age-old proverb comes into play; namely, that nothing is so bad but that someone else can make it a little worse and sell it a little cheaper.

I am sure that the transportation officials who buy all of their buses on written bid specifications and low bid realize this and

consequently spend almost 100 per cent of their time, which should be devoted to the vehicle selection, to writing bid specifications. It is, consequently, important that we give it some consideration when we talk about selecting a school bus.

On the one side of the ledger we have the people who actually make their vehicle selection based on good and bad experience, and then write their bid specifications so that the vehicle which they have selected will comply and other vehicles will not comply. This gets the job done in a sense, but we could not, in all fairness, contend that this is free and open competition.

Other people tend to set their own arbitrary standards of brake lining area, engine cubic inches and other physical dimensions, which enable the user to select vehicles with components which have previously been found necessary to satisfy his requirements. This also gets the job done in a sense, but this method has some bad side effects which we in the industry do not like. We know that a larger brake will last longer in a school bus operation, but if you buy brakes on their size alone then you destroy the initiative of the engineer who is constantly striving to build a longer life brake in the same size.

We know that an engine with a larger cubic displacement will last longer, but when you start buying engines on size alone, then you destroy the initiative of the industry to build more efficient engines and to build more engine life into engines which are of adequate size and power to do the job. When you specify clutches by diameter because you desire longer clutch life, then you give no credit to the countless number of people who are working on better linings in the same diameter and tremendous strides are being made in this area.

But, generally, when you buy school bus vehicles on price alone, then you are assuming that all of the vehicles offered are exactly equal and you destroy the incentive of individual companies to build more quality and longer life into their specific bus. You must recognize the differences if quality is to be an incentive to the manufacturer.

So it is the recommendation of the chassis industry that written specifications be based

on performance standards rather than physical dimensions. Tell us what you want this vehicle to do and how you want it to react so that we can take the resources which we possess, our efficient staffs of engineers and testing personnel, to build you the vehicle to do the job which you want it to do. Tell us what you expect by way of vehicle performance and vehicle life. Tell us what problems you are encountering which need to be solved and let us help you with them.

When you write bid specifications, take the time to investigate your specific needs

and write specifications which will result in the quality of merchandise that is required in your application. And when you make your selection from those offered, pick the units that are most economical in the long run, buses that will add to the dependability of your time tables and add to your vehicle life, that will reduce repairs, cut down your operating expenses and eliminate accidents.

Let the local chassis people help you with written bid specifications so that this six-sided figure will become balanced and resolve the way it should—around safety.

THE APEX IN SCHOOL BUS MAINTENANCE

By JOHN M. PARSONS

Supervisor of Transportation, Ohio Dept. of Education, Columbus, Ohio

Pupil transportation in the U. S. today is a big business. It is big in size, big in cost, and a big operation to administer. In many schools across the Nation, pupil transportation is the big problem of school boards and school administrators, and this problem is still growing.

A few short years ago pupil transportation was a small auxiliary service to be tacked onto the school budget and to be administered easily by spending a few hours with several bus drivers. Today the cost of pupil transportation is a major item in the school budget, and administrators spend many hours struggling with the problems that accompany this growth.

Pupil transportation is no longer an auxiliary service, but a necessary and important part of the total education program. Transportation is essential for the operation of most school systems today. The school bus has also become an extension of the classroom in many school systems. The use of school buses for educational trips such as field trips, county and state testing programs, county vocational schools, etc., is increasing.

School transportation is being used not only to transport pupils to and from school, but to extend the educational horizon, to help attain the American ideal that every

child, regardless of where he lives, or his physical handicaps, has the right to an adequate educational opportunity.

School transportation can be expensive, and it is becoming more so in an increasing amount annually. Many factors are helping to increase the cost of pupil transportation today. School district reorganization and consolidation have expanded this service to a vast number of students who now attend schools in areas far from their homes. The migration of large masses of city people to the suburbs has increased the number of students to be transported.

Mechanization of the farm has reduced farm population resulting in more sparsely populated farm areas. This, in turn, has caused an increase in the size of rural school attendance areas. The steady increase in our population, coupled with the fact that students attend school more years than in the past has added to the burden of pupil transportation.

School districts in the past have been typically small in area and population, because school districts were small the need for pupil transportation did not create any urgent fiscal consideration by school boards.

School boards were able to operate their pupil transportation program with a small fleet involving very little capital or opera-

tional outlay. These small fleets were usually maintained by local garages and since most schools had small fleets their yearly maintenance cost would be very minor in comparison to other component parts of the school budget.

For instance one district in Ohio ten years ago had a fleet of two school buses. The total operational expenses for the two buses for an average year was \$2,400. Today this district by consolidation inherited 20 additional school buses. The average operational cost ten years ago per bus was \$1,200. Considering the present average operational cost in Ohio for each individual bus at \$2,100 the total operational cost for this district with 22 buses would be \$46,200, not a small item anymore for school boards to consider.

Also, to be considered by school boards is the capital outlay needed to transport all eligible students. Replacing 22 buses at one time would cost a school board approximately \$132,000. Therefore, it is of the utmost importance, due to increasing operational cost and capital outlay, for a district to establish a safe, efficient and economical maintenance program that will insure maximum longevity for their school bus fleet.

I. Developing a Summer Maintenance Program

It is of the utmost importance for school districts to establish a maintenance program, not only for economy and efficiency but also for the safety of our students transported. A maintenance staff dedicated and responsible for a safe operation is the apex of a safe, economical, and efficient maintenance program. We in Ohio feel that during the summer months is the critical period and at this time a maintenance foundation for school buses needs to be established.

In other words, this is the time when mechanics can do a superb preventative maintenance analysis and have the necessary time to make proper repairs. If this foundation is not built strong enough during the summer months, then a maintenance problem is created for the coming school year.

In Ohio our summer issue of the *Pupil Transportation News Letter* is devoted entirely to maintenance. The following are some of the helpful hints and preventative maintenance tips we call "trouble shooting"

that are used to guide mechanics in their preventative maintenance program.

Low Oil Pressure: can indicate clogged oil pump, worn main bearings, worn rings or loose lines—small leaks are not too difficult to spot, and it has been estimated that an oil leak of one drop every 30 ft. will account for a gallon of oil in about 400 miles of driving.

Valves which do not seat properly, or do not have clearances adjusted properly can often be detected by sound, and, of course, can always be detected by the compression test.

Cylinder Head and Block: A defective head gasket or a warped head or block will result in loss of compression. Cracks in the head or block may be indicated by water on the spark plugs or in the oil pan, and may result in loss of compression, water in the fuel mixture or improper lubrication.

Engine Mountings: Visual inspection can be made to see if they are very loose. If the mountings are not kept tight, damage can be done to the clutch and/or drive line parts.

Clutch: In those buses equipped with a conventional transmission, power is transmitted through a clutch. Improper adjustment, i.e., no pedal free travel, will cause a slipping clutch which, of course, can be quite expensive. Improper driving habits, such as driving with the foot on the clutch, can lead to the same result. A dragging clutch is most likely caused by too much pedal free travel and natural wear must be compensated for by adjustment of pedal linkage.

Transmission Noise: Noise which seems to come from the transmission, may be caused by another assembly such as the axle, propeller shaft, universal joint, or clutch. Transmission noise may also result from the use of improper or insufficient lubrication, or from poor driving practices. Of course, if the gears are worn or broken, or the bearings on the shafts are bad, replacement is required. This is expensive.

Propeller Shafts and Universal Joints: Excessive noise or vibration can be caused by lack of lubrication; also if propeller shafts are not assembled with universal joints in the same plane, vibration will result. Worn universal joint bearings or journals or a sprung propeller shaft will cause vibration and noise.

Axles: An unusual noise is usually the first indication of improper functioning of axle driving parts. Noises which seem to come from the axles may be caused by the transmission or tires. If there is a continuous axle noise, drive the vehicle on soft ground. If the noise ceases, it has been caused by the tires and not the axle. If the noise continues on soft ground, it is caused by worn or improperly adjusted wheel bearings, worn or improperly adjusted differential gears and bearings, or insufficient lubrication in the differential. If the axle noise is heard in drive only, or in coast only, this is an indication that the differential pinion and ring gear are out of adjustment or excessively worn.

Wheels, Hubs and Tires: 1. Excessive or unequal tire wear—unequal tire pressure may be responsible. Inflate all tires to the recommended correct pressure. 2. Front wheel misalignment will cause unequal tire wear. Check and correct. 3. Bent wheels or damaged wheel bearings will cause uneven tire wear. Replace if necessary. Hard steering may be caused by under-inflated tires, steering gear in need of adjustment, or lubricant. Front wheels out of alignment or wheel bearings in need of adjustment.

Steering System: Proper operation of the steering system is closely related to other units in the vehicle. Steering difficulties may involve such factors as front axle alignment, front spring suspension, tire inflation, wheel and tire mounting, wheel bearing adjustment, frame alignment and brake adjustment.

Springs: Break of spring leaves is usually the result of overloading the vehicle or driving at excessive speeds over rough routes. The bus carries a plate giving the manufacturer's recommended gross vehicle weight. This recommendation should be followed, or if this is not possible, allowances should be made when driving the vehicle. Loose or missing rebound clips, or loose U-bolts can also cause spring failure. Frozen shackles, due to lack of lubrication, will also cause spring failure, and also cause springs to break.

Shock Absorbers: Where furnished, are an important part of the suspension system with the springs. They should be checked and filled or replaced when they do not serve their function of damping out rebound.

Brakes: Today's modern buses subject their brakes to terrific stresses. Therefore, it is imperative that brakes be kept in adjustment. If linings are allowed to wear too long, or if shoe contact is not true on the face of the brake drums, wear will be far more rapid and brake drums can become egg-shaped or out-of-round. To correct this wearing is far more expensive than the routine inspection. Tightening of connections, slack adjusters and the like and relining—should be part of your standard preventative maintenance program.

Body Maintenance: During the summer all school bus bodies should be checked for rust spots, deteriorating flooring and seats, emergency door operation, replacement of glass, body attachment to chassis frame, first aid kit, all warning devices and lights, fire extinguishers, flares, pots, etc.

Summer months are an ideal time for mechanics to touch up all rust spots or repaint portions of body. Older buses should be repainted. This will add longer life for the body, and will eliminate need to replace a school bus because of body deterioration.

A preventative maintenance summer inspection check sheet should be available for the mechanics and all buses should be checked thoroughly during the summer. We mail a check sheet to all schools early in the spring as a reminder to the maintenance staff that a preventative summer maintenance program should be a complete and thorough analysis and repair of the school bus chassis and body.

II. Developing a Preventative Maintenance Program.

Preventative maintenance is the necessary apex for a successful and economical school bus operation. An efficient and effective preventative maintenance program is the key for dependability; in fact, it is essential that school bus fleets maintain a dependable service. School administrators depend upon the pupil transportation staff for an operation that will deliver the students to school daily and on schedule.

Commercial bus fleets are adequately maintained, not only because road failures must be kept to an irreducible minimum, but because preventative maintenance is the cheapest way to maintain a bus fleet. Railways and airlines practice rigid preventative

maintenance to avoid mechanical failures during scheduled operation and to reduce total operating expenses. School buses must also be maintained properly if reliable and low operation costs are to be achieved. Safety of bus equipment is almost wholly dependent on preventative maintenance because even the finest bus becomes unsafe if proper inspections and preventative services are not provided.

Preventative maintenance differs from regular repair or replacement maintenance. In comparison, a preventative maintenance analysis or inspection is similar to an annual physical examination. Doctors evaluate and analyze the working parts of the human body to ascertain the need for a preventative medical program before the body has a serious major breakdown. This preventative program for human beings tends to extend the length of our life expectancy.

It is imperative to have a staff trained in proper methods and procedures for diagnosing trouble. Just as a doctor is trained for diagnosing human sickness so should the maintenance staff be trained in diagnosing mechanical sickness. A superb preventative maintenance program will extend the longevity, prevent major breakdown, and provide a safe, efficient and economical school bus fleet.

Developing and administering a good program of preventative maintenance for school buses is a cooperative undertaking that begins with the top level policy-forming officials and runs throughout the entire organization. Failure to place maintenance on a policy-forming level is a mistake that often results in inadequate care for school buses. A good maintenance program must be planned and executed, at the level of organization responsible for the transportation system.

III. Developing a Dedicated Maintenance Staff.

Developing a basic fundamental attitude and dedication toward preventative maintenance is one of the most difficult things to

accomplish. The development of a proper attitude by the maintenance staff is one of the basic goals that needs to be achieved if a good program of preventative maintenance is to be established. The maintenance staff should constantly be looking for new methods of improvement and dedicate themselves to perfection.

This is often difficult to develop since looking for work to do and its perfection is a concept not always easily acceptable.

The men who drive and service buses must fully believe that every bolt and screw has a definite function to perform, and unless each is in its place, the bus is not complete. Maintenance cannot effectively function where drivers and servicemen do not value the little things that do not immediately impair bus functions. A driver who is genuinely concerned when he knows that the slightest thing is wrong with a bus has a good maintenance attitude. He simply cannot let minor ailments go without attention.

A maintenance staff dedicated to an efficient and safe program of preventative maintenance needs to have many qualifications, but basically they should be dedicated to the following fundamental requirements:

1. Knowledge of all parts of a school bus, and especially the correct function and location of each part.

2. A pride or satisfaction in good workmanship. A good maintenance attitude can be satisfied only by doing things the right way all the time.

This kind of attitude toward preventative maintenance can be developed only through long and careful training. The need for careful attention to small details and the need for exact workmanship must be emphasized by school administrators, training and supervisory personnel, and by everyone having anything to do with school bus operations. Without this emphasis, it is impossible to develop a preventative maintenance program sufficient to insure long, dependable service, and economical operation.

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WHERE ARE WE? — WHERE ARE WE GOING?

By FRANKLIN M. KREML

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Where Are We? The Plus Side and the Minus Side.

1. Reduction in the death rate from 16 in 1935 to 4 in 1961. (If we had continued at the old rate we would today be killing over 150,000 people a year.)

However, personal injury and property damage accidents continue to rise and the cost thereof continues to mount steeply. The reduction in the death rate results in part, at least, from better handling of the injured at the scene of the accident and improved medical care in our hospitals.

2. Despite the fact of congestion, which is, of course, undeniable, we are moving at better speeds than ever before almost everywhere. But, with billions of dollars invested in facilities for movement and storage, we fall substantially short of the high level of potential efficiency present in these facilities, because we are unwilling to expend a greater sum—but still a very small percentage of the total—for adequate control, supervision, regulation and official personnel, necessary therein.

3. There is a greater public awareness of the problem than ever before, resulting from the great attention given by the mass media, but little of what appears in the public press informs with sufficient instructiveness to result either in better individual practices or in better individual or organized citizen activity. And beyond this, we cannot help ponder whether, after two decades of killing between 30,000 and 40,000 people a year on our streets and highways, the American people have not, by and large, come to accept this as a part of the American scene.

4. Accident prevention operations at all levels, both governmental and civic, have been generally improved, ranging from the prosaic though fundamentally important work of accident investigation, which now is being done intelligently if not scientifically in most American police departments, to more effective planning, both substantive and administrative for dealing with the problem.

On the other hand, one is dismayed by the time that it takes to get acceptance of application of these new operational methods and techniques. The worth of accident investigation and the basic methodology of carrying it forward was developed in this country in 1929, for example, but there are still many police departments which do not apply the modern, efficient version of this technique, despite the ready availability of texts, manuals and training schools.

5. Speaking of schools, training and education in all areas of traffic accident prevention is at an all-time high. Only a few short years ago—to, at least—there was but one such school, this being the then Harvard Bureau of Street and Highway Traffic Research, established in 1926—six students. But with the coming of the Automotive Safety Foundation on the scene, followed almost immediately by the Kemper Foundation for Traffic Safety, subsequently other substantial casualty insurance support, and finally the Insurance Institute for Traffic Safety, many other schools sprang up, including California, New York University and Northwestern University, to name but a few of the literally scores of institutions engaging in training and education in this field.

6. Yet, one cannot but be concerned over the superficiality of much of this training and the relatively few people trained, measured against the country's need, particularly since this springs in large part from our failure to develop a corps of teachers and instructors.

7. Research is going forward in an amount only dreamed of by my colleague and good friend, Sidney Williams, long-time director of public safety division, National Safety Council. Some of this research, particularly such as that going on at Cornell, has been most encouraging in that it has made a substantial, fundamental contribution to improved safety—in this case (Cornell) in the automobile itself. Heartening, too, is the substantial interest, supported by quite large sums of money, of the Department of Health, Education and Welfare and the National Councils of Health.

On the other hand, by way of a single, pertinent example, the apathy of the public towards the adoption and use of seat belts—though their usefulness has been irrefutably established by Cornell—is appalling. And I fear that at least some of the research supported by the National Councils of Health is more concerned with meeting academic standards of research than the urgent public need.

8. More money, both public and private, is being spent than ever before in the cause of traffic accident prevention—even excluding the great multi-billion dollar highway program—and this is important, of course; for the work cannot go forward without financial support. But even so, in relation to the size of the problem, the amounts being spent at all levels of American life, are almost completely inadequate. Thus, to quote from Justice Clark's speech at the Traffic Institute's 25th Anniversary Dinner, of the 80 billion dollars spent annually for automotive transportation, only one billion is spent in the area of traffic accident prevention—that is, only 1/80th of our total expenditure is devoted to insuring safe operation and use.

9. As a result of this added support, we have today more good people in the professional ranks of traffic accident prevention than we have ever had, but they are still too few and we have failed to get our share of the bright young lawyers, sociologists, political scientists, economists and even engineers. Our professionals, in the main, still come out of the work background of our enforcement agencies, engineering bureaus, motor vehicle departments, etc. It is good, of course, to have people of practical experience, but it would be even better had they had also a fine academic preparation that would help to give them the breadth of basic comprehension, the vision and the competences for the solving of new problems that we today continue to cope with on mainly the basis of the "best practice in the field."

10. Coordination between the professional safety people and the organizations which they make up at the national, regional, state and local levels, is better, I believe, than at any point in the past. This has been brought about, particularly at the national level, by the efforts of the ASF and the NHTS, and by the Bureau of Public Roads, which, with

their central control of funds and an appreciation of the truly important objectives, have brought about cooperation by the careful—and in many cases stipulated—allocation of monies.

However, individual and organization prestige program area prerogatives, and ordinary human jealousies have kept the field from presenting the kind of unified, coordinated front that makes the best use of all of our resources in dealing with the common problem. This situation is aggravated by the fact that some of our programs at all levels, including the national, are still largely, if not wholly, inadequate to the task to which they address themselves.

I am idealistic enough to suppose that this can be largely overcome, particularly if, as indicated earlier, we were to get our share of the bright young graduates of the country's university system.

In summary, we have progressed; we continue to progress but not enough or nearly fast enough and in a fashion that is, in my considered professional judgment, substantially wasteful of the resources of money and people available to us.

Where Are We Going?

1. The U. S. population by 1975 will be 225 million; 80 per cent will be concentrated in our great metropolitan centers. It is estimated that we will have in operation 113,642,000 motor vehicles that year. The only comment I wish to make here is that every such estimate we have made in the past has been low. These vehicles will not only be operating throughout the great metropolitan areas, but will, increasingly, be moving over the 41,000-mile interstate highway network which should be about completed by then.

Other forms of personal transportation, taking advantage of developments in jet propulsion, ground effects vehicles and electronic control systems based upon our missile tracking and guidance system principles, will be emerging—may, in fact, be numerous—may result in the obsolescence of the then recently completed highway system!

The capacity of state and local governments, as now constituted, to cope with the problems resulting from such growth and change in personal transportation is doubtful, and the contemplation of the cost of

the assumption of this responsibility by the federal government is horrifying.

Thus, we are going forward with programs, personnel, administrative machinery and governmental structure that are not adequate to cope effectively with our present problems into an era of larger, compounded, more complex and difficult problems than ever before—with no real plans to make our programs, personnel, etc., adequate.

What Do We Need to Do?

1. We need, as Sidney Williams so frequently pointed out, to mature; to grow up to our machines, to cause them to serve us—not victimize us—from the automobile to atomic energy. This is easily said, but not easily done, and is a responsibility of all people—not just Americans and certainly not just people engaged in the work of street and highway traffic accident prevention.

2. We need, to make our total national traffic accident prevention program much more effective than it is now. To this end, we need:

a. As I said earlier, a greater share of young college-educated people with an orientation to this field. If this means the encouragement—even support—of special fellowships to the baccalaureate and graduate level for likely young students as a part of a program of positive recruitment, we should do this, for the field will, after all, be no better than the people.

b. More substantial and long-term funding is needed, for we are, I think, still trying to bring down the bear with an air rifle. Even more important than this, we must develop, beginning at the level of the national organizations, a degree of operational coordination that will insure the best use of available resources. Unless we, who

are quick to assert the prerogatives of our leadership, accept the responsibility of it as fully, we shall court catastrophe in the years ahead, even as we did during the 20's and early 30's as a result of our inability to deal with the first great growth in the use of the automobile.

c. State, county and municipal government reorganization must be undertaken. It is patent that present governmental organization below the federal level is inadequate to the problems developing with the growth of huge metropolitan concentrations over large areas: the magalopoleis of tomorrow which are practically here.

d. I believe that one of the constraints within which we in accident prevention now operate is the deep concern of every one with the all-important question of war or peace. We must, of course, be concerned; and we must be ready morally and militarily for whatever lies ahead.

However, a very important part of our military and moral preparation is the conservation of American life and hands, which will be sorely needed if we pit ourselves finally against the great population masses of Russia and China. Beyond this, and in my view more important in the long run than the military consideration, is the fight for men's minds on the fundamental proposition of the importance of the human being versus the importance of the state.

We can contribute greatly to the winning of this—the real war—if, through our free, representative processes we deal as effectively and decisively with traffic accident prevention as I know we can, thus demonstrating our humanity, our sanity, our capacity, as a people, to effectively govern ourselves. To do less weakens us ideologically, morally, and militarily, and may cost us our freedoms, our lives, our world.

WHAT OFFICIALS WANT FROM CITIZENS' SUPPORT GROUPS

By HON. BEN WEST
Mayor of Nashville, Tenn.

I endorse and encourage the formation of citizens support groups for our traffic safety programs. I think we should encourage them, keep them informed on the overall picture of traffic safety, and foster a closer relationship not only between each group and their local government, but also between the various groups themselves. If there is more than one, it is evident that they often work at cross-purposes with one another, although all have the same ideals. I consider those thoughts worthy of repetition here with, perhaps, some elaboration.

The first thing an official wants from support groups is their cooperation. I have in mind the type and sort of cooperation which would cause them to clear with the proper department any project they might have in mind undertaking before actually embarking upon it.

I would want the degree of cooperation from them which would make them seek and then use the advice and counsel of responsible officials.

I would encourage them to establish criteria which would engender recommendations to their officials which were based on facts, not on hysteria, or selfishness, or because "it worked somewhere else."

Next, I would want them to exercise reasonableness in the sense of advocating projects which have a possibility of being successfully completed. A lot of effort, both public and private, go into the promotion of projects which have only remote chances of success. This energy channeled elsewhere would not be wasted.

Reasonableness also would keep their activities aimed at traffic safety and disconnected from the realm of partisan politics.

Reasonableness would see the elimination of petty, personal complaints, and the arbitrary advancement of "pet projects."

What sort of support should be expected? I do not know of any responsible public official who would not welcome the support

of good, constructive criticism. This criticism, however, ought to be made directly to the official involved and not to the news media for publicity's sake alone. Many good ideas have died in their infancy because of premature publicity and a lack of information given to public officials on the purposes of the program.

Along with the criticism should come positive suggestions from the group designed to sincerely correct the criticized action or lack of action.

Issues which are controversial need grassroots support. This could easily come from support groups if done in the right way. Community peace and harmony might be shored up and a higher degree of working relationship established if the support group laid the true facts before the official in the initial stages and afforded him an opportunity to evaluate the facts and determine the validity of the project. I am confident every official would enthusiastically promote any issue which possesses a reasonable chance for success. If issues which are not probable receive all the full attention of the support group, and the official is in the position of having to oppose such measure, then his and the support group's stand are both weakened in the eyes of the public.

In our own organizations, yours as well as mine, we should not view a new idea with skepticism simply because its author is not a traffic safety expert. An idea is good, if it is good, no matter what its origin might be. If the idea has merit, steps should be taken to develop and exploit it, even though it came from the newsboy on the corner.

I am not a traffic expert. Neither are most of the others actively interested in traffic safety. But we can all be public relations experts in this field if we want to.

Demographers, the population experts, predict an increase of some sixty million people by 1975, which shows that the American people have not been entirely asleep.

Figures submitted to my subcommittee by the Bureau of Employees' Compensation show that for 1959 we had 3,912 federal civilian employees injured in motor vehicle accidents, and 50 deaths. These employees lost 421,010 days from work as a result of these accidents, for a total direct cost to the government of \$4,335,307.

I have pending in the Committee on Interstate and Foreign Commerce, a bill which would do something about this. This bill, H.R. 1341, would establish safety standards for government-owned passenger-carrying motor vehicles. Extensive hearings have been held on this measure and have accumulated an impressive amount of favorable testimony from doctors, engineers, scientists and safety experts.

My bill not only would help to reduce the cost of highway accidents to the government but also would promote the building of safer automobiles for the public. Forced to meet safety standards set by the government, manufacturers would be encouraged to offer these same features as optional equipment or, perhaps, as standard equipment. Furthermore, government approval of certain safety features no doubt would lead to widespread public demands for the inclusion of these features on models offered the public.

That is what happened in the case of seat belts. When federal agencies, led by the Public Health Service, began installing and using seat belts, the public began to take interest. The states began to take interest. State legislatures passed laws requiring seat belt attachments on new automobiles. The industry then began offering front seat attachments on 1962 models.

In our hearings on motor vehicle safety, the American Medical Association submitted a list of safety features repeatedly recommended by physicians, researchers, and safety engineers with little success. These included seat belt anchorages, crash padding, improved steering wheel, safety door locks, removal of dangerous knobs, securely anchored seats, the elimination of pointed hood ornaments, and other hazardous exterior design features.

My bill, which passed the House in 1959, has been reintroduced and is now pending before my subcommittee. Hearings have been held but some question has been raised as to which agency should set safety stand-

ards and we have not worked out that problem.

The bill was bitterly opposed on the floor of the House on the grounds that it would increase the cost of automobiles bought by the government. Even if it did, I say the increased cost would be justified. But cutting down on deaths and injuries will save money, even if we could measure the worth of human life in dollars.

Furthermore, many or all of these essential safety features could be paid for by eliminating chrome and frills which serve no useful purpose. But, you will note that some of these recommendations such as eliminating hazardous knobs and gadgets, would cut costs. So economy cannot be the whole reason. There seems to be pride of authorship factor working here which makes any suggestion from a mere Congressman offensive to a professional designer of automobiles.

Be that as it may, the federal government has a responsibility to its civilian employees and military personnel to provide them with the safest passenger vehicles possible. There is no question of states' rights here. It is just a question of saving human lives and reducing expenses for disability pensions and death benefits.

At the same time, by putting safer cars on the market we will be making a real contribution to safety.

Earlier, I mentioned the growing demands from the public that the federal government do more to promote highway safety. Pressure increases each year for more drastic remedies to meet this problem.

Now, I am not one who believes that passing a law is the ideal way to solve any or all of our problems.

As a nation, we abhor regulations, and rightly so—especially regulation at long range from Washington. We like to see things which must be done accomplished voluntarily. But the fact that we have food and drug laws is proof that things, even essential things, cannot always be done voluntarily. The fact that we have federal regulation of aviation is proof that business, even big business, cannot always regulate itself.

Traditionally, we have relied on the states to set safety standards for passenger automobiles.

The states could force the industry to build safer vehicles and to provide the minimum safety features our doctors think are essential. This was suggested in a report to Congress in 1959 by the Department of Commerce.

That report said: "There are residues of weakness in automotive design and function, however, to which manufacturers and public officers alike need to give further attention."

Now, this is the Department of Commerce speaking and Lewis L. Strauss, the Secretary who submitted the report, cannot be accused of being a wild-eyed visionary or an enemy of business.

Continuing, the report had this to say: "Many states require certification through their motor vehicle departments that these standards have been met. An expansion of such standards, and a more widespread use of the certification process by the states, would lead to quicker adoption of desirable vehicle safety features."

A very good example of where the states could and should tighten up laws to protect the public is found in the situation facing a motorist who wants to buy some automobile brake fluid.

Last year, when Chrysler found that 28 per cent of the brake fluid sold in the Detroit area was substandard, I checked up and was surprised to learn that although 27 states and the District of Columbia had regulations covering the sale of brake fluid, in only about ten instances were the regulations really effective.

Now, an ordinary motorist just has no way of knowing when he has been sold substandard brake fluid and may not find out until his brakes fail at some crucial moment.

I understand that some of the states have tightened up their laws since I introduced my bill to establish federal standards for brake fluid but if the situation is not a whole lot better when Congress convenes again in January, I am going to press for early action on my bill.

In another area, the federal government may be forced to take action. That is in trying to curb the smog menace.

More than a year ago my subcommittee held a hearing on methods of controlling so-called blow-by gases, which we are told

account for 40 per cent of the smog-producing fumes caused by automobiles.

An inexpensive device for piping these unburned gases back into the engine will eliminate these blow-by fumes. Secretary Flemming, head of the Department of Health, Education, and Welfare, in the last administration, recommended the voluntary installation of these devices as standard equipment. The present secretary has joined in that recommendation.

Federal legislation may be necessary to force the installation of this device. We will have to wait and see. But air pollution is one of our major health problems and the public is demanding action.

I have introduced a bill to require that drivers in interstate commerce hold permits from states which have permit laws substantially in conformance with the Uniform Code. Perhaps this should be amended to require physical examinations. I understand that Pennsylvania now is the only state which has a physical examination requirement stringent enough to weed out all those unfit to drive.

I would go further than forcing the states to meet the minimum requirements of the Code regarding permits. We might even amend the law to cut off federal highway funds to states which do not adopt the uniform code.

I think we will all agree that most of the states are lagging in setting minimum requirements for drivers. Serious violations, such as driving while drunk, are being winked at. Potential killers are being left on the highways. There is too much ticket-fixing. In some of the states driver licensing laws are little more than revenue measures. Permits are renewed by mail on payment of a fee. Persons retired for physical disabilities are permitted to drive without physical examinations.

The federal government has not hesitated to require strict physical examinations for all airplane pilots. Why should we hesitate to require the same high standards for motor vehicle operators? It is a well-known fact that there are 75 million drivers of trucks and automobiles who constantly move over Uncle Sam's highways. Yet, our highways are literally filled with drivers who are color blind, partially blind, drug addicts, alcoholics and people subject to black-outs.

Persons with mental deficiencies and physical defects which should disqualify them from operating cars drive on high-speed interstate highways.

There is a great difference in dear old Uncle Zeke who drives from the farm to the country store in a small rural community and the same man driving on U.S. Highway Number 1 from Washington to New York.

While I have been an advocate of the construction of safer automobiles and still am convinced that industry can do a better job, I am perfectly willing to admit that one cause of our heavy accident toll is that operating the modern automobile calls for better physical and mental equipment than many states require.

I am constantly amazed at the tenacity with which many people fight to keep their drivers licenses as if driving were a God-given, heaven-endowed, or contractual right. To drive is a privilege, not a right.

People who would not dream of harming a neighbor by fostering a nuisance which endangers public health, think nothing of loading a car with the grandchildren and children of a neighbor even though they may require a magnifying glass to read a newspaper.

If the states cannot or will not do something about these potential killers, it is time for the federal government to take action.

I have not covered all of the areas in which my subcommittee has taken an interest but I have tried to hit the high points and give you an indication of the way things are going in Washington. Your comments and suggestions will be deeply appreciated by all members of the Subcommittee on Health and Safety, which has the responsibility of developing and considering plans and programs.

We welcome the counsel and advice of all those interested in this problem of highway safety.

THE INTERSTATE HIGHWAY SYSTEM

By ELLIS L. ARMSTRONG

Pres., Better Highways Information Foundation, Washington, D. C.

Perhaps our present most challenging problem in safety is that connected with highway traffic. The nearly 40,000 people killed and one and one-half to two million injured each year in accidents on our highways, with economic losses now totaling seven billion dollars a year or more, emphatically demonstrate the magnitude of this problem.

While we are making progress in reducing the accident rate, the continually increasing number of cars on our highways and the increasing miles of travel justify intensifying all efforts to reduce this great loss to our society. All three E's of making highway travel safer—engineering, education and enforcement—must each receive increasing attention. We must not become hardened into accepting death on the highways as death by natural causes.

Over a couple of holiday weekends each year we do get quite concerned over the

terrible rising score of deaths as the weekend draws to a close—as this ghastly rising number is hourly drawn to our attention by the news media. We don't always appreciate that this score is not much different from that which we chalk up day after day, week after week, every month of the year. On an average, over 100 people are killed every day on our highways.

Education and enforcement apply to the important element of the problem, which is people, and the way they act and react. Engineering applies primarily to the other two elements, the vehicle and the road. And progress is being made in engineering vehicles and roads for greater safety. No doubt, this progress also has a good effect on the driver's attitude and actions.

I was interested in a statement made in a recent report on highway construction in Italy and on their accident problems: "In 80 per cent of the cases casualties can

be traced back to violations of traffic regulations and carelessness; however, it is known this type of behavior is seldom observed with an efficient road system." The three elements of the problem, and the three E's of the solution are extensively interrelated.

Our modern highways incorporate numerous features which improve the safety of travel on our roads. One of the big problems is catching up with the needs. We now have an accelerated highway improvement program underway and are beginning to make progress, but we still have a long way to go. One of the most important parts of our present program is the National System of Interstate and Defense Highways.

The 41,000-mile Interstate is actually the backbone of our entire nationwide highway system. It is the basic network of controlled access, high capacity highways, with no grade intersections, generally divided roadways, and entrances or exits only at carefully controlled and engineered access points. It is a single purpose system, designed for the free flow of high volumes of through traffic with maximum safety. It is being designed and constructed to meet the traffic needs of 1975.

Traditionally, roadways have provided access and service to abutting land, and have served as parking areas, as well as providing for traffic movement. With increasing traffic volumes and speeds, new concepts were forced to meet the needs. The freeway concept, which the Interstate reflects, received its first big tryout with the Reichsautobahnen in Germany, on which construction began in 1933. Its prime function was to provide fast, uninterrupted movement of military traffic. The principle had been established by the Autostrada toll roads in Italy built a few years earlier.

Nationwide investigation was ordered by Congress in the Federal Aid Highway Act of 1938. "... with respect to the feasibility of building, and the cost of, superhighways not exceeding three in number, running in a general direction from the eastern to the western portion of the United States, and not exceeding three in number, running in a general direction from the northern to the southern portion of the United States. . . ." There no doubt were differences of opinion as to just what constituted a "superhighway" but the Bureau

of Public Roads in preparing the study used standards very similar to those now being applied to the Interstate System.

This study was the first complete assembly of data on the use being made of our national highway network and emphasized the need for a special system of direct inter-regional highways, with all necessary connections through and around cities. A number of other extensive studies followed, along with lengthy Congressional hearings, and finally culminated in the Federal-Aid Highway Act of 1956 which launched our present accelerated 15-year highway construction program, including the National Interstate System designed to catch up with present-day needs.

The Interstate is a logical development of our automobile age. The concept of access control is the first significant change in essential characteristics of road layout since the days of the Romans. It provides for our present-day needs for arteries carrying large-volume, high-speed traffic safely and efficiently and insures against obsolescence.

Need for Interstate System

The mobility of a population is a basic criterion of the growth, development and economic well-being of the citizenry. The freedom of movement in our modern-day America is unique, and has come about because of our rubber-tired automobile and our highways, and has actually created our present way of life. Early in America's history, the main arteries for movement of people and goods were the waterways. In fact, our first President had a 'grand plan' for a great interstate system of canals, and canal building was the first big public works construction program of the nation.

During the first half of the nineteenth century, construction of roads and trails progressed, but the growth was short-lived with the coming of the railroads, which took over most long distance movements of people and goods. Great economic growth and development followed the railroads. The railroad construction era was one of the great epics of America.

However, by 1900 travel for the average citizen was still unusual. One writer commented concerning the low excursion rates coming into vogue for special railroad or steamboat trips and stated that even travel was becoming possible for the common man.

This was only 60 years ago and is quite a contrast from the present average citizen who travels 10,000 miles per year in his automobile.

The invention of the self-powered, horseless carriage in 1893, followed by the development of mass-production methods, resulted in an ever-increasing number of automobiles on America's highways. This, in turn, brought about the development of our highway network; during the 1920's and the 1930's great progress was made in highway construction and betterment. However, most of these roads were built for low-volume, low speed traffic.

Following World War II the accelerating number of automobiles on our highways aggravated the highway neglect during the war and resulted in highway improvements getting further and further behind the needs. Highways and city and town streets were not designed for the traffic which tried to use them, and traffic accidents increased their deadly toll. The potential of the motor vehicle was limited and in some urban areas severely curtailed by congestion.

Road widening was accomplished and bypass routes were constructed, but generally to meet existing emergencies, and usually became overloaded when the ribbons were cut. Without access control, good bypass highways deteriorated to city streets as businesses moved out and set up along the roads. Many were, and still are, pessimistic about being able to provide for the highway needs of the present age.

However, the individual freedom of movement and of choice provided by our automobiles and highways, the widening of opportunity for employment, social contacts, better living environment, recreational and all aspects of modern life is something we like and is basic and we must realistically accept that it is here to stay. Transportation is consumed in production; the relationship between highway travel and the values of the total goods and services we produce each year is quite constant: 1.4 miles of travel for each dollar of goods and services. We now have over 75 million motor vehicles on our roads and we expect that in 1975 this will increase to about 115 million.

Traffic is the very lifeblood of our entire economy; and this is particularly true

of our cities. The requirement is for a varied, unimpeded flow of cars from area to area and from function to function. And it is this need that the Interstate meets, as the basic high-capacity, free-flowing part of the overall highway system.

To be most effective, a well integrated, balanced system of feeder and service streets and highways is required, along with the necessary freeways to supplement the Interstate, to make up the entire highway system. And in some of our more densely populated urban areas, the highway system requires supplemental rapid transit facilities to satisfy the transportation needs.

Purpose of the Interstate System

Federal law concerning the Interstate System provides that:

"It is hereby declared to be in the national interest to accelerate the construction of the federal-aid highway system, including the National System of Interstate and Defense Highways, since many of such highways, or portions thereof, are in fact inadequate to meet the needs of local and interstate commerce, for the national and civil defense.

"It is hereby declared that the prompt and early completion of the National System of Interstate and Defense Highways, so named because of its primary importance to the national defense and hereafter referred to as the Interstate System is essential to the national interest and is one of the most important objectives of this Act. . . . Insofar as possible in consonance with this objective, existing highways located on an interstate route shall be used to the extent that such use is practicable, suitable and feasible. It being the intent that local needs, to the extent practicable, suitable and feasible, shall be given equal consideration with the needs of interstate commerce.

" . . . The Interstate System shall be designated within the United States, including the District of Columbia, and it shall not exceed forty-one thousand miles in total extent. It shall be so located as to connect by routes, as direct as practicable, the principal metropolitan areas, cities, and industrial centers to serve the national defense and, to the greatest extent possible, to connect at suitable border points with routes of continental importance in the Dominion of Canada and the Republic of Mexico.

" . . . The geometric and construction standards to be adopted for the Interstate System shall be those approved by the Secretary in cooperation with the State highway departments. Such standards shall be adequate to accommodate the types and volumes of traffic forecast for the year 1975."

The geometric and construction standards adopted by the various states and approved by the Secretary of Commerce state that " . . . The highways of this system must be designed in keeping with their importance

as the backbone of the Nation's highway systems . . . they must be designed with control of access to insure their safety, permanence, and utility and with flexibility to provide for possible future expansion. . . . All known features of safety and utility shall be incorporated in each design to result in a . . . system . . . which will be a credit to the Nation." Minimum standards are outlined with the statement that it is expected that designs will generally be made to values as high as are commensurate with conditions.

Thus, by law, the present 41,000 mile system is a high quality, high capacity freeway network providing for efficient, safe, smooth-flowing traffic. It will compose 1.2 per cent of the total highway mileage but is expected to carry in 1975 over 30 per cent of the total traffic. Of the total mileage, 6,700 miles have been designated in urban areas. This urban mileage when completed will carry about one-half the traffic on the Interstate, and according to present estimates will involve 42 per cent of the total cost.

The Interstate incorporates 2,274 miles of toll roads and bridges as a part of the system. To supplement the Interstate System, additional freeways have been built and more are in the planning and construction stage. The general practice today is to design and construct new highway facilities to meet the traffic demands and the freeway is the answer where heavy traffic needs exist. California, for example, has a 20-year plan for about 10,000 miles of freeways in addition to the State's 2,100-mile Interstate System, to meet the needs of the increasing traffic ahead.

Cost of the Interstate System

The estimate of 1960 of the Interstate shows an average cost for the 41,000-mile system of about one million dollars per mile, the same as the 1957 estimate. This breaks down to approximately four million dollars per mile for the urban sections and 680,000 dollars per mile in the rural sections. Right-of-way costs average about 15 per cent, being six per cent in rural areas and 25 per cent in urban areas.

The real measure of costs, however, is the cost per unit of service, the vehicle mile, that the facilities provide. A detailed analysis of the cost of ownership of the

Interstate System, compared to other federal-aid highways was recently made by the Bureau of Public Roads. These costs include capitalization of the construction costs including right-of-way, and the costs of maintenance, operation and administration.

The study shows that the unit cost of service provided by the Interstate System is approximately 0.4 cent and is the same for both rural and urban as compared to about 0.7 cent on the remainder of the federal-aid primary system and three times as much on the federal-aid secondary system—approximately 1.2 cents. While the cost per mile of Interstate is high, it is by far the most economical way to provide for motor vehicle traffic when sufficient travel demand exists.

Because of the national importance of the Interstate System, the federal-aid matching ratio is 90 per cent federal funds and 10 per cent state funds, as compared to the normal 50-50 matching federal-aid ratio. The federal funds came from the special highway trust fund built up by Federal taxes on gasoline, rubber and trucks. Present legislation provides sufficient revenues for the trust fund to complete the Interstate by 1972.

Savings on the Interstate System

A large number of studies have been made of the savings in cost to the motorist of using the Interstate System. Wilbur Smith and Associates' analyzed the various studies made and arrived at the values shown in Table 1 as recommended values to use in evaluating cost savings. These are broken down into vehicle operating costs, accident costs, and time savings, and are the direct savings to the motorists. I am in general agreement with these estimates.

Two specific examples of Interstate savings, although there are a host of others, are the Schuylkill Expressway in Philadelphia and the Los Angeles freeways. Detailed studies of the Schuylkill Expressway show motorists are saving 18 million dollars a year in direct commuting costs. These savings alone will repay the construction costs of this expensive new facility in three years. The original 40 miles of freeways in Los Angeles completed by 1953 cost 130 million dollars. Studies by the Southern California Automobile Club show that in the seven-year period since then, the direct

savings of motoring costs have been twice that amount.

It should be emphasized that these savings are the direct savings to the motorist. In addition, such items as the saving of human lives and reduction in human suffering from accident reduction, the creation of new opportunities for growth and development, the rejuvenating effect on existing areas, the increase in land values, the overall upgrading of the economy as a whole, the triggering of new investment and construction, the easier access to cultural functions, schools and recreation facilities, the relief from driving tensions and the joy and pleasure of motoring on an adequate highway facility are all extra dividends.

TABLE I
Estimated Interstate Cost Savings in
Recommended Priority Cost Savings in
Urban Areas¹

Item	Cents per Vehicle Mile ²	1960	1975-1980
Operating Costs	0.97	1.12	
Accident Costs	0.73*	1.00*	
Sub-Total	1.69	2.12	
Time Savings for Commercial and Passenger Vehicles ³	2.58*	2.92*	
TOTAL	4.35	5.04	

Item	Cents per Vehicle Mile ²	1960	1975-1980
Operating Costs	0.00	0.00	
Accident Costs	0.72	1.00	
Sub-Total	0.72	1.00	
Time Savings for Commercial and Passenger Vehicles	0.98*	0.98*	
TOTAL	1.70	1.98	

1. "Future Highways and Urban Growth," Wilbur Smith and Associates—Estimates from analysis of various cost studies, February, 1961.
2. On basis of 15 per cent commercial vehicles.
3. Adjusted to reflect 15 per cent increase in operating costs 1960-1975.
4. 0.8 of assumed 1960 accident cost of 0.90 cents per vehicle mile.
5. Average savings 1975-1980.
6. Time savings for commercial and passenger vehicles prorated to all traffic and then totaled.
7. On basis all vehicles save 10 minutes per mile.
8. On basis all vehicles save 1.0 minute per mile.
9. On basis of 20 per cent commercial vehicles in rural traffic.
10. On basis all vehicles save 0.33 minutes per mile.

Safety and the Interstate System

The Interstate reduces accidents by reducing and eliminating conflict areas and minimizing decisions that must be made by the motorist. Records to date indicate the accident rate is reduced to one third or less of the average of all roads and the death rate is reduced to at least one-half of the average. Total savings of lives by completion of the Interstate alone has been estimated to save at least 4,000 lives per year,⁴ and more recent studies have increased this estimate to as high as 9,000 lives per year.⁵

The physical separation of lanes for travel in opposite directions, which is standard for most of the Interstate, minimizes the possibility of head-on collisions, usually the most severe type of highway accident. The modern design provides not only for broad medians between opposing lanes but, where possible, for the two separate roadways to follow different centerlines. They are placed on different sides of a hill or a stream, at different levels on a slope, and with separately varying curvatures to avoid long stretches of straight highway with constant medians.

This flowing design has produced some beautiful highways that are a joy to ride upon. They promote alertness and lend interest; the driver stays awake, enjoys his trip, and travels safely.

Control of access on the Interstate eliminates side-traffic friction, which causes many accidents. You may have in your area a "death mile" or "bloody boulevard," where a heavily traveled highway probably "modernized" to four lanes 10 years or so ago is continuously lined with roadside businesses with their accompanying driveways, pull-offs and parking areas, such that the traffic weaves in and out to suit each driver's whim. The providing for entrances and exits only at planned, safe access locations protects both the through traveler and the local driver.

Grade separations to eliminate cross-traffic problems is an accident-reducing feature. Provisions for accelerations and decelerations outside the regular lanes of traffic, and adequate weaving areas, minimize conflicts. The grades and curves used provide for maximum travel speed without hindrance from these factors. The 12-foot width of

lane is a feature that provides for increasing carrying capacity as well as increased comfort and safety.

Signing on the Interstate is an important feature that receives careful attention. The design of signing is an important part of the initial overall study. The most elaborate layout will be a failure if the motorist doesn't know what to do, and it becomes a death trap if he stops to find out.

The Interstate incorporates the best and safest features of design derived from long experience and research. As sections of the system are completed, they are under constant surveillance for improvements. A nationwide analysis of the sections of Interstate in operation was made about a year ago by a select group of Highway Engineers with general high praise for the standards being used and the resulting safety of traffic movement.

Savings from accident reduction alone, in many instances, are enough to pay for the construction of the Interstate. While Commissioner of Public Roads, I had an extensive analysis made of the Interstate in eight western states. The estimated cost of building the multi-lane Interstate was compared with the cost of maintaining the mileage in its present conventional form. The difference in cost in providing the separated lanes was nearly equalled by the saving in accidents by 1975.

Status of the Interstate System

At present over 11,000 miles of the 41,000-mile system are open to traffic, and construction is underway on about 5,000 additional miles. Motorists will be able to travel on approximately 3,000 miles of new Interstate per year for the next ten years on the basis of the present schedule.

The effect of the Interstate is going to be increasingly evident as longer stretches of this modern facility come into operation. The general approach has been to build first in those areas where needs are greatest, and this is now beginning to pay good dividends in relieving congestion in some areas.

One big problem in urban areas is that as yet no major urban area has the full system completed. As segments are opened for traffic, motorists are drawn from quite a distance in all directions, and as a re-

sult the section may get overloaded, with resulting criticism that new highways can't solve the problems. As the full system is completed, and it operates as a system along with the required improvements of the other streets, it is believed such criticisms will disappear.

On the basis of present legislation it is expected that the Interstate will be completed by 1972 or 1973. This completion date will be insured by continuing understanding by the general public of the needs and benefits of the system. For a public works program of this magnitude requires strong support, which this understanding will generate, for it to proceed on schedule to its completion date.

One of those areas of difficulty in keeping a program of this size underway is proper perspective. Even with the present program of improvement we are only spending 12 cents of our highway transportation dollar on our highways, as compared with 14 to 15 cents from 1920 to World War II.

Future Problems

Of course, the Interstate System won't solve all the problems of traffic or of highway accidents. It is only a part of the overall system of highways, even though a very important part, and the entire highway system must be made adequate for the traffic each segment carries, if we are to obtain a truly effective safe-operating system. While the Interstate will carry large volumes of traffic, that will be still over 75 per cent of the total traffic on other highways and streets.

The 1956 Act envisioned keeping the other highway construction in phase with the Interstate construction. This needs to be understood, appreciated and pushed. So far progress has been generally good.

While the Interstate is designed for 1975 traffic it won't become obsolete when that date is reached. With control of access the full carrying capacity of the system will be preserved. Generally right-of-way provides for expansion when additional needs develop. Further the major portion of the system will not reach its maximum carrying capacity for many years beyond 1975.

Needs in other areas not in the vicinity of the Interstate routes will require additional miles of freeways or Interstate

design standards. It is estimated that traffic needs in urban areas by 1980 will require 5,000 to 6,000 miles of freeways in addition to the 6,700 miles provided by the Interstate.

From the standpoint of safety, driving on the Interstate will require special attention. It is a high-speed facility and alertness must match speed. Hypnotic effects of high speed, steady driving needs special attention. Rear-end collisions and single car accidents by driving off the roadway are the principal accidents on the freeways. However, it appears that as drivers become acquainted with freeway driving, accidents decrease still further and some of our toll roads have chalked up amazing records for accident-free driving.

I think we're making progress on this problem of highway accidents. However,

we need to continually, realistically, face up to the problems, carefully evaluate various solutions, and carry out a program that can be accomplished. The improvement of all our highways adequate for the traffic they carry, will go a long way towards saving of accidents, lives and suffering.

1. Title 23, United States Code—Highways.
2. Geometric Design Standards for the National System of Interstate and Defense Highways, adopted July 12, 1954 by the American Association of State Highway Officials, approved July 17, 1956 by U. S. Department of Commerce, Bureau of Public Roads.
3. "Future Highways and Urban Growth," Wilbur Smith and Associates, February, 1958.
4. "Urban Expressway Earnings on Portions of the Schuylkill Expressway—Pennsylvania," Evan H. Gardner, Pennsylvania Department of Highways, 1960.
5. "The Federal Role in Highway Safety," House Doc. No. 93, March, 1959.

EFFECTS OF ENFORCEMENT ON QUANTITY AND SEVERITY OF TRAFFIC ACCIDENTS

By MAJOR GLENN KISSINGER
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Wisconsin State Patrol, Madison, Wis.

I hope that none of you here today came to this meeting hoping to hear me make this emphatic statement: "Yes, traffic law enforcement definitely does reduce the quantity and severity of traffic accidents," and then provide unchallengeable facts and figures to support my claim. You would be disappointed, for I do not have the conclusive statistics you are looking for.

But I will make this statement: "Traffic law enforcement reduces the quantity and severity of traffic accidents," and I will support my argument with logic and available statistics from my own state of Wisconsin.

To my knowledge, there has been very little research on the relationship between enforcement and accidents. The reason for this, I'm sure, lies in the very magnitude of the problem. There are so many variables to measure, that to do a thorough and conclusive job would require resources not available to most agencies.

It is easy enough to keep severity records on sections of highways in a police agency's jurisdiction. The Wisconsin State Patrol keeps such ratings based on accident reports filed by drivers involved. And it's easy enough to segregate those sections of highway where enforcement is concentrated, in order to compare the severity ratings on those roads with the severity ratings of roads where enforcement activity is sporadic or nonexistent.

But severity ratings do not take into consideration such factors as changes in the character of the highway, the elimination or creation of particularly troublesome intersections. They do not take into consideration shifting traffic patterns caused, for example, by construction of freeways or expressways. They do not take into consideration changes in the court system, with a lenient local judge being replaced by one who hands out stiff sentences to convicted traffic violators.

What constitutes a personal injury accident may be subject to variation. Some may define it as one which requires physician's treatment of one or more drivers or passengers. Others would call a scratched finger a personal injury. Severity ratings do not take this variable factor into account.

The quality of enforcement is another variable factor, even more difficult to measure. The mere fact that a patrol officer is assigned to a piece of highway for eight hours a day does not mean the section of roadway is receiving proper enforcement effort. How he operates in his sector while on duty—whether he spends too much time in the coffee shop—will influence the effect of enforcement. This is almost impossible to measure, since in the best of organizations it is bound to vary from supervisor to supervisor, and from man to man.

The only research on the subject with which I am familiar was done in 1957 by Mr. Robert P. Shumate, then of Northwestern University Traffic Institute and now of Indiana University, Department of Police Administration. This research project was carried out with the cooperation of the Wisconsin State Patrol and the U. S. Bureau of Public Roads, and is identified as Research Project R13.

In this project Mr. Shumate compared traffic accident severity on four routes in Wisconsin before and after the assignment of Wisconsin State Patrol officers to the routes on a line patrol basis. The routes were 26, 52, 104 and 208 miles long, and included both two and four-lane highways. Intensity of enforcement was measured not by the number of officer-motorist contacts made, but by the number of times a motorist should have seen a moving or stopped patrol car, conspicuously marked. Some pertinent conclusions from this study include:

1. The addition of patrol units to a given stretch of highway reduces the frequency of fatal and personal injury accidents up to the point where the quantity of patrol units reaches a ratio of one unit for each 13 miles of highway. When a ratio of one enforcement unit to 26 miles of highway is reached the frequency of accident occurrence shows no significant change.
2. Reductions in frequency of accidents tend to be more pronounced during the second

and year of effort indicating a possible cumulative effect.

3. Property damage accidents do not show as consistent reductions as fatal and personal injury accidents. This may be attributed to the fact that property damage accidents are more susceptible to changes in the completeness with which they are reported.

4. Substantial increases in the number of patrol units assigned to a given stretch of highway does not cause an appreciable proportion of motorists to change their travel habits even though there is an alternative route available.

The Wisconsin State Patrol, as it exists with 250 uniformed officers today, has been actively engaged in rural traffic law enforcement for about six years. During that time we have devoted our efforts toward accident reduction by employing the principles of selective enforcement whenever practicable. We have concentrated our forces where and when the accidents, fatal and personal injury, have been occurring. We are satisfied that our all-out program of concentrated enforcement has been successful in reducing the number of severe accidents on the highways patrolled.

What indications have we that our program is succeeding? Most of our statistics. Last year there were 4,144 accidents on state and federal highways under line patrol by the Wisconsin State Patrol. On those same roads in 1957, some of which were under line patrol at the time and some not, there were 114 fatal accidents. That's a reduction of some 25 per cent. During that same period of time, fatal accidents on all other state and federal highways in Wisconsin increased by 2.3 per cent. You may argue that these figures are not conclusive. Perhaps they are not, but they give us some indication of what is taking place on the highways placed under line patrol.

I am a traffic police administrator, not a researcher. I outlined earlier some of the reasons why I believe there has been little scientific study of the effect of enforcement on the quantity and severity of accidents. But I submit that any sound research that would be done on the subject would only underline what the bulk of traffic safety authorities have believed for years—that en-

forcement does indeed have a significant effect in reducing accidents.

Statistics show us that only an insignificant percentage of traffic accidents are caused by vehicle or road defects. The great majority is caused by human error, in short, violations, either unintentional or willful, of the basic rules of the road.

All states have traffic laws to cover virtually every conceivable driving situation. Can anyone challenge the assertion that if everyone obeyed every traffic law there would be few accidents, except, perhaps, those few caused by road or mechanical defects? I don't believe they can.

Once we have established that traffic law violations cause accidents, isn't it safe to assume that by reducing the number of violations we will reduce the number of accidents? If there are fewer violations there will be less potential for accidents to happen. Hence, there should be fewer accidents.

The next logical question would be: "Does enforcement reduce the number of violations, thereby reducing the number of accidents?"

For most drivers, there is probably no need for enforcement. They probably obey traffic laws because they realize their significance. They know that laws are written for the protection of everyone who uses the highways.

Some drivers, though, have to see a squad car or know that a policeman is or might be in the area before they behave. They are legal as long as they suspect they are being watched. Here enforcement is affecting their driving manner and is preventing the accident-causing violations.

Other drivers have to be arrested once or twice, pay the fine and realize they are just a few points from losing their licenses before they drive safely. Or, they may be in no fear of losing their licenses, but they may not be able to afford a fine. They may fear the publicity resulting from a traffic conviction. Whatever their motives, they still obey the traffic laws, not because they realize their importance, but because they shun the legal and social consequences of conviction. Nevertheless they still obey the

law and do not endanger themselves or others by improper driving behavior.

Finally, there is a small number of drivers who wilfully and wantonly disobey the law constantly. Take the chronic reckless driver; for example, the one who speeds down residential streets at 40 or 50 miles an hour, or down winding country roads at 80 and 90 miles an hour. Is he going to do this once or twice and then stop, forever after to drive safely and courteously? I doubt it very much. He's going to keep it up until one of three things happens: He kills himself, he kills someone else, or he is arrested enough times to lose his driving privileges. The hope of enforcement is that we can get to him soon enough, so that he stops driving before the accident happens. Then we have reduced the quantity of accidents by at least one.

I think, then, there should be little doubt that enforcement reduces the number of accidents. There is less reason to believe, however, that enforcement reduces the severity of accidents except in this respect—granted that there is a fairly constant ratio between fatal, personal injury and property damage accidents, any reduction in the total number of accidents is bound to bring a reduction in the number of fatal and personal injury accidents.

Mr. Shumate in his study noted that property damage accidents do not show as consistent reductions as fatal and personal injury accidents. If this is true, then enforcement is reducing the severity. However, Mr. Shumate pointed out that this may be attributed to the fact that property damage accidents are more susceptible to changes in the completeness with which they are reported.

In the short time allotted me, I have told you why I believe enforcement reduces the severity of traffic accidents. I have told you there is little statistical evidence why this may be so, and I have explained why I think the evidence is sparse. But can we who are engaged in traffic law enforcement sweep away the logical conclusion that enforcement does have a salutary effect on both the quantity and severity of traffic accidents?

ENFORCEMENT EFFECTS ON QUANTITY AND SEVERITY OF ACCIDENTS (RURAL)

By MAJOR J. M. THAXTON
Asst. Chief, Oklahoma Highway Patrol, Oklahoma City

Law enforcement is a vital part of our democratic way of life. To eliminate enforcement would be the only method of ascertaining the full impact of its effectiveness. With positive assurance that we cannot take such a drastic step, it is imperative that we use other methods of measurement to determine the effects of enforcement on severity and quantity of accidents.

If we in the field of law enforcement are to discover significant relationships between enforcement and accidents, we must continue to enlarge our area of research to a point where we understand more about the effect of the activities of related agencies such as highway engineers, educators, climatologist, automobile engineers and others associated with the modes, vehicles and conditions of traffic.

Since we have been unable to devise such a tell-all measuring stick and its foreseeable development is most remote, if for no reason other than this thing called driver attitude, our attention must continue to be directed toward enforcement. Each law enforcement officer is in the first line of America's defense against traffic accidents. I contend that it is his solemn obligation to perform his duties in such a manner—and this encompasses quality as a part of quantity—that the effectiveness of enforcement on this scourge of our nation, quantity and severity of accidents, will awaken the American motoring public to the fact that it is killing itself on the highways of this country.

Statistics reveal that enforcement per se does not produce results which are readily distinguishable from the effects of other contributing factors. Generally, this is true although a very noticeable effect of enforcement is evident when enforcement suddenly drops to a point near the normal increase in vehicle miles traveled. This situation adds weight to the general belief that a certain level of consistent enforcement is essential to maintaining a progressive traffic safety program.

There are many contributing factors which control the increase or decrease in traffic accidents. If there is a decrease in accidents, enforcement officials may be prone to say, "We did it." Highway engineers are ready and willing to take a large share of the credit while safety education authorities believe that they have finally changed the drivers' attitude. The automobile manufacturer lays claims to the decrease in severity although they are not so eager to talk about total number of accidents.

I know of no studies conducted by any group to determine the effectiveness of enforcement (or the presence of officers) on accidents. Despite the alleged effects and results adduced from such studies, the experience in my home state will not substantiate their findings in whole.

Much has been said about amount of enforcement but for the purpose of discussion, I would like you to think of it as the amount of enforcement which will create greater compliance with the traffic laws and will bring about a decrease in the quantity and severity of accidents. The deterrent effect on drivers, generated by the enforcement of traffic laws and the ultimate prevention of accidents, is to be desired.

When we speak of the "enforcement effects on quantity and severity of accidents," many relevant factors are involved. Placed high in importance among these factors is the quality of enforcement. Good enforcement means attaining maximum effectiveness in each instance as a deterrent to violations of the law. It means accomplishment of objectives which justify enforcement—preventing accidents. Furthermore, it means obtaining the best possible results through increased efficiency.

Additionally, it has been stated that there is a point below which the amount of enforcement is too small to have any appreciable effect, and our experience lends support to this statement. It has also been

stated that it is possible for the amount of enforcement to go beyond the point where additional desired results will be obtained. In other words, when the number of traffic arrests goes beyond the point where the deterrent effect is increased, additional arrests will not aid materially in reducing the number of accidents. No doubt this statement has some merit; however, we have never been able to get our quantity (with quality) up to this point. We, therefore, have never fretted about reaching this so-called "point of diminishing returns."

Selectivity of enforcement is one of the means of obtaining quality. Quality, however, is dependent upon many other factors. The caliber of enforcement personnel and the type, as well as amount, of training they receive is vital. Good enforcement procedures, good equipment and many other factors are involved. Selectivity is one of the means of obtaining quality.

Up to this point we have been speaking in generalities. This is fine, but I am sure that we are more interested in what to do about our common problem. What works best? I shall point out, with the aid of statistics, what our experience has been.

In Oklahoma, ten years of statistics were compiled in graphic form in order that an analytical study could be made and, if possible, to determine both the long range and the short range effect of enforcement on the quantity and severity of rural traffic accidents. At the same time, a study was made to determine the relationship between speed and the quantity and severity of rural accidents.

First, I must say that we are unable to determine from the so-called control studies of one or two years' duration a great deal more than speculative conclusions. Most of these studies have been conducted on roadways where enforcement has been greatest for a number of years. Does this give a true picture of the effect of enforcement? We do not think so because the maximum effective enforcement may have already been reached before the controlled study began, especially when most of these studies were conducted on trunk highways.

Through our method of selective enforcement, we were convinced that increased enforcement, applied in certain areas, provided the desired results, although we were

more concerned about the overall effects—statewide. We believe the statistical picture of the effect of our statewide program, during the past ten years, has shown us the overall effects of our program, and bettered our understanding of statistics. When compiled for a long period of time, they tend to disprove some of the short-period conclusions which may have been pulled out of the same statistical array.

Year by year, we compared statistics of accidents and enforcement activities and we were unable to correlate direct, immediate relationship of any of the changes year by year except in two areas.

1. A year of low enforcement activity is followed by a general increase in quantity and severity of accidents.

2. There is a direct relationship between speed and quantity, and especially severity, of accidents.

Again, I am reminded that to eliminate enforcement would be the only method of ascertaining the full impact of its effectiveness. We know that this will not be done although we got a fair sampling of this in Oklahoma in 1955, when, for a number of reasons, arrest activity dropped 37 per cent and warning activity dropped 65 per cent. Yes, the expected happened—a sharp rise in accident activity followed the next year—1956.

Since the year 1955, there has been a steady increase in enforcement activity.

1. The steady increase in the overall enforcement program was most effective on the federal highway system. This was the area where a greater portion of manpower and enforcement was applied; although it must be noted that engineering plays an important part, in providing more uniformity of construction, than is found in either the state or county highway system.

It is noteworthy, and probably significant to this topic, that accidents on the federal highway system have not shown a general increase during the past ten years even though the vehicle miles traveled have increased 35 per cent.

2. A lesser degree of enforcement has been applied to the state highway system; therefore, this could be the reason for a general increase in the accident trend, which appears to be in line with the continuous increase in vehicle miles traveled on trunk

highways, and the proportionate number of enforcement personnel patrolling this roadway.

3. The most significant pattern which has developed from this study is that of county highway-system accidents. Accidents are increasing at an alarming rate, not in proportion to the increase in vehicle miles traveled on this roadway network. The severity of accidents, especially personal injury, has increased 74 per cent during the past ten years. Compare this with a normal increase of 32 per cent on state highways and no general increase on federal highways. (The reference of the norm on state highways is a comparison with the increase in vehicle miles traveled.) The percentage as shown reflects, in reverse order, the approximate degree of enforcement applied to each of the highway systems and the degree of uniformity of engineering on these roadways.

There are strong indications that we have not materially changed the attitude of the drivers, but it is our belief that through selective enforcement, we do change their driving habits temporarily (a matter of weeks or months) at a given location, provided we are dealing with local people and a local problem. To this extent selective enforcement is most effective in the rural areas. It is also believed that enforcement, not unlike advertising, attains its greatest effect not by becoming monotonous, but by periodic changes in the programs (as evidenced by accident experience), which in turn creates renewed attention.

This leads up to the question of speed. A speed check was conducted at 35 locations throughout the state on federal and state highways. These checks established that as the speed decreased, during the years 1959-1960, there was not a single case where the severity of accidents showed an increase. Checks were conducted on a four-mile length of roadway two miles on either side of the radar speed check point. All of these sections of the highway system had been given maximum enforcement. It is also

noteworthy that there was no appreciable decrease in accidents or severity. Significantly, the total vehicle count did increase and the vehicle miles traveled showed an increase.

Does enforcement materially change the average speed? There are indications that it does for a period of time, then without any apparent reason, the speed increases even with added enforcement. Moreover, it appears to follow a regional trend. This leads us to believe that forces other than enforcement and engineering are temporarily stronger. I present this as a part of our enforcement problem. What are these forces and what do we do to combat them?

Can we for one moment afford to even relax our diligence on enforcement? Furthermore, with the stakes so high, can we afford to gamble, or even toy with the idea, that enforcement is not effective against quantity and severity of accidents? Is there an area of doubt which will justify compromises involving human life? Our dedication to duty, enforcement, and if you please, to truth and to humanity, will continue to carve wider paths to traffic safety.

Our greatest degree of uniformity, nationwide, is on the federal highway system. In our state we are, generally speaking, pleased with our enforcement and accident picture on this highway system.

Our future goal is to create a similar situation on the state and county highways. To do this, we must have added manpower (our troopers average 432 miles each or 950 miles per patrol unit) and we believe in continuously rejuvenated selective enforcement program; plus, of course, a closer working relationship with our highway engineers.

As the overall problem, month by month and year by year, becomes more acute and more complex, the challenge appears to be one of accomplishment and purpose. In closing on this somber note, I hasten to remind you that great challenges have always produced great champions.

Should traffic patrolling be increased?

THE EFFECTS OF ENFORCEMENT ON THE QUANTITY AND SEVERITY OF TRAFFIC ACCIDENTS

By **TERRENCE T. DOHERTY**
Chief of Traffic, Police Dept., Chicago

My contribution to this discussion of the effects of enforcement on quantity and severity of accidents will consist of relating an experience in the city of Chicago this year. I believe you will find that the experience I relate will bear specifically on the issue proposed here today.

In early 1961 the fatal accident experience in Chicago began to rise. The extremely low fatality figure of 270 for the year of 1960 was a challenge that was hard to meet. In planning a program to meet this rising trend it was decided to analyze the accident experience for Chicago for a period long enough to give significance to any trends developed from such analysis. Two years experience—1959 and 1960—provided the necessary volumes of accident statistics for this study.

It seemed logical to make an hour-of-day breakdown which would separate the week-day experience from the week-end experience. Therefore, one study was made of the five days from Monday through Friday and the other for Saturday and Sunday. The most outstanding fact discovered was that the hourly fatal trend conformed pretty closely to the injury trend, the property damage trend and the "all" accident trend. The only exception were two week-end hours, two AM and four AM which showed an exceptionally high fatal trend. A parallel to this was that injury accidents were significantly higher from about 12 midnight to three AM on week-ends. There were those who doubted the reliability of the two AM and four AM trends, pointing out that they contained only a small number of the fatal accidents. But the extraordinary injury trend of these hours answered this objection.

People in our field are all familiar with selective assignments by hour of day in which the staggering of five or six or seven shifts is arranged to match the entire 24-hour experience. But, why resort to this

refined, hour-by-hour, system when a concentrated attack on trends by eight-hour groups pointed the way to a chance to reduce the bulk of the accidents? Why not just pick out those hours which contained most of the accidents of the day and try to reduce this large number? Thus was born the idea of the "power" shifts which brought most of our enforcement efforts into short, eight-hour periods, almost to the neglect of the other hours of the day.

As might be expected the week-day hourly accident experience concentrated most accidents—fatal, injury and property damage—into the hours between three PM and eleven PM, a familiar pattern in cities. So the week-day power shift was three PM to eleven PM, with a smaller group working seven AM to three PM and a bare skeleton force on the eleven PM to seven AM shift. Matching the week-end trend was not so easy. Enough experience remained between three PM and eleven PM that these hours could not be neglected. The extremely high incidence of fatalities and serious injuries from nine PM Friday until five AM Saturday and from nine PM Saturday until five AM Sunday called for attention. In fact, the mere numbers of accidents did not seem to tell the whole story. There was a prevalent feeling that these were really the most dangerous hours of the entire week!

The problem was solved in this manner: The very large group assigned to the three PM to eleven PM shift was divided into three units. One of these units was designated as the "swing" unit because its hours were changed on week-ends. This group would not report for work at three PM Friday afternoon but would come out instead at nine PM. They would then work until five AM Saturday morning, reporting again at nine PM Saturday night for the tour until five AM Sunday.

Two minor difficulties developed with the swing unit: First, it was difficult for them

to resume duty at three PM Sunday after having worked until five AM Sunday morning. Secondly, this group encountered more than their share of drunken and reckless drivers, who had to be physically arrested instead of receiving summonses. Many of these had to appear in our "week-end and holiday" court because they could not make bail. This forced a morning court appearance on the already hard-pressed men of the "swing" unit. We believe that this factor discouraged some very important arrests in the early days of the program.

The court problem was solved when the courts agreed to allow a sergeant to represent all traffic cases in the week-end court, because they were mostly continuances anyhow. The fact that the Sunday afternoon accident experience was not serious led to a day off and "time due" system which relieved the hardship of doubling back on Sunday afternoons.

If the power shift idea consisted of nothing but the technique of assigning the most men to a certain set of hours, it would be so basic as to be not worthy of mention to a group of people who already understand this principle. But there was an important additional factor. The large groups assigned to these shifts also had to produce a higher "per-man-per-day" volume of work than men on the other shifts. We wanted the concept of the power shifts as "work" shifts. We wanted such an extraordinarily large number of traffic arrests during those hours that it would be noticed by the public.

In these hours there exists a number of accidents and violations out of all proportion to the other hours of the day. To put it another way, no other combinations of hours even approach the great volumes of accidents and accident-causing violations which exist during these hours. This is not a refined, detailed, selective enforcement program. This is a sledgehammer attack against accidents in volume, in order to obtain a maximum reduction in all kinds of accidents.

There was little encouragement in the early days of the program. It was instituted March 1, 1961, and one month later we had an actual rise in the fatal figures which brought the 1961 figures above the 1960 figures, so bad that at one time we

were running 41 deaths more than the previous year. Worse yet, all of the fatal accidents of April, 1961 occurred during the hours of the "power" shifts. Instead of then abandoning the program we decided that these shocking figures were a perfect corroboration of the correctness of our hourly assignments and that it was more important than ever to continue our efforts. Furthermore, it must be remembered that two years of accident experience was used to obtain our information, therefore quick results were not to be expected. We had to work for a long-term effect.

However, results were not so very long in coming. Early in May, two months after the introduction of the power shifts, the monthly comparison of the "ALL" accident trend, the injury trend and the property damage trend showed a slight reduction. At that time the fatal trend had not yet responded. At the end of May, they did respond slightly and we ended the month with lower figures than the corresponding month in 1960. In July the yearly comparisons went into the "minus" column on injury accidents, property damage accidents and total accidents. May, June, July, August and September also had fewer fatalities than the corresponding months of 1960 and our "deficit" in fatalities was down to 23 by the end of August, 20 by the end of September and 15 as of October 16th.

From the experience with the "power shifts" the following effects of enforcement on accidents is derived:

1. A level of enforcement, high or low, affects the accident experience a certain period of time later, depending, apparently, upon the size of the community involved. No change in the accident experience can be connected with enforcement being done at the same time the change occurs. This is the well-known "lag" principle.
2. Notice that the level of enforcement must be sustained over several months in order to produce any effect. Short period of "up and down" enforcement produce no measurable changes either way.
3. Increased enforcement reduces the accidents sooner than reduced enforcement allows accidents to increase. In Chicago eight months elapsed before the motorists sensed a decrease in enforcement and began to have accidents. But when enforce-

cent. In 1960 enforcement went up 119 per cent and accidents went up 103 per cent.

These effects are caused by several things. Number one, we admit, we are not as selective as we should be. Number two, public information and safety education activities are not as constant and as vigorous in the enforcement effort as they should be. In other words, our efforts are not adequately supplemented by public information and safety programs. However, progress has been made in this respect by the use of safety posters. Each year the police and safety officials meet and decide on what type of violations are causing the most accidents, then we come up with ten point programs. Posters are then made and distributed throughout the state of Michigan, so that a driver in Kalamazoo going to Lansing will see the same posters, calling to his attention, for example, that "following too

closely" is a problem throughout the state. In summary, it is my contention that we in the police field need more training for uniformity of action.

Public education is the most important tool in traffic safety. Keeping citizens informed as to what we, the official agencies, expect of them is very important. They must be educated, not policed.

Judges and prosecutors must come to an agreement on the problem of issuing citations in accident cases. Laws requiring the reporting of accidents and driving regulations should be uniform throughout the entire nation.

If it is a violation of the law to commit an unsafe driving practice in one section of our country, then it must be a violation in any other section, if we are to become a united fighting force in the control of our accident problem.

THE EFFECTIVENESS AND USE OF SEAT BELTS IN THE UNITED STATES

By ROBERT A. WOLF

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Many of you are familiar with the work of the Cornell Automotive Crash Injury Research project (ACIR), but a few words about the nature of its work may be appropriate as a backdrop to this paper. The project has been sponsored variously by the Armed Forces Epidemiological Board, the Ford Motor Co., the Chrysler Corp. and at present is supported by the Automobile Manufacturers Association and the National Institutes of Health.

ACIR has been in existence for about eight years and during this time has, with the voluntary aid of police, physicians and public health services, collected more than 45,000 automobile accident cases from 21 states throughout the nation. This massive data, as it grew through the years, has been analyzed with the principal objective of trying to determine the causes of injury to passengers in the hope that—if "causes" could be identified and understood, then "cures" could be brought about.

Many "causes" such as flying glass, ejection, steering wheels, etc., have been identified during the years, and the "cause-cure" interplay has been under continual observation and analysis by ACIR. As time progresses, evaluation of "cures" such as safety belts which began to appear in a few of our cars in the mid-fifties, has become a growing part of ACIR's activity. During the past few years this group has gathered convincing evidence that the lap type safety belt is indeed a powerful device for reducing death and injury on our highways.

I shall try to report on the general state of knowledge concerning the seat belt and especially what we at ACIR know about its functioning and its effectiveness—based on our own research.

Many years before the seat belt became the byword that it is today, a small group of engineers, doctors, airmen and safety minded persons began to experiment with various aspects of this device, borrowed

from the aviation industry, to determine if it could help to reduce the mounting toll of injury from automobile accidents. Names like DeHaven, Dye, Stapp became synonymous with this movement. The group became convinced that they had a powerful life saving device within their grasp—if only the public could be persuaded to use it. Laboratory tests pointed out the potential advantages—but this was not enough. What was needed was more convincing evidence that seat belts actually worked in real accidents.

By 1956, Cornell's crash injury research program had collected enough data on automobile accidents in several states to make one of the first studies of the effectiveness of the seat belt in actual practice. The first results were indeed startling. Could such a simple device really prevent almost two-thirds of the fatalities occurring in passenger car accidents? Incredible! Well, as it turned out later, this early result was somewhat optimistic; the sample was small and there were some inconsistencies in data. As accident data and methods of analysis improved, we began to converge on a fuller understanding of the action of the seat belt and a more realistic measure of its actual effectiveness was developed.

In addition to what we are doing at Cornell by means of accident analysis, a great deal of important experimental crash injury research is being conducted by others such as the University of California, University of Minnesota and the automobile industry. This research is generally of a laboratory nature, in contrast to ACIR's approach by means of statistical analysis of many highway accidents. The two forms of crash injury research, however, are complementary in that each supplies knowledge of different aspects of the problem which are vital to a complete understanding of the action and effectiveness of the seat belt. Experimental laboratory type crash tests with anthropomorphic dummies produce force measurements and observable motions of the dummies under controlled conditions of speed and direction of impact.

The experimenters also try to estimate the physiological damage which could result from the tests. High speed photography is used to observe the split second impact action and is essential to this type of investigation. The number of tests, however,

is generally limited by cost and time, so only a few of the situations encountered in real accidents can be simulated. Statistical analysis of injury which occurs in actual accidents such as done by ACIR examines the results of a great number and variety of factors by working backwards from evidence gathered during on-the-spot accident investigation.

I shall deal principally with lap-type safety belts, as this is the only type used extensively enough in this country to be evaluated by our method. Development and use of the safety belt is also proceeding in Europe where the diagonal shoulder strap type has gained prominence. I shall discuss the function and effectiveness of the lap belt and shall also make some estimates concerning present public acceptance of seat belts in order to show how the current upsurge in popularity may influence the national fatality picture during the next few years.

The public acceptance aspect should be of particular interest to those of you who have been engaged in seat belt promotional work during the past years and have begun to observe the upswing in public reception. It is astounding and very gratifying to witness this trend and I am certain that "explaining" the phenomenon will keep motivation researchers and sociologists occupied for many years.

The ability of the safety belt to influence the toll of death and injury on our highways depends on two main factors:

EFFECTIVENESS

The effectiveness of the device, itself, as a safety control measure—our research at Cornell produces the factual evidence.

USE

The extent to which this measure is used by the motoring public—your educational efforts influence this factor.

Knowledge of a marvelous cure for a disease is not enough—to be effective, it must be used.

What ACIR Has Found Out About Effectiveness

Since 1957 we have made several studies of the effectiveness of belts based on thou-

sands of persons involved in automobile accidents and we are coming closer each day to a true understanding of how the seat belt functions.

Even though our results in measuring the degree of effectiveness vary somewhat from study to study, the trend is always the same—seat belts really work. They are a powerful and effective means of saving lives and reducing injury but they are not "cure-alls." The belt appears to be very effective in controlling severe injury near the fatal end of the injury scale whereas its role in mitigating injury at the minor end of the scale is still obscure.

Our latest and, we believe, most reliable study, published in 1960, shows that "major to fatal" grades of injury are reduced about 35 per cent by wearing lap-type safety belts. Translating this result into a national goal for saving lives, it means that if all passenger cars on the road were equipped with at least two seat belts and they were used all of the time, about 6000 to 8000 lives could be saved each year; also, many other injuries resulting from ejection and impact could be eliminated.

This is a theoretical goal—obviously all motorists have not bought and are not wearing safety belts. A nationwide poll made in May-June of 1961 by the Auto Industries Highway Safety Committee indicated that only about 3.3 per cent of the passenger cars in the United States were equipped with belts at that time—so you can see how far we have yet to go to reach an effective goal. I am going to use the results of this survey later on in this paper to help make a forecast of public acceptance.

How does the seat belt function? In our analyses, we divide its functioning into two categories—Ejection Control and Buffeting Control.

It reduces EJECTION of passengers from the car; this is the major effect and accounts for about two-thirds of its control action.

It reduces violent BUFFETING of the passenger inside of the car; this accounts for the other one-third of its action.

Each of these functional categories influences a wide range of severities of injury. For example, if ejection and buffeting

could be completely eliminated as sources of fatalities, we would be very close to the goal of saving 8000 lives annually, whereas if only ejection is controlled, the number will be closer to 6000. The number of lesser injuries which may be mitigated by belts is unknown, but is very large.

Thus far in our research we have approximately "pinned down" the fraction of the effect due to control of ejection and have a good understanding of the injury patterns caused by ejection. We have, however, much more to learn about the detail effects of buffeting as they influence injury. Ejection, that is being violently thrown from the car, was shown in an early ACIR study made in 1954 to be a surprisingly frequent event.

A study made in 1958 showed that before safety door locks were introduced in American cars, about 14 per cent of the occupants of ACIR's injury-producing sample were ejected. These early studies proved that the popular belief that it was good to be "thrown clear" of an accident was a fallacy. Indeed, it has been proved that the ejection is more likely to be "thrown clear" to eternity.

The seat belt, if properly used, will hold the passenger in the car and prevent ejection. Although ejection generally occurs in medium to high speed accidents, it is by no means limited to this class of impacts. Many persons are ejected and killed in low speed accidents due to striking their heads on pavement, being dragged or run over, sometimes by their own car.

Let us now consider the other third of the belt's effectiveness—buffeting control. Unfortunately, ACIR has not yet been able to separate in a quantitative manner the various antibuffeting effects of the seat belt in forward, side, rear and rollover types of accidents, so these effects must all be lumped together under the single heading—buffeting.

This part of the discussion must, because of the lack of factual analysis, be limited to a more qualitative form than that of the preceding phase concerning ejection. Buffeting is used here to define the violent flailing of the passenger inside of the car under the overwhelming forces of impact as the automobile crashes, is decelerated and brought to rest. Control of buffeting probably has influence on all degrees of

injury varying from minor to fatal. It has been amply demonstrated, as one of the purposes of safe "jackknifing" that the passenger will have better chances of survival if he can be held tightly to the car so that he can be made to decelerate with rather than be thrown violently and uncontrollably against its interior surfaces.

What actually happens, if the passenger is restrained, is that the car stops suddenly whereas the passenger keeps on moving with his initial momentum until he laterally collides with the interior of the "upping" car. This is the critical "collision" which tends to make the passenger an integral part of the car and avoids the second, or inside, collision. Although the lap-type safety belt is now known to be an excellent ejection control device, we are not yet certain whether it is a completely effective antibuffeting control in all types of accidents.

Our rather meager data on antibuffeting action seems to indicate that in side impacts and in rearward collisions, the lap belt does a creditable job of holding the passenger because the interior side surfaces and the seat back also help to restrain the body. The belt's antibuffeting control is also quite effective in the rollover type of accident where, without a belt, the passenger is tumbled about in a most frightful manner as shown by motion picture studies of anthropomorphic dummies in rollover crash tests.

In the forward impact type of accident, the lap belt may be found wanting; the stretch in the belt and its fastening, coupled with the "jackknifing" of the passenger's body may allow the head to strike the windshield or instrument panel. In forward impacts there is a considerable forward translation of the body which may amount to 18 inches, coupled with the typical U-shaped "jackknifing" forward of the torso and forward extension of the legs and arms as the passenger bends around the belt. In the right front seat position even most full-sized American automobiles do not have enough space between the front seat and the instrument panel to avoid collision of the average passenger's head or knees. This characteristic is further emphasized by the smaller space of the European car and the American compact.

Bucket seats appearing in "sports" versions and recessed dash panels in some big American cars may be harbingers of a trend toward design for seat belt compatibility.

This area needs further clarification and ACIR hopes to do more probing into the injury effects of the front seat position. It may be well that especially in this position, the shoulder harness or diagonal belt is a better solution than the lap belt. Intrusion and observation of test crashes prompts the conclusion that there is a pregnant opportunity for applying real engineering ingenuity to redesign of the right front seat position in the American automobile. Such effort could be directed either toward local elimination of the instrument panel and provision of plenty of forward clearance to accommodate "jackknifing" or it could point toward development of a special type of safety harness to prevent "jackknifing."

In the latter direction, much of the "hardware" could be incorporated in the seat design. If we in this country are going to adopt exclusively the lap type safety belt, we must learn to redesign passenger compartments and provide our car interiors with the necessary clearances to be compatible with the known action of this type of belt.

As use of seat belts becomes more prevalent, questions are certain to arise concerning the belt itself as a "cause" of injury. Some cases of internal injury attributed to the action of European type diagonal belts have been reported in Sweden but it is too early to say whether the design of the harness itself is at fault, whether the diagonal is being improperly worn, or whether the severity and nature of the accidents were such that no form of harness would have prevented injury.

There is no doubt that, as passenger restraint is improved to the point where buffeting impact is prevented, a threshold of human tolerance to non-impact but very high acceleration forces will be reached; internal injury may then become prominent as a problem in certain accidents of great severity. There are, of course, limits to human tolerance of acceleration forces but there are many lives to be saved by present means before this threshold is reached.

ACIR has started to study the problem of injury caused by belts themselves but

thus far there is no conclusive evidence of a major problem. More data is needed which can only be obtained as belt usage increases. Results of this preliminary investigation are reported in a recent paper by John Garrett and Dr. Paul Braunstein—"The Seat Belt Syndrome." This paper also examined seat belt structural failures and found that failures occurred in less than one per cent of the thousands of cases examined.

In closing this part of the report on the status of research on safety belts, it is appropriate to point out that there are other types of belts receiving attention in different parts of the world. In Europe, for example, the diagonal shoulder strap sometimes combined with a lap belt is very prominent. The European engineers, in defining the original requirements for belts to be applied to their smaller cars, placed heavy emphasis on the antibuffeting requirements and reasoned that, because of the generally small compartment sizes and especially the short distance between seats, windshields and instrument panels, they must eliminate "jackknifing" and flailing of the torso—hence they specified the need for shoulder restraint. These factors started the public use of safety harness in Europe off in an entirely different direction from that in the United States.

Apparently ejection is not encountered as frequently as it is in the United States, so there is less emphasis on its control. The extent of public acceptability of this type of belt in some countries is astounding. For example, it is reported that by 1960, in Sweden, safety harnesses were installed in over 60 per cent of their cars compared with seat belts to the extent of about two to three per cent in the United States at that time—and they started later.⁴

A recent article from Sweden, concerned with the injury effects of safety belts, mentions that belt installations may be in 70 to 80 per cent of the Swedish cars by early 1961.⁵ Unfortunately, a study of the effectiveness of the European type of belt or harness, equivalent to ACIR's study of the American type of seat belt has not been made so there is no direct way of comparing the two types by means of accident-injury analysis. We are opening discussions with Swedish authorities to ex-

change information and determine whether comparison studies are feasible. Several designs of shoulder restraining harnesses are being offered at present by American belt manufacturers but their acceptance is very limited; it is reasonable, however, to expect more of these to appear in the future as their popularity increases.

Seat Belt Usage

In this part of the discussion I shall deviate from the role of the factual reporter of scientific evidence and take on the garb of a clairvoyant. I shall use the crystal ball to assemble a view of the future using some results from ACIR's research, some from the recent Auto Industries Highway Safety Committee Survey and some personal conjecture. This may help to give you some new perspective on the potential influence of the safety belt in the national highway safety program.

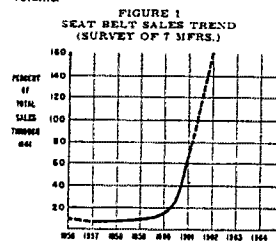
There is growing evidence that a real breakthrough in public acceptance of safety belts is occurring in this country. The tide has been slowly rising and ebbing for about five years and it now appears that the wave-front of the flood is about to deluge the country. Those of us who have been observing this surge are aware of its occurrence but find it surprisingly difficult to determine its magnitude; it appears that a sudden change began to take place during the Fall of 1960.

What is the actual trend of seat belt installation and usage? It is not easy to answer this question but some insight into public acceptance may be gained by examining seat belt sales throughout the country. ACIR is conducting an informal survey of seat belt sales with the cooperation of some American manufacturers of seat belts.

Response to ACIR's inquiry has been very gratifying, and although only a fraction of the industry is represented at this time, we hope the data is fairly representative of the national trend. It is planned to issue a separate report of findings on sales trends to the cooperating belt manufacturers and to continue the survey as more manufacturers join the effort.

This report has just recently been initiated and is of a preliminary nature. Figure 1 shows a composite curve of the industry's sales trend which, incidentally, has been

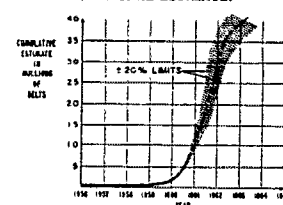
considerably smoothed. Each of seven manufacturer's sales data has been proportioned over the years to his own total sales, then combined with the total group and averaged; this produces a curve which represents the trend of sales growth over a five year period. This curve provides only the general shape of the sales trend but is not capable of showing total sales volume because it represents only a part of the industry's volume.



How then can we estimate total volume of sales? It so happens that the recent survey of seat belt installations made by the Auto Industries Highway Safety Committee in May-June of 1961 provides a bit of information which allows us to combine the sales trend curve of Figure 1 with the measured national installation of 33 per cent found by the AIHSC survey. We, thus, have a curve of typical form and a point on the curve. From this limited data Figure 2 is developed; this shows the estimated cumulative number of seat belts in American passenger cars for the five year period. Projections of future volume indicated by the dotted line are based on the established trend.

An additional assumption had to be made to formulate this curve; an "educated guess" is made that an average of 2.5 belts per car are being installed at the present time. On Figure 1 and Figure 2 the data collected up to mid-1961 is shown by the heavy lines; whereas the future projections are purely conjectural. It will be interesting to check the actual figures as they develop during the next few years.

FIGURE 2
NUMBER OF SEAT BELTS INSTALLED
(NATIONAL ESTIMATE)



In rationalizing the projected trend on Figure 2 for the year 1962 and beyond, it is believed that due to the increased convenience of installing belts in new cars as provided by built-in anchor points, in addition to mandatory regulation in some states, and the generally increasing public awareness of the value of safety belts, the rate of installation will actually continue to accelerate but, to be conservative, the acceleration is not incorporated in the projection.

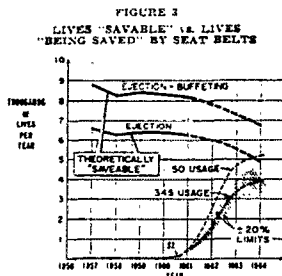
To indicate this conservatism, a straight line projection is used rather than an accelerating slope and is extended until 35,000,000 belts are reached. At this point it is assumed that market saturation starts to enter and the installation rate begins to "slough off" in some fashion as indicated. The exact point at which the rate begins to fall off is not predictable; it is shown here merely to express an awareness of the possibility—only experience will tell.

Lives Theoretically Savable versus Lives Actually Being Saved

There are various possible ways of expressing goals for a national seat belt promotional effort. One way would be to aim for at least two seat belts in each of the 61,000,000 passenger cars in the national registration on the assumption that this is the best one could hope to achieve. The Federation of Women's Clubs has chosen the very "catchy" slogan, "A Million and One in '61," and are working hard to achieve it.

I have selected a different way of stating a goal and outlining a method of measuring progress toward it by casting the seat belt in terms of its potential life-saving role. This choice may be less glamorous than others but it has the virtue of including a measure of effectiveness of the seat belt, an installation growth factor and a usage factor. All of these factors are important ingredients of the problem and may change with time and the changing habits of people. This scheme, therefore, provides us with a means for "keeping track" of the influence of the seat belt in the coming years and allows us to modify the major ingredients as they may shift about in the future.

ACIR has made two studies which may be used to estimate goals of "lives savable." The California seat belt study indicated a potential reduction of major fatal injuries of 35 per cent through combined control of ejection and buffering; the ejection study found that fatalities could be reduced by 25 per cent by means of complete control of ejection. Applying these results to "applicable" national fatalities produces the two upper curves in Figure 3 labeled "lives theoretically savable."



The top curves of Figure 3 show the lives savable annually by means of seat belts (ejection and buffering control); it is extended to 1963 and this may be considered as representing a maximum goal

of saving about 8000 lives per year. Notice that about 1962 the projected slopes of the curves start to slip downward at a faster rate; this reflects the fact that if the expected lives are indeed being saved, the total number of lives savable should also reduce.

The lower of the two curves (marked ejection) represents an approximation to a boundary of lives savable by means of ejection control alone; it indicates about 6000 lives per year as a lower goal. Consider these curves as being related to each other and that the region lying between them is a band of uncertainty which describes a wide "broad brushed" curve.

The up-sweeping curve at the bottom of the graph is the estimate of lives being saved annually by means of seat belts; this is based on the trend of belt installation developed through the sales survey shown in Figure 2. Since the theoretically "savable" curves and the actually "being saved" curves are dependent on each other, any intersection of the two would represent a simultaneous solution and would indicate the time when the theoretical goal would be reached.

The lower curve of Figure 3 indicates the estimated number of lives being saved for usage factors of .345 and .50 where "usage" is the per cent of time passengers wear belts. The fanning effect plotted about the .345 curve represents $\pm 20\%$ deviation about the mean; this device is used to indicate some of the uncertainty of the projection process.

The point on the lower curve at which the curve starts to break upward in 1961 marks the estimate of 92 lives actually being saved per year at the present time and gives us some indication of the distance we have yet to go to reach the theoretical goal of saving 6000 to 8000 lives per year. Note that the projected increase for 1962 is about 7-9 times that of 1961 and that of 1963 is about 20-30 times that of 1961.

The method used to estimate the number of lives actually being saved by belts is shown here in the event that some readers may wish to plot actual progress of events as some of the values change. Several ingredients are needed: number of annual fatalities; theoretical effectiveness of belts; number of belts installed in cars and the

percentage of times they are used; these and the available data are indicated below.

Number of Applicable Annual Fatalities (National Safety Council data) = Of about 38,000 fatalities, 60 per cent are "applicable" to the ACIR type of sample.

Theoretical Effectiveness (from ACIR Research) = 35 per cent reduction in major-fatal injury. Applied in this case only to fatal portion of national injury as an approximation.

Per Cent of Time Belts are Used (33 per cent from ACIR research 1958)¹ (34.5 per cent from NHTSA poll 1961)² = Use 34.5 per cent for this computation.

Number of Belts Installed (from NHTSA poll 1961)³ = 3.3 per cent of passenger cars in national registration.

The computation for estimating the probable number of lives being saved by seat belts in any year, for example 1961, is made as follows:

$38,000 \times 60 \times 35 \times 34.5 \times 0.33 = 92$ lives. It is interesting to note that earlier in 1961, the author made an estimate of 64 lives being saved by seat belts.⁴

38,000 = estimated annual highway fatalities for 1961.

60 = portion of annual highway fatalities applicable to ACIR sample.

35 = theoretical effectiveness of seat belts.

34.5 = usage factor, the per cent of time installed belts are used by passengers.

0.33 = per cent of passenger cars having two or more belts.

When the term "major to fatal grades of injury" is used, it does not include all grades of injury encountered in accidents. "Major" is used in the California seat belt study⁵ to identify two gradations in a scale of four grades: "complaint of pain" - "minor" - "major" - "fatal," so it applies to only a part of the whole injury spectrum.

Therefore, the 35 per cent reduction found by the study may be applied to only the fatal or near fatal fraction of the national injuries reported each year.

How Realistic is this Projection?

Can we actually reach these goals? I cannot, of course, guarantee when the goal will be reached or if it will be reached but if

everyone continues to work at seat belt promotion with the present zeal, it appears to be a distinct possibility. The "lives savable" and "lives being saved" curves will, of course, probably never really intersect as all automobile owners are not likely to install belts and people will not always use belts all of the time.

If the assumptions of this analysis prove to be reasonable, however, and the projected trends of belt installation and usage are maintained, it appears that somewhere about 1964 to 1966 the influence of the seat belt will have reached its potential influence in controlling fatal injuries from ejection and a year or two later will reach the limit of combined ejection and buffering control. From that time onward, it will be a matter of "holding the line" against other changes which may be occurring in public attitudes and traffic injury patterns.

Many factors may influence the accuracy of this projection to make it more or less optimistic. Probably one of the greatest negative disturbances could occur from the type of unpredictable sociological effect known as "sales resistance." For example, if the surprising surge in public acceptability which is occurring now is being produced by a small segment of the public who were pre-conditioned to be very receptive to the seat belt and were "ready" to buy anyway, we may be receiving a false signal about the total public's attitude.

There may be a large segment of "die-hards" lurking in the wings who will resist the use of belts and we will not encounter them until the "ready" group has played out its part. Such a factor would cause the "lives being saved" curve to fall off at a lower level and a lower slope from that which is indicated. Several factors may modify the slope of the curve which, in effect, determines the time period when the maximum life saving influence will be reached.

The effect of differing "usage" may be seen by comparing on Figure 3 the two values of .345 which represents present usage with .50 which represents an improving public habit pattern and produces a much steeper slope.

The projected slope of sales on Figure 1 which determines the basic trend used in the rest of the analysis contains a large

uncertainty. We have factual data on seat belt sales only up to mid-1961—beyond that the trend is pure conjecture. It is particularly difficult to determine a representative slope of the upswelling trend because we are at the beginning of the transition phase. The sudden rise started in the Fall of 1960 and data was available only to mid-1961—not enough to firmly establish a slope for the future. ACIR plans to gather future seat belt sales data and perhaps in a year we shall have a better "fix" on the projected trend.

On the other side of the picture are several factors which indicate that a fairly high degree of optimism is warranted. There are several "islands" of probable public acceptance of safety harnesses or belts which indicate that installations can indeed approach a very large portion of total car population. The Swedish experience indicates that safety harnesses are installed in 70-80 per cent of their cars.

In the United States a recent survey of 531 doctors, made by the American Medical Association, indicates that 32.8 per cent of the group have and use safety belts. Consumers Union recently reported that about 17 per cent of their readers of *Consumer Reports* have safety belts and some commercial automobile fleets have very high records of installation and use of belts. Other factors which are at work to stimulate public acceptance are: the promotional campaigns jointly sponsored by the National Safety Council, American Medical Association and the United States Public Health Service, the campaign of the General Federation of Women's Clubs, the provision of convenient seat belt anchor points in the 1962 model cars, legislation to make installation of seat belts mandatory—such as Wisconsin's new law, and general support of hundreds of safety groups, the automobile industry, the press, the radio and television industries.

I also have a suspicion that having seat belts may be acquiring a status symbol and, if this is so, there should be a strong "following the crowd" effect.

Before closing I must point out that I have presented a somewhat oversimplified view of the projected influence of the seat belt as a "cure" to ejection. We must realize that there is another "cure" work-

ing on control of ejection at the present time, the safety door lock, and it has had a head start on seat belts in the role of a life saver. Very effective safety door locks were introduced by the American automobile industry in 1956 models and current designs include further improvements.

I have avoided putting a "door lock" curve on Figure 3 because of the technical complication of comparing it with seat belts and the confusion it would undoubtedly cause at this point. A curve of lives being saved by door locks would begin to appear about 1957 and would rise slowly to a value of about 800 in 1961.

I have discussed the relative positions of the lock and belt as life savers in a paper earlier in 1961 at which time it was estimated that on a national basis door locks were saving about 800 lives per year while seat belts were saving 64 lives. The 64 rate has, with the passage of time now become the 92 rate of this paper and is rapidly increasing. The important point to remember is that both of the devices are working toward the same end—saving lives and reducing serious injury.

It would be a most gratifying experience to have one of the National Safety Council's statisticians knock on ACIR's door sometime about 1964 or '65 and excitedly proclaim—"We have been noting a mysterious downward break in our annual automobile fatality curves for several years and we're at a loss to explain it!" I would then ask—did it start to break about 1960-61?

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WHAT MAKES EFFECTIVE SEAT BELT PROMOTION

By HOWARD N. SCHULZ
Committee on Medical Aspects of Automotive Safety
American Medical Association, Chicago

In discussing this topic from the viewpoint of the medical profession and the American Medical Association, I plan to briefly outline what results have been shown by surveys and to discuss what we have done to promote the use of seat belts.

This summer our advertising department conducted a survey on automobile preferences among physicians. The questionnaire was sent to 1,000 doctors selected by the records department as a random sample of the physicians in private practice. There were 11 questions asked. Only one question with five parts concerned seat belts.

Answers were received from 531 physicians. The questions were as follows:

1a. Do you have safety belts installed in your car(s) at present?

32.8 per cent have safety belts installed in their cars at present—99.5 per cent do not—7.7 per cent did not designate.

1b. Do you intend to install safety belts in your car(s)?

46.9 per cent intend to install safety belts in their cars—23.8 per cent do not—27.3 per cent did not designate.

1c. Do you recommend the installation of safety belts to others?

81.5 per cent recommend the installation of safety belts to others—12.8 per cent do not—5.6 per cent did not designate.

1d. Do you favor making safety belt anchorages (front and rear) standard equipment?

88.1 per cent favor making safety belt anchorages (front and rear) standard equipment—7.9 per cent do not—4.0 per cent did not designate.

1e. Do you favor extending standard safety equipment to include crash padding, improved steering wheel and recessed post, etc.?

92.5 per cent favor extending safety equipment to include crash padding, im-

proved steering wheel and recessed post, etc.—3.6 per cent do not—4.0 per cent did not designate.

This seemed to be an extremely high percentage. Even if all of the 469 who did not reply did not have seat belts, the results still would show that at least 17.5 per cent of the 1,000 physicians who were queried had seat belts.

Within a very few days of this survey a letter was received, reporting another survey from Jefferson County, in which 500 physicians received a letter and a reply card. The response was 66 per cent and the data indicated that 34 per cent of those replying used seat belts, and 92 per cent believed in the value of seat belts.

These results have been achieved almost entirely by means of the written word. The AMA News which goes to all physicians as one of the benefits of membership in the AMA, has carried out a continuing campaign. Rarely does an issue come out without some story, editorial or reference to seat belts. We feel that this has been effective.

The publication *Today's Health* also goes to all physicians. In addition, about 600,000 subscriptions are sold to the public. Feature stories on seat belts have helped the campaign.

Very often, physicians write in to inquire what they can do as individuals to help in the seat belt campaign. A good answer to them is in the forms of a series of questions. Do you have some community leaders as your patients—the mayor, a congressman, judge, chief of police? Do they now have seat belts in their cars? Can you use your influence as a personal physician to get them to use seat belts? This approach which can be carried out on an individual basis is only one of many. The main thing is to encourage people to make their contribution to this program, whether it's an individual effort or community project.

ened not only to bring additional motorists to install seat belts but to pound away at the theme that a seat belt is of no use unless it is worn. Complementing these efforts must be the continuation of all of the other traffic safety measures outlined in the balanced program of the President's Committee for Traffic Safety.

The old adage, you can lead a horse to water but you can't make him drink, is certainly true in the case of seat belts. A recent national poll revealed that, of the estimated two million motorists who have voluntarily equipped their cars with seat belts, only one-third use them at all times in their driving. These are drivers who at one time obviously recognized the benefits of seat belt use but now only a third will take the few seconds necessary every time they enter their car to fasten their seat belts.

This is one of the reasons why we do not feel that the answer to the problem of increasing seat belt use lies in legislation requiring their installation. The answer, as I see it, will be found in education on a distinctly personal level. Arguments for seat belt use must be presented to drivers on a "benefits to you" basis.

Let's face it, the average driver is not particularly concerned with accidents involving the other fellow. He is concerned with accidents as they affect him or his family. When he reads that so many millions of accidents occurred during the year—this is the result of the other guy—the bad driver—the one who needs seat belts. But when he reads that accident rates are down two per cent over last year, this is a result of his own superior driving ability.

In promoting seat belt use, we must find means to take advantage of this feeling of superiority by associating seat belt use with above average drivers. I believe the insurance industry touched on this philosophy somewhat when they reduced rates for drivers who equipped their cars with seat belts.

Speaking of insurance, I think we would do well to encourage drivers to view seat belt use just as they do their auto insurance. They don't take out a policy to protect the other fellow but to protect themselves. Most drivers know from experience that their chances are something like one in seven of having an auto insurance claim in any given year, yet they continue to renew their policies year after year. Seat belt use follows this pattern and, like auto insurance, should be there when needed. Failure to fasten a seat belt should be regarded just as seriously as failure to renew an insurance policy.

I also believe that this classroom, most particularly the driver education classroom, can be instrumental in effectively promoting seat belts. Many of the training aids, publications, and films distributed to schools by companies within the auto industry do contain information on seat belts and all cars loaned to schools for driver education through the manufacturer-dealer cooperative programs are equipped with seat belts to encourage their continued use after graduation.

We feel that such measures as these will have increasing impact in the safety picture as time progresses. Thank you.

MANDATORY PERSONAL APPEARANCES IN TRAFFIC COURT

By JAMES A. RAVELLA
Municipal Court Judge, Warren, Ohio

This is a very important matter and we have all heard it said, and we've said it ourselves, that all moving violators should be made to appear in traffic court. Why?

That is the basic question.

For what purpose or purposes should moving violators appear in traffic court? What do we hope to accomplish thereby?

For convenience and expedience these cases could be handled in a traffic violations bureau. But should they?

I think we are going to come up with some valid reasons for bringing these moving violators before a judge in a court of justice.

But we are going to be faced with a second question. That question is whether or not the time, trouble and expense involved, in bringing these cases to court, is justified by the result that will be attained.

Basically these two questions merge into one:

What can the judge do better in the courtroom than the cash register does in the violations bureau, and how much savings in human life is going to result, if any?

Our basic premise is that all moving

traffic violators should appear in traffic court. We know, however, as a practical matter, that there aren't enough judges and traffic courts in the land to handle all these cases, and not enough hours in the day to review the citations of the approximately 10 million moving traffic violations which occur annually in the nation.

So as a matter of expediency shall we amend our goal and have it only require that "all hazardous moving violators appear in traffic court"? What, then, about the contention that many penalties, as permitted in some violation bureaus, are ineffectual in reducing the shocking automobile accident rate, especially where the offenders are persons who can afford the luxury of breaking traffic laws and thus become "violators for a price."

MANDATORY PERSONAL APPEARANCE IN TRAFFIC COURT

By EARLE W. FROST
Judge, Municipal Court, Kansas City, Mo.

Most traffic courts now require personal appearance in traffic cases except as, to first, second, or even third moving violations within a certain time limit. Therein, as to these moving violations, lies the problem posed by the subject of this discussion.

It was recognized, even in the early years of the program for traffic safety and the improvement of traffic courts, that "a traffic violation bureau should be considered a legal expedient rather than a safety measure" (Enforcement for Traffic Safety, page 41).

Warren, in *Traffic Courts*, 1942, pages 57 and 58 said:

The theory which lies behind violations bureaus is the establishment of a method for disposing of some of the traffic offenses when their number begins to overwhelm the regular court. The effective use of these bureaus avoids badly overcrowding traffic dockets and permits the bench to exercise thorough judicial consideration of the more serious traffic cases. But the use of such bureaus is to be weighed against the purpose of the traffic court—to enforce the traffic law effectively and promote safety—and when utilization of this device does not or will not promote these

ends a violations bureau is out of place. For this reason "inferior court" jurisdiction should be limited to offenses against public convenience and should not include those which involve public safety to a serious extent. It is most desirable that all traffic offenders be brought before the judge for corrective as well as punitive action.

The predecessor to the Traffic Court Division, the Traffic Court Committee of the National Safety Council, in 1943 recommended specific proposals for the improvement of traffic courts, including the recommendation that "a traffic violations bureau, set up under the direct jurisdiction of the court, should be in operation to receive cases of minor nature—ordinary parking violations and possibly a few minor moving violations."

The 1946 President's Highway Safety Conference Committee on Enforcement recommended:

The bureau should handle the least hazardous violations and should deal with moving violations only when they respond to treatment outside the courtroom. Major traffic law violations should never be handled in a violations bureau. (1946 Report, page 26).

Obviously, if hazardous moving violations are actually major traffic law violations, as we are more and more inclined to conclude, then there is no place in a traffic violations bureau for any hazardous moving violations.

There is, of course, a logical basis for the use of the term "hazardous" in connection with any discussion and treatment of moving violations, since the traffic codes of some states include as moving violations some violations that cannot be classed as hazardous moving violations and which have no direct relationship to traffic safety.

Judge Edward C. Fisher, now of the legal staff of the Northwestern University Traffic Institute, said in his book *People's Court* in 1947, page 38:

These violations bureaus are simply an expedient, not a solution of the traffic problem. They are adopted when the volume of business begins to overwhelm the court and are merely a development of the ancient system of bail forfeiture. The customer never sees the court, but simply pays his money over the counter, a stipulated sum for each violation and the whole transaction is purely on a financial basis. . . . Under no circumstances should violators charged with hazardous moving violations be permitted to pay their penalties at a violations bureau.

In 1949 Chief Justice Vanderbilt, in speaking of the New Jersey record of the first year following their new judicial establishment said:

The most significant aspect of the work of these courts (referring to the new municipal courts) is the increased respect now accorded them in the public eye. . . . The resultant increase in respect for law in the part of hundreds of thousands of defendants and witnesses who are brought into the municipal courts is quite as important as the improvement in the enforcement of the traffic laws. . . . (Annual Judicial Conference, Sept. 1949).

In 1953 the Conference of Chief Justices adopted sixteen resolutions concerning traffic law enforcement. One of these resolutions, No. 10, referred directly to the subject of this discussion, as follows:

RESOLVED, That because of the increasing toll of highway accidents, trial courts of first instance should require all persons charged with moving violations to appear in court in person and the traffic judges should increase the amount of individual attention given to each case of such nature for the purpose of assessing adequate corrective penalties and that, if necessary, steps be taken to add additional judges and prosecutors to accomplish this end.

Of this resolution Chief Justice Vanderbilt said:

This resolution is to be read with Resolution 15 providing for a violations bureau to

handle nonmoving traffic offenses so as to give the traffic judge more time to deal in person with moving violations. Given such personal attention will not solve the problem of handling moving violations satisfactorily unless he can give each case the amount of time necessary to master it thoroughly, a prerequisite to a wise decision. Accordingly, the most important part of the resolution is the last clause calling for more judges and prosecutors if needed to enable each judge to give each case as much time as it may reasonably require. Hurried justice is likely to be the reverse of justice.

The citation of authorities on this subject would, of course, not be complete without the word of the supreme authority, the expert to end all experts, Mr. Traffic Court himself, James P. Ecomomos, who stated his views in the "Administration of Traffic Courts," page 36 of *Judge and Prosecutor in Traffic Court* as follows:

Only those violators of the traffic laws designed to promote public convenience, such as parking and standing regulations, should be processed through a traffic violations bureau. This means violations of regulations designed to promote public safety—moving violations—should be heard by the judge.

The primary aim and objective of a traffic court is not to punish the violator for the sake of the punishment alone, although, unfortunately, we must recognize that there are some violators, we hope a very limited number, who do not understand any other language.

The Traffic Court Committee of the National Safety Council stated in 1943 the recognized primary objective of the traffic court, as follows:

The primary aim of the traffic court should be to impress defendants with the need for traffic law observance rather than to penalize. This may be stated as a simple objective, but as can be gathered from the few standards we have been discussing, it requires application of some rather important principles if it is to be achieved. (Specific Proposals for the Improvement of Traffic Courts, 1943).

Now, obviously, this objective can never be achieved through payment of fines in a violations bureau. The only way it can be achieved, if at all, is in the traffic court and the first requirement must be that the violator be required to appear personally in the traffic court.

Traffic court judges are fully aware of the desirability of requiring all hazardous moving violators to appear in court, however, the great increase in traffic cases in metropolitan areas has far-surpassed the present capacity of traffic courts to handle

all hazardous moving violations in the courts. Of course the resolution of the Chief Justices supplies the theoretically correct answer, that is, obtain more judges and prosecutors.

As a practical matter, however, officials of cities, hard pressed financially, are sometimes the first to suggest letting all moving violators, including speeders, pay at a violations bureau, arguing for public consumption the convenience to the violators, but no doubt thinking about all the increased revenue the city may obtain when the violators can conveniently and guiltlessly pay for their violations for a price at the bureau.

Moving violators, if not corrected, become repeaters and ultimately reach the court after the damage, injury or death has occurred. Prevention, at the cost of additional judges, would be much cheaper and more compassionate to the victims.

A captive audience, such as traffic violators compelled to be present and listen, may quite understandably be inclined to be a hostile and an antagonistic audience. Yet all judges who make appropriate opening remarks before traffic sessions will, I am sure, verify my experience that the making of such remarks invariably and very noticeably increases the cooperation and respect of all violators. Even the repeaters often express regrets and apologies for returning and promise never to be there again instead of arguing about what a bum rap the cop gave them.

All judges are aware of the fact that many violators in court, charged with carelessness after having had a collision, who vehemently protest they are good drivers and never had a collision before, are found, on checking the records, to have a long record of many moving violations, paid over the years at the violations bureau.

They have never been in court and it quickly becomes apparent they do not know the right-of-way rules. It is utterly astounding how many drivers, of many years driving experience, have not even the faintest conception of the fact that there is a right-of-way rule for every traffic situation, much less what the rule is. Good defensive drivers, of which fortunately there are many, have saved them in the past but finally their luck runs out.

How many times have you judges had

such drivers before you, who blandly tell you, even though you may be a traffic judge of long experience, even as much as over 20 years, how right they are and how wrong the other driver is, and you also, if you decide against them. In addition they magnanimously proceed to give you the benefit of their solution of the whole traffic problem.

These are the drivers who cause many "accidents" by their carelessness, inattention, failure to yield right of way, downright discourtesy and the almost psychopathic attitude of many drivers whose inflated ego behind the wheel leads them to believe they are perfect drivers instead of rank amateurs; that all the rules, many of which are unknown to them, apply to the other driver but not to them; that it could never happen to them to be involved in a so-called accident; that if it does it is always the other driver's fault; and that if the judge decides against them he is just a confused old man and doesn't know what he is doing or is just picking on them.

If ever education is needed it is for these egotistical but thoroughly ignorant, almost morose, drivers who endanger themselves and their innocent victims every second they are behind the wheel, and the time it is needed is when they are busy committing the moving violations and before the so-called accident occurs. True, a regrettably large number of drivers cannot or will not assimilate the needed education but that, too, becomes quickly apparent to the experienced judge and then the answer must be to speak to them in the only language they can or will understand—heavy penalties to deter future moving violations that will lead to the inevitable collision.

Many years of traffic court experience has caused me to conclude that the greatest failure and fault of even the better-type driver, as well as the inferior types, is lack of education, understanding and application of right-of-way rules. This becomes self-evident when we realize that if right-of-way rules were known and followed by all drivers, assuming proper driving habits to enable them to do so, we would never have an intersection collision!

Preventive education of moving violators by means of required court appearance might well be the answer to the education and

understanding necessary to secure voluntary compliance with right-of-way rules, provided we also simplify our right-of-way rules and definitely place the continued responsibility of yielding on one of the two drivers without permitting any exercise of opinion or judgment by the driver. Other bad driving habits and faults, including those which frequently make it impossible for the driver to yield right of way, could be spotted in time, by requiring court ap-

pearance, so that many tragic collisions of the future might be avoided.

Thus the need for specialization in the handling and in the education of moving traffic violators is of the greatest importance if we are ever to solve or even greatly improve the traffic problem. This cannot be done unless the hazardous moving violators are required to come to court, so the court can educate and impose selective judgment on such violators.

REPORT ON AMERICAN BAR ASSOCIATION NATIONAL SYMPOSIUM ON CORRECTING THE VIOLATOR, AND THE NEED FOR RESEARCH

By THOMAS M. POWERS
Presiding Judge, Municipal Court, Akron, Ohio

I have long felt that all traffic violators should appear personally before the traffic judge unless there are compelling reasons that make such appearance impossible or impracticable.

Now it is my assignment to report on the National Symposium on Correcting the Violator panel program at the recent annual meeting of the American Bar Association held at St. Louis and jointly sponsored by the Standing Committee on Traffic Court Programs of the American Bar Association and the National Association of Municipal Judges. Also, after the report I shall say a few words concerning the need for further exploration and research in this field of correcting and penalizing the violator.

There may be some here who were fortunate enough to hear the interesting and able speakers at that symposium but for those of you who were unable to attend, let me say that you missed a real treat because never in the many meetings that I have attended where this subject has been discussed have I heard such complete and enlightened discussion of it.

One speaker ably concluded his remarks by stating:

Traffic courts should at all times be firm and forward in the imposition of proper

penalties as long as justice is meted out and with the thought in mind of serving the following purposes: penalizing the violator so that the penalty will act as a deterrent, educating the violator, making the proper impact upon the community, and last, but not least, instilling in the violator a voluntary desire to be a good, careful driver and to respect and obey the traffic laws so that the streets and highways will be safe for everybody, motorists and pedestrians alike.

Another speaker reminded us of the difference in intent and in the type of individual involved in the traffic violation as opposed to the person who is regarded as a criminal in the usual sense of the word, emphasizing that the methods of handling actual criminals cannot satisfactorily be applied to traffic violators.

Another speaker carefully analyzed the different types of traffic violators, the "can'ts," the "don'ts" and the "won'ts," pointing out that if correcting the violator and getting voluntary compliance with the law are the central objectives of the traffic court then we should treat these three different types of violators more understandingly and with the view to attaining desired objectives.

Another speaker emphasized the importance of the judge, proper court facilities and proper atmosphere and concluded with some pertinent remarks by the Honorable Tom Clark, Associate Justice, United States

Supreme Court on the importance of the Traffic Court in our judicial system:

In saying that the traffic court is the closest court to the people in pointing out the millions of people that come there every year, and then saying that respect for law and respect for court indeed begins right at this level—the traffic court—we are pointing out something that is vital in our judicial system. Those who are charged, or who go into our traffic courts not being charged but just as visitors, see in action perhaps the only court they know anything about. The condition of that courtroom, the manner in which its procedures are carried out, the demeanor of the judge and the attitudes of the court, the method in which the court is carried on, and the time, perhaps, one has to wait in order to have his case called, all these things are impressed indelibly upon those people who come and sit in that courtroom. This is true whether or not they take part in the proceedings. There can be no more important court in this whole land than the traffic courts of the various states, of the various counties, of the various municipalities. Here is where respect or disrespect for law, for order, for the courts, and for government is fostered.

Finally, another speaker pointed up the unbecoming motivation of revenue-raising that permeates too many traffic courts, deploring the violations bureau and its posted schedules of fines for different offenses, deploring the growing tendency toward resort to this type of push-button justice rather than the individual consideration of the facts and circumstances of each case; and deploring, finally, the growing disrespect for law observance when the public feels that by "paying the price" there is a full acquittance for the violation.

So much for a summary report of the symposium to you. It would be impossible, because of time limitation, to do justice to all the good points brought out by the different speakers.

Let me in conclusion make a plea for more such symposiums and may I add thereto a plea for further exploration and research in this field of correcting the violator.

It is axiomatic that no person's judgment is better than the facts on which it is based. There is a great disparity and a great lack of uniformity among the traffic courts of the nation in treating, in handling and penalizing, traffic violators. As an example, in some places a D. W. I. defendant gets off with a \$23.00 or \$30.00 fine and no jail sentence or loss of driver's license, while in other places the same defendant under the same facts and circumstances would get a \$100.00 fine, thirty days in jail and lose his license for one year.

I do not believe in uniform fines or penalties because I do not believe they make for justice in the individual case, which should be considered in the light of all the attendant facts and circumstances. However, I do believe in the uniform approach of considering and weighing the proper penalty to be meted out in the light of the objectives to be obtained and considering the tested and proven techniques and tools available to the court for treating the violator.

In summary, concerning this matter of research, I feel that what is meant by correct penalization and the methods and techniques of achieving same should not be just something that we ourselves discuss and accept and believe to be efficient methods, but rather should be discussed and explored more publicly at the national and state levels, to the end that there will be a better public understanding of what we are trying to do and why we are trying to do it, and what we believe the objective should be in the penalizing process.

Without this understanding, we will never get the public support that we should have for better traffic courts; and in this respect we are making the same plea that years ago was made to the public when gradually and finally there was understanding and support given for the enlightened and humane treatment of juveniles, rather than having them herded together with hardened criminals, and treated and penalized under the criminal code as adult criminal offenders.

I am not saying that traffic violators are juveniles. The vast majority of them are not, nor are they criminals in the usual sense of the word.

Research, education and understanding are needed for everyone, judges included.

As the matter stands now the Traffic Court Program of the American Bar Association is practically the sole agency trying to bring understanding and order out of chaos in this field of corrective and enlightened penalization for traffic violators.

However, they are handicapped because of lack of funds and personnel to raise the torch in the darkened areas throughout the nation—a torch that is sorely needed in every state of this nation because there is no spot so remote today that the motor vehicle does not reach it, and where traffic violators are not processed.

IS DRIVER LICENSE SUSPENSION FULFILLING ITS ROLE: DRIVER LICENSING VIEWPOINT

By EDWARD SCHEIDT

Commissioner, North Carolina Department of Motor Vehicles, Raleigh, N. C.

In discussing the question of whether driver license suspension is fulfilling its role, it is first necessary to define what its role is. Suspensions, as carried out under the authority of driver license administrators, should have the objective of making safer drivers, and therefore suspensions should be regarded as a part of the driver improvement procedure. The term "driver improvement," in the parlance of the administrator, has a special meaning rather than merely a general meaning; it refers to the improvement or correction of dangerous driving practices or habits by changing the attitude of drivers through procedures available to the Department of Motor Vehicles such as advisory letters, conferences, driver improvement clinics, or suspensions and revocations.

The authority of the driver license administrator to suspend a license or to put into effect other driver improvement measures is, for the most part, limited to situations involving the conviction of drivers for violations of the motor vehicle laws. There are some exceptions to this but mainly suspensions are based upon convictions.

To justify driver license suspensions as a "driver improvement" technique, it is necessary to demonstrate that there is some relationship between violations of law and accidents. Motor vehicle administrators and safety experts have long been convinced that there is a very close correlation between violations of the traffic laws and accidents; and, therefore, if violations are decreased through driver improvement procedures the likelihood of drivers having accidents would also be decreased. Another strong belief or assumption by administrators has been that existing driver improvement procedures actually have a beneficial effect.

Both of these assumptions, namely, that there is a close correlation between violations and accidents and that there is a likelihood that violations and accidents can be decreased by driver improvement procedures, were given strong support by a very significant study made in the years 1956-58 under

the auspices of the American Association of Motor Vehicle Administrators.

This study was made possible through a grant from the Esso Safety Foundation and was supervised by a committee of motor vehicle administrators of which I had the privilege of serving as chairman. The staff work of this study was done by the Institute of Government of the University of North Carolina at Chapel Hill. This study covered the operations of point systems in driver licensing and other driver improvement measures throughout the entire United States and the Dominion of Canada.

One of the most interesting and revealing disclosures of the study was the conclusive relationship between violations and accidents, as shown by a scientific sampling involving 40,000 drivers in the state of North Carolina. I understand that the sampling methods were such that the results would not have been materially different if it had been possible to examine all the drivers files in the department.

The 40,000 drivers whose files were tabulated were classified as to whether they had no violation of traffic laws charged against them, one violation, two, and on up to five or more violations. This related to violations which did not involve accidents. The tabulation then showed how many accidents subsequently occurred involving drivers in each of the categories.

The results shown were that drivers who had no violations had very little likelihood of having subsequent accidents; those with one violation had a greater probability of an accident, and so on up to the point where it was a virtual certainty that drivers having as many as five violations would have subsequent accidents. To put it another way, the more violations committed by a driver, the more likely he was to have an accident later.

The same study also contained considerable information to support the thesis that driver improvement procedures, such as advisory letters, conferences, or re-examina-

tions, result in fewer violations and accidents involving the recipients of the driver improvement action than by individuals not receiving such action. These conclusions were made possible by the existence of control groups which had the same characteristics and experience, the only difference being that one group received driver improvement attention and the other did not.

In a sense it might be said that license suspensions represent a failure of the other driver improvement measures which preceded the suspension, for presumably if the other driver improvement procedures had been effective, it would never have been necessary to suspend the license.

To the average individual the suspension of his driver license represents a much sterner action than warnings, conferences, or other measures which do not actually interfere with his privilege to operate a motor vehicle. It follows that properly administered and properly understood the suspension power can play a very vital role in highway safety. It is, therefore, well that all those to whom this authority is entrusted take every precaution to insure that the suspension power is utilized to its greatest possible advantage.

There is no question about the fact that tremendous progress has been made and is being made in "driver improvement" in its various phases, including that of suspension of the driving privilege. Noteworthy work is being done by the American Association of Motor Vehicle Administrators in helping to upgrade the driver licensing function in all of its facets. Particular tribute should be paid to the interest shown and financial assistance rendered by the Insurance Institute for Highway Safety in supporting the efforts of the American Association of Motor Vehicle Administrators in this vital area.

Since performance should always be measured in terms of its potential, it can be stated that at the present time driver license suspension is not entirely fulfilling its role, although tremendous strides have been made throughout the years. Administrators are generally and basically doing a good job in carrying out their responsibilities but there is always room for improvement. In my judgment, the most urgent needs in the way of driver license suspension fulfilling its role are not matters within the immediate author-

ity or jurisdiction of the licensing authorities, but relate to the assistance and cooperation of other agencies who also have vital and indispensable functions and responsibilities with respect to driver licenses.

The first such agency is, of course, the police. Unless individuals who commit violations of the safety laws are arrested in the first place, their licenses will never be suspended for the violations which, if unchecked, cause accidents. Therefore, the truly effective driver improvement program begins with effective policing on the front line.

Another area in which the police are indispensable is in the apprehension of individuals who violate suspension orders. If drivers can, with impunity, ignore their suspensions and continue to drive in violation of suspension orders, it makes suspensions impotent and valueless. This suggests that all police should consider the detection of violations of suspension orders as an important police responsibility and not merely a matter for licensing authorities as, unfortunately, the attitude has sometimes been.

The cooperation of the courts is also indispensable for driver license suspension to fulfill its role. Some of the things which courts can do in this connection include:

1. Forwarding conviction notices to the Department of Motor Vehicles as soon as possible. While courts generally send these notices in promptly, occasionally there is some delay in doing so and, of course, the greater the delay the less effective or weaker is the driver improvement action of the Department.

2. Careful consideration by the courts as to whether the judgment rendered is one which will enable the Department to take driver improvement action. The Department can only act upon convictions which are valid under the driver license laws and any instance where the judgment does not constitute such a conviction and final judgment, the Department is powerless to carry out any of the driver improvement procedures affecting the individual, thus depriving him of the possible benefits of such actions.

3. Recognition by the courts of the difference between the function of the courts to administer punishment to individuals convicted of law violations and the function of the driver license officials in carrying out

the provisions of suspension orders or other driver improvement procedures which relate to the conditions under which the state grants or withdraws the driving privilege and are not to be confused with the concept of punishment for an offense.

Finally, for driver license suspension or driver improvement measures to achieve their potential, greater interest on the part of all public-spirited citizens is needed. The driver licensing authorities should be sup-

ported wholeheartedly by individual citizens and by all organizations having any direct or indirect interest in highway safety in their efforts to derive the most benefit from driver improvement procedures. Citizen support is a necessary ingredient whether a program of vigorous enforcement of the traffic laws is to be sustained or whether suspension provisions and other driver improvement measures are to achieve their potentialities.

IS DRIVER LICENSE SUSPENSION FULFILLING ITS ROLE?—CITIZEN VIEWPOINT

By A. E. HUBER

Executive Dir., Indiana Traffic Safety Foundation, Inc., Indianapolis, Ind.

It would appear there exists some difference of opinion regarding who actually should have (or does have) the authority to suspend the driving privilege. Unfortunately, these differing views are representative of the situations which exist in most of our states.

As a citizen, I am not as concerned about who has the vested authority to suspend a driver's license as I am who has the authority and the responsibility for making a driver license suspension program effective.

I feel most informed citizens accept driver license suspension as an essential tool in our nationwide effort to reduce traffic losses. Most citizens accept the logic of the safety authorities reasoning that, in order to protect the general public from a potentially dangerous driver, it is sometimes necessary to suspend an individual's driving privilege until his condition can be examined and serious defects corrected.

I'm sure most citizens feel that, in other instances, it is necessary to suspend the license of an individual in an effort to impress upon him the real value of the motor vehicle and of the license to operate. But there is ample evidence that license suspensions are not being used to their fullest extent and that even where the suspension is used, all is not going as well as it might.

Far too frequently we read headlines such as "Suspended Driver Nabbed in Police

Chase," "Suspended Driver Held in Fatal Crash," or "Suspended Driver Attempts to Elude Police." Frankly, I sometimes feel that the only drivers apprehended for driving while under suspension are those who become involved in accidents or serious violations while ignoring a current suspension. From the frequency of such occurrences in our part of the country, I have become quite concerned about the number of drivers under suspension who obviously continue to drive.

One of our Indiana judges indicated that he believed as many as 25 to 30 per cent of the drivers receiving suspensions violate their suspension. One of our deputy attorney generals, who handles appeal cases for our Motor Vehicle Bureau, estimated that based upon his conversations with drivers and attorneys involved in appeals from suspension action, he believes that as many as 50 per cent of the suspended drivers will ignore their suspension orders. (This would mean, in our state alone, 10 to 20,000.)

To me this is shocking evidence that many offenders are openly contemptuous of our traffic courts and license administrators efforts to reduce traffic losses and that a completely inadequate job is being done to make suspensions effective.

This is even more serious when you consider that many individuals elected or appointed to serve as traffic judges are reluc-

tant to recommend suspensions in almost any case, regardless of its severity. Certainly when suspensions are recommended and placed in effect they should be rigidly enforced. I feel we are most fortunate, in our state, to have mandatory suspensions for some of the more serious driving offenses. Otherwise, I feel suspensions would never be effected in many of our communities.

Other courts are tardy in forwarding abstracts of conviction and recommendations for suspension to the license administrator. This results in long periods of time elapsing between arrest for the violation and action by the driver license administrator. This lag in direct and positive action may be responsible, in part, for growing disrespect for suspension orders. It most certainly must tend to lessen the seriousness of the original offense in the mind of the violator.

It seems to me these conditions should be matters of grave concern to every jurist handling traffic cases, to every public official with responsibilities in traffic and to every citizen interested in a law-abiding society.

I fully recognize that in most instances

neither the courts nor the driver license administrators presently have the personnel to conduct periodic follow-ups on the large number of suspended drivers to insist upon compliance with suspension orders. However, it seems to me that some agency or official body must conduct such follow-ups if the driver license suspension is to serve as an effective means for improving safety on our streets and highways.

In view of general conditions in this area, I feel as citizens we have every right to ask not only—

"Is driver license suspension fulfilling its role?" But, more directly to ask—

"How can license suspensions be made more effective?"

"Which agency shall be directly responsible for performing the follow-up to insure that suspended drivers respect their suspension?"

I fear that if we permit the continuation of what obviously is widespread disrespect for suspension action, we are tolerating a condition which will seriously undermine our entire system of traffic law enforcement.

THE AGING DRIVER

By E. R. KLAMM

Accident Prevention Dir., Allstate Insurance Co., Skokie, Ill.

The matter of the aging driver is receiving greater attention today. It is replete with many angles and I would like to discuss just a few.

In reviewing material previously written on this subject matter, the following major thought prevails. "Driving performance, not age, should be the determining factor in permitting any person to drive." Burt Marsh of the American Automobile Association did a very comprehensive study "Aging and Driving" last year.

In further reviewing this situation, it seemed paramount to me that I personally review the situation with our senior citizens. This was a revealing experience and certainly one that was extremely educational to me. First and foremost, we must recog-

nize that the senior citizen will not accept driving restrictions without a struggle. In fact, the senior citizen can assemble quite a force to prevent any restrictions from being administered if he so desires.

These were some of the highlights that "Mr. Senior Citizen" stressed to me.

1. After age 60, 65 or 75, he still has an imperative need for his operator's license. He indicates that he will be probably traveling more if he has sufficient funds to retire than he did prior to retirement age. If he retires, he and his wife would plan to travel considerably by car. Such travel is educational, less expensive and more convenient. He will also be in a position to visit his children and their families and, for the most part, they will be spread throughout the

U.S.A. Oftentimes, he and his wife, who may be his junior by a few years and in better physical condition, will share the driving chores. So, Mr. Senior Citizen does stress the vital need for keeping his driver's license.

2. If any restrictions are to be imposed, he will rebel to his political friends. Or, he may employ a lawyer to protect his "so-called rights." Some indicate they will even go directly to the "governor's office" to prevent any injustice from being imposed upon themselves as far as their driving privileges are concerned.

3. They will protect their constitutional rights and prevent any discrimination against their freedom.

So, it seems essential that any planned program dealing with the senior citizen as a motorist should be planned and administered slowly. The aging driver also stresses that any decisions involving his own group should include some of his own type on any committee making such decisions. That is, he wants to "voice his opinion" and be in on decisions rather than having "some young whipper-snappers passing laws or administrative acts restricting the senior citizens' own use of the vehicle."

The senior citizen did agree that there were certain physical shortcomings that did affect their operation of a vehicle. His physical condition deteriorates, his mental processes work more slowly, vision slackens, perception declines, coordination is oftentimes adversely affected, his response to emergencies may be somewhat curtailed. Nevertheless, he feels these are all factors he can compensate for in his driving so that he does not feel that his license should be placed in any jeopardy because of any physical shortcomings. He does not concur that a mandatory physical examination should be completed by every person as he reaches age 65, 70 or any other age. Driving ability is far more important than age. Age is relative and he will certainly stress this fact.

In asking for suggestions from our senior citizens, the following points were stressed by them to me.

1. The senior citizen should be remembered among any committee considering this problem.

2. Representatives from the American Medical Association and/or state and local

medical associations should be included on any committee dealing with this matter.

3. The Department of Health, Education and Welfare is vitally concerned with the senior citizen problem and so they should be involved in any matters referring to the senior citizen in traffic—both as a driver and a pedestrian.

4. Driver training is essential for all, not just senior citizens. Nevertheless, senior citizens are anxious to attend driver training sessions where convenient for them. This is extremely important in staying abreast of the traffic situation. They single out that the senior citizen who drives should take driver training.

5. Where driving ability is questionable, then a request for a re-examination is in order for recertification of the operator's license.

6. The use of driving simulators should be encouraged in training programs available for senior citizens particularly in reference to driving on expressways and under emergency conditions.

7. Newspapers and media can devote more time and space to safe driving for aging drivers. Also, that the press widely publicize any senior citizen "voluntarily giving up his license." They are insistent that they are "matured."

8. All drivers should recognize that senior citizens have a right to drive as much as anyone and so, "other drivers must adjust to the driving of senior citizens." If a senior citizen is driving slowly, he is driving at the maximum speed capable for his ability and so, he should not be forced or coerced to drive faster or "forced off the road." The senior citizen states he has paid considerable tax dollars to support the building of roads so he is entitled to the use of them.

9. Driver training schools established by the courts, police, or motor vehicle departments should be available for the senior citizen. Also, there should be special hand-out pieces for safe driving for senior citizens. They do stress that the official government should give greater consideration to this matter and be able to expand their services to the senior citizen so that he or she will be better informed to properly adjust themselves to driving situations. They are anxious to learn and they are anxious to "stay out of accidents." So, like in many

other areas, the official government should consider "ways and means" of properly serving the senior citizen so that he can properly adjust himself to all driving situations.

Senior citizens who are competent drivers to begin with and who learn to compensate for the toll of the passing years need not be a problem just because of advancing age. This means those who avoid serious disabilities, who restrict their driving as to amount and time of day, and who keep pace with driving knowledge.

Last year, the total number of fatal traffic victims over 65 years old amounted to approximately 6,000. Of these, more than half were drivers and most of the balance were pedestrians who were never drivers. In the years to come, the number of drivers in this age group is expected to skyrocket, thus aggravating the problem.

Of the many circumstances that contribute to accidents among aging drivers, the inability to properly adjust to constantly changing driving situations and failure to acknowledge their physical limitations stand out as the principal ones. Loss of ability to judge speed and to discern audible and visual clues are also prime factors. In addition, older people are often absentminded and totally unprepared for emergencies, which under stress renders them indecisive, erratic or just too late in responding.

Here is what the driver must cope with as he ages. Physical condition deteriorates. The mental processes work more slowly. Vigor slackens. Perception declines. Side vision in particular is reduced, underlining the need for an older driver to compensate for his narrowed field of vision by turning his head from side to side so that he can take full advantage of all the vision he has. The capacity to manipulate the car, especially

in emergencies, is curtailed but can be improved somewhat by the use of power equipment in the car. Coordination is oftentimes adversely affected.

Failure to yield the right of way ranks as the most frequent accident-producing error among older drivers. Inattention and an unwillingness to adjust (the one-track mind) is mainly responsible. A California study has shown that right of way conflicts increase sharply with the driver's age.

Exceeding speed limits is not prevalent among older drivers, but there is a speed problem. Elderly drivers often fail to drive at speeds at which they can maneuver their car under control when adjustments are called for.

Improper turning is a problem with older drivers. Forgetting where they are in relation to traffic appears to be behind most of it, probably due to poor vision or hearing and misjudging speed. They often turn from or into the wrong lane and afterward lose control of the car. This problem is compounded by the fact that older drivers have trouble correcting their mistakes. Even a small mistake may not be corrected in time.

Older drivers need more supervision conducted under the driver licensing authority. Close tabs on their mental and physical fitness (particularly vision) must be maintained. Senility and other competence-debilitating disorders of old age must be detected as quickly as possible and be automatic grounds for license revocation.

The medical profession has a serious responsibility to effectively cope with this "individual" problem. Opportunities for the senior driver to improve his driving and keep up to date, as long as he is able, should be readily accessible.

THE AGING DRIVER

By O. D. SHIPLEY

Commissioner, Bureau of Traffic Safety, Harrisburg, Pa.

I feel safe in assuring Ed Klammer and other senior drivers that motor vehicle administrators, by and large, are not "out to get" them. At best we would be fools and

at worst tyrants to attempt to deny driving privileges to any group on the purely arbitrary basis of age. The motor vehicle is a much too important economic and

social factor in this day and age to deny its use to anyone without justification.

A person's chronological age is of no importance by itself when we're talking about competency behind the wheel. The ability to operate a motor vehicle safely on today's high-speed highways and in modern traffic conditions should be the only justifiable criterion for determining whether an individual should be granted the legal privilege of obtaining as well as retaining a driver's license. Our American sense of fair play and just plain logic and common sense rule out any other approach.

This is not to say that the senior driver does not have problems which are related directly to his years. As human beings reach their later years, their physical faculties inevitably tend to deteriorate to some degree. This may or may not effect their ability to handle a vehicle safely in traffic. Persons who began driving in the early decades of this century may need help in adjusting mentally to the ever-changing traffic environment of today.

Neither the senior citizen nor the licensing authorities can afford to ignore such problems. To do so would endanger the lives of all highway users in general, and of the aging driver in particular.

But there is a right way and a wrong way to handle these problems. The wrong way, in my opinion, is to question the aging driver's ability solely on the basis of advanced age. Such an approach is a form of discrimination not in keeping with our democratic traditions. It implies a biased attitude toward a particular group of our citizens that can only tend to prejudice any subsequent judgments of actual driving ability.

Any program which singles out the aging driver is bound to be self-defeating. No matter what the merits or good intentions of the program may be, the older licensed operator almost invariably sees himself as a "victim of persecution." The resulting psychological effect on the aging driver can only be detrimental to the cause of traffic safety.

I firmly believe that the most effective way to meet the problem of the senior driver is to question the competency of ALL licensed operators, regardless of age. After all, we have far too many young

and middle-aged persons who are menaces on our highways because of extreme physical or mental deficiencies. Do they have any more right to cover our roads with innocent blood than the aging driver who may or may not be incompetent?

As you know, Pennsylvania has undertaken a pioneering program which calls for the periodic visual, mental and physical re-examination of all of its five and a half million licensed drivers.

After more than a year of operation, I can tell you frankly that this is an effort of colossal proportions. But even at this early stage, hundreds of drivers with extreme physical and mental disabilities have been eliminated from the streets and highways.

Quite naturally and inevitably, this program initially alarmed some of our elder operators who saw it as directed at them primarily.

This fear was groundless. Before the re-examination program was inaugurated in June, 1960, Dr. Charles L. Wilbur, our Secretary of Health sent a lengthy memorandum to the more than 20,000 physicians in the Commonwealth. It was intended as a guide in the performing of driver physical examinations. In his concluding statement, he said:

"The physical standards (for obtaining or retaining a license) do not specifically single out the aging driver, because the common view that older drivers are more likely to have accidents has been contradicted by the facts. No one in Pennsylvania will lose his operating permit if he is physically and mentally competent to operate a motor vehicle, regardless of age. The important yardstick is not the chronological age, but the functional age of an individual. The physician, of course, by virtue of his training and knowledge, is the best qualified to make the essential determination."

I'm sure Dr. Wilbur was neither surprised nor alarmed when a 91 year-old driver was pronounced physically fit to drive, or when a 16 year-old was grounded because of mental incompetence.

In selecting the drivers to be called for examination each week, we use a letter-

type system based on the permanent plate numbers appearing on our operator's license. This does two things. It gives us a cross-section of all age groups each week and assures the older drivers that they are not being singled out.

Incidentally, our re-examination program is yielding several important by-products in the field of preventive medicine. Many individuals are benefited by the visual and physical check-up in terms of their personal health.

Individuals who haven't visited a doctor in years have been informed by the examining physician that they are suffering from dangerously high blood pressure, glaucoma, extremely poor vision and other serious disorders.

The value of this diagnosis and treatment is obvious.

The Pennsylvania Medical Society has given outstanding cooperation to every phase of the program. In the light of time-worn problems involving doctor-patient relationship, this cooperation assumes extreme significance to the success of the program.

The public reaction to this unprecedented program of ours has been overwhelmingly favorable. But, perhaps the most gratifying reaction of all came from our senior operators.

Shortly after the first group of 200,000 physical examination notices were sent out last year, we began receiving letters from elderly persons voluntarily surrendering their operator's license.

One elderly man wrote: "Having reached the age of 84, I think the sensible thing for me to do is to stop driving and will ask you to cancel my license application."

Another man, 72, stated: "After returning from the hospital following a critical illness, I realized that I will never be able to drive an auto again, so I am returning my 1960 driver's license."

A 63 year-old operator declared: "I do hope everyone feels the same way I do about physical conditions. I know I am not able to drive like I used to and will not venture out on the highways anymore, because I might be the cause of an accident. The method of physical examination is a wonderful thing, as I see so many people in our community who should never

drive again due to their age and physical defects."

From a male driver in his 67th year came a letter which read: "For my health and perhaps someone else's, this is the best thing you've ever done for safety on the highways."

I could go on quoting from more letters of this sort, but I think the point has been made. When confronted with the physical fitness requirements embodied in our new licensing program, many of our older citizens took stock of their own deficiencies behind the wheel. And many of them faced up to the fact that continued operation of a motor vehicle endangered their own lives and the lives of others. This is a tribute to their intelligence and honesty.

In terms of our discussion here today, I doubt very much whether our older drivers would have responded in this manner if we had instituted a licensing program aimed exclusively at them. By launching our attack against incompetent operators of all ages, we made the older people feel that we held no particular bias toward them solely because of their age.

Our new physical standards deny licenses to persons suffering from inadequate vision, severe cardiac conditions, circulatory and neurological disorders, uncontrolled epilepsy and diabetes, chronic alcoholism, narcotics addiction, and other severe physical and mental disorders that can, and do, cause them to lose control of their vehicles on crowded city streets or high-speed highways.

Would a program aimed only at older drivers eliminate such menaces from the highway? Some, of course. But what about the mentally unbalanced Kenneth M. Shelley, who sped down the Pennsylvania Turnpike at 90 miles per hour in the wrong lane? He was only 37. Or the middle-aged gasoline tank truck driver who had nine accidents all at the wheel of his mobile Molotov cocktail, before it was discovered that he was subject to epileptic seizures?

During the years of 1957, 58 and 59, the Classified Operators Section of our Bureau of Traffic Safety, removed the operators' licenses of 6,567 persons for the following reasons:

Mentally Ill—1713
Uncontrolled Convulsive Seizures—1206

Chronic Alcoholism—460
Narcotics Addiction—580

Failed to pass or declined to take the offer of a re-examination—2111

Voluntarily surrendered their licenses in lieu of the re-examination—291

All of this was accomplished prior to our re-examination program. How did we find these people? Reports from doctors, hospitals, relatives, police officials and other safety-minded people. At best, this amounts to a scratch-the-surface technique,—however, the results definitely highlight the need for periodic re-examination.

It is hard to believe that people of all ages with such disabilities are being licensed all over the United States, and will continue to be licensed until other states lay down physical and mental standards for granting a license such as has been done in Pennsylvania.

On a nationwide basis we license more than 1,300,000 drivers each year who are physically, mentally or visually unqualified to handle a motor vehicle safely. This figure is an estimate based on minimum medical standards and was arrived at by projecting the results of our examinations of over 600,000 drivers in Pennsylvania during the past 15 months.

I am of the firm opinion that unless the various states show by positive action a willingness to cope with this appalling problem, the Federal Government will step in with a program of federal control of driver licensing. I, also, firmly believe that driver licensing should remain the prerogative of the states.

The adoption of an effective, comprehensive driver licensing program is no easy task. If it would be, Pennsylvania would not stand alone today with its re-examination effort.

I have been most fortunate in my efforts in having a Governor who recognized the full tragic extent of the driver improvement problem and has been willing to risk political unpopularity to push the cause of traffic safety so that lives may be saved, even if votes are lost.

The legislature is a horse of another color. The hard, bare fact is that no overall traffic safety effort can be truly effective

without enabling laws. And legislatures across the land have, with terrifying consistency, refused to risk their political necks on legislation urgently required to toughen our licensing procedures.

There is documentation—if these lawmakers would make the effort to seek it—that for every vote they lose through supporting sound traffic legislation, they will gain ten.

We sorely need leadership on the part of Motor Vehicle Administrators and Chief Executives coupled with some legislative foresight if we are to make substantial progress in eliminating carnage from our streets and highways.

The aging driver has a higher stake than most in sound traffic safety legislation and comprehensive, fair driver licensing programs. He needs two things basically: fair treatment in the judging of his competency to drive, and help in adjusting to modern traffic conditions. I am sure that he would not ask for more than this.

It is the responsibility of motor vehicle administrators and legislators to see to it that he gets both. In the end, the entire cause of traffic safety in this age of the motor vehicle will be served to the benefit of everyone.

I have indicated the need for careful handling of problems involving the advanced age driver and his acceptance of the program.

Obviously, this acceptance is not universal, and frequently it is necessary to handle some extremely delicate situations in a firm manner. It isn't easy to tell a 75 year-old driver that his driving days are over, but, in the interest of public safety, it is necessary.

A few months ago, a very feeble senior citizen came into my office in an extremely belligerent state of mind. "Look here, you young whippersnapper," he said, "I can drive as well as I ever could. Much better than you can, so why are you taking my driver's license?"

I carefully explained why it would be extremely hazardous for him to continue driving and suggested that he hand me his operator's card.

I failed to convince him. In fact, his belligerence increased, and he said, "Neither

you, the Governor nor the State Police are going to stop me from driving. If you take my license, it will have to be by force, and even after you do this, I'll just drive without it."

In the calmest manner I could muster, I attempted to reason with him, but he shuffled out of my office mumbling under his breath some invectives that I assume were uncomplimentary.

In less than five minutes he was back. "Mr. Shipley," he said, "I want to apologize

to you. You are right. I know you are right. I know I shouldn't be driving, but I felt I had to make one last effort to keep my driver's license."

Then, with tears in his eyes, he put a trembling hand on my shoulder, handed me his driver's license and said, "Thank you for being so patient with an old man. Your program is good. God bless you for having the courage to do what is right."

Not it isn't easy to take away the very precious privilege of driving a motor vehicle.

SHOULD ALL MOTOR VEHICLE ACCIDENTS BE INVESTIGATED? — AFFIRMATIVE

By CAPT. G. S. FRIDAY
Capt. of Police, Police Dept., Columbia, S. C.

I am happy to have the privilege of being on the affirmative side.

First, I would like to put a few questions in your mind.

1. Do we investigate all criminal complaints that come to our department?
2. Do we investigate all complaints about our police department?
3. Haven't we been taught that traffic is a major part of law enforcement?
4. Don't we teach our recruits the causes of traffic accidents?
5. Where did we get all this information for the clearing house?

Webster's *Vest Pocket Dictionary* says "Investigate means to search into" and this little book also says that an "Investigator is an examiner." So, by all use of words, when a police officer goes to the scene of a motor vehicle calamity, he is an "accident investigator." (School solution: definition, "A systematic and analytical enquiry and examination of all facts, physical feature conditions, observations and results in a motor vehicle collision.")

I will agree that each accident should be handled as an individual accident and the necessary steps should be taken to get all the information that you may need at a later date.

You assist a lot of people when you collect data on an accident:

1. You represent your department at the scene—what you do at the scene places a picture in the minds of the public of what your department really is, so it's good public relations to investigate all accidents.
2. You collect data to be used by attorneys—they are business men of your area.
3. You collect material for insurance companies—many of us would not have been able to get our training had it not been for insurance companies, and Lord knows we owe them a great gratitude for their assistance.
4. You collect "selective enforcement" information that should guide your department on the who, when, where, why and how. From this information, you assign your personnel to your needs.
5. It is impossible to get all facts but get as many as you can. Your accident prevention program is based on accident investigation.

When we investigate all accidents we learn the characteristics and habits of people. We technical people usually look at a situation in a biased way. Minor collisions cost less than major ones, true, but you usually have ten minor to one major. If you ignore

the minor and investigate the major, you are not getting a true picture of the causes of accidents at a particular location. To clear up a problem area, you need time and statistics—and the only way to get statistics is to investigate all, large and small.

You are really doing the drivers a favor by investigating all accidents. An accident, minor or major, which has been investigated, with the proper charges made for the violations, should prove influential to the drivers in making them more accident conscious in the future, thereby strengthening our accident prevention program. If little emphasis is given minor accidents, little interest will be shown on the part of some drivers who may continue to take accidents "lightly" until they are involved in a serious one sometime.

Another thing, what does this investigating major and may be just recording minor acci-

dents do to the attitude of the public? If the public realizes, and they will, that you are only interested in them if they have a major accident, what will they think of your department? To the policeman, it may be a "minor," but if I ever have the chance to save up enough money to buy a new car and someone would crash a fender, by gosh that would be a "major" to me!

Our department policies are set up to give service to the public we work for and if it takes 30 minutes or all day to give this service to our people, I think we should do it. Nothing will make more friends for your department as much as helping someone in need, and a person upset from an accident is surely in need.

The one thing I would like you to remember is this: "Don't ever get so technical and efficient that you sacrifice your department's relations with the public."

SHOULD ALL MOTOR VEHICLE ACCIDENTS BE INVESTIGATED? — AFFIRMATIVE

By SHIRLEY CURTIS

Capt., Safety and Traffic Bureau, Michigan State Police, East Lansing, Mich.

In my opinion, all motor vehicle accidents should be investigated for several very important reasons—

1. Police are legally responsible for determining if a traffic law violation has been committed when an accident occurs and for taking proper enforcement action. Then, too, it is the sworn duty of police to protect life and property which is a primary consideration in any accident investigation.

2. Investigation of an accident permits the officer to observe the driver and report to the proper authorities any condition which appears to make him unfit for licensing as well as the fact that said driver was involved in an accident. The latter is a prerequisite for motor vehicle administrators in carrying out a driver improvement program.

3. Highway conditions which appear to need special attention based on the observations of the officer at the scene of the ac-

cident can be brought to the notice of proper authorities.

4. Investigation of accidents provides information on the number and causes of accidents which is a legal requirement in most jurisdictions. In this connection, facts reported by a trained police officer based on his investigation of an accident are unbiased and far more reliable than information on accidents reported by the drivers involved.

5. Complete and accurate information on the traffic accident situation is necessary to provide the basis for a sound accident prevention program—by police, educators, engineers, motor vehicle administrators, courts, public information media, and by the legislature. In addition, it provides the basis for training and research.

Before discussing in more detail the reasons why all motor vehicle accidents should be investigated, we need to know what we

mean when we say all accidents should be investigated. According to the Uniform Vehicle Code, accidents should be reported which result in death, injury, or property damage in the amount of \$25, \$50, or 100 dollars.

Although highly desirable to investigate the most minor accident, it certainly is not feasible to attempt to investigate those accidents which aren't even required to be reported by the Uniform Vehicle Code, namely,溜 car dents, fender scratches, or others resulting in minor property damage. Let's say for the purpose of this discussion that when we say all accidents should be investigated we mean all those resulting in death, injury, or property damage of 100 dollars or more.

Another term needs clarifying before we proceed and that is what do we mean by investigation. Webster defines investigate as meaning, "to follow up or make research by patient inquiry and observation and examination of the facts." According to the last report on traffic accident records, developed in 1960 by the President's Committee on Traffic Safety, accident *reporting* means the collection by police of readily available facts about accidents, while *investigation* is a far more thorough process calling for detailed inquiry into all available information pertaining to an accident.

These definitions of investigation are quite inclusive and few, if any, police departments have manpower or time to make the detailed inquiry necessary to obtain all available information pertaining to an accident. In fact, the Committee on Traffic Accident Statistics fully realized this when it prescribed certain minimum information which should be obtained on all accidents reported by the police.

It is my recommendation that investigation by police be sufficiently thorough and complete to obtain this information on all accidents resulting in death, injury, or property damage to the extent of 100 dollars or more. In addition, I believe it mandatory that information be obtained to identify any unusual driver, vehicle, highway, or operating control condition which there is good reason to believe may have contributed to an accident and any violation of traffic laws.

These are my minimum requirements for

the investigation of any accident. This statement, however, should not be interpreted to mean this information is sufficient for all accidents. Many times it may be necessary to go much further in the investigation on one or more particular phases of an accident.

The whole concept of accident prevention is based on the fact that nearly all so called accidents are caused occurrences and are not merely chance happenings.

Most accidents have a number of contributing factors, including driver failures, roadway deficiencies, vehicle defects, etc.

Furthermore, it is known that the same contributing factors which result in a minor accident one time may result in a crippling injury or death the next time under slightly different circumstances.

We also know accident patterns remain quite constant when traffic volumes and other influencing factors remain about the same and that future experience can be predicted within limits when past experience is known.

Sampling techniques may provide the information to establish some trends. They cannot, however, provide the necessary facts to quickly identify drivers with multiple accident records or high accident locations, nor evidence necessary for enforcement action in individual cases. Neither can such information be obtained from the prejudiced and highly rationalized reports of drivers.

Unless reliable and complete information can be obtained, accident prevention programs must be based on guesswork and opinion. And, past experience indicates such programs all too frequently are misguided, inefficient and costly.

What is needed is careful investigation of all accidents which occur by carefully trained, impartial and competent official investigators. Our own department considers this not only a legal requirement, but so necessary that it is our policy to investigate accidents at the scene whenever they are brought to attention regardless of the extent of damage involved. However, before closing our case, we would like to elaborate further, as time permits, to support our contention and ask our opponents a few questions as to how they would prosecute violations and carry out other recommended

accident prevention activity without investigating all accidents.

The apprehension and conviction of traffic law violators is considered one of the most effective accident deterrents and one or more violations are reported as contributing factors in most accidents. We would like to ask how enforcement action can be taken against violating drivers in accident cases unless accidents are investigated.

We believe if an officer is to take enforcement action when the driver commits a violation, but no accident occurs, it is even more important for such action to be taken when the same violation results in someone being injured or property damaged.

The importance of enforcement action in accident cases also is fully recognized by the Traffic Committee of the I.A.C.P., which recommends a minimum satisfactory accident arrest rate of 55 per 100 investigated accidents. Our own department exceeds this minimum arrest rate in accidents which are investigated and the number investigated exceeds recommended reporting ratios of 20 injury and 35 property damage accidents for each fatal accident in rural areas.

As previously stated, we also believe it is a primary responsibility of the police to assist in securing medical aid and transportation of injured persons and do everything reasonably possible to protect the scene from further accidents until injured persons and damaged vehicles can be removed.

Another question we would like to ask is, how is it possible to detect those drivers involved in accidents who appear to be physically or mentally impaired to the extent they should not be licensed to operate a motor vehicle unless all accidents are investigated. Our state of Michigan official traffic accident report provides a place for the officer to check when he thinks a driver should be re-examined for license competency and when this is done he explains his reasons for his recommendation for the benefit of licensing authorities.

We would like to raise another question, how it is proposed to bring to the attention of the proper officials inadequate traffic controls or roadway conditions which appear to require attention to minimize the likelihood of future accidents, unless all acci-

dents are investigated? Our official report form provides space for the officer to check when he believes the scene of the accident should be inspected to determine the need for engineering attention and, when this is done, he also explains his reasons for his recommendation. A copy of the officer's accident investigation report, in turn, is referred to the proper engineering officials for their consideration and as a result special corrective treatment is applied to many locations each year.

Still another question for our opponents is, how can they obtain necessary reliable information on the number, location and characteristics of accidents to serve as a sound basis for accident prevention programs by the various officials and agencies charged with responsibilities for accident prevention, unless all accidents are investigated?

Some of the kinds of information needed by the different officials include—

1. Engineers want to know the exact location of accidents, the effectiveness of their operating controls and accident frequency in relation to varying highway design and roadside characteristics.
2. Police want to know who was involved, what happened, if a violation was committed, where and when the accident occurred, as well as the condition of the driver, vehicle and highway.
3. Educators need to know who is involved and as much as possible about contributing factors, as well as the general characteristics of accidents.
4. Driver license administrators want to know who is involved in accidents, whether a violation was committed, the physical condition of the drivers involved, and any other information available which might have a bearing on the drivers' fitness to have a license.
5. Traffic safety groups and public information media need to know the extent of the problem, accident trends, contributing factors, etc.
6. Legislators need to be kept informed on the extent, trend and characteristics of the problem upon which to base the need for new or corrective legislation.
7. Those interested in basic research to

find out new and better ways to cope with specific aspects of the problem need to know what has already been learned from accident investigation to serve as a basis for further exploration.

Our opponents will probably say it is not necessary to investigate all accidents to obtain such information and even if it were

there is not enough manpower or money to carry out such a program.

The question before us is, should all accidents be investigated? not, is there enough manpower or money to do the job?

We firmly believe all accidents should be investigated and we believe we have cited adequate reasons to support our contention.

SHOULD ALL MOTOR VEHICLE ACCIDENTS BE INVESTIGATED? — NEGATIVE

By MAJOR MARTIN M. PUNCKE

Chief, Training & Personnel Div., Maryland State Police, Pikesville, Md.

The effort put forth.

Cost of the effort.

Results of the effort.

These are basic criteria used in any project or business operation involving saving of lives or financial gain. The police are no exception and our work must be evaluated by these criteria, if we are to enjoy the reputation of an efficient organization.

The subject under debate is certainly not a new one. I would like to quote from a report made to the National Conference of Uniform Traffic Accident Statistics, and the Traffic Committee, International Association of Chiefs of Police in 1955, by J. Stannard Baker, Director of Research and Development, and Roy E. B. Fisher, Research Assistant, for the Traffic Institute-Northwestern University.

Accident reporting forms and procedures generally represent a compromise between those reports simple enough to encourage complete reporting and reports complex enough to get complete information on each accident; that is, a compromise between quantity and quality.

As a result, neither quantity nor quality has been achieved. It would be better to try to get less information on the majority of accidents—only that necessary for administrative purposes—and more detailed information—for technical purposes—on some, if only a few accidents. It follows that an important distinction between reporting accidents for quantity and investigating them for quality must be made.

A workshop attended by representatives of interested national organizations, was held at the National Safety Council in 1952. Here it was agreed that the report of the accident should be simplified to meet only the administrative needs and thereby reduce police

work and encourage more complete reporting on the part of drivers.

This conclusion was subscribed to by the Committee on Accident Records of the National Safety Council, and by the Traffic Committee of International Association of Chiefs of Police.

The subcommittee on forms and statistical practices of the National Conference on Uniform Traffic Accident Statistics also considered the problem of getting better information about causes on a sample of relatively well-investigated accidents.

This is one of the main points involved when discussing the negative point of view on the subject of "should all motor vehicle accidents be investigated?"

We feel that if a proper sample is taken and evaluated, a valid result can be predicted. We already agree that the origins of sampling lie in probability theory. In most instances, the detailed examination of a valid sample is more accurate than the result compiled from large masses of material.

The man hours consumed by either a metropolitan or state department in accident investigation during the period of a year is certainly a large percentage of the overall man hours used by the enforcement agency. We must include, not only the time consumed by the investigating officer at the scene, but the time involved in making the report, sketches, processing by departmental personnel, punching of I.B.M. cards if this equipment is available, and the publishing of analytical reports. We feel that this time could be materially cut if the sampling procedure was used.

The man hours used for this purpose could be more effectively used in normal enforcement procedures.

In discussing this problem, we invariably ask ourselves, "What is the responsibility of a police organization in accident investigation?"

We are certainly charged with saving of lives and property. We have the responsibility of determining whether or not a violation has been committed, and to develop and preserve sufficient evidence to substantiate the charge in court.

We are responsible for making available sufficient statistical information obtained during our normal operation to other organizations having an interest in the accident problem.

I feel that the additional investigation time spent in determining the background causes of accidents, a development of factors which would tend to determine the civil liabilities involved, and any other detailed fact-gathering data requirement on all accidents, is not the primary responsibility of the police department.

Special studies on specific problems should be accepted by various organizations, and this information pooled for the use of all. A very good example is the study made by Cornell University on the crash injury problem.

Check your summary reports for the past few years and see how many factors have changed. In a specific area, has there been a sufficient change in hours of the day, day of week, or road condition to change your enforcement policies? I think not.

The gathering of accident investigation data with our present form, and the compiling of this information is a procedure which has grown with the advancement of police activity. Are we taking the approach, "This is the way we did it for the past 30 years; why change?" It is our opinion that this entire procedure now must be re-evaluated to determine exactly why we continue to follow the old procedures.

May I refer to the present controversy on the responsibility of police while on freeway patrol?

The police were expected to patrol the highway, investigate accidents, check abandoned cars, report defects in road conditions which, in my opinion, are all police functions.

We are then expected to assume the responsibility of miscellaneous duties of assisting people who are out of gas, changing flat tires, making minor repairs on motor vehicles, and many other non-police miscellaneous items.

We must ask ourselves, "Have we permitted the accident investigation problem to get out of hand in the same manner? Do we need and use all of the statistical data obtained? Are we obtaining it in the most efficient manner?"

The proper evaluation of a well-defined, complete, sample would be of more value than the processing of a volume of material.

Deputy Chief Sullivan, will show there is no relation between accidents versus accidents, but there is a relation between violations and accidents.

Manpower properly used on a great percentage of this activity may be used more efficiently in the direct enforcement effort. Violations do cause accidents, and the possibility of being involved in an accident is in direct proportion to the number of violations committed. Police must have the manpower to make an initial arrest.

The remarks of Mr. Huber are pertinent, that up to 50 per cent of suspended drivers continue to drive; and of Capt. Gardner, that we must have manpower to properly enforce the laws.

Enforcement is our primary responsibility; therefore, I sincerely recommend that we take a very close look and evaluate our motor vehicle accident investigation procedures.

ENGINEERING TRAFFIC SAFETY IN THE SMALLER CITY. WHERE DO WE GO FOR HELP?

By MYRON K. LINGLE

Traffic Eng., Illinois Div. of Highways, Springfield, Ill.

Traffic engineering assistance from the state is available to smaller incorporated communities in varying degrees.

First. On streets and highways under state jurisdiction, all traffic engineering service will be furnished by the state.

Second. On streets and highways under local jurisdiction, no preliminary traffic engineering service will be furnished by the state; but for local projects financed with motor fuel tax funds, the preliminary traffic surveys, plans and specifications must be submitted to the state for approval. The state will make final inspection for conformity to state specifications and policies.

Third. On streets and highways under local jurisdiction, where motor fuel tax funds are not involved, no detailed traffic engineering service will be furnished by the state. Engineers in highway districts and bureaus will respond to inquiries of local authorities with limited advice and recommendations.

In Illinois, it is unlawful for any local authority to place or maintain any traffic control device upon any highway or street which is under the jurisdiction of the Department of Public Works and Buildings without having obtained approval of the department. Without exception, the department will determine the need for traffic signs, and will erect and maintain them.

State traffic engineers devote a major portion of their time in defending the uniform system of traffic control, in refusing to employ unorthodox methods, and in educating the public. That traffic engineering is an art and a science is a truth not commonly known to most officials and citizens of smaller communities. And civic leaders are eager for traffic engineering by means of emotional appeal, by petitions, by political pressure, and by repetitious coercion. Sincere and enthusiastic workers for traffic safety cannot understand that a sign or signal installed in conflict with the traffic engineer's judgment is no cause for civic

reviling. A sign, a flasher, or a stop-and-go signal that violates a principle of traffic engineering is harmful; other control devices lose a share of their effectiveness, and motorists develop an increasing contempt for all signs and signals.

Speed zoning is the least appreciated art of traffic engineering. Routine complaint letters offer this hackneyed contention, "At least half the drivers are violating the 40 m.p.h. sign—the speed limit should be reduced to 30 m.p.h." The layman fails to see that a lowering of the number on the speed sign would merely increase the number of violators. Of course, the reason for these appeals for unrealistic speed limits is the popular, but erroneous, belief that motorists who travel 50 m.p.h. past a 40 m.p.h. sign would travel 40 m.p.h. in a 30 m.p.h. zone. When the traffic engineer explains that data from a speed survey are plotted and the plots joined with a speed-accumulation curve, and that the speed limit is based primarily on the 85 percentile speed of all vehicles, understandably the layman considers this a ridiculous method, and says so. He wants to control the speed of the motorists, not let them drive as they please.

Professor C. C. Wiley of the University of Illinois reported in 1949 that the changing of numerical values on speed signs, and the removal of speed signs altogether, did not affect the speed pattern of vehicles appreciably. This conclusion has been verified many times and places. When speed limits on Illinois highways through small communities were raised to realistic values, in accordance with the absolute speed law enacted in 1937, before-and-after studies demonstrated that actual speeds of vehicles were not faster, but slightly slower.

Civic leaders need to be convinced that realistic speed limits cannot be based upon opinion. Moreover, this is the law. A motorist, arrested for violating a speed zone which has been fixed without the benefit of a traffic investigation, can offer this lack of data as a valid defense.

Traffic signals installed within a municipality, on or off a State or federal route, must be financed by local authority. The need for the signals is generated by local traffic, and is not aggravated materially by through traffic. Local authorities may choose to use motor fuel tax funds for this purpose and usually do. Application for the use of M.F.T. funds for an intersection must be accompanied with vehicular and pedestrian counts and motor vehicle accident data. Minimum volume or accident history warrants must be satisfied to justify the installation of signals.

There is a popular notion that stop-and-go signals are the remedy of all traffic problems at busy intersections. But drivers who are halted on the thoroughfare for only occasional vehicles on the cross street will become impatient with these frustrating signals. Such signals are harmful because this disrespect for an encroaching number of unrealistic control devices grows into a general disregard for all of them.

Traffic signals must not be placed on the basis of opinion, nor because of a spectacular or publicized accident. When justification is based on accident history, a collision diagram must be prepared and only those accidents considered which can be prevented by traffic signals. For example, while signals may reduce right-angle collisions, they may actually contribute to rear-end crashes.

Traffic engineering in smaller communities too often is based on public and individual opinion. Promiscuous placing of stop signs and posting of unlawful speed limits are expedient attempts to solve local complaints and satisfy petitions. And yet these communities are confronted with an ever-growing traffic problem: school and pedestrian protection, parking, pavement marking, intersection design, access control, one-way streets, street lighting. Where do they go for help? Consulting engineers are one answer; sharing a traffic engineer with other communities is another; the county superintendent of highways is another. And then there is the state highway department.

Only twelve communities in Illinois employ full-time traffic engineers. Consultants, city engineers, and police usually perform traffic control functions in the twelve hundred cities and towns with a population

of less than 25,000. In the eight hundred incorporated communities with a population under 1,000, little if any traffic engineering is practiced.

The State does not have sufficient trained personnel to offer a complete traffic engineering service to these thousand communities, more or less. Our engineers are available, upon request, for the interpretation of traffic and motor vehicle laws, for workable explanations of the state and federal manuals of uniform traffic control devices, and the application of department policies.

In Illinois, the statutes require that all traffic control devices conform to the state manual published by the department. The manual prescribes the minimum warrants justifying the use of various traffic control devices, describes the purpose of each device, and specifies the size and shape of signs, signals, and pavement markings. This manual, together with the federal manual, is a workable textbook on traffic engineering sufficient for the small communities. The standards and principles contained in these manuals can be of great service in finding solutions to traffic situations, and in weighing the merits of proposals advanced by various citizen groups. The state manual is available, free of charge, to every incorporated community and to every county in the state. The federal manual can be purchased for two dollars from the Government Printing Office.

It is a source of wonder to me that city and town clerks, and leaders of citizen groups, write to the Governor, the Secretary of State, and State Police, and the legislators, for solutions to traffic problems. One would expect them to know that the engineers who built the highways, who erected the signs and signals, who painted the center lines and edge lines, surely are supervising the safe operation of the highways through their communities and environs. Civic leaders concerned with traffic safety should become acquainted with the district engineer in whose district they reside. They should know the district traffic engineer and the district maintenance engineer, for these are the operation officials of their highways and route numbered streets.

The district traffic engineer can do much

to effect the proper understanding between the public and official agencies in many traffic situations. One of his principal objectives is to replace opinions with facts. Local citizens must be educated to accept

uniformity in traffic control devices and their application. The district traffic engineer is a good and understanding neighbor. He is the one to whom the smaller cities can go for help.

ENGINEERING TRAFFIC SAFETY IN THE SMALLER CITY — SOLUTIONS TO THE PROBLEM

By JERRY P. GILBERT
Traffic Engineer, City of Springfield, Ill.

The problems of inadequate street capacity in urban areas of medium and small size, and the importance of curb-side parking as it restricts a street's ability or capacity to handle traffic are important in small community traffic engineering.

It appears evident, that everyone is not in complete agreement on all facets of this topic. It is these areas of divergent opinion, which, I believe, merit and require further consideration.

A great deal of research has taken place in the past on the subject of capacity as a function of roadside conditions, the most noteworthy and comprehensive of which is the *Highway Capacity Manual* by the Bureau of Public Roads.

This manual is frequently referred to throughout the following discussion.

The fact that curb parking restrictions increase street capacity is seldom questioned and is general knowledge among motorists and the general public. How much street capacity is increased by parking removal under various conditions is not realized or appreciated, either by the general public, or by many officials directly or indirectly involved in the highway transportation picture.

It is the quantitative aspect of the problem of capacity which has been treated so extensively in the manual and which make it so valuable. The information contained in the report now permits the prediction and evaluation of highway performance either before or after improvements.

My experience in three medium-sized communities in two states has led me to the conclusion that about the most fre-

quent cause of complaints, and the most difficult problem to solve, is the removal, restriction, and control of curb parking. And the smaller the community, the more unacceptable are these measures as a means to increase capacity.

Furthermore, it is in the smaller communities that alternate means of increasing capacity (street widening, expressways, etc.) are less available because of costs. Cities the size of Springfield appear to be too small to support expressways but too big not to have them.

In this respect, it seems that the smaller communities are going to be faced with traffic problems which are more insurmountable than those facing larger communities, relatively speaking. Yet the fact remains that more than half of the population of the United States is concentrated in cities of 100,000 population or less.

This situation coupled with the fact that it is estimated that the number of vehicle miles of travel will increase roughly 75 per cent in the next 20 years poses problems of inadequate capacity which are going to have to be met with widespread curtailment of parking in conjunction with other methods.

How these increases in motor vehicle travel and registration are going to be provided for is the subject of much discussion and concern throughout the country, and is one of the major challenges of our time.

Throughout these discussions, there appears to me a rather obvious omission of any positive statements as to what is

- in the future, for vehicular travel, and not for parking.
2. That the total costs to a community for storage of vehicles on the street is enormous—taking into consideration the costs of accidents, costs of capacity restrictions and delays, and other costs mentioned above.
 3. That curb parking restricts capacity much more than most people realize.
 4. That curb side parking on our major streets must inevitably be eliminated in the future, in view of projected estimates of auto registrations and travel.
 5. And that if curb-side parking must

ultimately be removed, even on widened or improved facilities, should not our policy of waiting until volumes build to capacity, be changed perhaps to recognize or take into consideration the problems which will develop at some future date when parking is removed?

I believe that curb side parking creates a much larger problem than most of us find it convenient to admit, and that the solution to the problems created by the removal of this parking is going to require much more cooperation and coordination of effort in the future, than has been given in the past.

ENGINEERING TRAFFIC SAFETY PUBLIC ACCEPTANCE AND IMPLEMENTING THE SOLUTION

By BERT W. JOHNSON
City Manager, Evanston, Ill.

Some say it cannot be done. Traffic congestion must get worse before the public will permit the solution. Don't propose more traffic capacities. More traffic will result. Don't offend by the rerouting of heavy traffic. Keep it where it has been. If traffic gets bad enough maybe mass transit will have a chance. Save the trees at all cost. Divert through traffic away from our community.

These are typical of the public's reasoning when they violently resist proposed street widenings, traffic rerouting, creation of cul-de-sacs and other proposed traffic engineering and safety improvements. This resistance, if voiced by enough people of prominence, seems to indefinitely delay needed progress and to alter priority scheduling so that "what can be accomplished is accomplished."

Politics is supposedly the art of the possible. As such, our political leaders must be convinced that the traffic problems are real, that they will not evaporate if allowed to do so. We need to do a better job of defining the problem.

We need to convince citizens and their political leaders, that traffic is with us in relentless and in ever-increasing volumes. We need to confess that there will never be total solutions to all of our urban problems. There appears to be no prospect for making everyone happy. One citizen's solution is another citizen's problem. Some gain, others lose.

In solving traffic safety problems especially, there are conflicts, contradictions, incompatibilities, and differences—between citizens with respectable motives and citizens of known self-interests. These differences must be tempered, shaped and molded if traffic solutions are to be implemented. There ultimately must be a balance between proposal and performance. No planning study, no engineering research should be authorized unless there is a political commitment that some positive action on the ultimate solution is to be voted.

Paul Ylvisaker of the Ford Foundation keyed the Washington World Traffic Engineering Conference last August and made this observation: "Cities are caught now be-

tween the extremes of contemplation and performance. Judging from the enthusiasm with which research has lately been welcomed by planners and politicians alike, we're in the stage where a study is worth a thousand deeds. The fact is, a study may make a thousand deeds unnecessary and another thousand deeds possible—by correctly redefining a problem or preparing the community to accept action. But that's not always the intent of those who commissioned the study; and there comes a point where someone must take responsibility and act."

In proposing a 1959 Budget for the city government of Evanston, Illinois, we tried to focus attention on the many-faceted character of our citizenry. This approach was used in the belief that we tend to direct our reporting to all of our citizens in general without making a conscious effort to relate it to distinct citizen groups in particular.

Here are a few citizen groups with diverse needs and preferences:

1. *Our Tax-paying Citizen.* He wants more for his money and resists any increased tax demands, whether on property, on his car or on the gasoline it uses. He resists street improvements financed by special assessments.

2. *Our Resident Citizen.* He wants little or no traffic to go by his home. He wants the bus routed near him but not in front of his property. His concern is for the safety of his children. He sees increased traffic as a depressant on property values, especially if any trees are involved.

3. *Our Motorist Citizen.* He is annoyed by traffic delays. He suffers from accident and personal injury and death. Up to a third of them do not live in the city through which they must travel. He is told that "taxpayers pay for a convenient, safe traffic system whether they receive such a system or not." He goes home to become a member of another citizen group with diverse needs and wants.

4. *Our Pedestrian Citizen.* He is too often the victim of unresolved traffic engineering problems, through delay in travel and through hazard to life and limb. School and college officials are wisely concerned about student pedestrian safety; yet the large school is a large traffic generator and

is often located on or near major thoroughfares.

5. *Our Merchant and Parking Citizen.* He, like all of us, oversimplifies. Parking should be abundant, free of charges, tax in enforcement. He tends to overlook the high priority of external accessibility, of circulation convenience, of safety values. Condemnation of parking enforcement is made in face of the known fact that a well-located parking space is worth at least \$15,000 in sales annually and that there is proof that merchants and their employees tend to pre-empt these prime parking spaces.

6. *Our Visiting Citizen.* He may be a temporary guest on his way to the office, a weekend shopper for downtown, and as a result will add to the traffic problems as he contributes to the economy and helps establish the reputation of the community's traffic engineering and safety practices. We cannot build a wall around our cities unless we are willing to reap the dire consequences.

7. *Our Future Citizens.* He is the youngster who cannot vote. Yet he will be affected by the decisions made. He should be encouraged to locate in communities which face up to decisions. He should be made to understand and support community objectives. He should be assured that there will be a financial base to support community standards.

How do we resolve these diverse interests, concerns and wants? This presents a challenge. We must balance separate interests to the general objectives of the community. In Evanston, Ill., we have recognized the need for obtaining agreement on our objectives. In 1956 a 35-item statement was unanimously adopted by the city council. Relating to traffic are excerpts from objective concerning Evanston's "street system":

- a) (30) . . . This street system serves two main purposes: 1) access to property, and 2) routes for the moving of vehicles and pedestrians within and through the city . . .
- b) . . . In order to relate traffic movement to the proper development of land, certain streets should be designated as major thoroughfares. These streets would continue to provide access to abutting property, but would also serve as the principal routes for vehicular traffic within and through the city. To serve effectively as such an artery, a thoroughfare must have the capacity to carry the traffic volume seeking to use it. . . . It is hoped that the present street system, with minor adjustments, will adequately serve fu-

ture traffic volumes and that street right-of-way will not require widening. . . .
or (2) . . . It is recognized that on-street parking must be restricted where it interferes with the primary function of the street on traffic movement. . . .

One of Evanston's proudest achievements has been its nationally recognized traffic safety record. There's no acceptance of complacency. It is not popular to be a ticket collector. It is in this setting that the city council authorized a 20,000 dollar transportation survey which will be released soon.

Does this mean that public acceptance and implementation of recommendations will ensue? It does not. It means Evanston has a rich history and has agreed on objectives to help provide a hopeful prospect. I must reserve the right to alter this picture five years hence.

Our six-year capital improvement program will advance traffic engineering proposals for 1962 through 1967. We know there will be controversy. There will be changes.

There will be postponements as Evanston continues in its search for excellence.

All of these proposals represent a real challenge for leadership. It requires a sense of relevance which not only anticipates tomorrow but creates the tomorrow in which we shall live. Public officials, elected and appointive, are involved.

Civic goals and standards must be high and the rate of progress must be creditable. Citizens also should be challenged to desire community standards to match their own private standards for living. Together, officials and the citizens they serve, must be equal to our traffic safety problems. We must be open to the new as new problems emerge. We must be positive in our approach.

Citizens must be confronted with the alternative courses of action. We must further dramatize the penalties of inaction and delay. As public officials, we must continue to be worthy of the public trust that is ours.

ILLINOIS JUSTICE COURTS — THE NEW LOOK

By ROBERT MCCLORY
Illinois State Senator, Waukegan, Ill.

During the past two years Illinois justice of the peace courts have moved from the kitchen of the justice's home, or from back of the hardware store where the justice of the peace was carrying on his regular business, to the Court House, the City Hall, or other public or appropriate place to hold court with dignity and decorum.

That is not to say that the transition from the old system to the new has taken place in every instance, but it is to say that in large measure a great transformation and improvement in the local court system has been accomplished during the past two years.

The impetus for local court reform occurred when a new judicial article was proposed by the legislature and voted upon at the 1958 general election. The most violent critics of the old system emphasized the need for eliminating the then existing fee system of justice, and substituting a system whereby the local Justices would be paid a salary.

Some of those who defended the old

judicial article contended that the justice of the peace system could be revised by legislation.

At any rate, when approval of the judicial article failed by a narrow margin, the Illinois General Assembly with the support of the Judicial Advisory Council, and the American Bar Association Committee on Traffic Laws and Courts developed a comprehensive program which was enacted into law at the 1959 session.

The 1959 legislation accomplished these goals:

1. Reducing the total number of justices of the peace from more than 3,500 to approximately 400.
2. Abolishing the fee system under which a finding of guilty was generally necessary in traffic cases in order for the justice of the peace to collect his costs, and substituting a flexible salary schedule under which county boards could fix appropriate salaries for the fewer justices of the peace.

3. Requiring that each county should be divided into justice districts of not less than three, nor more than five, with one justice of the peace for not less than each 20,000 of population, nor more than 40,000, or major traction thereof, except in Cook County where each township was designated as a justice district.

4. In addition to the salary provision, each county board was authorized to provide expenses for the office and assistants required by the justices.

Certain other changes were made at a special session of the legislature held in 1960, and at the recent regular 1961 session further improvements were made in the new system. Again, the Judicial Advisory Council was the sponsoring agency of this legislation, after having received thoughtful cooperation from James P. Economos, director of the traffic court program of the American Bar Association.

These further improvements consisted of provisions authorizing assignment of justices of the peace from one district to another in order to equalize work loads. In Cook County the assignments are carried out by the county board with the approval of the court administrator. In the downstate counties, the transfers are made by the county board under the supervision of the county court.

The county board was granted authority to fix the office hours of justices of the peace in order to assure their availability to administer justice at the local level. In addition, the county board has been authorized to establish minimum courtroom standards to be prescribed by the court administrator. As a result of this legislation, Dean Albert Harbo, court administrator for the state of Illinois, through the cooperation of the Illinois State Bar Association Committee on Traffic Laws and Courts, as well as through the cooperation of the American Bar Association traffic court program—and especially the good offices of Mrs. Lillian Baraban, Mr. Economos's assistant, has set forth a schedule of minimum standards which every county should be able to adhere to.

Provision and establishment of a central depository for justice of the peace records, and authority for a simplified modern day permanent record to replace the laborious

handwritten "well bound book" of earlier days has been enacted into law.

Efforts to simplify the approval of bail for traffic violators were unsuccessful at the recent session. However, practical solutions have been found in most counties, whereby designated police officers and sheriffs deputies have been appointed to approve bail in almost all traffic cases. In addition, the jurisdiction of the justice of the peace has been enlarged so that they may hear the more serious cases of driving while intoxicated, reckless driving, and leaving the scene of an accident, where approval for the hearing of such cases is granted by the County Court on motion of the states attorney.

Justices of the peace have been elected and are operating in all except 17 downstate commission form counties. These commission counties will elect their justices of the peace in November, and thereafter the fee system of justice will be at an end, except in those few municipalities where Police Magistrates were elected in 1959 and whose terms will expire in 1963. Thereafter, all police magistrates elected will be required to serve on a salary basis.

Some opponents of the new system have made strenuous efforts to discredit, and even to undermine this new system of local justice. However, my information, which includes a detailed report from the chief of the state police, indicates that in almost every county of the state, the new system is receiving local support and is reported to be working well. Further improvements are certainly needed. From the reports being filed each month with the county boards, and with copies to the court administrator, an important record of local court statistics will be available soon. In addition, the Committee on Traffic Laws and Courts of the Illinois State Bar Association, again with the cooperation of many other agencies, are developing a manual of procedure which should bring greater order, uniformity, dignity and respect to the justice of the peace courts of Illinois.

It goes without saying that the impression gained by the traffic violator in the local traffic court is an important factor in promoting traffic safety. We are proud of the improvements that have been made in Illinois, and will strive for further Traffic Court improvements.

PROPOSED UNIFORM TRAFFIC COURT RULES IN OHIO

By PAUL R. DONALDSON
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In the 1959 session of the Ohio legislature, three new sections of the Ohio Revised Code were enacted to authorize the Supreme Court of Ohio to promulgate rules and forms for criminal and traffic cases in all Ohio courts inferior to the Court of Common Pleas. In January, 1960, at the request of the Supreme Court and acting under this new legislation, the president of the Ohio State Bar Association, Allan B. Diefenbach of Akron appointed a nine member committee to study this problem and formulate rules and a form of traffic ticket for use in Ohio.

This committee consisted of a municipal judge, now a common pleas judge from a small rural area, the chief justice of Ohio's largest municipal court, a county court judge, the president of the Ohio State Automobile Association, a common pleas judge who formerly served as county prosecutor, a former assistant prosecutor, now in private practice, a member of the American Bar Association's Standing Committee on Traffic Courts, and a municipal prosecutor, who was formerly a police officer.

With this wealth of background and knowledge, the committee began to review the overall problem and its many related facets. It found, for example, that in the Bedford municipal court, 14 municipalities plus the state Highway Patrol and the sheriff's office bring traffic citations before this court. In the Shaker Heights municipal court, five municipalities plus the state Highway Patrol and the sheriff's office bring cases before the court. The problem of filing space in the clerk's offices of the different sizes of all of these various tickets was mammoth and necessitated a separate filing cabinet for each separate jurisdiction.

The committee found that some tickets did not even state a cause of action, while others did not state an offense. Some were completely unreadable and the judges of these courts found a great deal of trouble in properly determining the seriousness of each violation.

The committee, meeting almost every two weeks and during voluminous work individually between meeting dates, presented its first report to the Supreme Court December 2, 1960. Although the committee had furnished information to the Ohio Association of Chiefs of Police and the Buckeye State Sheriffs Association, the Supreme Court was besieged by police officials who asked the court that they be allowed to be represented on the Bar Association Committee. The court concurred and added to the committee two chiefs of police and another municipal court judge. The Supreme Court also sent to the committee a list of seven specific comments for them to review.

The review was made by the larger committee in semi-monthly meetings and on May 25, 1961, the final report was submitted and forwarded to the Supreme Court. We are, at this time, awaiting action of the court. Almost every large newspaper in Ohio has commented editorially on the new ticket, endorsing the idea and, in the meantime, over 100 municipalities have adopted the ticket as approved by the Ohio State Bar Association and many others are only awaiting the action of the Supreme Court to adopt the new ticket, although it will not go into effect officially until January 1, 1963.

The basis of starting on the ticket and rules was a booklet entitled "Uniform Traffic Ticket and Complaint and Modern Rules Governing Procedure in Traffic Cases," prepared by the American Bar Association Court Program, copies of which are available from the American Bar Association in Chicago.

In drafting the rules and designing the ticket, the committee consulted with the Ohio Department of Highway Safety, the Ohio Municipal Judges Association, the Association of Ohio County Court Judges, the Ohio State Automobile Association, the Ohio Association of Chiefs of Police and the Buckeye State Sheriffs Association. In

each case, suggestion and comment were invited. The ABA ticket, which is used extensively in New Jersey, Michigan, Missouri and many individual communities, and the basis for study, has the following essential characteristics:

1. Quadruplicate form, so that upon a single writing, various sheets, serving the court, the licensing authority, the police agency and the accused, with identical information, with consequent lessened opportunity for "fixing" tickets.
2. A series of pre-printed boxes for checking, which are descriptive of common driving offenses.
3. A similar series of boxes describing a series of road and pavement conditions.
4. A place on the reverse side of the respective sheets to record court action in the case.

The ABA uniform traffic ticket is approximately four and one-half by eight and one-half inches in size. Ohio adopted a ticket four and one-quarter by eight and one-half inches in order to meet the problem of some agencies in filing. Unfortunately, for use in Ohio, the ABA ticket was designed around offenses in fixed speed limit states which adhere strictly to the uniform Vehicle Code. Ohio has a prima facie speed limit law. Further, many of the listed offenses on the ABA ticket do not exist in that form in Ohio. However, the general format of the ABA ticket has been retained, including identification as to defendant's race, sex, weight and height. These essentials appear necessary for proper police records.

In describing the offenses, some difficulties were encountered stating the "assured clear distance" charge, the "reckless operation" charge, and the non-overtaking "left of center" charge. In each case, care was taken to use sufficient statutory language to make the charges adequate and clear for both the courts and the public. Some measure of variation from a standard form has been permitted to local courts in the design of the defendant's copy of the ticket. Most metropolitan courts permit waivers for minor violations, while courts with a lesser case load do not. Alternate forms are, therefore, provided, depending on the presence or absence of the waiver or traffic violations bureau. Latitude has also been af-

forded police departments to design the back of their copy of the ticket to comply with local requirements.

As to the rules, the problem of preparing procedural rules varies considerably from that encountered in New Jersey and Missouri. In those states, the state court of last resort is entitled to promulgate the entire system of pleading. In Ohio, the rules must be supplemental to and consistent with a statutory system. In addition, the system of pleading as established by the legislature in 1959, containing many amendments, is so new that insufficient opportunity has been afforded to note "bugs" and inconsistencies in the various statutory sections. Where these inconsistencies were obvious, an attempt was made to reconcile or at least state them. The rules themselves were grouped into four basic classes, as follows:

1. Preliminary, definite and general.
2. Arraignment and motions.
3. Specialized traffic practices including the ticket.
4. Trial and appeal.

In the preliminary rules, the committee re-stated some obvious and inherent court powers. While this might seem superfluous, it must be remembered that many misdemeanors and traffic cases are decided by mayors and county judges who are not lawyers. Consequently, it was considered desirable to remind them that they are judges, bound by professional standards and subject to discipline.

As to arraignment, the concept of separation of traffic and non-traffic cases, which is an important principle of the ABA program, is dealt with in these rules. Strict separation of arraignment of traffic and non-traffic defendants is attempted. The model ABA traffic rules carry this separation even further by having separate trials on different days or in different places. No such solution is realistic for Ohio, when one considers the large number of judge's or mayor's courts and the space problems of many multi-judge courts. Therefore, none was attempted. An additional reason for deviating from the ABA model rules is that in other states, arraignment and trial seem to be the same thing, whereas, in Ohio the two are considered separate. The rule on motions

is designed to encourage the filing of all available motions at one time to prevent unnecessary delay in trial.

As to the traffic practice portion of the rules, the committee felt strongly that traffic courts must not be operated for revenue to municipalities and that unrestricted use of the "bail forfeiture" and of the "traffic waiver" where tickets are light, should be discouraged. The committee recommended a general statement disapproving forfeiture without attempt at apprehension but countenancing it in individual cases for good reasons. An adjunct to this rule is the attempt to validate the sending in of a record of forfeiture for "points" under Ohio's point system for the non-appearance of a defendant who has not posted bail.

In dealing with the "waiver" system, the committee proposed two basic rules for a traffic violations bureau:

1. A specific list of the more serious offenses which cannot be handled without court appearance under any circumstances.
2. Any violation accompanied by unusual circumstances requires personal appearance in court by the defendant.

As to trial and appeal, the committee had

three more proposals. First, the rule for covering jury trials in courts not of record, is intended to confuse by differing language of the statutes and at the same time spell out some of the machinery for transfer of the jury demand cases.

The second rule is intended to be educational. Some sections of the Revised Code contemplate a thirty day rule for the filing of bills of exception. Unfortunately, other provisions create a ten day rule. While the committee considered the thirty day rule preferable, it was obliged to admit that under ordinary rules of statutory construction, the ten day rule would probably prevail. This conclusion is spelled out in this rule.

The third rule spells out the procedure under the jeopardy plea.

The largest current improvement in traffic courts in the state of Ohio in recent years was the abolishing of justices of the peace courts. The adoption of uniform court rules and a uniform traffic ticket is the next big step. The abolishment of mayor's courts in favor of elected municipal and county court judges who are experienced lawyers, trained in dealing with traffic offenders, could be the next big step.

TEENAGE TRAFFIC COURT AND SCHOOL

By JOSEPH P. CASKEY

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Last November a referendum was voted on favorably by the people establishing a new municipal court system for Baltimore City. Under this bill, all existing lower criminal courts and traffic courts were abolished; and an entirely new court with permanent judges, taking jurisdiction in the lower criminal and traffic cases, was established. The Governor appointed 15 judges for terms ranging from 18 months to six years, at salaries of \$15,000 a year for 14 of the judges and \$16,000 for the chief judge. At the expiration of the terms, they must run for election to a new term.

However, I would like to talk primarily about a specialized court, taking jurisdiction

in all teenage traffic violations, involving young people between the ages of 16 and 21. This court convenes each Saturday morning at nine A.M. and is opened by the showing of a traffic safety film of about 10 minutes duration, usually depicting a serious accident and pointing out its cause and prevention, as well as other safety education data.

The bailiff announces the entry of the judge; and after everyone is seated, the judge gives an opening statement on the purpose and aims of the court, which is to help perhaps the first-time violator, but on the other hand to deal stringently with the persistent youthful violator who disregards

the safety of others on the road. The judge will also quote statistics and other safety hints.

In this court, the judge can render one of three decisions: dismiss the case, fine or jail and suspend the license, or probation before verdict.

The last finding has become the one in which the court can retain an association with the youngster for a six month period. This special teen court has brought out the fact that the teenager is basically honest—in 95 per cent of the teen cases, the defendant enters a plea of guilty; however in the adult court, the reverse is true.

Since many youths are accompanied by either their parents or friends, the film and talk by the judge have an effect on all—even the police officer. The hearings are conducted on an impartial basis. The judge will call the youth by his or her first name, and here too the parents will for the first time get both sides of the story, which may differ greatly from the one told by Junior as having been picked on.

This specialized court also provides a tremendous opportunity to impress our youth with the dignity and fairness of our judicial system, since most of these young people will never have any contact with any other tribunal, and the first impression is usually lasting. Probably the greatest advantage of such a court is the control. Since the court retains jurisdiction over all under 21 violators, the persistent violator appearing in this court will soon be dealt with in a severe manner.

At the outset of the establishment of this court, we were carrying more than 300 cases each Saturday morning, where now we are averaging about 160 cases each week, and you must remember this is in a city of over a million population!

Of course, in Baltimore City, when Junior is given a traffic ticket, he cannot give it to Dad to mail for him. Junior must appear in court and stand on his own two feet, since under 21 years of age violators cannot pay out in advance of trial except in parking cases.

When the judge gives a youth probation before verdict, he or she is screened as to background and prior record to ascertain if he or she will be accepted. If accepted, the teenagers are instructed to report personally

twice a month for a personal check-in, at which time we can question them as to the driving and overall behavior; and likewise they may seek any help or ask any questions with which we may help. This phase brings us into direct relationship with the teenagers. Once a month they will be notified to attend a traffic safety class, which is held in the court room.

After six classes have been completed, a written test is given; and if passed, the youth is graduated and the violation is not placed on the driving record.

Each class is opened by a member of the clergy with a prayer, since we embody into our program the moral aspect. At the outset they are apprised of the reason for bringing them to these classes, and the value placed on these classes is the saving of the very life.

They are also told that completion of the course will result in no mark on the driving record—this is a strong incentive. The teenagers themselves are the lecturers, and this is one of the most important parts of the entire program, since they will listen to those of their same age and in the same boat.

Slides of recent accident victims are displayed on the screen, and this also has proved to be a powerful part of the class. At times the clergyman will give a talk of about ten minutes showing the moral responsibility involved in the operation of a car. The class is concluded by the showing of a traffic safety film of about 25 minutes, involving a complete story of a serious or fatal accident.

We are presently carrying more than 1000 on our rolls, and since the inception of this program, we have graduated about 15,000 from our school and have had less than ten per cent come back with repeat violations. Since we retain jurisdiction in these cases until the probation has been fulfilled, a subsequent traffic ticket will mean violation of probation; and since he must stand trial in the same court, the judge will have the probation case and the new case, and he can impose fines in both cases and suspend the license. In situations where a boy reports for a while and then stops reporting, we can summons the youth and remand him back to court and the penalty imposed.

This entire system began when I was given the post in charge of the teenage program with 25 teenagers to handle. I experimented with these 25 one night in April of 1951. This proved to be the first traffic safety school within the traffic courts in the nation. In June of 1951, upon the advice of Jim Economos, we issued the pay-out cutoff for under 21 years of age violators. This clogged our courts with teen violators, and of course this led to the establishment of the teen court in October of 1951.

There is no question as to its value and

its possibilities. During these years, this system of court and school has had a direct effect on our youthful community and has served as a deterrent in numerous instances. This court gives us a ready-made pool from which to select those drivers who want to know how to drive properly and keep their licenses. In many cases the young people beg for probation, since they know it will mean education and a clean record. Probation in this court is considered a break of courtesy, since not all are given this privilege.

WHAT DIRECTION CHEMICAL TESTS?

(a) LEGISLATION

By ROBERT L. DONICAN

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In discussing the legal aspects of chemical tests to determine alcoholic influence, it is interesting to look back a few years and review a bit of history on this subject. It was almost 25 years ago, February 6, 1937, to be exact, when the accused in the first chemical test case to be taken up to a court of appeal in this country was arrested for driving while under the influence of intoxicating liquor as he drove his automobile up the driveway to his home. The Supreme Court of Arizona, in approving his conviction for this offense, charted a favorable course for the use of chemical tests by law enforcement agencies throughout the nation in combatting the danger of the tipsy driver upon our highways. This decision was followed not too long thereafter by similar favorable opinions by the appellate courts in California, Iowa, and Ohio.

Over the course of this quarter of a century, a firm foundation of case law has followed these initial cases, involving almost every question which could be raised by the legal profession relating to the admissibility in the courtroom of evidence concerning the use of chemical tests to determine alcoholic influence. Appellate courts in the federal jurisdictions and in 45 states—in all the states except Alaska, Hawaii, Louisiana, Mississippi, and Wyoming—have had occa-

sion to pass upon legal questions relating to this type of evidence. The number of these cases may surprise many—it is just short of the 400 mark to date. 363 reported cases to be precise.

In general, our appellate courts have overwhelmingly approved the use of chemical test evidence in both criminal and civil cases involving inebriated drivers—when the tests have been properly conducted by qualified personnel and the evidence has been properly prepared and presented in court. So far, no appellate court has ever reversed a case taken up from the trial courts on the ground that chemical tests to determine alcoholic influence are not valid.

In the late thirties, state legislatures began to take cognizance of this relatively new (at least in this country) weapon against the motorist who injudiciously mixes his alcohol with gasoline. At its 1939 session, the Indiana Legislature was the first state legislative body to enact a law providing for the admissibility of chemical test evidence and establishing the familiar statutory presumption that a driver found to have 0.15 per cent or more blood alcohol concentration is under the influence of intoxicants.

In the early forties, three other states followed suit by enacting similar legislation—Maine, New York and Oregon. This was

soon followed by action of the National Committee on Uniform Traffic Laws and Ordinances in including recommended legislation on the subject in the Uniform Vehicle Code. Since then, other states also have enacted chemical test legislation in this field. Their number now is 36, plus the District of Columbia. But not all states have followed the pattern recommended in the Uniform Vehicle Code.

It behooves us here to note that permissive legislation has never been necessary in any state to establish the admissibility of chemical test evidence in the courtroom. Such evidence always has been admissible in every state when properly prepared and presented, under the age-old rules of evidence applying to the admissibility of any type of scientific matter. Many persons interested in traffic safety upon our highways, however, have diligently promoted and worked for the enactment of such legislation in their respective states with the view of encouraging and fortifying the use of chemical tests in their communities and thus greatly increasing the application of this modern scientific tool.

In some of our states, there has been active opposition for these many years against the proposals of these well-meaning safety-minded persons, usually and predominantly attributed to legislators themselves. The several reasons for such opposition among a few of the old warrior assemblymen, who are nevertheless the duly elected representatives of our people, are as well known to most of you as they are to me. A study of some of the recent legislation on this subject in a few of the states indicates that these influential but die-hard legislative opponents, in finally giving in, have taken their toll by bargaining for deviations from the recommended legislation in the Uniform Vehicle Code and successfully imposing undue limitations and restrictions upon the admissibility of chemical test evidence, to the point that some states were much better off solely under the case law of their appellate courts and without legislation in this field, than they are with it. To those devoted proponents of chemical test legislation in the 14 states which yet do not have it, there is a piece of advice to be derived from these experiences—do not compromise for the mere sake of having some chemical test legislation upon the stat-

ute books of your state to the extent that departure from the national standards recommended in the Uniform Vehicle Code is so great you just create another "Munich."

Over the years as the public has become better educated on the subject of validity and value of chemical tests to determine alcoholic influence, as more and more states have enacted specific legislation on the subject, as appellate court after appellate court has approved the use of this type of evidence against the "DWI" driver, it is found that in an increasing number of jurisdictions the motorist who gives little thought to how dangerous the mixture of gasoline and alcohol is and can be, is becoming wary of these tests, not by refraining from driving while in this condition, but it is manifest in his refusing to submit to such tests when the law finally catches up with him. This, of course, is most pronounced in the repeater-violator—he who has the prior conviction based upon chemical test evidence. In Indiana, where probably, percentage-wise, there are more law enforcement agencies with chemical test programs than in any other state, and for a longer time, it is reported that in a number of areas refusals to submit to chemical tests by drivers accused of operating while under the influence of intoxicants is greater than 40 per cent. During the legislative session in Illinois, this year, it was reported that the number of such refusals in Chicago now constitutes about 46 per cent. In a recent publication of the National Safety Council, it was reported that the percentage of refusals on the part of those apprehended by Oregon State agencies amounts to 68.5.

This naturally has resulted in a demand by many persons highly conscious of the need for traffic safety for a "compulsory" chemical test law—a statute which would make it mandatory for a motorist arrested for driving while under the influence of intoxicants to submit to a chemical test of his blood, urine, or breath to determine the extent of his blood alcohol concentration, even to the point of physically forcing him to submit to such a test if necessary. To most of our American citizens, the idea of the latter, of course, is highly repugnant, no matter how high the need for safety may be. With our inherent tendency to zealously protect the rights of the individual in this country and our ever present fears of creat-

ing a police "state," probably no American legislature will ever permit such action by force.

The problem, however, has led to the birth of a new type of chemical test statute—not a "compulsory" law, but the "implied consent" type of law. It provides, in effect, that as a condition of the privilege of driving a motor vehicle on the highways of the state, a motorist impliedly consents to submit to a chemical test of his blood, breath, or urine if he is ever arrested for operating while under the influence of intoxicating liquor, but that if he fails to comply with this condition by refusing to submit to such a test when so arrested and there is probable cause to believe he is under the influence, his privilege to operate in that state shall be revoked and cannot be restored for a definite period of time, usually six months. It also provides that if there is a refusal, no chemical test shall be conducted.

Thus it is not, as so many persons have mistakenly called it, a "compulsory" law. The accused has a choice—of refusing and forfeiting his privilege of driving, or submitting and, at least for the time being, retaining his privilege of driving. It also will be noted that there is no provision for signing an agreement upon the application for a driver's license—which would not reach the unlicensed driver or the out-of-state driver. The implied consent type of law reaches all of these alike—any privilege of driving in that state is forfeited upon refusal to submit. And the revocation of the driving privilege becomes effective regardless of the outcome of the criminal charge against the accused for operating while under the influence of intoxicating liquor. Even though he may be acquitted eventually upon trial of the criminal charge, revocation of his driving privilege because of refusal to submit to a chemical test becomes an accomplished fact.

A model law on this subject was drafted and approved by the National Conference of Commissioners on Uniform State Laws in 1937 and was approved officially by the American Bar Association in that same year. It is now under consideration by the National Committee on Uniform Traffic Laws and Ordinances for inclusion in the Uniform Vehicle Code. Many national organizations interested in traffic safety, such as the Na-

tional Safety Council, the International Association of Chiefs of Police, the American Medical Association, and others, have recommended the adoption of this type of law by all states.

To date, nine states have enacted this type of legislation—Idaho, Kansas, Nebraska, New York, North Dakota, South Dakota, Utah, Vermont, and just this year, Minnesota. The court decisions relating to the existing statutes on this subject in those states have been most interesting. Whenever the constitutionality of the act has been attacked, the courts have sustained its validity. Of special interest are recent decisions approving the validity of this type of law by the Supreme Courts of Idaho, Kansas, and Nebraska. Other decisions have been instrumental in clarifying for the law enforcement agencies and particularly, the motor vehicle administrator, how such a law can and should be administered. Reports from those states in which it has been in effect for some time indicate that the law is working out well and that its objectives are gradually being attained—encouraging the use of chemical tests on the part of those agencies charged with the responsibility of enforcing the traffic laws, reducing the numbers of drivers who are chancing operation of their vehicles after drinking, reducing the numbers of those who refuse to submit to chemical tests after arrest for driving while under the influence, and taking off the roads for an appreciable length of time those who refuse to submit to such tests and thus making it difficult for them to have their driving privileges restored.

Here again, though, those traffic safety conscious persons who are so diligently working to have their legislatures enact the implied consent type of law must be warned against undue compromise with some of the hard-bitten opposition against them. An example to be heeded is the recent legislation in Minnesota, which many of us believe has strayed so far from the provisions of the "Uniform Chemical Test For Intoxicating Act," recommended for adoption by the American Bar Association and the National Conference of Commissioners on Uniform State Laws, that its eventual effectiveness is much in doubt. Time, and experience with its administration, soon will show us whether the law is worth having on the books of that state.

Another phase of legislation to be specially noted is the recommended reduction of the 0.15 per cent statutory presumption to the level of 0.10 per cent. Many of our scientists in this country for a long time have felt that the 0.15 per cent figure has been far too liberal. This has been based upon many additional experiments in the past several years conducted under rigidly controlled and recorded conditions, which have led the vast majority of scientists experienced in this field to come to the definite conclusion that practically all of us human beings are unfit to drive a motor vehicle upon the highway under modern conditions with as much as 0.10 per cent blood alcohol concentration, and that many of us are unfit at levels much below that.

Pursuant to this, some national organizations with this background of support are recommending that the presumptive statutory level of 0.15 per cent be reduced by state legislation to 0.10 per cent. The National Safety Council has already gone on record in recommending that the provision in the Uniform Vehicle Code be amended accordingly. North Dakota has been the first state to follow this recommendation. This year, the legislature of that state amended its chemical test law to provide that if a person charged with the offense of driving while under the influence of intoxicating liquor is found, after a chemical test, to have 0.10 per cent blood alcohol concentration, it shall be presumed he was under the influence of intoxicating liquor. This presumption is applicable also in all other criminal cases and civil proceedings against him arising out of his driving while under the influence in North Dakota.

Some persons may contend that New York was the first state to set a pilot course in this direction. What that state actually did two years ago was to create an offense of a lesser nature than the offense of driving while in an intoxicated condition to which the statutory presumption of 0.15 per cent still is applicable. The lesser offense is known as "driving while in an impaired condition" and is supposed to be applicable only to those accused motorists who submit to a chemical test after arrest and their blood alcohol concentrations are found to be at levels of 0.10 per cent or more but less than 0.15 per cent. The possible punishment and time of loss of driving privileges upon

conviction, of course, are considerably less than upon conviction for the greater offense. An accused to whom a chemical test was not available, or who refused to submit to one, may still be convicted of driving while in an intoxicated condition in New York, but in order to be found guilty, technically, of the lesser offense of driving while impaired, the result of a chemical test is essential evidence.

This kind of law has intensified the spotlight on the oft-repeated question: "Why not a law in our states making it an offense of graduated degrees of seriousness to drive while having certain quantities of alcohol in the blood?" In other words, say persons who ask this question, why don't we have the type of law reported to be in effect in some European countries, e.g., Norway and Sweden, in which it is a crime to drive a motor vehicle when one has as much as 0.05 per cent alcohol in his blood, but if a chemical test shows 0.15 per cent or more alcohol in the blood, the mandatory punishment is much greater than for lesser quantities? Attention is directed to the fact that the offense is not for driving while impaired, or while intoxicated or under the influence of intoxicating liquor, but for operating a motor vehicle when having certain quantities of alcohol in the blood.

Of course, to enforce this type of law the result of a chemical test of the breath or body fluids is essential for prosecution. This brings up that old-age problem again in this country: should the motorist be compelled to submit to such a test, does he have the right to refuse it, do his civil rights under our federal and state constitutions prohibit requiring him to submit, etc.? Most likely the European countries are not confronted with these legal questions and therefore are not bothered with this problem in enforcement.

But when the public generally in this country become better educated as to what alcohol is actually doing on our highways in the matter of taking life, e.g., recent surveys in some of the states which show that it plays a role in anywhere from 40 to 60 per cent of the fatal traffic accidents in the community, then it is quite possible that we will have such legislation. The courts of last resort in this country in many instances have already charted such a course by holding that the well-known and widely discussed

privilege against self-incrimination is only applicable to testimonial compulsion and not to the obtaining of physical evidence and that the use of our highways by a motorist is a privilege, and not an absolute right,

which may be regulated by reasonable action on the part of a legislature. Already there are individuals and organizations in this country earnestly striving to have such legislation recognized in the various states.

(b) ENFORCEMENT

By JAMES R. BARRETT

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The course of police in chemical test work has been clearly and consistently forward for more than twenty-five years.

The handful of experimenters who pioneered in this field in the early thirties has been joined by literally hundreds of officers who now perform the tests on regularized basis.

An idea of the extent of present service can be drawn from the reports on chemical test use. The latest shows that tests were performed in at least half the larger American cities (those with a population of 10,000 or more) in 1960 and that the number of arrests and convictions for drinking driving was appreciably greater than in the previous year.

These were more or less predictable occurrences and represented a continuation of a trend of earlier years.

The reasons underlying the upsurge of interest in this area, however, are not quite as apparent and it might be well to give them more than passing consideration.

Need for an objective measure

Police for many years were almost wholly dependent on subjective sobriety tests. On arresting a drinking driver, they would make tests of muscular coordination and note, in detail, his reactions and outward appearance.

Neither the test rating nor the officer's diagnosis were ever regarded as completely satisfactory evidence of intoxication. The reports were challenged by attorneys, questioned by expert witnesses, and patently disregarded by jurors.

Such a situation made it difficult, at best, for police to deal meaningfully with the inebriated driver.

It was little wonder then, that chemical tests proved to be of such immediate interest. Police, from the very first, saw them as a dependable and reliable way of demonstrating that a person had been drinking and, if he had, the amount of alcohol that remained in his bodily fluids.

This to them, represented a long step forward and they were anxious to utilize the tests to the fullest possible extent.

Legislative sanctions

Test results were offered in evidence as early as the mid-thirties but the full benefit of the newer methods was not realized until they were given the sanction of law.

The enactment of chemical test laws started in the late thirties and continues to the present time.

Thirty-six states now have chemical test laws and others give indication that they may soon adopt similar regulations.

The basic law affords recognition of tests and specifies the blood alcohol concentrations that may be regarded as evidence of alcoholic influence.

This is important but police soon found that they were somewhat handicapped by the driver who refused to submit to a test.

They might suspect that he had a high blood alcoholic content but unless a specimen was forthcoming, no test could be performed.

The solution to this problem came from the legislative halls. The state of New York, in 1953, enacted the first of the implied consent laws. It directed license revocation by administrative action for anyone refusing to submit to a test. This, in part, eliminated a great many refusals. Eight other states have since followed New York's example

and now have implied consent laws of their own.

As tests found wider usage, judges and prosecutors gave closer attention to the test report. They have come, in some jurisdictions, in fact, to look upon the blood alcohol reading as the determinant of the action to be taken in a case and have even, in some instances, gone so far as to regard a blood alcohol concentration of less than 15 per cent as a bar to prosecution on a drinking driver charge.

While always somewhat debatable, this view became even less defensible after findings of recent date showed that drivers could be adversely affected by blood alcohol concentrations of considerably less than fifteen hundredths per cent.

Here again legislation afforded help. The driving while impaired law passed by New York legislature in 1960, specifically prohibits operation of a vehicle if the operator has a blood alcohol concentration of even ten hundredths per cent.

The effect of this statute has been to encourage action against a whole class of drivers who otherwise might have escaped detection and arrest.

Figures show that there has been a twenty per cent increase in combined judicial-administrative action under the new law in the twelve months ending October first.

Judicial acceptance

The courts in the early days were extremely cautious in their expressions about the tests. They permitted their use in evidence but were more than guarded in any statements about the weight that was to be attached to them.

Gradually, however, a body of decisions developed and the status of the tests was more clearly defined.

Word of the new views was circulated largely through the Regional Traffic Court Conferences and Traffic Institute's specialized reporting service.

Enforcement was encouraged and chemical test case prosecutions greatly facilitated.

Police interest in tests

Conscious as they were of the advantages of the tests, police were generally a little hesitant about embarking on this field.

They saw the tests as a technical activity and looked for training that might serve as a bridge to a sound and workable program.

The Traffic Institute shared this view; and late in the thirties, it began giving chemical test training both in Evanston and at regional training sessions.

Armed with this background, trainees returned to their home departments where they started routine testing.

The favorable experience of agencies using these methods has whetted the interest of others and encouraged expansion of chemical test work.

Technical, professional advances

The enlargement of interest was fortunately accompanied by improvement and simplification of chemical test procedures.

Devices and instruments perfected in the late thirties enabled police to perform tests that had previously been laboratory specialties. This offered the advantage of immediate results and prompt arraignment of violators in court.

Further and more recent refinements in equipment have made it possible for police to perform speedy on-the-scene tests.

Scientists and technical people have at the same time, been doing important research. They have made extensive studies of the relationships between accidents and blood alcohol levels. They have found that alcohol is an important accident causative factor and they have established that driving ability can be materially impaired by even very small alcoholic concentrations.

Their beliefs and findings are reflected in statements of recent date. The declaration by the scientists at the Indiana Symposium on Alcohol two years ago had marked effect on operating practice and led, in several jurisdictions, to the reduction in permissible test levels.

The publications, reports and the manuals of the scientific groups have helped spread general knowledge and understanding of the tests.

The endorsement by medical and bar associations and those of the Safety Council and leading scientific groups have continued to win respect and support for the tests.

The approval that goes with routine use

of tests in medical and post-mortem examinations has also had beneficial effect.

Enlargement of public understanding

Public interest has, of course, been a primary force in shaping the over-all test program.

The citizenry, speaking as jurors or as complainants in the motor vehicle cases has made known its views on chemical tests.

The doubts and uncertainty that once prevailed have been dispelled by the flood of material that found its way to journals, news bulletins and other types of publications.

Acquaintance with the tests has been extended by discussion and demonstration. Police have been free in exhibiting the apparatus and explaining how it works.

Safety and medical organizations have shown chemical test displays to thousands upon thousands of people.

The education has had perceptible effect. The public, in recent years, has begun to show genuine concern about the drinking driver.

Despite the progress, and it's been considerable over the years, the chemical test movement has never been without difficulty.

Obstacle upon obstacle has beset the path of those endeavoring to advance the cause. Each, however, has been successfully met and the work continues as before.

Police have assisted in the preparation of legislative bills; they have taken part in public hearings and they have tried through the services available to them, to follow the course of the judicial decisions.

This has proved to be a sound approach and the pattern has been followed in state after state with good success.

The enforcement people have been conscious, too, of the dangers of misuse of tests. They have shown active interest in training and have accepted and furthered the idea of having a core of key men

schooling in standard test methods.

This has more than overcome the tendency of ambitious and irresponsible individuals to make exaggerated claims about the tests and test findings.

It has also been necessary, on occasion, to defend the tests against groundless but sensational attack.

Reports have occasionally appeared in the press about individuals who supposedly have found a way to negate or circumvent the tests.

Police and members of the national committee have been quick to respond to these charges and to furnish a true statement of fact.

Probably the greatest problem of all has been to overcome the popular misbeliefs about alcohol and its effects. Only the repeated recounting of instances about drivers with low blood alcohol contents who were killed or injured has had any marked effect in changing the view that drinkers are seldom if ever hurt in motor vehicle accidents.

The thoroughly fallacious theory of improved coordination and complete relaxation on the part of the drinker still commands a surprisingly wide following.

The police, in citing research and personal findings, have been able to do a great deal of good in this area.

As in other dynamic situations there are opposing forces at work in the chemical test field.

Cynics, obstructionists and violators would like to see a relaxation of present controls.

Police, administrators and scientists would like to have them extended to the point where they completely limit and restrict the number of drinking drivers traveling the public roads.

At the moment, the constructive view prevails.

The amount of test usage is on the increase and has been for some time.

(c) TESTING DEVICES

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Chemical tests for intoxication—the analysis of body materials for alcohol level, based on the accepted theory that alcohol is distributed quite uniformly in the water of all parts of the body—have achieved a degree of precision, reliability, and specificity that when properly conducted warrant the confidence of police, courts, and the general public.

The search for an objective and dependable correlate of alcohol impairment began with the advent of the machine and motor age at the turn of the century. The search tended in the direction of analysis of body liquids such as blood and urine for the purpose of diagnosing alcoholic influence.

Literally dozens of laboratory methods have been devised to fulfill varying requirements such as analysis of blood or urine from cadavers, the analysis of urine, blood, or saliva in traffic arrests when immediate results are not required, or the study of alcoholic effect in research problems.

These laboratory analyses of body liquids, while excellent for the stated purposes, are hardly helpful to the police officer who wants to use the results as a factor in making his decision as to how to deal with a drinking driver under investigation.

As the symbol of the impaired driver changes from gross drunkenness to impairment of intellect and judgment, so changes the need for immediate answers as to whether alcohol is present in sufficient quantity to account for the police officer's suspicions.

The breath tests, based on the principle that there is a reliable relationship between the level of alcohol in the blood and in the breath, offer a solution to this problem. Whether the results are used only to tell the investigating officer if he is right in his suspicion or whether the results are used for prosecution purposes, they become an important investigative tool.

A quarter of a century ago the National Safety Council established the National

Safety Council Committee on Tests for Intoxication. This committee remains to this day (now called the Committee on Tests for Alcohol and Drugs) the clearing house for information in this field for the Nation. One of the first actions of the Committee was to formalize the use of both the tests for physical signs of impairment and the chemical tests for alcohol by designing a standard reporting form. Another act of the Committee was to set up standards interpreting the meaning of blood alcohol levels.

The Committee encouraged research in all areas of the problem. With this the search was on for methods.

Even predating the establishment of the Committee, Hesse conducted experiments on human beings, perfecting an analytical method for determining urine and blood alcohol levels.

The apparatus and reagents for this method soon appeared as a package laboratory called "LaMotte Outfit for Determining the Concentration of Alcohol in Blood and Urine." This method is used considerably to this day.

Harger, basing his work on the quantitative excretion of alcohol from the blood into the breath, devised a method of analysis for breath alcohol that met the needs of law enforcement agencies so well that by 1937 his apparatus and method, the Drunkometer, were in routine use by police in many parts of the United States and other countries.

Soon two additional breath methods were described. Greenberg announced the Alcometer, a push-button, photo-electric, automatic, sequence-locked apparatus, and Forester reported the Intoximeter, a portable, sample-collecting test packet that can be used at the scene of an arrest. A preliminary reading is available at the scene to help the police officer make his decision concerning possible arrest. The rest of the packet is designed to be sent to a laboratory for analysis.

Following World War II, the activity

of the Committee on Tests for Intoxication was spurred by a recommendation by the President's Highway Safety Conference. The use of chemical tests for intoxication mushroomed.

Along with these increases in need, acceptance, and usage was considerable technical advance.

New chemical tests for practical law enforcement appeared. Kitagawa of Japan, announced the Drunkotester. It is semi-quantitative, disposable, and not intended to provide evidence-quality results, but rather quick screening results for the police officer's information, as do Grosskopf's Alcotest tubes, made in Germany.

The Breathalyzer, a quantitative photoelectric instrument, was first shown in 1954, followed by Harger's variation of the Drunkometer method using rebreathed air, an analytical simplification.

About three years ago The Photoelectric Intoximeter was announced by Forrester. This instrument is another photoelectric device using two breath samples taken simultaneously, one for an immediate answer and the other for later confirmation.

These are the breath tests to date, and 1961 finds chemical tests for intoxication in use in every state in the Union, according to the reports of the National Safety Council.

The use of breath as a material for chemical analysis has become popular for two reasons. First, the sampling and analytical procedures are so simple that a trained police officer can make reliable analyses. Second, the results are available at the time the police officer needs them . . . shortly after arrest.

The future may hold the adapting of advanced techniques such as gas chromatography or infra-red absorption spectrophotometry to this field. However, the mandate of the breath tests, speed, simplicity, and adequate accuracy, must be maintained, otherwise complexity will neutralize their effectiveness.

The breath methods, each requiring its own kind of maintenance and calibration, will, if used by properly trained operators; backed by professional level expert testimony to satisfactorily explain technology and to interpret the results, yield results that are sufficiently precise, reliable, and specific to deserve the confidence of police officers, the courts, and the public alike.

The need today is for better public understanding of the meaning of the tests and more adequate training for users to increase public and courtroom confidence. This would result in headlines in newspapers and be positive contributions to highway safety.

CHEMICAL TESTS IN DRIVER RESEARCH

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It would be impossible in the space available here to discuss or even to list the many ways in which chemical tests for the presence of alcohol have been, are being, and will in the future be used for highway safety research. Such purposes relate to the entire gamut of questions which arise in connection with the uses and misuses of motor vehicles. This follows from the remarkable preponderance of the use of alcohol as a factor in motor vehicle accidents, both fatal and non-fatal.

As a result, the scientific evaluation of almost any other aspect of motor vehicle accident causation requires a determination of the extent of its relationship with the drinking-driving, drinking-accident problem. In view of this, it is noteworthy that in a number of recent, uncontrolled and controlled investigations seeking causes of accidents, this has not been done with even minimum adequacy.

Fundamentally considered, the chemical tests, as they are referred to here, are

merely a tool, a yardstick, available for the measurement of one characteristic of drivers, whether under experimental or non-experimental conditions. There is nothing magical, or unique, about these tests—they have many parallels in related fields, notably in forensic and clinical medicine—and their use requires, regardless of the purpose for which they are employed, the same competence, care and intelligence as do such other analytical procedures; requirements which must be observed for the work in question to be both scientifically acceptable and practically useful.

These tests for alcohol have a necessary role in research concerned with groups of drivers and their accidents for the very same reason that they have a necessary role in the investigation of the accidents of given individuals. This follows from the well-documented fact that except in clear-cut and extreme cases these tests, when properly performed, provide the only reliable yardstick of the presence of alcohol and of its concentrations in the pertinent tissues of the body.

It has been repeatedly demonstrated that competent professional observers will frequently miss even the very presence of alcohol when confronted with a drinking driver, and that their estimates of the blood alcohol concentrations and degree of impairment involved when its presence is recognized frequently under-estimate the actual state of affairs to such an extent as to make such subjective methods largely useless for research purposes.

This would not necessitate the routine application of such tests in field studies of drivers involved in accidents, and of those not so involved where controlled work is done, if it were not for the work of Heise,¹ Smith and Popham,² Lucas *et al.*,³ Barmack and Payne,⁴ Freimuth *et al.*,⁵ Haddon and Bradess,⁶ McCarroll and Haddon and others. These workers have all shown that wherever and whenever the matter has been investigated with objective methods, pertinently high blood alcohol concentrations have been found to be the common denominator of large percentages of drivers in both fatal and non-fatal accidents.

In view of this and, in particular, because of the documented, frequent and substantial unreliability of other methods, (*e.g.*)

it has now become mandatory in field research concerned with eliciting causes of accidents, whether on a case study or scientifically controlled basis, for such tests to be applied in a routine, uniform fashion to very high percentages of all of those studied, whether or not the investigators concerned happen to suspect the presence of alcohol or believe this variable to be of importance in that aspect of the motor vehicle accident problem with which they are concerned. Where this is not done, and the complete practicality of doing so in the case of both fatal and non-fatal accidents has been well established by the same workers referred to above, the biases discussed may be expected to lead to gross underestimations of the extent to which this factor is present in the groups in question. This in turn may be expected to lead to very substantial errors in the relative importance placed on other factors which may also have contributed to the accidents in question.

The scientific adequacy and practical value of any investigation concerned with the field study of the causes of either fatal or non-fatal motor accidents, in which this has not been done, must be, for the reasons cited, most strenuously questioned. This holds regardless of the source involved and regardless of the difficulties, whatever their nature, cited in excuse. Theoretical and practical difficulties are the rule rather than the exception in research, and the ability to overcome them is the measure of scientific adequacy.

The mere fact, however, that such tests are employed in connection with the study of a group of drivers whether accident involved or experimentally studied—for example, in connection with their performance on a driving range—does not in any way guarantee that the work in question deserves to be either described by the word "research" or regarded as worthwhile. In short, the use of this particular tool, or any other, does not in any way absolve those using it from the responsibility of meeting at least the same minimum standards of scientific method customary in other fields of scientific activity. This has long been overlooked, chiefly by non-professional workers, undoubtedly sincerely interested in highway safety, but who appear to labor under the misconception that any process in

which data are collected, particularly in great volume and heavy with anecdote and reasonable sounding detail, automatically thereby ranks as scientific research. This is not the case.

The few dozen workers in the world now engaged in scientifically acceptable research with respect to highway safety are acutely aware of this situation, whether it involves the use of chemical tests or other aspects of highway safety. They are daily deluged with volumes of material: releases, reports, anecdotes, official pronouncements and statistics, speculations and (perhaps) claims of program efficacy, aches and explanations, all of which must be waded through in the hope that an occasional item will prove an exception to the rule that virtually none are worth the paper on which they are printed.

This is not a harmless situation. Much of this volume of material is, probably, dribbled with the vague intent to inform, often by responsible groups which would certainly know better with the result that improvement in the quality of safety research is even further delayed. In addition, the public standing of the profession from which this material is derived, and by which it is endorsed, the confidence with which it is proclaimed, all merely hide the state of our ignorance and the academic poverty upon which these statements are so often based.

If this seems an overstatement of the nature of certain of the forces delaying understanding of the problems of accident causation and prevention, consider the statement of the secretary to a then prominent official of one state after several years of daily concern with this problem:

"The most important thing we found out (about highway safety)," he said, "was that the bulk of the information we were getting from those in the field was the product of the sheerest and most mediocre of speculation and guesswork. Until we found this out, we did not know that our highway safety program was substantially without acceptable scientific or factual foundation."

To a major extent the few years which have elapsed since that statement was made have not diminished the accuracy or pertinence—nationwide—of his comments. (This is particularly true, incidentally, in connection

with the many current proposals and programs to deny driver licenses on medical grounds, since there is now no acceptable evidence that any medical group now known has an accident rate in any way different from that of otherwise similar drivers, or that even if this were the case that such measures would either constitute fair and reasonable measures of social policy or contribute to highway safety to any significant or worthwhile extent.)

It would be too much to hope for improvement in this chronic problem now entering its seventh decade if it were not for the slow but increasing entry into this field of increased numbers of professional research workers well trained in the disciplines which its problems entail, and who are little impressed with the methods and pronouncements still dominant in it. Such workers, together with the small number of scientists long active in the field, have already thoroughly documented the falsity of a number of items in the long established folklore on highway safety. Three examples, two from the subject area of this panel, should suffice to illustrate this, and the hazard inherent in the type of guesswork, subjective opinion and "common sense" on which so much in highway safety is based.

It was long believed by many, for example, that it was advantageous to the occupants of a car involved in a crash to be, as it is customarily phrased, "thrown clear," a belief which has apparently persisted unquestioned, but widely endorsed, for more than a half century. We now know, as the result of the excellent work of the Cornell crash injury research program, that the chance of fatal or other grade of injury is very greatly increased if the car occupant is thrown out of the "package" in which he has been riding. If highway safety experts had only faced up to and pointed out their ignorance of the facts even of this one aspect of the picture when the issue first arose decades past, it is likely that the matter would have been studied and decided before as many thousands were killed in this fashion.

As a second example of the harmful effect of such subjective guesswork and "common sense" as the basis of highway safety policies and pronouncements, consider the seemingly simple problem of the determination of the fraction of fatal ac-

cidents in which alcohol has been used by one of the principals (i.e., drivers and adult pedestrians). At the time four years ago in the Westchester County study of the frequency with which drivers killed in single vehicle fatal accidents had been drinking, a number of the policies and official statements of the state involved were based on an official statistic that alcohol was present only in some two per cent of the state's fatal accidents, a figure totally unsupported by scientifically adequate methods of data collection. The inappropriateness of this figure and its use in policy determination became quickly apparent when at very little cost, and with simple but scientific methods, it was found that for at least eight years the actual percentage of such single vehicle accidents in the large and heavily populated area studied was in reality 70 per cent.

Very similar data have more been obtained on a controlled basis for fatal accidents of one and other types occurring in New York City. Again, another example of the need for having opinion and policy on scientifically derived fact rather than guesswork, and of the harm which can accrue if this is not done.

As a third example, consider the widely believed, but scientifically unsupported folklore, that the very intoxicated driver poses no problem. This belief is nicely indicated by the following from an authoritative text: "It is the slightly intoxicated driver who constitutes the real threat . . . who characteristically demonstrates impairment of judgment more than impairment of sensory functions or psychomotor responses."

The "locked driver" constitutes neither a pedestrian nor a driving problem. Most of these individuals are either too drunk to drive or walk and hence sleep it off . . . Unfortunately, whenever the blood alcohol concentrations of fatally injured drivers have been scientifically analyzed, a relatively simple procedure, a very different picture emerges.

For example, in Baltimore, among 156 drivers killed consecutively in accidents of all types in a five year period, 37 per cent had blood alcohol concentrations of at least 0.15 per cent. Similarly, in Westchester County in the eight years 1950-1957, 49 per cent of drivers killed in single vehicle accidents had blood alcohol concen-

trations meeting or exceeding the liberal *prima facie* definition of intoxication (0.15 per cent by weight) and some, as has been often observed elsewhere, had concentrations which exceeded twice that value.

Finally, in the recently completed comparison of the blood alcohol concentrations of drivers fatally injured in New York City with those of non-accident involved but similarly exposed drivers, 46 per cent of accident responsible drivers had concentrations of 0.25 per cent or higher in comparison with 0 per cent among those similarly exposed, but not involved. These results, although also of significance in many other respects, here emphasizing, again, the need for appropriate methods as opposed to those currently serving in their stead.

These remarks have deliberately been chosen to cover certain of the broader problems of the sources of facts used by those who are either given the serious public responsibility of designing and directing control measures or who as members of the public particularly share the common concern with our continuing tolls of crushed bodies and vehicles. The same general and specific principles apply to research and facts relative to the use of chemical tests, whenever, wherever, and for whatever purpose employed. In the absence of such a foundation there should be a moratorium on statements and conclusions with respect to the subject, public or private.

That this is indicated is shown by the fact that as far as can be determined, there is not now a single United States or foreign jurisdiction reporting adequately collected and analyzed data with respect to the frequency of given blood alcohol concentrations among all principals (i.e., drivers and adult pedestrians) fatally injured in motor vehicle accidents grouped by accident type and length of survival. Until accurate reporting is instituted, it is impossible to measure the impact, if any, of prevention programs. It is even impossible to state the exact magnitude of the problem or to discuss the reasonableness of given proposals for its control.

Since we do not now have such continuing baseline information, we do not now know whether or not we are through our extensive and expensive programs of education and enforcement in any way influencing the occurrence of drinking-driver accidents.

This is not to suggest the discontinuation of these programs nor to suggest that they are unreasonable or without effect. Rather it is to point out that until we begin to use what this symposium refers to as chemical tests in a routine, scientific manner, we will not have any yardstick with which to measure the impact of our programs and the ways in which they can be improved.

No industry with a budget a fraction of that of organized safety would protect year in and year out without a highly sophisticated and carefully designed program of quality control. With respect to the prevalence of the drinking driver and the drinking driver accident, there is at present no such system anywhere in the world today. The time is long overdue.

The minimum requirements for adequate baseline reporting have been spelled out elsewhere in detail.¹ The general requirements in the case of fatal accidents, the area which should be cleaned up first, however, are very straightforward. First of all, it is necessary that a qualified medical examiner system, or its equivalent, be in operation and that the postmortem, blood alcohol concentrations of all of the adult principles (drivers and pedestrians) killed in the given jurisdiction be determined routinely, without exception. This is done at present in very few areas.

Second, post-mortem results derived from those living more than a few hours after their accidents should not be combined with those dying more quickly, since the body's metabolic processes reduce the concentrations of alcohol in such cases the longer the post-accident antemortem survival. This is but rarely done in the handling of such data.

Third, it is essential, a point almost universally overlooked, that the results be reported not as a hodge-podge derived from accidents of all different types, but rather, in terms of clearly defined, discrete accident categories. For example, it makes little sense to include the alcohol concentration, if any, of a driver killed while stopped at a stoplight with that of one killed by hitting a bridge abutment.

It is a relatively simple matter to divide accidents into one group in which the driver or his vehicle was probably responsible and a second, in which he and his vehicle were

clearly not responsible or less obviously so. In the former group fall drivers killed in accidents in which only their own vehicles are in motion and drivers killed in hitting other drivers in situations which leave little doubt as to their responsibility. An example of the latter is the driver who completely crosses the median strip on a divided highway and is killed in hitting an innocent car head on.

In the second category, composed of questionably responsible and non-responsible drivers, fall those killed either through no fault of their own or under circumstances in which responsibility is unclear. When these measures in the collection and analysis of data are instituted, a very different picture as to the alcohol concentrations of accident responsible drivers may be expected to emerge than that frequently given by official statistics.

Reference has already been made to the recent New York City work, one of the very small number of investigations in which these requirements of adequate data collection and analysis have been observed. That investigation demonstrated, as had the earlier Westchester County work the complete practicality and usefulness of adopting such long overdue methods. The organized highway safety profession will not be able, again, to measure with any degree of adequacy the pertinence and efficacy of its programs in this area until similar methods of data collection and analysis are adopted nationwide.

When this is done, it will be discovered as has already been the case in some areas, that there is often something very wrong with the ways in which accident data are now being collected and employed in justification of safety measures. This should not in any way pose a threat to those sincerely interested in the alleviation of the burdens which now result from our annual tolls of highway fatalities and injuries. The agencies responsible for highway safety have thereby a responsibility to supply this information. The applied research involved is straight-forward and relatively simple, and these results are at present more needed than those of any other simple type of research which involves the use of chemical tests: the subject of this symposium.

There is no reason why the immediate

future should not see the substitution of fact for the present over-abundance of opinion and guesswork in this as in the entire arena of highway safety. To the extent to which this is not done, extensive and expensive programs said to be pertinent to the saving of thousands of lives and the prevention of the maiming of millions more will continue to lack a rational, factual and scientifically defensible foundation.

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JOINT SESSION WITH HOME SAFETY TRAFFIC SAFETY AND DRIVING SIMULATION

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It would be worthwhile at the outset to say what is meant by driving simulation (which is accomplished by a driving simulator). It means that a driver is placed in an automobile in a laboratory. He is then surrounded with a potential driving environment and upon commencing to drive he sees pictures, hears sounds and feels physical forces all of which are as realistic as is necessary for the particular study.

Essentially what it amounts to is that this fellow is pretending to drive but he is actually standing still; his reactions can be observed in detail. It also enables duplication of the exact highway situation for many subjects; that is to say, the same series of traffic events can be presented to a hundred people thus getting a statistical measure of what a hundred drivers do when faced with one set of traffic circumstances.

In addition to the ability to repeat identical situations, it also is possible to present traffic conditions that would be too hazardous or too costly for field experimentation on the road. The simulator also enables isolation of a single variable by holding all conditions constant except the one to be studied.

A national conference on driving simulation was held last March in Los Angeles under the sponsorship of the Automotive Safety Foundation, the U. S. Bureau of Public Roads, and the U. S. Public Health Service. Participants included engineers, highway administrators, scientists, and educators. There were representatives of industry, government, universities, safety organizations and research institutes.

The conference report¹ included on page 16 the following: "Driving simulation has been defined. Its role in highway safety research has been suggested, its benefits and limitations put into perspective. The assessment makes clear that new and useful

techniques are available for experimental research which can contribute importantly to safer highway transportation.

"Ultimately, a step-by-step development of increasingly complex simulators offers promise of new and urgently needed information on the functioning of the vehicle-driver-road system. This could lead to a major break-through in the program to increase traffic safety."

Simulators range in cost and complexity from million dollar flight trainers for jet pilots on down to devices that can be purchased for less than a thousand dollars to train high school students to drive. For research uses, the cost is dictated by the behavior to be studied. Complex traffic situations will require complex simulators; however, the cost will be more than balanced by savings in lives, insurance, repair charges, and time, as we put research results into practice.

The need for creating driving simulation research facilities was pointed out in the Williamsburg Conference Report in 1959. In a recent publication of the Special Committee on Highway Research Priorities of the Highway Research Board of the National Research Council, the driving simulator was included among the "19 broad areas of highway research, each of which is adjudged to rate A-1 in importance and urgency."

We believe that important advances may result from laboratory and field research into problems arising in driver licensing, highway design, vehicle design, traffic engineering control, and law enforcement and education. Driver reactions and habits play a large roll in all of these fields and to that extent they can benefit from driving simulation laboratory research and evaluation studies. At this time, by way of example, I shall discuss only three promising types of investigation: fatigue, aging, and

experience. Each is representative of a different type of study.

*Fatigue*² can be generally defined as a mental and physical condition of decreasing efficiency from which full recovery is possible. Some characteristics of importance for research are:

1. The act of measuring can drastically alter the condition.
2. The condition is likely to be irregular over time and specific to sub-tasks.
3. The experimenter must control environments and direct behavior in order to produce the condition.
4. All drivers can be affected by the condition.

I suggest that these characteristics also describe the following conditions:

- A. Effects of some ingested chemicals, such as drugs, alcohol, food, etc., excluding irreversible effects, e.g., poisons.
- B. Emotional states, such as anger, despair, frustration, etc.

These conditions represent research interests that today are somewhat diverse, each with its devoted group of investigators. If there are the common characteristics suggested above, and because of this a consolidated research effort can be mounted using driving simulators as a general tool, it might herald a number of simultaneous breakthroughs in previously unrelated areas.

Even if the driving simulator laboratory approach only serves to bring these researchers together, it will be worth the expenditure in terms of the interdisciplinary mental cross-fertilization that can result. I have yet to talk with a researcher interested in human behavior who did not become enthusiastic over the possibilities of doing his research within a simulation laboratory.

*Driving*³ can be generally described as a gradual process of organic change eventually resulting in irreversible impairments to function.

Research characteristics are:

1. The act of measuring has little if any effect on the condition.
2. The behavioral effect is likely to be consistent and predictable and resistant to change.
3. The condition must be investigated as

it is found in various individuals and groups of drivers; it is not subject to experimental manipulation.

These research characteristics apply at least in part to the following:

- A. Physical disabilities, sensory and motor.
- B. Mental disabilities, such as emotionalism, rigidity, persecution feelings, etc.

Experience in this context refers to exposure to a series of critical driving situations which affect subsequent driving behavior. Learning through experience provides driving training for the bulk of our population.

Research characteristics are:

1. The act of experiencing greatly effects responses to subsequent exposures of identical events.
2. Past exposures are difficult to determine and evaluate.
3. Some experiences terminate the drive.
4. Experiences can be vicarious in nature.
5. Negative transfer must be evaluated.

Research into the learning process as it continually occurs on our highways can result in more effective programs of public education and implement a positive approach of guidance to replace the current practice of scolding and punishment.

All three types of human factors exemplified by fatigue, aging, and experience lend themselves to vigorous and fruitful investigation in driving simulation laboratories. If science can discover what exactly happens to the abilities of the temporarily incapacitated, and the disabled and just how it is that drivers are learning to survive, a wealth of remedial efforts can be launched to offset the traffic toll.

Progress to Date

The simulation techniques that have been used so far at the University of California at Los Angeles are built around the showing of movies that were taken from cars moving on the highway. This work, on a limited scale, was initiated in 1948 by J. H. Mathewson and has resulted in a series of Institute studies of the human factors in highway transportation. Some simple task simulation techniques were developed and

cific areas of standardization. The subcommittee titles included general medicine, cardio-vascular diseases, neurological disorders, visual standards, auditory standards, orthopedic standards, mental health and drug and chemical aspects. These titles were similar to those used by a Symposium on Medical Aspects of Motor Vehicle Accident Prevention held in December, 1956, by the New York University—Bellevue Medical Center and the Center for Safety Education of New York University.

Using all available studies they could obtain, these committees reported a year later to the Board of Trustees of the medical society, which then accepted the report. The report was forwarded to the Secretary of Health and to the Governor's Traffic Safety Council. The Secretary of Health served as a liaison person between the medical society and the Secretary of Revenue. The Pennsylvania Optometric Association had submitted a somewhat different set of standards for visual testing, but one meeting between the committee of that association and the medical committee on visual standards quickly resolved the differences in favor of the standards set by the committee of ophthalmologists. The standards were then approved in principle by the Governor's Traffic Safety Council. They were later accepted by the Governor and the Secretary of Revenue, and after a tooling up period, put into effect a little over a year ago.

Last there be any thought that these standards might be considered final or unequivocal, there is hereby quoted from the introduction of the prepared driver standards the following: "Because of the sparsity and unreliability of statistical data, the standards which follow are based on an armchair analysis. Since automobile transportation is such an important economic factor, the emphasis is on restricting rather than revoking licenses. A functional approach has been attempted wherever possible. The diagnostic entity is important in predicting progression and recurrence of signs and symptoms."

It was further pointed out that because the periodicity of the examination of drivers is an important factor which must be considered from an ideal and practical standpoint, the report recommended that the examination be given all drivers on initial

application and re-examinations given at ages 30, 40, 50, 60, 65 and every five years thereafter. Periodic examination is still our aim, but it will take several years to get the initial examination of the five and a half million licensed drivers in Pennsylvania and to definitely establish the periodicity of examinations. In fact, we estimate that at the rate of 15,000 examinations per week, it will take seven and a half years to cover all of Pennsylvania's drivers.

Considering the importance of the human factors in driving safely and how lethal the modern vehicle is, today's driver unquestionably should be in a physical and mental condition which is not a severe hazard to himself and to his fellowmen. For many years, the Pennsylvania law concerned with driver licenses has had a general clause requiring the licensee to be free of any disorder which might prevent him from properly driving an automobile. Licenses have been removed, suspended or given on a restricted basis upon decision of the Bureau of Traffic Safety of the Department of Revenue that the individual was incapable of properly handling an automobile. The Bureau, however, had no well-defined medical standards for making its decision until the present ones were established.

A number of case histories of severe accidents clearly indicated the dangers to life and limb caused by drivers suffering from severe physical and mental disorders. In one instance, an individual was on the blind pension payroll and was operating a light truck, with his steering being directed by a child sitting between his legs. He was, not surprisingly, involved in a fatal crash.

In another instance, a truck driver hauling gasoline on a tractor-trailer truck was involved in seven or eight accidents before it was discovered that these accidents were caused by convulsive seizures. Not long ago, a mentally disturbed young man who had some psychiatric treatment drove east in the west bound lane on one of the high speed highways of the state for about 40 miles. Although it was night, he turned off his lights and drove at speeds of 90 to 100 miles per hour. He was killed when his car crashed into a roadblock the police had thrown across the highway. In

other instances, before the required examination for drivers went into effect, individuals were sporadically prohibited from driving because of reports sent in by practicing physicians.

The standards approved by the medical society and others concerned were condensed into categories or disqualifying groups which are listed on an IBM punch card for the purposes of simplicity, identity and ease of mailing, filing and tabulating. As listed on the card, disqualifying factors include the loss of use of both hands; 20/70 vision or less in the better eye with correction; neurological disorders, such as to prevent responsible control of a motor vehicle; any cardio-vascular disorder, including hypertension, such as to prevent control of a motor vehicle; neuropsychiatric disorders such as to prevent control of a motor vehicle; conditions causing lapses of consciousness, e.g., epilepsy, narcolepsy, hysteria, etc. (may be considered for licensure if episode free for two years with or without medication); alcoholism, addiction to narcotics; and uncontrolled diabetes.

Inasmuch as the Pennsylvania State Police has for many years been charged with the responsibility for visual acuity tests and were equipped with instruments and testing areas, it was decided that the visual testing and the testing for the loss of use of both hands would be done by the State Police. Thus, the individual who is to be tested first takes these two tests from a state policeman and then takes his testing card to a physician of his choice. He is encouraged to use his family physician for this purpose, since in some conditions, the medical history is a pertinent factor, but the individual makes the final choice as to his examining physician. The physician then mails the completed form directly to the Bureau of Traffic Safety of the Department of Revenue.

Prior to the initiation of the physical examination program for drivers, each physician in Pennsylvania was furnished by the State Health Department with a copy of the American Medical Association pamphlet "Medical Guide for Physicians in Determining Fitness to Drive a Motor Vehicle" as well as a short guide specifically concerned with completing the examination form.

Results of First Year of Operation

As of the first of June of 1961, this program had been in operation for a year. Like other large, new programs, this one started slowly and had a few difficulties at its inception, but is gaining momentum. The State Police have a limited number of persons and facilities for the examinations. It was therefore decided that for the first six months, only those newly applying for drivers licenses would be examined. It had been hoped that the next to be examined would be drivers licensed before 1924, a time when no examination whatsoever was required for obtaining a license; but, unfortunately, a flood in 1936 in Harrisburg destroyed or ruined a number of record files, so that this was not possible. Consequently, since the beginning of 1961, driver names have been selected at random for examination. In addition, all persons driving automobiles on state business have been required to be examined.

The physicians of Pennsylvania have cooperated extensively in promoting this program. At first, there was some fear on the part of a number of physicians about their legal liability in case an individual who had been examined had an injury-causing accident. However, the Attorney General of the Commonwealth has quieted these fears by an opinion which stated that the physician's responsibility as to the condition of the individual applied only to the individual's condition at the time of the examination and to those elements included in the examination. Furthermore, the legal department of the American Medical Association has stated that for the physician to be held liable, it is necessary to show:

(1) he was guilty of negligence in conducting the examination or in reporting his findings to the state; (2) that the negligent act was the primary cause of injury or accident; and (3) that damages resulting from the negligence were foreseeable, since an injury which cannot be foreseen, or reasonably anticipated as the result of negligence is not actionable. The decision is to whether an individual receives a renewal of his driving permit, receives a limited permit, or has his permit suspended or revoked rests with the Secretary of Revenue, so that the legal decision is made not by the physician doing the examination.

program activities as shown in the annual traffic inventory. Of the eight major states in the group in which Pennsylvania falls, Pennsylvania was the only state to receive such an award. The fact that Pennsylvania has the lowest rate here is, of course, not necessarily tied in with the driver examination program nor even necessarily the result of the thirteen-point improved traffic safety program inaugurated in February of 1960.

Of these thirteen points, the only one other than the medical examination program which might be considered in the health field is an educational program to encourage the use of chemical testing for intoxication. It is interesting to note in this respect that a survey by the State Police to determine the attitude of judges and district attorneys in the 67 counties of the Commonwealth on this matter indicated that in 55 counties there was favorable reaction toward chemical testing, but in the remaining 12 counties the authorities involved were either indifferent or against chemical testing. The 1961 session of the Pennsylvania Legislature passed a state-wide chemical testing law. As passed, it is a much weakened version of the original bill, using 0.15 per cent by weight in the blood as presumptive of intoxication instead of the recommended 0.10 per cent, and requiring specific consent of the driver for the testing rather than the recommended implied consent.

Pennsylvania is pioneering in an attempt to remove from behind the steering wheels of its automobiles, drivers with handicaps so severe as to make them, in the best of medical judgment, hazardous to themselves and in other individuals. The comparatively low percentage of rejections encountered among the 422,000 persons examined during the first year indicates that not many individuals are losing their driving privileges because of this examination requirement. We feel that the driving license is a privilege. In some respects it may be considered a right of an individual, but one individual's rights end where the other one's begin and therefore because of society's right to determine various types of licensure, the term privilege might be the best one to use.

Case histories, not only in Pennsylvania but elsewhere, have shown individuals with

the types of disorders used for rejections in Pennsylvania to be dangerous drivers in many instances. While we cannot, without more specific research data, such as some obtained by studies by McFarland in Boston, Goldberg in Sweden, Popham in Toronto and McCerroll and Haddon in New York City, adequately predict the number of severe or fatal accidents which will be prevented by removing such hazardous drivers from our highways, the "functional approach" as it is called by the medical society's committee, seems to be justified and reasonable.

It might be pointed out that this type of reasoning is behind many traffic accident preventive measures and many public health measures. The number of lives or disabilities saved by a traffic light at a given corner, by an unbroken white line in the middle of the road on a given hill, by the installation of a sewage treatment plant or by an air pollution abatement program cannot be well documented, but from the case history approach and in some cases from years of experience, (but experience which would not have been attained had ultimate, definitive cause and effect research been allowed to delay application) we continue to vigorously encourage and support these preventive measures.

It is to be hoped that the findings of the medical examination program in Pennsylvania will provide useful data to other parts of the nation in their evaluation of this aspect of working with human behavior factors of traffic accidents, the most important causative factor involved. It is believed that as the general public becomes more aware of the gravity of the problem, persons in ever-increasing numbers will turn to their physicians for advice and assistance in this field. Although the role of the physician in making decisions in this regard is not always an easy one, it is hoped that more and more physicians will accept this responsibility as a part of their role and duty and will realize how vital to the saving of lives and the prevention of injuries is an honest, critical evaluation of the driver.

Much more detailed consideration needs to be given to the age component for the major chronic disabilities of our people increase considerably as they get into the older age brackets. Pennsylvania has not yet completely decided on the periodicity of its ex-

aminations, but as has been pointed out by the medical society study, this component must be seriously faced and a decision made before long.

An important auxiliary benefit of the examination program is the uncovering of a number of cases of heart diseases and other disabilities of a chronic nature, often unknown to the individuals involved. Such conditions are being discovered on a rather large scale, and individuals with these conditions are receiving earlier treatment and subsequently have a better chance of preventing death or disability from them than would have been the case without early discovery due to the examination program.

The Governor's Traffic Safety Council, the Commissioner of Traffic Safety and the Department of Health feel that a further constructive step in driver safety would be a requirement that taxicab, bus, truck and other commercial vehicle drivers have a more frequent and a more rigid physical examination than the one currently in use for all drivers. Bills have been introduced into the state legislature along this line but none has, as yet, been enacted.

Summary

1. Since the behavior of human beings seems to be the most important factor involved in causation of traffic accidents, physicians and health departments should play a major role in helping to reduce traffic mortality and morbidity by focusing their time and efforts towards solving the problems of the physical and mental behavioral components that lead to accidents.

2. In the Commonwealth of Pennsylvania one point of a thirteen-point traffic safety program inaugurated by the Governor at the beginning of 1960 has been a medical examination for all individuals obtaining new driver licenses or renewing driver licenses. The compilation of this program took three years before it was actually put into effect. During this period of compilation, the Pennsylvania Medical Society, the Pennsylvania Department of Health and the Governor's Traffic Safety Council worked

together to devise a program of driver examination which would remove drivers who, by reason of severe handicaps, could be considered to be especially dangerous drivers.

3. The results of the first year of application of the physical examination of drivers program are reported. Of 421,837 learners and re-examined drivers, 0.14 per cent were rejected as being unfit to drive in accordance with the established criteria. By age, percentage of failures ran from 0.05 per cent in the 21 to 30 age group to 0.79 per cent in the 61 and over age group. Of this group of failures, there were 133 individuals who voluntarily surrendered their licenses because they felt they would be unable to pass the examination and so notified the Bureau of Highway Safety. In addition, a house-to-house survey of 978 applicants who failed to take the physical re-examination after notification found 130 to have failed to take the examination because they felt they could not pass it. This latter group had not officially notified the Bureau of Highway Safety.

4. Heart diseases and other disabilities of a chronic nature are being discovered due to the mass examination of drivers and potential drivers. Individuals with these conditions are thus enabled to receive earlier treatment than would have been the case without such screening examinations.

5. It is felt that in consideration of the marked increase in severe chronic disabilities in the older age groups, the examinations will need to be given on a periodic basis, although this periodicity has not yet been determined. The medical society's study recommends that examinations be repeated at ten-year intervals to age 60 and at five-year intervals thereafter.

6. It would seem to be desirable for drivers who spend much of their time on the road as commercial drivers of such vehicles as taxicabs, buses and trucks to have a more frequent and a more rigid physical examination than the one now required for all drivers.

REFERENCES

1. Workshop on Traffic Safety with representatives of American Association of Motor Vehicle Administrators and State Health Officers, Washington, D. C., February 17-18, 1960.
2. Workshop on Traffic Safety with representatives of American Association of Motor Vehicle Administrators and State Health

The performance of the 167 rescuers was as follows: of the untrained rescuers, 90 per cent were able to produce tidal respiratory volumes above 300 cc's within one minute by the first variation of the mouth-to-mouth technique, and 89 per cent were successful in the same task with the second variation. By the mouth-to-airway technique, 100 per cent were successful, 50 per cent were successful with the mouth-to-nose technique, all within 60 seconds.

Of the trained rescuers using the back-pressure, arm-lift method (Holger Nielsen) under the same conditions, only 14 per cent were able to produce tidal volumes above 300 cc's within 60 seconds with that method and with the addition of an artificial oropharyngeal airway, 39 per cent were successful. Using a chest-pressure, arm-lift method (Sylvester) alone, 31 per cent were successful, and with the same method and an artificial oropharyngeal airway, 50 per cent were successful.

Thus, it can be seen that under these conditions, the mouth-to-mouth technique in the hands of untrained rescuers with minimum instruction was much more frequently successful than the back- and chest-pressure and arm-lift methods in the hands of trained rescuers.

What is the reason for the success of the mouth-to-mouth technique in this comparative study? I think that the essential difference is in the position of the head and neck, and jaw, of the victim in the mouth-to-mouth technique, in extension, by which the air passageway to the lungs is kept open; whereas with the back- and chest-pressure and arm-lift methods, this position of the head and jaw in extension cannot be maintained by the rescuer, who must devote his full attention to applying the pressure. The tendency of the tongue and jaw muscles in the relaxed, paralyzed position of the victim is to collapse, thus blocking the airway unless the head and jaw are extended, even with the insertion of an artificial oropharyngeal device.

The preceding points are illustrated by the following study on 80 anesthetized women, also done by Safar and his colleagues. These women were breathing normally and spontaneously, but their jaw and neck muscles were relaxed by the influence of the anesthetic. In other words,

they were asleep as during an operation (light, general anesthesia, stage 3, plane 1-2).

The airway of these patients was recorded as being open when the anesthesia-machine breathing bag was moving freely and there was no noise in breathing. The airway was recorded as being partially obstructed when the bag was moving but there was noisy breathing. The airway was recorded as being obstructed when the breathing bag was not moving and no air exchange could be heard despite respiratory motion of the patient's chest and abdomen.

In the supine position (lying on back) with the head flexed and the chin down, 100 per cent had an obstructed airway, and even with an artificial oropharyngeal airway, 98 per cent were still obstructed and 2 per cent partially obstructed. With the head in mid-position between flexion and extension, 36 per cent were obstructed in natural breathing and 54 per cent partially obstructed, and only 10 per cent had an open airway. With an artificial oropharyngeal airway inserted, 29 per cent were still obstructed, 51 per cent partially obstructed, and 20 per cent had an open airway.

In the extended position of the head, with the chin up, 5 per cent had an obstructed airway, 46 per cent had a partially obstructed airway, and 49 per cent had an open airway. With an artificial oropharyngeal airway, none were obstructed, 12 per cent partially obstructed, and 88 per cent had an open airway. With extension plus support of the jaw in a forward position, with natural breathing, 1 per cent were obstructed, 21 per cent partially obstructed, and 78 per cent open.

With an artificial oropharyngeal airway, none were obstructed, 2 per cent partially obstructed, and 98 per cent had an open airway. A similar incidence of airway obstruction was found with the patients in the prone position (lying on the stomach), both with the face directly downward, and with the face to the side, as in the usual back-pressure, arm-lift method.

I think that the preceding study corrects a number of popular misconceptions. To quote Safar, "It is a common belief that airway obstruction due to 'swallowing of the tongue' is prevented by the patient in the prone position. Our data and roentgen-

grams (x-rays) indicate that in the prone position the tongue does not simply 'fall forward' but rather that the site, mechanism, incidence, and degree of pharyngeal obstruction is similar in the prone as in the supine position.

"The thought that foreign matter such as vomitus or water would drain from the mouth by gravity provided another basis for the recommendation of the prone position in the past. In actual resuscitation, we often found semisolid vomitus and other foreign matter which did not 'drain'. Water and mucus formed foam could only be removed by wiping out or by the use of a suction machine. Drainage of foreign matter from the lungs in the prone position is as unlikely as in the supine position since the trachea is horizontal in both."

The performance of artificial resuscitation on the unconscious infant has long been a matter of considerable difficulty. The reasons are in part anatomical. Not only are the infant's ribs and chest softer, but the ribs are in a different position than in the adult, extending more directly forward from the spinal column. For this reason, the infant's breathing is more completely due to diaphragm motion than the adult's breathing.

The chest- and back-pressure and arm-lift methods of artificial respiration are intended to produce movement of the chest wall, but such movement as is produced is often negated by the contrary motion of the relaxed, flaccid diaphragm which moves back and forth instead of air moving in and out of the lungs.

This is, of course, not true in the normal conscious person, in whom the diaphragm is contracted and tends to move with, rather than against, the respiratory motion produced by chestwall expansion and contraction. Suffice it to say, in infants, methods to overcome the special problems they present, such as the rocking method (Eve), have been shown to be relatively unsuccessful; and the only method which

can be relied on to successfully produce sufficient air movement in and out of the infant is the mouth-to-mouth technique.

Detailed studies of the oxygenated hemoglobin and carbon dioxide levels in simulated victims' blood have shown that these are maintained within or close to normal limits, and that they are rapidly attained when the mouth-to-mouth technique is started. Additional advantages of the technique are the fact that additional pressure can be exerted, by forced expiration on the part of the rescuer to overcome partial obstruction of the airway that may exist despite the most skillful effort, due to the anatomy, the presence of excessive obesity, or other peculiar conditions existing in the victim which would preclude success by any other method of artificial respiration.

Large differences in the size of the rescuer and the victim are easily offset, and boys and small women have been successful at resuscitating victims twice their size. Mouth-to-mouth breathing can be done for over an hour by the untrained rescuer without excessive fatigue; this has been demonstrated a number of times.

Due to the advantages of the mouth-to-mouth technique of artificial respiration which have been detailed above, the National Academy of Sciences—National Research Council's Ad Hoc Panel on Manual Methods of Artificial Respiration—unanimously recommended this technique. Subsequently, the American National Red Cross, the several departments of the Armed Forces, the Public Health Service, and numerous other organizations adopted the mouth-to-mouth technique as the method of choice.

Case histories of many successful resuscitations performed by laymen with this method demonstrated that it is readily acceptable, easily learned, and has been, on a number of occasions, successfully applied without previous practice in the method by the rescuer.

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WOOD PRODUCTS SECTION

YOU CAN'T TRAIN SUPERVISORS

By LOUIS B. HOELSCHER
Safety Director, Weyerhaeuser Co., Tacoma, Wash.

We don't train our supervisors; we don't believe that we can train our supervisors. We do believe that if we provide the climate, if we provide the tools, and if we provide the information, a supervisor can develop himself.

To put each of us on the same level of understanding, we ought to clarify what we mean by the word "training." Most people think of training in terms of teaching or using an imaginary funnel to pour knowledge into a supervisor's head. We view it in a different perspective.

Training, as we apply it, can be defined as the clarification and development of thinking and putting that thinking to use.

Even though I say that we cannot train supervisors, I will use the word "training" for lack of another word that communicates this process to other people.

I would like to review with you one phase of our supervisory training as it applies to safety; this one phase is the basis for most of the things we do or should do in supervisory safety training. We call this phase a Duties and Responsibilities Program. The program is based on the assumption that most supervisors do not know specifically what is expected of them. They are told that they are responsible for safety, but they do not know what this entails or what it means. They do not know how far their authority and responsibility in safety reaches.

How does the program work? We call in a homogeneous group of supervisors, sit down with them on a discussion basis and develop and clarify their duties and responsibilities. First we use a master list of major areas of possible duties and responsibilities and get agreement from this group of supervisors that these, part of these, and/or other areas are the areas in safety where they have or should have responsibility. (Attachment "A.")

When we have reached agreement upon the areas of responsibilities, we break down each area into specific duties and responsibilities; for example, one area in which the group feels they have duties and responsibilities may be accident investigation. We then develop and clarify with each group of supervisors the specific duties and responsibilities they have in this area of investigation. Through discussion, the group develops a list similar in content to Attachment "B," but much longer in length.

This list is then checked by their boss, who either agrees or disagrees with the individual points. If he disagrees with any of the points on the list, the group is called back into a meeting and the boss interprets to them why he feels this is not a duty and responsibility of theirs. Once the group knows the "why," they generally will accept the boss's decision. The group also has the opportunity to express the reasons why they feel it should be their duty and responsibility and through this process, have changed the boss's thinking. The same process is followed if the boss feels the group has omitted a duty and responsibility.

I know one of the questions raised in your minds is, "Why do all that? Our foremen know their duties and responsibilities; they know what management expects of them."

Some of our management people felt the same way, but let me give you an example of what actually happened in one operation. With one group of supervisors we developed 67 duties and responsibilities in safety. Without giving their boss an opportunity to review their list, we asked him to develop what he thought the duties and responsibilities of the supervisors in the group should be. He came up with a list of 31. The surprising thing, to us, was that only 14 items were on both lists.

Another question you might have is, "Why can't the boss sit down and write out the responsibilities for his subordinates?" First,

in our organization, we found that none of our bosses had a halo around their head—they didn't have all the answers. They just didn't know what should be all of the specific duties and responsibilities of their subordinates, and the example I just quoted bears this out.

Secondly, the big advantage to having the group of supervisors develop their own duties and responsibilities is that, through discussion, each member of the group has a chance to gain a better understanding of why this particular duty and responsibility is theirs and why they should carry it out.

For example, a specific duty and responsibility in the area of accident investigation might be to determine the real cause of the accident. The group leader's job is to get the group to clarify through discussion the question, "Why is it important to determine the real cause of the accident?"

During the discussion the inexperienced man in the group listens to the old hands and gains experience from them. The old hand has to listen to the ideas of his fellow supervisors and gains from their experiences. The inexperienced man many times injects new ideas which help add to the know-how of the old hands. The results we seek from these discussions can be stated in one sentence:

"People will always support that which they helped to create."

You may also ask the question, "Why do all this when we have job descriptions?"

This is my answer. Our company has one of the best programs of job descriptions in industry, but job descriptions have one drawback. A job description does not give a comprehensive outline of supervisory responsibilities for specific areas such as is outlined in Attachment "B"; nor does it provide a vehicle for carrying out other phases of the program, one of which I will review next.

We do know that developing the lists of duties and responsibilities is effective and fruitful. We also know that there is as much or more value in using the list for other purposes.

The list can be used to spot the "weak points" of an individual or the "weak spots" of an organization.

For example, we can take the list and evaluate each man's performance against each specific duty and responsibility.

For example, under the area of Logging Side (Attachment "B"), the supervisor can ask himself these specific questions of his subordinates: "Does the foreman pick out safe landings?" "Does he see that the jammer is properly and safely set up?" With each point he can ask similar questions and check whether the man is O.K. or needs help.

If the foreman needs help, the boss can call him in and review with him the lists of duties and responsibilities. The boss can then point out his weak points and talk to him in terms of how to do a better job; talk to him in terms of what problems he is having which prevent him from doing a better job in this area; talk to him in terms of what the boss, the safety supervisor, or the training supervisor can do to help him do a better job. Through this process we provide a climate by and through which the supervisor, in effect, sets up his own training program to help develop himself.

As a result of the individual evaluations, it might become apparent that a majority of the management people are weak in one specific area. For example, by evaluating each individual, the results may show that the group as a whole is weak in the area of accident investigation. With this information, the boss may want to set up group sessions on how to do a better job in accident investigation.

We base these sessions once again upon group discussions and supplement the supervisor's present knowledge with technical background and information with which they are not familiar and which will help them to do a better job of investigation. There are other phases of the program which the lack of time does not permit me to review with you.

Our method is based upon a principle that other levels of management, including staff, will fulfill their role best by insuring that the supervisor is provided with the climate, the tools and assistance, and the information necessary to inspire the wholehearted and constant interest and support of the crew. In our enthusiasm to promote a specific safety program it is very easy to detour around front line management. For example, is it better to publish a beautifully done brochure for safety induction purposes, or is it better to train the foreman to do the job? The first is the easiest and the trap many of us fall into. The supervisor must be helped

Wood Products Section

to do the job in safety rather than the safety man doing it for him.

Although we believe you can't train supervisors, we do believe we must provide the climate, the tools, and the information that will help him to develop himself.

ATTACHMENT "A" Woods — Safety

1. In Case of Injury
2. Investigations
3. First Aid
4. Crew Welfare
5. Inspections
6. Training
7. Protective Equipment
8. Crew Transportation
9. Housekeeping
10. Discipline
11. Safety Meetings
12. Records and Reports
13. Falling and Bucking
14. Logging Site
15. Log Loading
16. Log Transportation
17. Road Maintenance
18. Road Construction
19. Use and Handling of Powders
20. Machinery and Equipment
21. Log Dump and Rafting

ATTACHMENT "B" Duties and Responsibilities of Side Rod in Safety

LOGGING SITE

1. Pick out as safe a landing as possible
2. See that jammer is properly and safely set up.
3. Establish ground rules and instruct men in commands of landing.
4. Have dangerous trees and snags felled around landing.
5. Place men properly (put the right man in the right job insofar as possible.)
7. See that there is a safe disposition of the crew in the woods.

8. Decide when weather is too hazardous to work in when camp foreman is not present to make the decision.
9. Maintain as safe working conditions as possible.
10. See that visitors are standing in safe place.

IN CASE OF INJURY

1. Know first aid and be able to use it.
2. Decide whether an injured man is capable of continuing work or should receive medical attention and arrange immediate transportation in the latter case.
3. Properly equip injured person for transportation and send attendant with him.
4. Get rest of crew back to their own work and out of the way as soon as possible.
5. Replace first aid materials and stretcher used as soon as possible.
6. Following procedure to be used in case of any injury requiring medical care:
 - a. Notify timekeeper immediately by phone or radio of seriousness of accident and if ambulance and/or doctor is needed.
 - b. Tell briefly what happened and type of injury.
 - c. Give man's name (be sure it is correct).
7. If fatal accident, crew should quit for the rest of the day.

LOG LOADING

1. Instruct all men on landing in safety rules
2. See that horn signals are given before any movement of trucks on landing using the following signals: 1 blast of horn for alert, 2 blasts for go ahead, 3 blasts for back up.
3. See that truck comes to a complete stop before allowing men to climb on and off truck while hooking trailer.
4. Have safe disposition of men on landing.
5. See that all loading equipment is mechanically safe (hooks, machines, ropes, etc.)
6. Exercise authority and control over truck drivers and shovel loaders at shovel landing.
7. See that the correct number of binder chains are used and that they are used in the right place.
8. See that loads are built safely (both truck and rail).
9. Maintain as safe working conditions as possible.

NEW HORIZONS IN SUPERVISORY TRAINING IN ACCIDENT PREVENTION ACTIVITIES

By D. W. C. MAC BEAN
Accident Prevention Coordinator, MacMillan, Bloedel and Powell River, Ltd.
Vancouver, B. C., Canada

The following remarks made by E. G. Shorter, executive vice-president, MacMillan, Bloedel and Powell River Limited, at our logging operations' safety award meeting in Nanaimo, B. C., on January 20, 1961, spell out in clear terms the key to a successful safety program:

"The key to accident prevention is the quality and know-how of management and supervision, who must accept the responsibility and who are accountable to:—

- (a) Train and direct the working forces in production and safety.
- (b) See that our plants and equipment are safe, well maintained, and efficient.

"Our company considers safety one of the main functions of management—we cannot

accept poor safety records."

Safety is a subject of vital concern to everyone. When you compare conditions today with those of half a century ago, it is clear that the safety effort has succeeded remarkably well. When you compare the safety activities of supervisors today with those ten years ago, you will note a remarkable improvement in the safety performance of supervisors.

But in spite of the progress that has been made, there is still a long way to go in improving the safety performance of many supervisors.

Experience with past programs has revealed six major weaknesses in the accident prevention activities of some of our supervisors. Six corrective actions have been taken to overcome these weaknesses:

WEAKNESSES

1. Inadequate analysis of job hazards.
2. Inadequate analysis of accident causes. (Failure to honestly fix responsibilities.)
3. Inability of some supervisors to accept responsibility for employees' safety. (Lack of acceptance.)
4. Some supervisors do not understand how to communicate effectively.
5. Failure to measure performance of participating supervision.
6. Failure of employees to accept personal responsibility.

CORRECTIVE ACTION

Prepare new, and improve existing written job safety analyses.
Investigate all accidents promptly, thoroughly, and determine underlying causes.
Safety training of supervision.

Training in communications for supervisors.

Establish and maintain adequate gauges.

Motivation and education of employees.

Five of these weaknesses reflected directly on supervision, the sixth indirectly on supervision.

MAJOR PROBLEMS IN ACCIDENT PREVENTION WORK

Some of our supervisors have told us that their accident prevention problems are:—

1. Communication (Inadequate)
 - a) Lack of skill in communicating effectively.
 - b) Foremen not trained to effectively communicate.
2. Lack of time in which to carry out their safety responsibilities.

Caused by:—

 - a) Inability to delegate.

- b) Inability to plan.
- c) Work overload.
- 7. Lack of knowledge on how to utilize time to maximum advantage.
- 4. a) Lack of knowledge of their own duties and responsibilities.
- b) Lack of knowledge on how to delegate some duties and responsibilities to other people.
- 5. Clarification of areas of responsibility.
 - a) Areas overlapped by different foremen.
- 6. Inability to use safety aids and material to best advantage in group meetings and with individual employees.
- 7. Inability to recognize accident prevention problems within their department.
- 8. Lack of recognition, by management, of excellent past performance.
- 9. Inexperienced crews.
- 10. Incorrect crew attitudes.
 - Caused by:—
 - a) Limited knowledge of safety program.
 - b) Human difference.
 - c) Indifference.
- 11. Limited cost budget.
- 12. Lack of inter-departmental co-operation throughout division.
- 13. Failure to —
 - a) Recognize the importance of their safety duties and responsibilities.
 - b) Recognize the extent of their authority in safety work.

Our company decided to develop an accident prevention training program for supervisors based on the workshop principle. These workshops for supervisors would only be carried out at the request of divisional managers. They analyze the performance of their supervisors. They decide if their supervisors haven't the know-how to carry out their safety activities correctly and then they request us to help them through the medium of accident prevention workshops.

What should be accomplished by an accident prevention workshop? The persons re-

sponsible for the overall direction of the workshop must decide on the objectives to be reached and must formulate a comprehensive program to attain the objectives. Unless this is done the participants will derive very little benefit from the workshop. These programs, of course, are aimed at eliminating supervisory safety weaknesses as defined by divisional managers.

Our objectives are:—

- 1. To get the supervisors to define their accident prevention problems.
- 2. To enable the supervisors to gain a full understanding of their duties and responsibilities in accident prevention work.
- 3. To develop a practical plan of action for implementation throughout their operation, and based on various facets of accident prevention being considered by the group.
- 4. To get the supervisors to organize, plan, and develop their own accident prevention programs.
- 5. To coach supervisors in how to develop accident prevention programs.
- 6. To help supervisors develop themselves as workshop leaders.
- 7. To help supervisors learn involvement techniques. These techniques will enable supervisors to secure full participation from all workers in their accident prevention program.
- 8. To enable the supervisors to understand the importance of frequent talks about safety with their people.
- 9. To help supervisors gain the necessary knowledge and skill to communicate regularly with their people about safety.

Material Used in Workshops Include:

- 1. Supervisors Safety Training Manual—National Safety Council.
- 2. Quiz program based on the manual—National Safety Council.
- 3. Pattern for handling a quiz.
- 4. Question pattern for use of workshop leader when summarizing notes of actions resulting from discussions.
- 5. The "Communications For Safety" film series for foreman—National Safety Council.
- 6. Quiz program based on the films.
- 7. "Psychology of Safety In Supervision"

by Dr. J. L. Rosenstein—National Safety Council.

- 8. Twelve Target Program—B.C.L.M.A.
- 9. Pattern For Progress Program—State of Ohio.
- 10. Single Objective — Safety — United States Steel.
- 11. We Fix Responsibilities — Monongahela West Penn Public Service Co.
- 12. "Men and Motives In Safety Supervision"—National Safety Council.
- 13. Supervisory Responsibilities For Training.
- 14. Safety Quizzes—How To Use.
- 15. Problem Solving Procedures.
- 16. What Is Your Responsibility For Safety.
- 17. Guide For Discussion—Group Chairman.

Our Company conducts these workshops in the following manner:—

- 1. Number of sessions—(5) Five.
- 2. Number of supervisors in workshop—minimum of six to a maximum of ten.
- 3. Time of each session—Six hours.

FIRST SESSION

At the beginning of the first session the manager outlines:—

- a) Objectives of the company in accident prevention work.
- b) Divisional problems in accident prevention work.
- c) The results which he expects the supervisors to secure from the workshop.

The Workshop Leader, points out to the participants that the sessions will be on a participating basis. In other words, everyone will be involved in carrying out assignments throughout the sessions. The first session will be under the exclusive direction of the leader. The subsequent sessions are chaired by the participants themselves with the leader acting as a coach.

Items Dealt With In First Session include:

- 1. The group analyzes the manager's speech and decides on actions which they should take regarding the key points outlined in his speech.

2. The group (as individuals) outline problems they have in carrying out their safety duties and responsibilities.

3. Problem solving techniques are used on some of these problems, (using problem solving sheet).

4. The group analyzes the material and problems in Chapter 1 of the Supervisors Safety Manual utilizing (a) Quiz and (b) Pattern For Handling a Quiz.

5. Actions regarding Chapter 1 which should be considered by supervisors in setting up and organizing their own department safety programs are decided on by the participants, utilizing the question pattern sheet.

Similar procedures, as outlined above, are followed in dealing with the "Communications For Safety" film program of the National Safety Council, i.e.:

- a) Problems in films analyzed and corrective actions decided on.
- b) Key points in films analyzed.
- c) Actions, re key points shown in the film, which should be considered by supervisors in setting up and organizing their own department safety programs are decided on by the participants, utilizing the question pattern sheet.

The group progresses through the material to be covered during the subsequent sessions. Each member of the group carries out specific assignments related to the material being covered in the discussions. The workshop leader now confines himself to coaching all the participants.

The workshop group decide at the final session on an overall plan of action which they can incorporate into their department safety programs and into the overall divisional program.

Let me give you an example of a solution to a problem dealt with by a workshop group.

The problem—

Inability, and failure of supervisors to honestly fix responsibilities for accidents.

The procedure—

The workshop leader:—

- 1. Outlined a significant case to the group.
- 2. Outlined questions asked of the super-

visors concerned and the answers received from them.

3. Workshop group analyzed the case, the questions and answers related to the case, under the following headings:—

The "X" Division Case

Objectives:

- (i) to identify supervisory problems in the case.
- (ii) to determine correct actions for supervisors to utilize to offset identified problems.

This workshop group decided that their own analyses were:—

- (a) inadequate.

- (b) that a control should be set up to review their analyses.

As a result of the conclusion, a Superintendent's Foremen Investigation Board was established. This group reviews all investigations made by supervisors and pin-points responsibilities. The solution arrived at by this workshop group has brought an acceptance of supervisory responsibilities, previously lacking, for safety.

It is my belief that these workshops as used in our company have been successful in improving the safety know-how of line supervisors and in strengthening the accident prevention program throughout the company.

LOGGING SAFETY — INTRODUCTION

By FRED C. SIMMONS

Technologist, Northeastern Forest Experiment Station, Upper Darby, Pa.

Last year we considered the hazards involved in falling and bucking in our logging operations in the various forest regions around the country, and the safety programs designed to minimize them. This year we are going on to the other phase of our logging jobs—skidding, loading and hauling.

These also are high hazard operations, like falling and bucking. There is an important difference, however. In falling and bucking, the hazards are confined almost entirely to the workers themselves. There is a slim chance, of course, of dropping a tree on an unwary hunter or a walking bus, or a National Forest inspection officer. But with the almost universal use of the noisy power chain saw this has become very slim indeed.

But when you load a truck with logs and start it down a traffic-cluttered highway, it may be like shooting a 25-ton projectile down that highway. If the tires, brakes and steering apparatus are not in perfect condition, if the load isn't properly balanced and bound down, or if the driver isn't competent and alert, the results may be as disastrous as firing a projectile.

Like other industries, our lumbermen have

been caught in a cost-price squeeze in recent years. The price they could get for their products has been held down by that at which competitive products, many of them from foreign countries, were available. Their costs of labor, stumpage, supplies and equipment have been going up.

In an effort to overcome this squeeze, productivity of skidding, loading and hauling has been increased. These operations have involved heavier and heavier loads, and higher and higher speeds.

A few years ago I was stuck with the job of conducting a Yugoslavian economic planner around our region. He was a confirmed Communist, and very highly critical of almost everything he saw, and obviously didn't believe half of what I told him. He wouldn't believe the personal cars he saw parked around the entry road to a logging show in the Adirondacks belonged to the woodcutters. He wouldn't believe the vacationers he saw around Lake George were mechanics and stenographers. To him "profit" was a dirty word. But he was always bragging that there was no unemployment in Communist countries.

Then, near the tail end of the trip, we visited the Meadow River Lumber Co. log-

ging job near Rainelle, W. Va. We told him that up until 1945 this company was employing a crew of 200 men in the woods to supply 100 thousand board feet of logs a day to the mill by hand and horse methods. Now, with modern equipment this 100 thousand a day is supplied by a total crew of 60 men, in the form of tree lengths, and along with it comes enough material to make 200 tons a day of chips. His reaction was, "We couldn't do anything like this. What would we do with the other 140 men?"

The point is that on this job each man is forwarding more than three times the volume and weight of wood he was back in 1945. This means heavier loads and higher speeds—and increased safety hazards. Of

course, we have developed better and safer methods and equipment now than we had back in 1945; that has helped tremendously in diminishing these hazards. Much credit is due our equipment manufacturers for their excellent cooperation in improving the built-in safety features of the machines provided for our logging operations.

There are still plenty of things to be done in our safety record in skidding, loading and hauling. Every new machine or change in method brings new hazards that must be recognized and overcome. In addition, we are now commonly operating the year around, instead of just during the good weather periods. This creates additional problems for the safety officers.

LOGGING SAFETY — SKIDDING, LOADING AND TRUCKING

By J. L. TURGEON

Manager, Quebec Lumber Industries Safety Assn., Quebec, P. Q., Canada

Before entering the main subject of logging safety, I would like to give you a bird's eye view of what I consider to be the Northeast. I realize that the area is well known to most of you, however a few might not be too familiar with our part of North America.

In Canada, forests cover the greater part of the four maritime provinces; that is, Newfoundland, P.E.I., Nova Scotia and New Brunswick, and also of the provinces of Quebec and Ontario. In New England, the states of Maine, New Hampshire, Vermont and New York also have an important share of merchantable trees.

We find all kinds of topography: flat ground, hilly ground and mountains; we have well drained, sandy soil as well as clay and muskeg. Temperature varies a great deal, according to the region and season. While it sometimes reaches the nineties in July in New England and the southern part of eastern Canada, during the winter months, it is often 60° below zero, sometimes lower, in northern Ontario and Quebec.

If topography and soil formation does not

have too much bearing on felling and bucking, which were last year's theme, it is quite a different story when it comes to skidding and trucking. Good, solid ground will permit mechanical skidding, providing the slope is not too great. Nowadays, logging operations are getting more and more mechanized thereby reducing the number of men employed in the woods. I am convinced, however, that machinery will never replace or eliminate the horse in the North-eastern logging operations.

A few years back, skidding was responsible for only 4 per cent of our logging injuries; we cannot, therefore, consider skidding a very dangerous part of the logging operations. With mechanization, I believe that the frequency of injuries should go down and the severity up. As long as the machine operator knows his machine well and its capacity, this job is safe enough.

The helper or chockerman should never turn his back to the tractor and once his job is done, he should stay well away from the logs or trees being skidded and also the wires. What we do not like to see on skidding operations is the wheeled farm

tractor. It is not designed for the job and flips over too easily.

More attention is necessary when skidding with horses. Unlike a machine, you cannot stop his motor and put the brakes on. He is liable to move or kick at any unexpected moment. The horse should often be checked for injuries. A well treated and well taken care of horse is a gentle animal that may become quite vicious, if abused.

When approaching a horse, a person should always speak so as not to startle him. Several skidders direct their horses by voice and seldom use the reins. The man should never shout his commands; it will confuse the horse and make him nervous. When attaching the skidding chain, the man should stand beside the log, and not between the log and the horse.

When no reins are being used, the skidder should walk behind the logs and not too close. If reins are used, the trail should be wider so that the workman can stay well away from the logs; he should also walk on the inside of curves. The skid trail should be as straight as possible, free of stumps, roots, rocks and other obstacles. Steep slopes should also be avoided.

Skidway sites should be as level as possible and free of obstructions. There should be at least three or four feet of clear area on each side of the skidway so that the workmen can do their work without tripping. When the logs are small, a man usually works alone, using what is called a skid jack. If the logs are of medium size, they usually work in pairs. In either case, they must use their leg muscles to lift and not their backs.

Large logs are handled by horses with the use of a chain and block. In this case, the workman should never place himself between the skidway and the horse; he must stay in the clear and also at a safe distance from the horses.

When tractors or other mechanical equipment is being used for skidding, the dozer blade is often used to roll the logs on to the skidways. Loaders such as the Drott are also being used. If hauling immediately follows the skidding, they don't bother making any skidway at all.

Next step is trucking, which includes the loading of trucks, the trucking itself and

the unloading operations. I must say that we are more concerned about the trucking operations than we are about skidding. In 1959, 340 accidents, including two fatalities occurred on trucking operations; this represents 10.21 per cent of all logging and sawmill injuries for that year. The direct cost to the industry for these accidents represented 21.61 per cent of all costs; their severity is therefore higher than the average. In 1960, nine out of eighteen fatal accidents happened on the hauling operations and we are very much concerned about it.

Log loading of trucks is a dangerous operation and should be carried out with extra precautions. If a jammer is used, the cables and chains should be inspected daily to detect any weakness. The hooks or pig's feet should be kept sharp and in the proper shape. The bull ropes being used to direct the logs and release the pigs feet must be long enough so that the workers can stay away from the logs and the trucks.

If a side or Bouffard loader is used, the operator must always be on the watch, particularly when topping his load. Top logs will frequently roll over the pickets on either side of the truck and are liable to fall on anybody standing close or going by. When bringing down the arms, the operator must make certain that men rolling the logs are out of the danger area.

Drott and other specially designed loaders are now being used, and nobody has to handle the logs until they are on the truck, thus reducing the hazard. The operator, however, when moving his machine, must make sure that the helper or other persons are not in the way. A workman is usually required on the truck to rearrange the logs. He must be on the look out at all times and must get out of the way when the machine is bringing in a load. If he stands on the roof of the truck cab, he must have something to hang on to as it is often slippery and falls from this position are too frequent and cause serious injuries. Cranes equipped with log grapples are also being used in a less extensive way.

We have noticed on too many occasions that the pickets holding the loads are too short; sometimes more than 1/3 of the load extends over the pickets, and I am not exaggerating in stating that; at

other times, the pickets are too weak and could break if the load is shifted. Most of our truckers have a tendency to overload; this is a very dangerous practice, more so if the hauling is entirely or partly done on public roads. If the centre of gravity is too high, there is an additional danger of the top logs skidding forward or backward when going up or downhill and the excessive weight lessens the control of the operator over his truck.

Whatever the size of the load, at least, two good wrapping chains should be used.

Trucks must be in first class condition; the steering, brakes, lights and tires should be checked daily. Each truck should carry a first aid kit, fire extinguisher, emergency light or flashlight, and fares or warning flags.

Bush roads should be wide and kept in good condition, curves should be as long as possible and the inside cleared of trees or saplings to provide the best possible visibility. Steep grades should be avoided and when possible it is better to go around than over.

FOREST FIRE FIGHTING SAFETY

By MERLE S. LOWDEN
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U. S. Dept. of Agriculture, Washington, D. C.

Fighting forest fires is dirty, hard, mean and dangerous work. We are constantly trying to make it safer. In spite of all that has been done, however, we have been unable to eliminate entirely many hazards of the job. This year 18 men died fighting fires for the U. S. Forest Service. In the last five years 59 men were killed in this work. In addition, there were many serious accidents resulting in broken legs, lost eyesight, brain concussions, and back strains, as well as hundreds of minor injuries. I don't need to tell this group of the pain, misery and hardship these caused. These accidents are sobering and a real challenge to forest fire control men everywhere.

Before I tell you what we are doing to meet this challenge, it might be well to explain something about the nature of forest fire fighting, its accident potential, and why it results in more fatalities than all other jobs of the Forest Service.

First, there are many dangers encountered in getting to forest fires. Our aim is to reach fires as quickly as possible after they start and to stop them while they are small. We have no opportunity to select the place where they start. Many fires start far from roads in rough, steep, timbered areas that are difficult to reach. Men must travel to these by foot, often without trails, or go by air. If by air it means parachuting, as in the case

of smokejumpers, or by helicopter. If by helicopter, they go to a place where the aircraft can set down, or the men jump while the copter hovers above the brush. Then the balance of the trip is by foot.

While all of these have their dangers we have had a good safety record with the smoke jumpers and helicopter crews. There have been no fatalities from jumping in 22 years and lost-time accidents have not been frequent. Airplane crashes associated with dropping chemicals, however, have been alarmingly frequent with four fatalities this year.

Even travel to fires by car or truck over rough and often poor mountain roads is dangerous, as I'm sure you realize. We have many serious truck accidents each year. This year we lost two men in a truck accident going to a fire in Montana and two on a motorcycle that ran into the back of a pickup on the way to a fire.

Our accident potential is further increased by the location or surroundings in which men work on fires. Often fires burn in very steep country. Men work on steep hillsides and sometimes literally on the sides of cliffs. In a few instances we have lowered men over cliffs by ropes to put out a spot fire which had the potential to spread fire with the wind and cause additional trouble. There are often rolling rocks or rock slides which

must be gone over or around. Getting through brush or timber can be particularly aggravating. Brush is often almost impossible to get through and can trap men in front of an advancing fire. There may be tall timber or snags which obstruct the view of the men. Tops and limbs may fall on them without warning.

The situation in which men work on fires is also a hazard. In spite of careful planning and organizing there is excitement, anxiety and hurry in a fire. Tensions are built up and men work under stress. It is hard work and men get very tired. All this is bound to contribute to more accidents, especially when duty on a hot fire usually means working around the clock. Night work is often especially hazardous.

Most tools are a hazard. Axes, hoes, saws, and similar tools are sharp and a slight glance or deflection can badly cut a leg, arm or head. Powered equipment such as tractors, trenchers, plows and pumps have their own special hazards. Something can go slightly wrong with machines and cause a serious accident.

We use as many trained and experienced laborers and supervisors as possible in fire fighting. However, regular crews are not sufficient to handle the large number of fires at one time that we have had in the last two years. There were 25,000 men on the fireline at one time last year and about the same during our worst period this year. There were 10 large fires burning uncontrolled in Idaho and Montana at one time in August of this year.

This large buildup of manpower forced the use of less experienced men in many places. We try to get mill and logging crews, agricultural workers and organized Indian crews as far as possible. These all work out well.

However, it is sometimes necessary to hire workers who have little knowledge of fire fighting, even though the employment service is very cooperative and helps us as much as possible to eliminate the unfit. The men are required to have suitable clothing and shoes. We try to have a doctor available to make an examination. A fireline is no place for a person with a weak heart and we have some heart cases each year. This all adds up to use of men inexperienced in the work and more prone to accidents.

I know you don't want me to dwell too much on our problems. Instead, I should tell you something about what we try to do to overcome them. A strong part of our program is analyzing the hazards and our own experiences to learn what we can do to improve our safety performance. Each lost-time accident is carefully investigated, analyzed and reported. We try to be penetrating in these studies and find out not only what happened but why it happened, and what we could have done to prevent it from happening. We go into the background and training of the man and his supervisor. We try to find out what part of our program reached each of them, or didn't reach them, and where it failed.

In 1960 we employed a psychologist for the summer fire season to visit our field stations and "go in" fires. He interviewed both laborers and bosses. He tried to find out how men reacted under stress on fires. One of the critical items this man pinpointed was the highly important job of the crewboss, the man in charge of 15-25 men. We knew he was important but this study brought the facts into stronger focus.

We have followed this with a special crewboss study this summer in which one of our experienced fire men studied the work of the crewboss on many fires in western states. From these studies we have valuable suggestions and recommendations for improving our efforts. We are already busy producing a special training movie on the crewboss job and otherwise changing preparations and giving more emphasis to this position.

Each year we have several workshops on special phases of our work where safety problems receive major attention. Workshops are held on such activities as smokejumping, air operations and equipment use. Recommendations of these sessions are reflected in work programs, handbooks, instructional material, and current plans.

Major emphasis in our entire fire program in recent years has been on improving work through training. Transfers of personnel and changes in duties are common in our organization. We also add many new men each year. A large per cent of our supervisory men have other regular duties in addition to fire control. Many work on fires only when called upon in an emergency. This gives us great strength in being able to make

maximum use of our own people for supervisors even though we have to shift some long distances. This year in August we brought in nearly 600 supervisory personnel to help on fires in Idaho and Montana. To have all these men competent to do one or more specific fire jobs is a large training order. We integrate safety into all instruction on the premise that a job well done is a job safely done.

In firefighting it is important that bosses know fire behavior—a highly technical subject. Our behavior training starts with national courses for top fire men who carry the training to regional and local schools. We have a basic requirement that every man in the Forest Service receive at least four hours of instruction in knowledge of fires and what to do in blowup fire conditions. Even though men have no regular fire duties they may be caught in the woods in a fire situation. They must be able to act with knowledge and decision to save those with them as well as themselves.

It is a constant challenge in our work, as I know it must be in yours, to do a better training job. We are having more men to train and, it seems, less time to do it. Last year a special development project was set up in our fire division to find out what others are doing and to find new and better ways of training. Training machines are getting widespread attention and we plan to give these a thorough trial. We are working with consultants on a fire simulation proposal which looks particularly promising. In simulation training we expect to place men under stress and on their own to learn by doing complicated fire problems.

We have had practice fires for a long time but we hope to have more sophisticated problems. We have a long-term program for developing training films, slides, and other visual aids. We have a training film for air attack on fires—a movie which recently won a national award.

A strong part of our fire safety program is to place responsibility with line supervisors. The boss man at every stage or level of the operation must have the responsibility for safety of all men under him. We use a lot of ways to get this. One device is to insist on strong discipline in our fire work. By this I mean discipline in the broad sense where we make men feel full responsibility

for the job they do, and for the men they supervise. We try hard to have men know we will not countenance mediocre work.

Strong policies and specific safety rules are further foundations in our program. Following a very serious fire incident in which 13 men were burned to death in 1956, we had a task force study the entire subject of fire fatalities and especially men being caught in fast-spreading fires. One recommendation of this task force was that we adopt a set of fire-fighting rules. The purpose of these rules—called our Ten Standard Orders—was to have men know them so well they would automatically react to what was required.

I might cite several to give you an appreciation of what they are like.

No. 2, "Know what your fire is doing at all times, observe personally and use scouts."

No. 3, "Base all actions on current and expected behavior of your fire."

No. 4, "Have escape routes for everyone and make them known."

No. 5, "Pos. a lookout."

No. 8, "Give clear instructions, be sure they are understood."

No. 9, "Maintain control of your men."

And then this admonition by the chief of the Forest Service, "Every Forest Service employee who will have firefighting duties will learn these orders and follow each order when it applies to his assignment." These Standard Orders are aimed chiefly at the crewboss or the leaders but they have application to the individual fire fighter too.

We have many rules on air operations. Rules are made for such things as use of parachutes and the height aircraft fly above the ground. For example, air tankers are strictly forbidden to fly closer than 75 feet from ground obstructions. Even that, you will agree, is low and is somewhat an arbitrary compromise. We are trying to increase this height and still hit the target. We have a limit to the hours pilots can work each day.

These rules have grown from the experiences of our men over many years and a multitude of jobs. Two years ago we had a young man rush to the cab when a helicopter landed. He was hit with a rotor blade on his head. Even though he was wearing a hard hat, he was killed. Now we strictly

insist that a watchman keep men clear when a helicopter lands. The pilot is busy landing the ship and cannot watch the people already on the ground.

Safety is directly built into our fire organization. On large fires the safety officer has many duties, including looking after the welfare of the men, being certain a fire behavior forecast is available to line supervisors, and many other things. He is not charged primarily with first aid, or welfare, or making out accident reports, although of course he is interested, and may help on these. His main job is to be certain safety practices are followed and that necessary preventive work is done before accidents happen.

We stress physical fitness for the firefighters. I mentioned previously men are required to take a physical examination. We try to have doctors at hiring centers. Our main organized crews, such as the Southwest Indians, are required to have a physical examination before they become members of a regular organized crew, and they have cards to certify this. We had some difficulties in getting the Indians to take these examinations. However, they like the work as it is a good income for them. When we made this an absolute requirement we had no further trouble.

I was in a national forest in California recently which had signed up more than 500 local Spanish-American laborers. These men work in fruit and other crops, but have many off times. They are organized into fire crews and more than 500 have cards certifying they had had their physical examination.

We limit the age of firefighters. Only in exceptional cases do we hire anyone less than 18 years of age. We check on older men who might not be physically able to stand the exertion required in fire fighting.

Another keystone in our safety program is research and development. There are many possibilities in equipment development to add to the safety of fire work. We have projects to develop better parachutes for both smokejumpsers and pilots. This work is centered at Missoula, Montana.

Many advancements in the type of chutes and other equipment which smokejumpsers use have been made. This includes protective clothing, which is important. It protects

their face and other vital parts of the body. One particularly perplexing problem has been shoes. Shoes for all firefighters, but particularly smokejumpsers and helijumpsers. We made special studies on shoes. The Army Quartermaster group has been particularly helpful in this and other development work.

During the last few years much attention has centered on flame-proof shelter or clothing for men. We have been helped in this by the quartermaster corps. We found that many men badly burned or who died from burns suffered greatly when their shirts and other clothing burned on them before they could get them off. We have developed specifications for materials that are flame resistant. These are being given comprehensive trial this year by several crews. If the material proves as suitable as is indicated, we expect to use it for most firefighters.

We have developed an "escape" fire shelter which weighs about two pounds. It is aluminized fabric packed in a bag to be worn on a man's belt. Through many tests we found men could stay in these shelters and have fires go around them. They are an emergency measure. We would not expect them to be used except where men were caught. If these shelters had been available previously the lives of many men would have been saved in fire accidents. These are not available to all firefighters this year because we could not get sufficient quantities in time, but we are getting widespread tests. They will probably be required for all firefighters in the future.

Many changes in methods of attack in recent years aid safety. We are trying to drop chemicals effectively from greater heights by varying amounts of materials, using different chemicals, and by getting chemicals to stick together better for effective drops. We hope in the future to be able to raise the effective height of air drops as I mentioned before. Then men need not take chances in flying so close to the ground.

Missile development work is now receiving attention. We are negotiating for a contract for a glide bomb, or device which will drop retardant or suppressant material on a fire to put it out or hold the spread until men can arrive.

There are many problems in the way of success, including a suitable container, what

to do with the container in order not to injure men on the ground at the fire, and how to warn men on the ground. One requirement of such a device would be to have it equipped with a built-in warning system to be heard for a considerable distance both in front and to the sides of the flight route. You can realize how much safer it might be to send a manless carrier than to fly a plane at low levels.

While we have a large and varied safety program we still have many accidents. We

know there are many opportunities for improvement. We must continue to analyze our changing job. We must better our training, our rules, our instructions, in fact our entire program. We hope some of the developments and research on equipment and techniques now under way or new ideas we haven't yet started to work on, will make fire fighting safer. We want our program to be keyed at all times to Fire Rule No 10: "Fight fire aggressively, but provide for safety first."

JOINT SESSION WITH PULP & PAPER SECTION

SAFETY IN PULPWOOD LOGGING

By CHARLES T. WRIGHT

Safety Eng., American Mutual Liability Insurance Co., Raleigh, N. C.

Last February, I had the pleasure of meeting with the Safety Section of the American Pulpwood Association in New York at their annual convention; an informative meeting.

Many constructive ideas and plans were developed. However, on several different occasions, I heard the supposition mentioned that a rather wide difference in educational levels exists between worker groups in the woods in different geographical areas of the United States. Somehow, this so-called "educational level" was getting the blame for differences in work methods, types of tools, etc., between different geographical areas. The impression was left that this somehow created an insurmountable problem safety-wise. Nothing tangible, mind you, just an impression.

For instance, one man gave an opinion that this "educational difference" is the reason the bow-type chain saw is used down South while the blade-type saw is used farther North. I leave it to you to judge whether or not this is significant in the measure of accidents.

I mention all of this only in making the point that we sometimes use pointless and often unrelated excuses for not having effective accident control in our operations. Is it not a fact that when we have a problem to cope with we must take *whatever* approach and action is necessary to an effective solution? You might say that "Teddy" Roosevelt's policy of "walk lightly but carry a big stick" meant that when he had a tough problem he managed to get just a little bit tougher and solve it for a desirable solution.

About two years ago the North Carolina Forestry Association decided something had to be done in the logging and lumbering industry in North Carolina, as a whole. Putting their decision into action, as a first step they organized an insurance committee and began doing research analysis to determine just what the reasons were behind the high cost of insurance in logging operations.

The committee, after much study, found out what insurance companies and the various state labor and compensation departments had known for some time. They found that while a number of factors were actually involved, just one major item was visibly responsible. What was this? Just this: The logging industry was having a high frequency of accidents which were, for the most part, of a rather severe nature. That is, they were costing a lot of money in hospital bills, doctor bills, and in many other tangible, directly related ways. All of this cost was in addition to the very high cost of inefficient operations which resulted from the same basic causes as the accidents.

What are these basic causes? The most important, at least the most basic and most in need of immediate attention, were:

- (a) Lack of adequate top management safety policy.
- (b) Poor to no enforcement of any existing policies.
- (c) Poor liaison or supervision between management and field.

The basic lack of top management policy had resulted in a disparity in equipment, tools, etc., used in the woods. A nearly complete lack of adherence to any safety standards existed. In a nut-shell, everything was wrong. Something had to be done about it.

On receiving the committee's report, the North Carolina Forestry Association and the North Carolina Department of Labor, who had worked so effectively in development of accident prevention in other industries in the state for so many years, called on some of the insurance companies' safety engineering departments to work jointly toward the attainment of the safety objective dictated by the high accident frequency referred to earlier. American Mutual hap-

pened to be one of those available and willing to do everything within reason to help.

The over-all record in both the pulpwood and saw log experience indicates that a lot of people have either forgotten some of the things they do know, or else they just aren't taking time to plan ahead and be guided by the things they have learned.

The main points we are trying to make here are:

First, people who are concerned with pulpwood in its various phases of production and use, go to great length to assure full growth and high production of pulpwood timber, but give *considerably less* attention to safety, in either the use of proper tools and equipment or in training workmen in safe work methods and practices.

Secondly, I would like to show that these same people are capable of accomplishing the latter by showing evidence of certain types of effective planning which they are doing, in a contrast comparison to some of the weak points where planned attention is missing.

Workmen's Compensation insurance carriers and other organizations, as well as individuals interested in safety, found many years ago that high accident frequency and severity go hand-in-hand with low operating efficiency, and therefore, result in high operating costs. The same sound engineering principles that can and do control accidents will normally produce highly efficient operations as well.

Safety in pulpwood logging can also mean efficiency in pulpwood logging.

The forest in North Carolina is third-ranking in product value in the state. It produces approximately \$750,000,000 in product value annually. The forest is second only to textiles as a source of industrial employment, furnishing 78,000 jobs. The total annual payroll amounts to approximately \$243,000,000.

These figures give us a basis by which we may estimate the value of safety as an efficiency factor. They also provide a measure of exposure to accidents and suffering in the industry as a whole. A relatively high percentage of this exposure, and certainly the majority of severity is to be found in the log woods.

The forest, in most any area, is a beautiful

Joint Session with Pulp and Paper Section

place, that does not readily reveal the vast number of hazards that lie there waiting to trap the poorly equipped, the poorly trained, or the careless pulpwood worker.

The great progress that has been made in controlling and improving the growth of forest timber is phenomenal, to say the least. Read the story in growth rings. Is there any doubt that the same brainpower that has developed such control could also develop controls that would prevent accidents and suffering to workmen? No, I'm sure there isn't.

There are examples of the results of very poor or no attention to *planned* forestry. Misshapen and damaged sections of trees which you often see are proof that many men in the pulpwoods are operating or have operated unsafely and without planned control of accidents.

An outstanding example of control of timber growth is found when a tight intersection of growth rings indicate the forest was being choked off by too thick growth for the first 15 or 16 years, but after thinning, the width of the growth rings increased immediately. Such a tree grew as much in the last six years after thinning, as in the 15 years prior to thinning.

When you see planning in action, the forester marks the butt of a tree, using a yellow dye and a manually operated pressure can. The tree is marked also at a higher point. When this tree is harvested, it will be cut because it is marked, and the stump, left in the ground, will show the mark. Trees that are not marked will not be cut. This is planned thinning.

The forester checks height of trees, and measures diameter. Often he takes a boring sample as a means of checking width of growth rings to determine rate or speed of growth. Seedling trees are used in speeding clear cut land.

Certain tools should be available and used by pulpwooders in the woods. Fire control items are a must for a well rounded control plan. Unfortunately, on many woods operations, we do not find these items.

Woods workers must learn basic safety precautions. Often you may find a man filling a chain saw gasoline tank by using an unsafe type can, perhaps with a spout too short and too large to enter the opening in the tank. Gasoline is often spilled on

saws with this type of unsafe equipment. This creates a rather serious burns hazard to the operator, to say nothing of the potential for setting fire to the entire woods area. Explosion is also a major accident producing potential.

Another unsafe operation is often found in starting the saw. On a very still day, the fumes that have risen from the gasoline filling operation are still hovering in the area. When the saw is started, the fumes may be ignited. If the unsafe gasoline can is too close, this can, and probably will, start a fire. It isn't necessary to explain the many heartaches that could result from this unsafe practice.

When felling a tree, the men should be properly equipped with safety helmets. When a tree is over 10 inches in diameter, it should be notched before cutting, in order to be sure of controlling direction of fall. Many other things must be taken into consideration but this is a primary need in directional control.

The men should be warned about felling a tree without first properly clearing or "swamping" on the back side of the cut, although the opposite area is clear enough to allow a proper escape route.

When you see a man pushing the tree with his hand, to control direction of fall, this puts him in a rather awkward position. Obviously it is necessary that he push the tree, because he has not notched it. It is all right to push the tree, but this should be done by another man with a pole long enough to reach well above the man using the saw.

When the tree falls through brush that was not properly cleared before the cut was started, the brush could whip back and strike the eye of the sawyer. A man experienced in this type of occurrence usually will turn his head well away from the potential whipping brush. However, this does not constitute proper protection. Certainly the man should have spent just a few seconds clearing out the area before cutting, thus minimizing the exposure.

When a felled tree has lodged on the heavy limbs on the underside, the sawyer may limb the tree by cutting underneath the log to remove the supporting limb. This means a high probability of the tree falling

and causing injury to the man. He should have properly blocked the tree to prevent its falling. Better yet, proper study of the tree would probably have dictated felling the tree in another direction where there would have been no blocking limbs.

When a sawyer is cutting tree into pulpwood lengths without proper support underneath, his saw will probably hang, creating additional hazards in trying to loosen the saw. It is conceivable that damage could be done to the saw during interruption of work. Need for proper shoring here is obvious.

Woodmen must be always on the lookout for the "widow maker" (broken limb hanging above men who are preparing to cut a tree below). Any disturbance of this broken limb could drop it on a man's head or shoulders.

At times you may find a sawyer breaking just about all the rules of safety in felling a tree. You can see that he does not have on a safety helmet. He is pushing the tree with his right hand while holding the saw with his left, throwing himself into a rather awkward position. Then you'll observe the vulnerability of his head to any loose or dead limbs that may be overhead and become dislodged. The brush is so thick that the saw could hang and cause it to jump into the man's leg. Worse, the brush will probably obstruct his escape route. In addition to creating unnecessary hazards, this is a case in point of complete inefficiency in the woods.

After the cut the tree may hang suspended in the air and the men are going to have to cut other trees before they can drop the intended one. This means they will expose themselves to serious "falling objects" hazards.

Proper pre-planning for direction of fall and good clearing would have allowed a clean fall to ground. This further demonstrates what we mean when we say safety and efficiency are one and the same.

When a small tree is bent over by the tree that hung, the man cutting it with a hand axe may be setting up a dangerous situation by cutting from the top side of the tree rather than underneath. With his first cut, a long sliver splits off and springs outward. This frequently causes injury to either the axeman or other personnel. This is a completely unnecessary operation that

could be eliminated or avoided if proper planning is utilized in the first place.

Fortunately, there are occasions in the woods when you see a little more planning for safety. The men are all wearing safety helmets, and are properly dressed otherwise. The sawyer who will be wading out in the swampy areas is wearing snake bite leggings in addition to the safety helmet and good protective clothing. Men with yellow helmets are supervisors. You may see the producer who stays with and supervises this particular pulpwooding crew.

You will see one of the sawyers approaching the tree, with his foreman looking on. The sawyer will be sizing up the top, determining best direction of fall, etc. He will take into consideration shape of top, location of other trees, direction of wind, velocity of wind, most advantageous point on ground for limbing, etc.

Prior to cutting the tree, the sawyer will use an axe to swamp out around the tree or clear the area for freedom of movement and safety. This is being done to prevent saw from hanging and jumping into his legs and also to give him a clear path to get out of the way of the tree when it begins to fall.

When the sawyer is making a cut, in the properly cleared area, he will be using both hands on the saw. This demonstrates what we referred to earlier. That is, the sawyer can hold onto his saw with both hands while another man uses a stick with a sharp point that will reach up some 10 feet on the tree for the purpose of pushing so it falls in the proper direction. And the supervisor will be looking on.

The limbing operation with chain saw presents the hazard of the saw hanging in brush and jumping into the legs. Severed limbs should be moved out of way as they are cut, as a means of improving controls over this potential accident producer.

A limbing operation with an axe should be done on the opposite side of the log from which the axeman is standing. Loose limbs also present a very serious hazard here in that they may be deflecting the axe into the person.

In some operations, logs are snaked out of the woods into a clear area for additional cutting and loading. There will be a protective cover over the tractor cab. This

protection is a must for safety of operators. The hard hat will protect against relatively light limbs, etc. and will give a measure of protection against larger trees. However, the sturdy cab protector is necessary for full protection of the operator.

One of the most hazardous situations in logging is found where a man is operating a farm type tractor which shouldn't be in the woods in the first place. In addition to the fact that it does not have any protection overhead this machine is not designed to snake logs. The tow chain is positioned above line of axle.

The center of gravity, that is the line of force, is located well above the axle and if the log bangs, the tractor can turn backwards onto the driver. This frequently happens.

In a specific accident resulting from one of the farm type tractors turning backwards on to the operator occurred recently down near Beaufort, North Carolina. Investigation revealed that the operator was 15 years old (violation of the North Carolina Labor Law) and had been placed on the tractor without any previous experience, although he had told the pulpwood producer that he had driven a tractor some place before.

At any rate, the log being towed by the tractor hung against the stump and the youth's foot slipped off the clutch and the automatic drive caused the tractor to turn backwards and crush the young fellow. The details of the investigation of this accident are too numerous to mention here but they did reveal many areas where planning was lacking and apparently absolutely no attention was given to safety of workmen.

Another major producer of accidents is lifting and handling of heavy materials. This produces serious strains. The safe handling of material requires a thorough knowledge of the correct way to lift; requires putting this knowledge into practice at all times, not just part of the time. It is estimated that manual loading of logs is practiced in approximately 90 per cent of the cases.

If anyone doubts that loading a truck of pulpwood logs is a big job, just multiply the weight of the log (about 80 to 90 pounds) times the distance it is handled, times the number of logs on the truck and you get a pretty good idea of the foot pounds of energy expended during a loading operation.

The man on top doesn't have an easy job either. He faces a number of very serious accident producing potentials. For instance, we could list the strain hazard from the lifting and handling of the log; the falling objects hazard in case he drops the log; the hazard of falling off the truck. Spikes should be worn on the shoes of the top loader. Just imagine what would happen if he makes a misstep backwards, or if a foot slips on loose or slick bark.

You may often find the wood being loaded by a man much too old to be straining and lifting in the log woods. Better selectivity and job placement would control this needless exposure.

An example of poor planning found recently was in the elevation plates welded on a truck bed to keep the logs off the tires. They were too small. The man has to cut short timbers to lay lengthwise on the bed to keep the logs up off the rear set of wheels. This lack of effective planning is symptomatic; may be a major cause of woods accidents.

Badly worn tires are hazardous. A blow-out on the road means, at the very minimum, a spilled load and a reloading operation, (again we have inefficiency). It could mean many more things, such as a severe wreck, death, collision with some other vehicle, and death or permanent disability to several people rather than one.

We have found there is some effort underway to reduce the exposures to accidents and to increase the efficiency of pulpwooding operations. Machines have been designed and built by people who have had many years of experience in pulpwooding. Such a machine can go into the woods and pick up a load of pulpwood, one stick at a time, load it onto a cradle, hook on and drive out to a more convenient pick up point for transport trucks, in an extremely short time. All of this is done with just one man at the controls. This man controls the pickup arm and does all the driving of the tractor. All of his pick up, handling, loading, etc. is done long after the sawyers have dropped the tree and sawed it into pulpwood lengths. This eliminates exposure to others being near by.

Obviously, this machine can take a lot of work off the individual and it is not nearly so subject to strains, injuries from falling

objects, etc., as a man is. Unfortunately, all pulpwooding operations cannot afford such a machine. What they have to do instead, is to properly equip their men with the best available, properly select the men to do the job, outfit them with safe clothing, and teach them the correct way to do the work. Sufficient supervisory follow-up is absolutely necessary to see that this is done.

It is reassuring to find a logging outfit that has taken the trouble, and felt it economically worth while, to construct a good useable road for access into the logging area. We'll find the foreman of the wood crew equipped with safety boots and safety helmet.

He will have the safety devices necessary for topping out trees on the stump, or for setting up derrick rigs for skidder operation where high water is a factor. The man's spikes are sharp and workable. Those rubber boots he is wearing have safety toe-caps.

Another safety type shoe shows the proper method of wearing trousers tucked into boots to prevent hanging on snags, etc. when trying to get away from a falling limb or tree.

We photographed a work truck with a lot of unsafe features:

1. Gasoline cans were carried on the same truck with workmen. (Unsafe type at that.)
2. The safety sides or cover over the truck only extended part way back, certainly not enough to fully protect a truck load of men.
3. There was no tailgate to protect men from falling out at the rear.
4. The truck was not equipped with a rear bumper and we doubt seriously if the lighting arrangements on the truck met highway standards.
5. Preventive maintenance was obviously lacking.

Another better rig for hauling men, not considered completely safe, did not have proper type seating. The truck did have a tailgate, was equipped with a complete cover and carried fire extinguishers and first aid kits.

Additional hazards inherent in log woods operations include the black widow spider, timber rattler, copperhead and cotton-mouth moccasin.

Yes, the log woods are beautiful, but such a small thing as an axe with blade up can

be compared to the copperhead—just waiting to strike. A small thing, but it's the small things that accumulate and result in big losses. Many times it's the small things we do and fail to consider important that create our most serious accident occurrences.

Most any way you go in the log woods you find beauty. You also find many hazards, many places where men can be badly injured or killed. Careless workmen can

injure themselves and others, they can start fires that will damage millions of feet of timber, and destroy wildlife that furnishes sport in hunting and trapping, for people who like the outdoors.

Proper planning, proper outfitting, careful selection of employees, training of employees, and sufficient supervision to see that this training program is carried out on a continuing basis, can prevent such happenings.

THE FUTURE OF TWO-WAY RADIO IN LOGGING SAFETY

By DONALD R. JONES

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Motorola Corp., Chicago

Your presence here today marks each of you as an expert in safety. As representatives for your company or governmental agency, your principal objective is to further improve safety programs and to seek out new tools which will aid you to reach your objective. My purpose is to provide you with information about two-way radio—a working tool which can assist you in your efforts for greater safety.

How can radio help you? Many ways! There are many examples of companies who have successfully employed two-way radio to improve their safety record. The problems of safety programs are not simple to solve. Each of you has specific problems. Effective use of radio in one particular application to provide improved safety for one of you—will not necessarily be what is required or needed by the man next to you. Nonetheless, the results achieved in some applications can provide insight to possible other applications.

I will have accomplished something worthwhile if one of you takes away the germ of an idea, which when further developed, will increase the safety in your organization. I shall spend my time exposing some sample applications of radio equipment to safety programs. I hope that the examples will stimulate your thinking and result in solutions to your particular problems.

First, radio can provide you a means of

communication which no other medium can provide in your particular working environment. Practically all operations today require a high degree of mobility. Without the application of radio, the person on the move, whether on foot or in a vehicle, is out of contact—unable to be reached until he checks in at various times during his tour. Lack of communications due to the requirement of mobility can make management substantially more difficult and operations far less efficient. For you, it may make an effective safety program impossible.

A good example of the use of radio in a safety program occurs in the trucking industry, which has had a substantially bad safety record. Two-way radio has become a common operating device for truck fleets in various industries. Expanding its use from the usual status as a means to increase efficiency to a place in the company's safety program has proven to be rather profitable in several large fleet operations.

In one trucking company, for instance, radio is installed in the vehicles used by the firm's five very active safety coordinators. The radio keeps the inspectors always available so that they can be directed to any place their presence is required—at the scene of an accident, for instance. More important, the radio communication allows the supervisors to prevent accidents because they can continually check the drivers.

TEXTILE SECTION

SAFETY IN COTTON GINS

By W. KEMPER BRUTON

Exec. Vice Pres., Arkansas-Missouri Cotton Ginners Assn., Blytheville, Ark.

Any program of promotion—safety or otherwise—can be just as successful as the attitude of management of the business that the promotion is built around. Our problem with management in the ginning committee is the two-fold type because we must first "sell" the association who in turn must reach the management of the 6000 gins operating from coast to coast.

As background information, there are 17 major states which produce and gin cotton, but only eight of them are represented in ginning by associations with full time executive officers. California and Arizona can be included in the group with organized leadership in safety because three large commercial ginning operations maintain their own safety engineers. They do not, of course, reach all gins in those states with an accident prevention message.

Knowing that to reach management effectively you must put the "dollar sign" on your approach, the members of the committee have been delving into the ramifications of costs in terms of lost time, medical aid, insurance, etc. As the ginning season shortens and volumes of bales per hour increases the item of lost time or down time resulting from an accident becomes increasingly serious.

The preliminary surveys made by the Ark-Mo Ginners Assn. on the costs of insurance per bale (as high as 70 cents) definitely set out the need for concerted action to reduce one of the ginner's highest costs in his operation. No one needs to be reminded of the skyward trend of medical care and its demands on the pocketbook of every individual today.

In trying to find "handles" to put on these various aspects of our problem, and to first of all ascertain some facts about our ac-

cident experience, we've found our industry is lost in a maze of rather unrelated statistics. We believe ginning accidents should be recorded as such and that we should not carry the burden of accidents happening in outside influences but charged to the gin because the employee's payroll record was in the name of the gin. Our committee has set forth to secure an IBM reporting system through the State Workman's Compensation Commissions with this goal in mind. We believe the insurance companies can be of great help in this matter.

Progress is being made. We have designed a "package" safety program for all state associations. It will include the new data sheet now in the hands of the NSC staff, news releases, posters, safety tips, leaflets, and, in the future, a manual.

No lost-time accident awards are being made by the Texas and Ark-Mo associations. Texas has issued a manual—very comprehensive and practical. Other associations are using NSC posters and allied material. A file of pictures of gin hazards is being compiled by Extension Service at much cost of time and effort. Slide presentations on safety practices have been made in several states. USDA is testing anti-slip materials to prevent falls in gins. A school for gin safety engineers is being prepared to be held next April.

Somewhere—someway—your committee feels it will be successful in developing a live-wire accident prevention program which will reach into every gin in the United States. The machinery manufacturers are with us—educational agencies are with us—we know the NSC is with us. All we need now is the owner of the gin—and through him—his employees.

FLAME RESISTANT TEXTILES

By THOMAS D. MILES

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The constant presence and contact with textiles in daily living, from personal clothing to household furnishings, make their safety properties of general interest. How readily textiles ignite and spread flame is one of these properties.

Why do textiles burn? Follow a typical cotton fabric from the time a flame is brought near it and it bursts into flame. The flame spreads across the fabric until only an ash is left.

Take each step. The flame brought near the fabric heats it up. The heat decomposes the cotton into gases. The cotton is heated on a thermo-balance up to 500°C. The weight is continuously recorded. At lower temperatures, the weight of the cotton is unchanged. But as the temperature of the fabric rises, as it would in contact with a flame, the cotton decomposes into gases. The black line of ash is the weight of the solid remaining. Note that as the temperature rises most of the cotton is converted into gases. The remaining solid is a black char.

The first step, then, in the burning of a textile is the production of flammable gases by heating the fabric. As these gases move out from the fabric, they mix with air. At the point where the upper limits of flammability of this mixture of decomposition products and air is reached, ignition takes place.

The next step is that the flame spreads. Heat from the ignited gases (radiation from the flame and convection by hot gases) is sufficient to decompose more of the cellulose into flammable gases and the process continues until all of the textile has been decomposed. An ash is left which cannot be decomposed into additional flammable fuel.

Thus the textile burns because the flame source decomposes it into flammable gases which ignite and produce sufficient heat to decompose more of the fabric, to continue the process and spread the flame.

What can be done to change the burning properties of the textile? We have seen that flame spread needs two conditions. One is fuel, supplied by the decomposing cellulose. The other is heat to decompose more of the cellulose and allow the flame to spread. If heat or fuel could be removed, then flame spread would cease. The action of flame retardants has been explained either on the basis of removing the heat or removing the fuel.

There has been little direct evidence to support those theories based on removing the heat, since the measurements are difficult to make. However, it has been proposed that diluting the decomposition gases with inert gases moves the flame away from the fabric by changing the upper limits of flammability of the mixture. When the flame is moved away, sufficient heat cannot return to the fabric to further decompose it and spread flame. Bromine and chlorine containing compounds have been proposed to have the effect of diluting the decomposition gases. Another way of removing the heat is the use of chemicals that would undergo endothermic or heat absorbing reactions.

Most of the evidence that is available from studies on flame resistance is concerned with removing the fuel by changing the decomposition pattern of the cellulose. Evidence to support this theory is easier to obtain, since a variety of measurements can be made, such as the quantity of gas produced, the rate of decomposition of the cellulose, weight losses and the identification of the chemicals produced during pyrolysis. There is considerable evidence available that effective flame retardants alter the thermal decomposition of cotton.

This can be seen from the previous example. You will recall that this is heating cotton on a thermobalance. All flame retardants would initiate the decomposition of cotton at a temperature lower than the untreated fabric and all of them would con-

vert more of the cotton into a non-flaming char and thus less gaseous products than occurs with untreated cotton.

Effective flame retardants for cotton have been shown to be non-volatile acids or compounds which decompose into acids at flaming temperatures. They act as catalysts to change the decomposition of cellulose, both the rate of decomposition and the products of decomposition, to deprive the flame of further fuel. Listed next are some of the typical flame retardants used.

Ammonium sulphamate, mixed with diammonium phosphate, is typical of the non-durable flame retardants. About 5 to 7 per cent of weight is added to the fabric by the treatment which is applied by dipping the fabric or garment into a water solution of the retardant and drying it. There is no loss in strength of the treated fabric. The color and hand of the treated fabric are similar to those of the untreated. In addition, the non-durable treatments have the advantage of low cost, provided that the use does not require frequent retreatment. The main disadvantage is that they lose flame resistance on contact with water and thus have limited uses.

In looking for ways to make flame retardants durable to laundering, research was influenced by the early durable resin finishes for textiles. These were urea formaldehyde, melamine formaldehyde and vinyl chloride resins. Urea phosphate, THPC melamine formaldehyde and vinyl chloride-antimony oxide are examples of durable types. The weight added to the fabric is about three times that of the non-durables. This additional weight represents the reactive groups or binder that imparts laundry resistance.

With the exception of the aminophosphates (urea phosphate or other nitrogenous compound), which have durability to only a few washes and can lose their flame resistance through ion exchange, the durables can be subjected to repeated launderings and the flame resistance is designed to last the life of the garment. With all of the durables there is a reduction in strength of the fabric. To some extent this is characteristic of the chemicals used; for example, the APO types have less effect on strength than the others.

The amount of strength loss is also influenced by finishing conditions such as

cure time and temperature. This coupled with the fact that all of the durables require a cure with its need for special equipment, curing ovens, means that the durables are a specialty finish applied for the most part by a few finishers.

TABLE 1
COMMON FLAME RETARDANTS

	% Add-on	% Loss in Tensile Strength
Non-durables		
Borax-boric acid	5-8	None
Ammonium Sulphamate	15	None
Diammonium Phosphate	10	None
Ammonium Sulphamate-Diammonium Phosphate (2:1 ratio)	10	None
Durables		
Amino-phosphates	20	50
THPC	15-20	50
Vinyl chloride	25-30	35
Antimony Oxide	18	25
APO Types	18	25

What about the future of flame retardants? Have they reached the point where little or no improvement is to be expected? The non-durables have just about reached this point for the limited area where they are useful. There will probably be no major improvement in the properties of the non-durables in the future.

However, there is considerable room for improvement for the durables. Strength retention and cost are two areas for improvement. We have seen that the chemical types used for durables parallel the resin finishes and share some of their problems. Strength reduction is one of the problems associated with resin finishes. The future will probably see greater emphasis in the area of "non-resin" durable flame retardants.

Within the past few years there has been an enormous amount of research in many countries on inorganic polymers. This research is aimed at supplying, for rocket and missile uses, materials that will withstand extremely high temperatures. This is a property which most organic polymers do not possess. One of the by-products of this extensive research may be compounds that will find uses as durable flame retardants—an inorganic polymer that will have the low add-on and strength retention of the non-durables with the added feature of being resistant to laundering.

Less attention has been paid to flame resistant finishes for synthetic fibers. In contact with a flame the majority of synthetic

fibers melt. If this melt is free to drop away, the flaming does not spread along the synthetic. However, the melt is flammable and if it is held, for example by the presence of a resin finish, then flame will spread. Thus some of the flame retardants for melt fibers are designed to produce the melting and dripping that occurs with the untreated material.

An example is nylon netting with a resin to stiffen the net. Thiourea formaldehyde has been used in such combinations to make the finished netting melt and drip in contact with a flame. Its effect is due to the fact that the melting point of thiourea formaldehyde resin is near that of nylon.

The acrylics and modacrylics are examples of synthetic fibers which do not melt in contact with a flame. The modacrylics are flame resistant and include within the structure of the fiber, compounds such as vinyl chloride. The acrylics burn readily. It is known that diammonium phosphate is an effective flame retardant for the acrylics.

Although no studies have been made on the mechanisms for flame retardants for the acrylics, it might be interesting to speculate on what such mechanisms could be. It is known that under controlled combustion, the acrylics can be converted into a black char which retains fiber properties. This black fiber is nonflaming. Although the fiber has the appearance of carbon, studies have shown that it is a stable ring compound of carbon and nitrogen that has formed.

It may be then that effective flame retardants for the acrylics would be compounds that catalyze the thermal decomposition of the acrylic into this charred fiber form that results under controlled combustion.

What methods are used to measure the flame resistance of textiles? There are two general types of flame resistant test methods. One is the standardized method, an almost quality control test method, where emphasis is on the reproducibility of the test results. These are the methods that appear in procurement specifications of fabrics and in various regulations covering the use of flame resistant fabrics. These tests are widely accepted, and usually have been in use for a long time. Another characteristic is that an exact definition of all of the test conditions is listed.

An outstanding example of such a test is the vertical burning test. A sample of the textile about a foot long and several inches wide is held in a vertical position in contact with a flame for twelve seconds. The length of time the sample flames after removal of the flame source is recorded as well as a source of the amount of char that is present. This is estimated by the length of a tear made in the sample. The force applied in tearing the charred area is much less than that required to tear the uncharred portion. The standards throughout the world for tests of this type are shown in Table 2.

TABLE 2
INTERNATIONAL FLAME TEST REQUIREMENTS

Nation	Designation	Flame Source	Contact Time (sec.)	Measurements
U.S.	CCC-T-191 3903	Bunsen	12	afterflame char length
U.S.	CCC-T-191 3904	Candle	12	afterflame char length
U.S.	ASTM D526-61T	Bunsen	12	afterflame char length
Great Britain	BS 3119 1959	Bunsen	12	afterflame char length
France	94 03	alcohol (2cc)	10	afterflame char length
Australia Std	310-1959	alcohol (0.1cc)	10	afterflame char length
Germany DIN	53 906	Bunsen	6-14	afterflame char length

It is evident that a 12 second exposure to a bunsen flame is a test method that has been standardized throughout the world. In some of the test methods you will note that a candle is used as the flame source. This is for field testing since the candle has the advantage of being portable. Some of the cities in this country use this type of flame source in their test requirements covering tents for public assembly, and the test is run at the site where the tent is pitched.

The other general type of flame resistant test is the special purpose test. For various types of protective clothing, the flame source that will be the hazard in burning the textile is known. For example it may be molten steel, it may be an explosive powder. A test method is designed which uses the molten steel or explosive powder as the flame source.

A test method used in steel mills for protective clothing simulates the splash of molten steel on the fabric. It is also designed to tell whether the fabric system provides insulation enough to the molten steel to prevent serious burns. The fabric sample held at an angle is placed over a polyethylene film. The molten steel is poured on the sample and any flaming of the fabric or melting of the polyethylene film is noted.

In a test of protective clothing for handlers of powder, a weighed charge of the powder is ignited and it is noted whether or not the garments stuffed with flame resistant rags will ignite. In such a test it is of interest to know whether or not the conditions at the site of the sample garment are severe enough to burn untreated cotton.

The next example shows an attempt to include such a control in the test. Bits of untreated cotton are suspended on a wire fence in the same plane as the test garment. After the test is over each bit of cotton is examined and listed as not affected, scorched, or burned. Such bits show the areas where the conditions were severe enough to burn untreated cotton and those where only scorching occurred.

Another type of special purpose test is for areas where it has been found that the vertical bunsen test or some other standardized test cannot be used as a criterion of flame resistance. One example is the air-supported shelter. The escaping air from the tent is sufficient to put out any flaming.

Another example is a fabric that will pass

the vertical bunsen test but fail a field burning test. A weighed amount of paper is placed along one side of the tent and ignited. This fabric passed the vertical bunsen test but it burns readily in the field burning test. In trying to find an explanation for the behavior of this fabric, it became obvious that the plasticizer was the cause of the burning.

In the vertical bunsen test, the short contact time with the sample was not sufficiently long to distill the plasticizer from the fabric. However, in the field burning test the conditions were right for the distillation and ignition of the plasticizer. By making a cone of the fabric and heating it with a bunsen burner, the plasticizer could be ignited with a burning splinter. No ignition occurred when the plasticizer was removed with a carbon tetrachloride extraction. It was found that contact of the flame source through holes in the cone could replace the burning splinter as a means of igniting the plasticizer.

A brief word about uses of flame resistant textiles: in addition to the established uses of flame resistant textiles, such as military tentage, protective clothing for industrial workers, draperies and furnishings for places of public assembly, there has recently been added one use that is new in this country. This is hospital textiles. The Veterans' Administration has initiated a program to provide flame resistant textiles in certain hospital uses; for example, cubicle curtains that are used as room dividers, and clothing for the handicapped.

A STATE LABOR DEPARTMENT SELLS SAFETY

By W. C. CREEL

Safety Dir., North Carolina Department of Labor, Raleigh, N. C.

Safety must be sold and sold and sold. This has been said so many times that it is almost trite to a group of safety people. Everyone agrees, but sometimes the safety director fails to sell the supervisor, who, in turn, neglects to sell the worker. The same situation exists with state agencies. Too often, the state agency fails to see

the necessity for selling safety. In some instances, the power of legal enforcement overshadows the basic concept that safety must be sold on all levels by those who have the responsibility for promoting industrial accident prevention.

The state representative cannot carry a briefcase in one hand and a big stick in

the other and sell safety. He must be allowed to sell, he must be trained to sell, and he must believe in what he is selling. If the best results are obtained by a state agency, safety must be sold to industry just as it is sold by industry.

We at the North Carolina Department of Labor know that ours is a service agency. We also know that one of the services most needed by industry is in the field of accident prevention.

The need for accident prevention assistance by a State Labor Department is especially great for the small plant, and over ninety per cent of all the establishments in North Carolina have less than 100 employees.

Safety services can be sold because there is a great need by management as well as by the workers. There are those who say that a state labor department should direct its activities to the worker. We, at the North Carolina Department of Labor, do not feel this way. We feel that our services should be for the worker but should be directed through top management. Top management, especially in the small plant that does not belong to the National Safety Council, does not have a safety engineer and receives little assistance from his insurance carrier, needs assistance to curtail on-the-job injuries. Even more important, the most and best benefits for the production worker can be achieved by working through management.

There are many good ways for a state labor department to sell safety, and I like to think that we use most of them. However, I want to tell you about just one method which works well for us. I want to tell you about our special industry safety program.

Special industry safety programs are based on the need for special concentration in industries with high frequency rates or special problems. Programs have been conducted in six North Carolina industries with the following reductions in disabling injury frequency rates:

Industry	Per cent
Brick and Tile	36
Wood Furniture	43
Flywood and Veneer	15
Cotton Grey Goods	29
Fertilizer	40
Cotton Yarn	27

At the present time, we are conducting programs in our toundry and lumber industries.

The special program which I want to tell you about is in the textile industry, and this is our state's largest industry. The average employment is over 221,000 with an annual payroll in excess of 668 million dollars. We have concluded two programs in this industry, one in cotton grey goods and one in cotton yarn. I will discuss the cotton yarn program.

The elements of a special industry program include the following:

1. Review of industrial accident experience.
2. On-the-job study of operations and hazards.
3. Training school for industrial safety inspectors.
4. Special materials.
5. Consultations and visits.
6. Analysis and recommendations for perpetuating progress.

After the entree into an industry which we try to reach through the trade associations, the success or failure of a program largely depends upon our industrial safety inspectors whose job it is to carry the program to the individual plant. Our department is fortunate in having a fairly large staff of well-trained industrial safety inspectors. These men have received 150 hours of basic safety training and nine ten-hour special courses or training through the Bureau of Labor Standards of the U. S. Department of Labor. This includes ten hours of on-the-job training in a representative plant just prior to the beginning of a program.

Five visits are made to each plant with emphasis on plant inspection, accident analysis, and consultative service in organizing a plant safety program to fit the needs of the individual plant. The inspector has the training, he has the information and materials, and he has the desire to sell top management on the special industry safety program.

Participation in a special industry safety program is purely voluntary. It is a special safety service without charge and there are no strings attached. Special safety recommendations, including those as a result

of plant inspections, are made by the inspector at each plant participating in the special program. Again, compliance with these recommendations is voluntary. Even so, compliance has been secured for over 95 per cent of the recommendations.

Special materials are prepared to meet the immediate needs of an industry. These include process flow charts, how to inspect charts, and a series of safety bulletins which are sent from the Commissioner of Labor's office with an appropriate letter each month.

In addition, the best of the appropriate materials produced by the National Safety Council, the insurance companies, and other state and national agencies, are used. A special industry program usually lasts for two years, but long after the program is concluded, the results as measured by frequency rates and workmen's compensation insurance rates continue. From time to time, as the occasion may arise, special follow-up materials are prepared and distributed.

As the industrial safety inspector makes his five visits to each plant participating in the industry program, he collects detailed descriptions of every disabling injury which has occurred during the program period. As a result of this accurate and current information, worthwhile analysis of the industry injuries can be made.

On analysis of a three year period of the parts of the body effected by 5,746 disabling injuries in over 400 cotton yarn plants showed the following:

Part injured	No. injuries	Per cent
Hand or finger	1,903	33
Back	1,089	19
Trunk	783	14
Foot or Toe	745	13

A study of the same 5,746 disabling injuries showed the source of work injuries as follows:

Source	Per cent
Handling Objects	27
Machine	25
Falls of Persons	17
Falling Objects	9

A breakdown of the machine injuries shows the following: looms, 17 per cent;

spinning frames, 14 per cent; cards, 12 per cent.

One very tangible benefit of a special industry safety program is the preparation of a special operational safety checklist. The cotton yarn list includes specific checks for the following operations: combing, drawing and roving frames, spinning frames, cards, and lappers. These check lists are widely used through this industry.

While the North Carolina Department of Labor makes no direct claim for being responsible for industry safety achievements, other than bringing the problem to the attention of the industry leaders and carrying the message and materials to the individual plant management, we are proud of the continued safety progress in industries where special programs have been conducted. The results have been good and have been lasting. In North Carolina's vast cotton yarn industry, the state disabling injury frequency rate at the beginning of the program in 1951, was 10.9. The rate for 1960 is 6.3. This 42 per cent reduction is highly indicative of the success of safety work in this industry.

Along with the reductions in frequency rates comes reductions in workmen's compensation insurance rates. Despite several increases in workers benefits and many, many increases in medical and hospital benefits, the rise in workmen's compensation insurance rates has been very small. In fact, the increase has been far less than in other direct costs of labor, materials, or transportation. The cotton yarn workmen's compensation insurance rate for a North Carolina plant is now 65 cents per 100 dollar payroll. This rate compares favorably with the rates in other states, and surely is a direct result of fine and continuing accident prevention work in the industry.

A state labor department can, and should, sell safety. There is a real need and the special industry safety program offers a real opportunity.

We, at the North Carolina Department of Labor, are delighted with the opportunity to work with industry and will continue to do so at every opportunity.

LET'S LOOK INSIDE!

By D. V. HILL
Safety Director, Kingsport Div.
The Mead Corp., Kingsport, Tenn.

I know very little about the textile industry, or problems with reference to the prevention of accidents. In fact, I doubt if I would know the difference between a "spindle" and a "loom."

But I am sure you do have problems, and your people get hurt! And you wish to learn how to solve these problems. I want to help!

Definitely, your management is interested in accident prevention. You must be interested, or you would not have dedicated your life's work to the cause of suffering humanity.

And the people in your plant are interested, because their lives, and the welfare of their families depend upon how efficiently the accident prevention program is carried out in your plant or industry.

The things I will say to you today are not new! Those of you who have been in the field of accident prevention for a long time have probably heard everything that I will say.

But, perhaps there is someone who is new to the field and I can help him, or her, just a little bit. If I can, this paper will have been worthwhile.

So, let's look inside this business of organized accident prevention. Let's see how effective it has been. Then we will look inside our own plant programs and see how they can be made more effective.

Last year in our country, the National Safety Council tells us, 93,000 of our neighbors and friends were killed by accidents, and 9,400,000 were hurt. Of this number, 13,800 were killed and 1,950,000 were hurt in industry, while 38,200 were killed by automobiles and 1,450,000 were hurt.

In our homes, 27,500 were killed and 4,100,000 were hurt. These included such cases as the small child scalded to death by the overturned pan of boiling water on the kitchen range, the man who dropped his electric razor into the sink filled with water and the mother and baby who were

electrocuted when a small radio toppled into the bathtub from a shelf.

While we are primarily talking about industrial accidents, we must not forget that a worker killed off the job is just as dead as he can be!

You may be saying to yourself, "Surely our accident prevention program must not be very good if we let almost 100,000 people die needlessly by accident, and 9,400,000 people are hurt—and property losses in amount of \$13,600,000 were incurred in 1960!"

But let me remind you that if the accident rate that prevailed in 1914, when the National Safety Council came into existence prevailed today, the figures I quoted would be many times greater than they are.

We have made progress, and we must continue to go forward. So let's see what we, as individuals responsible for accident prevention in our industry, are doing and can do.

I have often heard it said that there are two causes of accidents: men and women.

But I am being facetious. The principal causes of accidents are (1) unsafe acts or (2) unsafe conditions, and, in many cases, combinations of the two.

First, let us define the word accident:

The word accident is used universally to infer a "happening." Usually there is couplet with its meaning a sense of "suddenness." Existing definitions for accident range from short expressions containing only a few words to lengthy compositions. There seems to be a tendency to color the definition because of certain aspects that are predominant in the mind of the writer defining the word.

A pointed definition is that accidental injury must be sudden but not necessarily instantaneous.

Accident has been called an unlooked-for mishap or an untoward event that is not expected or designed. A learned judge says that if a third party deliberately and will-

remember when a logger, or a paper mill worker, or a textile worker, or any man, needlessly dies, be it in Oregon, Maine, or South Carolina, or anywhere on this globe of ours, his death diminishes you and me, because we are "involved in mankind."

And just as "No man is an island, entire of itself," so no single industrial organization is an isolated island of self-benefit. Every store or factory, every individual enterprise is "a part of the main." So whatever you are doing to prevent acci-

dents in benefiting, not just yourself, not just your industry, not just your community, it is benefiting mankind.

The men who have devoted their lives to accident prevention know full well "for whom the bell tolls," and their great and eternal objective is to silence its tragic knell, by stamping out needless suffering, hardship, and death in our society.

Let us look inside our hearts to see if we have that most important weapon with which to fight our battle! Thank you.

EVERYONE—EVERYWHERE—ALL THE TIME

By PAUL F. HILL

Asst. General Mgr., National Safety Council, Chicago

You will search the pages of history unsuccessfully for a single example of a social problem in which acceptance or rejection did not finally follow the dictates of public opinion. Regardless of the speed at which this opinion was formed or regardless of how long it took for public opinion to be translated into public demand, the entire basis of action was predicated on the public's knowledge and understanding of the problem.

We also know that developments from experience have become dictates to the systematic and orderly approach to the solution of any major problem.

Let me ask the question—how much physical punishment, torture, sorrow, unhappiness and economic waste will it take, beyond the point of public opinion, to cause us Americans to refuse to tolerate needless accidents?

If we were to turn to a half-dozen of our best known dictionaries for a definition of this thing called an accident, we would, of course, find a half-dozen good and acceptable definitions. In going one step farther and summarizing all these definitions, we would find that "an accident is an occurrence in a sequence of events which usually produces unintended injury, death, or property damage."

We who have spent some time in this particular field of accident prevention all

too often recognize that the word "accident" is used as a cover up for law breaking, clumsiness, risk taking, fatigue, temper, illness, infection and plain lack of intelligence. We know that each and every underlying cause of every accident, regardless of whether it is in our home, in recreation, on the highway, or on our job, could be minimized if we were determined that steps be taken to provide adequate knowledge, skill, and proper attitude in the minds of members of our society relative to their everyday activities.

Everyone—everywhere—all the time—clearly defines the need to work at the accident problem 24 hours a day, every day of the week.

Is there a great difference in the area of personal responsibility when it's related to how one becomes injured or loses his life? What is it that causes us to callously disregard certain types of accidents which take so many lives and cause so many injuries? All too often those of us involved in accidents hurriedly and frantically drum up excuses or alibis to justify our being involved in an accident.

In our home, it's frequently the condition of floor surfaces, or some member of the family that has left some obstacle out of place, that provided that basis for a mishap. In traffic, it's the other driver, or the highway engineer, or a breakdown of

equipment. At play, it's something else; and at work, it can either be an act of a fellow worker or something management has or hasn't done right.

To this point it's doubtful that I have given any one of you a new idea or told you anything which you haven't long ago learned for yourself. Each of you in your respective company or staff positions has adopted systems of record keeping, or analyzing these records, and of promoting accident prevention techniques based on these data. Your companies have invested funds in giving you the tools and equipment necessary to carry out your assigned responsibilities. Many of you are reporting outstanding records of accident reduction in your plants, but have you checked the number of man-days lost on the job resulting from accidents happening away from work?

Some of you have maintained, and some of your companies are maintaining, good records on off-the-job accidents. Many companies tell us that there are many more man-days away from work resulting from home accidents, traffic accidents and recreational accidents than are recorded on highly hazardous-type jobs in the plant.

Now what can we do in our "fraternity of safety men" to further bring down this accident curve, both on and off the job, among members of our family, our fellow workers, associates, and friends?

First, we must emphasize individual responsibility and it must be exercised at all times and in all activities. The feeling of safety must permeate from the top to the bottom every family, in every plant, in every community and throughout the nation. Cooperation, mutual recognition of necessity, mutual respect, and mutual confidence are the basic components essential to a successful safety effort. Yes, they are the basics to any successful program or effort.

It is interesting to note that French officials in the 18th century recognized this fact and enacted into law a requirement that workers and management in government explosive works have their homes and rear their families in the immediate premises of the plant.

A well-planned action program to reduce all accidents may be thought of as "a system" to derive maximum benefits from

existing resources. The question of leadership, program direction and united cooperative effort can then be effectively focused on the problem.

We must clearly answer the following questions, which are uppermost in the minds of people:

1. Why should I become interested and more active in the accident prevention program?

2. What proof is there that a reduction in accidents will benefit me or my family?

3. What evidence is there to prove that, as an individual, I can do anything worth while?

4. What steps should be taken to effectively organize a coordinated approach to the problem?

5. Where may I obtain selective source materials and information on the subject?

6. To whom may I turn for help in activating a sound program?

The merging of individuals into group effort, and groups into organization effort is essential if our impact is to be productive. Prevention of accidents will be the measure of our success.

We must not fail to develop in the minds of every individual with whom we have contact a feeling of deep and sincere responsibility for his fellow man. We must go up stream, against a flood of public apathy and assume the responsibility for leading others in the same direction. The job of packaging "safe living" so as to make it attractive and acceptable is not an easy one. It can be done however, and we can do it.

In the words of Winston Churchill, it will take "blood, toil, sweat and tears." A great transformation in the public's understanding of the humanitarian and economic aspects involved in the accident problem is the first priority.

If we would consider ourselves as members of a select, special team assigned to work on the "new frontier" of accident prevention, return to our respective communities determined to take the lead, others would soon join in the effort.

In conclusion, we must bear in mind that cooperation, consideration, confidence and conduct go hand in hand in the leadership role to prevent accidents to everyone—everywhere—all the time.

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BILL GOVE

*President—The Bill Gove Organization
Coral Gables, Fla.*

Bill Gove delivered the Early Morning Class lectures at the 49th National Safety Congress, October 17-20, 1961, attracting overflow crowds to the grand ballroom of the Conrad Hilton Hotel, Chicago. Mr. Gove has addressed the members of more than 100 trade associations, 372 service clubs and hundreds of sales and advertising clubs, and has lectured at several universities. He has conducted sales clinics for many leading companies.

TIME MANAGEMENT

(Early Morning Sessions of the 49th National Safety Congress)

By BILL GOVE

Pres., The Bill Gove Organization, Coral Gables, Fla.

SESSION 1 — TIME — ITS NEW DIMENSIONS

I was with Minnesota Mining for 15 years and pretty close to safety. They talk about it and think about it. It is a pretty dedicated place. You say, "How do people get this way?" And then someone says in a lot of cases it is compulsory, and you have got to get this way. Someone else will just say it is common sense.

You know you have to keep people healthy. It increases man-hours, output, production. It is simple to explain, and then someone like Ned Selman says, "This is not the real reason these guys have a gleam in their eyes. You will find it out. This is people at their best. This is one guy who in a lot of different ways is trying to help another guy."

"It sounds kind of corny, but you are going to be here with these people all week, and you will find this is the way it is—one guy trying to help another guy, and this is people at their best."

It is good to be back to the land of the living. I've been doing a communications conference with some college professors out on the Coast.

I figure they are saying something that we could use in the manager-man relationship. They are saying something that will make all of us do better and be better and take a bigger bite of life, but I will be darned if I can figure it out.

There are about 15 anthropologists that work with people in huts, and also with octopuses. I had lunch with a guy named Gregory Bateson. I know he is saying something I want to hear.

I said, "Dr. Bateson, bring your material down to me. I would like to build myself up to what you are saying, but I figure you are talking to other anthropologists."

"For instance, they talk about multiphasic

tests. They bring their people in and try to put a square peg in a round hole." We found a guy who could do it.

In reference to what I am going to talk about before we are through, I think he said something we could all use in all relationships, not only manager-man, but maybe parent-child, and husband-wife, and friend-friend, and citizen-community, and certainly man-safety. We like to do it this way this morning.

I would like to talk about the idea that has been near and dear to my heart, an idea of not how to do the job, but how to find time to do the job, and maybe find extra time.

Tomorrow I would like to talk about what we talk about when we get together, building stronger, more grown-up relationships.

The third day I would like to talk about some of the areas of persuasion which again we talk about when we get together, but here is something I asked Roy Benson about this morning.

I thought it might be a good idea. I am going to be riding around the corridors all week, and I thought if you had a question in communications or about boss-subordinate relationships, that you might stop me and say: "Here is one I would like to have you cover." Now if I don't have the answer, and there may be a pretty good chance I don't, I know people around the greater Chicago area that do have the answer. I will call Phil Prince over at Sears Roebuck, or I will call someone at St. Paul. I'll get the answer or close to the answer for you, if you want it. I'll be the vehicle for reporting back to you. I thought this might be fun.

You know, generally the speaker-audience relationship is strictly one way. You know,

I'm talking. There isn't much you can do about it. I would like to change that. We are going to be together for four mornings. Here is your chance to participate.

Do you know what that means to me? That means there is a tremendous amount of power in this room. If you have a problem, there is a pretty good chance that you can solve it if you have the opportunity of meeting with everyone here.

Just a word about business around the country as it affects all of us. When you zoom in on cities, towns and villages all over the country, and you see the new plant expansion and the new churches and the hospitals and schools, and shopping districts, it is hard to be anything but optimistic.

You know, my subject this morning has to do with the dimensions of time, and it all started as a result of a most unsophisticated study. I kid you not. It was an unsophisticated study.

For instance, when I find someone who is really doing it, I guess because I'm such a wheel spinner myself, I am intrigued by this guy.

I know people who write a couple of books a year. They write 20 trade journal articles on safety. They serve in the vestry.

This guy serves in the vestry in his church. He is just doing it. He has got an animal farm, and all the chinchillas are in heat. He is just swinging it.

So I go to this guy and I say, "How do you find the time?" And you know, here is a funny thing. Generally, they can't tell you. They can't articulate. The real doers can't articulate this.

I know what the books would say. They would say this man has a profound respect for time. I don't think he has. In fact, if anything, I think he might very well have a profound disrespect for time as we know it.

You ask this guy any time during the day, "What time is it?" He can't come within an hour and a half of telling you. I guess this is the reason, because when we think of time, we think of it in terms of seconds, minutes, hours and days.

I think he has a different concept of time. Oh, I guess he uses external techniques. Most of us when we are overwhelmed with detail write things down,

don't we? Psychologists say that we relinquish some of the responsibility when we put it down. Take it out of here, put it down, so we can see it. It loses a lot of its bigness, and I think people use spare time to get a lot of things done.

I was on the plane from Chicago to San Francisco with Mr. Herbert Hoover. He said, "Mr. Gove, you talk about the time thing. Last year I wrote a book in my spare time. Did you know that 15 minutes a day equals 11 full days a year? Did you know that 30 minutes a day means 22 full days a year? All I do is use the time waiting for dinner, waiting in the airports. Just waiting. I wrote a book."

I'm sure they all do this, but I am more convinced that when most of us think of time, we think of a clock, of a calendar, and we play games called: "Beat the Clock." We figure we get up a little earlier, stay up later, and we have got it beat. There is no way in the world you can beat this. It goes relentlessly on and on. I am convinced, and this is the idea I want to share with you this morning, one of four ideas—I am convinced when the real doers think of time, they think of it as having more than one dimension. They think of time as having many dimensions.

Here is the key. They know they can't do anything about the clock. It will beat them to death, but they can do something about the dimensions of time.

Here is "habit" as the first one. Look, when I relegate to habit those irritating, nonproductive details that bug me, that take so much of my time—when I delegate or relegate them to habit, then I free myself for conscious, creative effort, and when I do this, habit you see, becomes a dimension of time.

Here is the key. You can't do a thing about the clock. You can control habit.

I think it was Albert E. Gray of Prudential who said: "People who get things done have formed the habit of doing the things other people don't like to do."

This almost sounds oversimplified to the point of saying good baseball players get more base hits, catch more balls, score more runs, bat more runs than do bad baseball players.

There is more to it than this. Mr. Gray followed it up by saying: "And generally

the people who get all these things done, don't like to do these things any more than anyone else at first, but they do them, and here is the key. They do them because they found the results they get more than make up for the effort they put forth."

Now if you check this out with the psychiatrist, he would probably put it this way. He would probably say when we start to do anything—attend a safety meeting, take a cake, join Alcoholics Anonymous, take piano lessons, improve our golf game, any human activity, when we start to do anything we are either motivated by pleasing methods or pleasing results.

Now if we're motivated by pleasing methods, we do the parts of the job that are fun, pleasant, easy, the things we like to do—which probably accounts for the fact that 85 per cent of the people who take piano lessons learn to play one song, "Peg O' My Heart." The people on the other hand, who are motivated by pleasing results, do the parts of the job that are fun, pleasant, easy, and then they form the habit of doing some of the things they don't like to do because they know this is the answer.

When I first heard this, I thought it was the most exciting thing that I, as a salesman and as a father and as a husband, had ever heard, because I have always been a little worried about myself.

I don't go for this confessional-on-the-platform-introspection bit, but in the first place I hate to get up in the morning. I'm the world's worst. I put a call in. I have a wrist alarm. I give the maid on the floor at the hotel permission to break the door down if I don't get up in the morning. I could sleep in a bowling alley, you know.

Well, this has always worried me, and I hate detail work, and this has worried me. Actually, I'd rather call on someone I know than I would to establish a new relationship. Well, you know, I figured I might have a thyroid deficiency, or I might be a slob, you know.

Then all of a sudden someone like Dr. Gray, that I can trust, comes along and says, "Man, you are perfectly normal. Nobody likes to get up in the morning. In fact, if you jump out of bed with a smile and you say, Boy, what a day! Oh, I can't

want to get on that job! Those wonderful people! you are nuts."

You know the problem, not me; but it was most encouraging after all these years of reading all the books on motivation and taking all the management development courses. Boy, what a relief to find out that people who get things done don't seem to have any more education or inspiration or drive or ambition or adrenalin in their glands than anyone else. They just form the habit of doing the things other people don't like to do.

I have a neighbor who hates his boss. He said, "My boss is the kind of a guy who would vote a town dry and then move."

I said, "You're making a liar out of me. I tell people one of the prime requisites for happiness is liking one's job. You hate your job, but you are real big."

"Oh," he said, "This doesn't have much to do with . . . You see, I don't intend to spend the rest of my life working for this guy. But while I'm working for him, I can't afford to develop any lousy habits, because when I take my record to some guy I want to work for, I want to show him my record, and I want to be able to say, 'Look, this is what I did. This is my record. This is the kind of a job I did for a guy I didn't even like, and now think what I can do for you, Dad, if I started to like you just a little bit.'"

You know, at Braniff, we used to tell the hostess: "The reason you want to do a good job, Mary, is because you are about the only contact we have with the customer. If you are nice to them, they will come back, but if you are inconsiderate and impatient and surly, there is a pretty good chance they won't, because we get a high percentage of first riders. It is important we keep them. If you do a good job," it was implied, "we will prosper."

So we approach it differently altogether in this area. We say: "Look, Mary, don't do a good job for what doing a good job will do for Braniff. Do a good job for what a good job will do for you later. You're only going to be with us a year and a half. We know what the figures are. That is about as long as you gals stay. While you are with us, some of the habits you develop you will carry over with you into the more important job of being a

mother and a wife and a citizen. So don't be polite, patient and considerate of our passengers, just because we'll do better. We will do better, but be patient and considerate for what doing it his way with another person does for you."

I get a feeling there is a lot of this in safety. You don't do it because it makes it better for General Motors. You do it because this is the way one guy should react to another guy. You don't have to read the books to know this.

I think it is this way with safety. You don't do it because the books say it. You do it, and we do a lot of things in manager-man relationships that the book doesn't say ought to be done.

People don't write a thesis about this. You can't dig it. It is being pool-room smart. It is acting this way toward him because that is the way you are supposed to act. Habit, and the habit of.

I must tell you about this friend of mine out on the Coast. I wish he were here to tell this story. You would all walk out sideways so you wouldn't fly.

His name is Carl Bock. He is a Jewish refugee. One leg is shorter than the other. He has a thick lip and a heavy accent.

He has had a tragic background of a brother and a sister made into soap in the concentration camp. He came to this country as a butcher by trade. He worked one year house to house for the Fuller Brush Co. He led the West Coast despite the fact he only knew fourteen words of English. What a guy!

He had been here a year, and a life insurance man—I think there is a story here for all of us as parents, as managers and as men—wrote him a \$20,000 endowment policy.

After the salesman had the sale worked up, Carl said, "How much did you make selling me this?"

The salesman told him. Carl said, "Take me to your boss."

That was 11 years ago. Carl Bock wrote ten and a half million dollars worth of paid-for life insurance, and I want to tell you when we get together as salesmen, this is as good as you can get.

You could take all the 3 million dollar writers in Chicago and put them in that

phone booth out there and still get in yourself.

In our business this is the 4-minute mile. This is not only climbing Mt. Everest, it is taking the family up there for a picnic. This is drinking goat's milk. This is 63 home runs a year.

How did he do it? We figured if we could find out what makes him tick, we'd have a story to tell teachers and parents and managers.

So they brought him in. The Ph.D's gave him a battery of tests. They put wires on his arms and gave him the shock treatment. What did they find out? Did they find out he was smarter than we are? He has a 92 I.Q.

He works harder than we do? No, he doesn't. He spends more time in front of people who can buy than we do. He has a wonderful technique. He talks with prospects. He pats them on the cheek. He says, "Buddy, if you look as good on the inside as you look on the outside, I think I can get you a little more life insurance."

He says, "I wouldn't guarantee it, but if we'll work together, we will see what we can do, Buddy."

You say he must have a dynamic sales personality. Here is a man who must be supersensitive to people's needs and wants. Actually, he irritates as many people as he sells. He wouldn't recommend you to sell this way.

How does he do it? His boss says this is not oversimplified. He says the average life insurance man gets up in the morning. He dresses. He says, "I should call some people. I should check with my bird dogs. I should send out some longhand direct mail letters, but it's hot. I'm not in the mood. This is not my up-cycle today."

Carl Bock gets up in the morning, dresses, shaves, calls five people, checks five bird dogs, sends out five direct mail letters.

Carl Bock has formed the habit, so with Carl Bock habit is his executive assistant. Habit takes care of the things that we should do as regularly and as automatically. You shouldn't have to think about safety. You should feel about this the way you feel about brushing your teeth in the morning. You shouldn't go to work without this

any more than you go to work without your pants on.

Carl Bock has formed the habit, so habit becomes a dimension of time. You can't do anything about the clock. You can control habit.

Here is another one—energy. You talk about this all the time in the plant. Work simplification. Time and motion, waste energy, waste money. We never talk about it as people.

Mertness. Just staying awake. Oh, what a story there is for you. Just staying alive, staying awake, keeping tuned in, keeping your antenna. It is more than an attitude problem. It is a dimension of time.

I live in Coral Gables. We have a suburban high school. We compete in all sports with Miami senior high tough kinds: Miami-Jackson, Miami-Edison. We have been state champions three out of the last five years. We have got a tough little guy coaching who brings out the best in the kids. Those who quit, they hate him.

Those who stay call him when they come home at Christmastime before they call their mother. He asked for the best. He brought out the best. It is tremendous.

We're talking about this time thing. Maybe you will get a kick out of this story.

He said, "You know, the school board only allows us 20 days in the spring. Everyone gets it. There are 20 days in the spring for spring practice. So I get my kids together," and I say, "How would you like 40 days?" They say, "Oh, you are kidding, coach."

"No, no. I will show you how we can get 40 days. Here is how, if you listen, if you stay awake, if you try to get it the first time, if we don't have to repeat. When that whistle blows, stop the play. If you are in midair, stop."

"If you listen, I will promise you to

double your effectiveness; that is just like having 40 days."

Staying awake, being alert. Here is the idea this morning.

Too many of us, when we think of time, think of seconds, minutes, hours.

You probably imagine this thing I'm holding is a 3-minute egg timer for timing eggs. It is to you and me, but to a good friend of mine this means more than a 3-minute egg timer.

He calls on doctors for the Lincoln Pharmaceutical Co. He details doctors. He has to compete with Eli Lilly, Upjohn, and those fellows for time.

He walks in to the doctor. He says, "We're very good. We have drugs that we don't even have a disease for yet. Next year we're coming out with a new wonder drug. You have to be in perfect health to take it."

"I call on doctors, and they are busy. They go on house calls and then to the office. I only get in there for a few minutes a day. I say: 'This is a 3-minute egg timer. I took all the things I want to tell you about, broke them down into a 3-minute sales talk, and when the sand gets to the bottom, I will quit talking and like the Arab, steal quietly away.'"

"The doctors say, 'For heaven's sake, Charlie, you can't give your talk in three minutes.'"

"I can, providing I do all the talking."

"If the doctor interrupts, I turn it right back again. If the phone rings, I turn it back. He ain't going to be treating his patients on my time."

We are going to be talking about the dimensions of time, and I can almost hear someone say, "Why doesn't he say safety? This should be number one." It is.

I didn't think it was until I got here, but what a dimension of time this is.

This was the springboard. In fact, one of the boys said, "If a good looking gal comes to the door and says, 'Why, young man, come right in, don't go in.'"

So I think over the years I have made a lot of mistakes, as is apparent, but I think that working with my boy, Billy, working with Nancy and Harry, I have tried to be careful. If there was a cause for criticism, I tried to make sure that I criticized the thing they did and not them.

And this is first page, I know, in every human relations manual, but we get so preoccupied with the job to be done it is very easy to criticize the guy. There is a big difference between refusal and rejection.

I say to my Billy, "There is nothing in the world that you could do, Billy, that would make mummy and me love you less. You could get in a marijuana raid and you are only eleven years old, and it would be front page in every paper in America, and we wouldn't love you less. You would still be our boy, but boy, we are going to call you on things we don't like."

We're being bombarded on all sides by books, magazine articles, lectures on how to be better. Isn't there a danger of taking this thing too seriously?

I think so. The most unattractive managers I ever had were the guys that were growth-oriented, but real pompous and officious. They don't get through to the men.

We used to talk in Minnesota Mining about personnel, and growth in this area was more a matter of subtraction than addition. When we cut out, when we eliminate greed, avarice, jealousy, hate, we are closer to the whole person.

Bob Tosky is a pro at our country club in South Miami, and he talks about the golf swing as more a matter of subtraction.

He said, "Too many times we go to the teacher and he has us putting our hands under and holding the club like you do a bird. I want to be able to take that club away from you when you start back, start back with the hips and when you come down, come down here in one piece. You know what they do, they forget to tell you to hit it."

Tosky says, "Take the club back and if you move yourself into position, the rest will take care of itself."

I think there is a lesson here. He said we don't make a bad shot because we lift up our heads, he says, "We lift up our heads because we make a bad shot."

Subtraction. We cut out. We talk about our organization cutting out.

We said yesterday that too many of us—and I'm included and talking to myself—too many of us, when we think of time, think of minutes, seconds, hours, days, this is the time and so forth. We play games about beat the clock. I suggested that maybe we think instead of the clock, which goes relentlessly on, we think of time as a habit.

We will negate that habit and free ourselves.

I've been talking about energy. We have been talking about energy in the plant for years, wasted energy, wasted time, a real correlation between the two. Yes, how I feel when I go on the job pretty well determines how I feel about doing the job and ultimately how I do the job and in my particular case as a salesman, how long it takes me to get through to someone.

And when I say it is no longer a problem of personality or function, it is a time problem, for it calls for a time concept.

I said alertness to stay awake, a dimension of time. Stay awake. Fewer accidents, more output, the meaning of time.

Here is the fourth one. I said I would save this for today—attitude. I don't have to tell you about this. All around the corridors yesterday and today we have talked about these safety attitudes. Some people have it and some people don't.

They talk about some of the old timers. "You are just a kid. I've been on this job for 35 years."

They say the younger people coming up into the organization are generally easier to get to be safety oriented, to have safety attitudes. I could only talk about the attitude in my business. I hope the adapting will be up to you.

What kind of an attitude are we talking about that gets through to people? What is the grown-up attitude that we talk about every time we get together?

Well, J. F. Croft of Minnesota Mining used to sum it up this way. We would have a three-day seminar and they would fill us up with training, motivation and con-

trol. And you walked out figuring you were a salesman. You didn't do anything, you were going out with stuff loaded up to here and you would think, where in the world were you going to use all this stuff.

But we hope it stays filled up to there so that it will come through for you in the clunch. That is why we give so much.

I used to say, you know, we can forget everything we know about selling, we can forget everything we know about supervision, we can forget everything about being a good parent and father, if we will always remember to go into every relationship with the attitude, "How can I help this other person solve a problem?"

How can I help this other person grow, if he wants to grow?

At the communication conference, we talked about this for a week and I think there's something here for us in all our relationships. They said, "We goof up in communications. We fail to get through to people. We have communications breakdowns, because too many times, we get so concerned with the answer; too concerned with the answer and not concerned with the problem itself."

In fact, on the table they had a big card that said, "To hell with the answer; what is the problem?"

We talked about this.

Now in the seller-buyer relationship, we say it this way: "I am a salesman, I am trying to get through to him." Now in a persuasive situation like this, you are a supervisor and try to get through to the man.

In the situation like this, there are two problems involved: Mine—how to get the order. His—how to get a product, a service that will do the job for him. His is the key, I think.

My success in solving my problem is in direct proportion to the number of his problems I help him solve.

Here is what we say to our salesmen. When I, as a salesman emphasize my problem, I am acting like a peddler, and they are a dime a dozen. But when I emphasize his problem, mine takes care of itself. I am acting more like a pro.

We had a guy who went to a meeting in the morning before breakfast and this guy worked over his men. They called him the Colonel. He was the president of his company. You wouldn't believe it. He was answer-oriented.

He worked these poor guys over at 8 o'clock in the morning. They called him the Colonel. I asked one of the fellows, "What is he? Was he in World War I?"

He said, "He started it."

So the Colonel said, "We are going to have a new contest. Those that get their quota will get to stay on the payroll."

You know, murder! And then he wound up and he held up a product and said, "I have got 105,000 of these in the warehouse. What will I do with them?"

I just wonder how they can survive with this kind of leadership? How can they get by with this primitive leadership pushing people around?

Then at 11 o'clock they had another meeting on top of this meeting and the general sales manager, who knew what the score was said, "We have to get an increase. You heard the boss. But let's talk about how we are going to get it. Let's forget the answer and talk about maybe taking a look at the quality of our calls. Eighty per cent of our business is coming from about twenty-five per cent of our accounts. So let's do some forecasting."

"Let's really look this over."

I have a friend of mine who is really shy. When we were toastmasters together, he used to say he couldn't lead a group together in silent prayer. He said he didn't play football because every time he saw the guys in a huddle, he thought they were talking about him.

I think there is a story here.

He came to me and said, "I have a real problem." He is an auditor and he was going through this orthodontist business and having a new baby in the house and he said, "I understand some guys pick up some extra dough on the outside. Any ideas?"

I said, "What do you think of mutual funds?"

"To sell them or to buy them?"

"No, what do you think of them?"

"Oh, I think it is a good idea. An insurance program. It is good to gamble."

I said, "Well, Aetna is looking for some qualified people. Call 'em over the weekend."

He said, "Oh, Bill, I couldn't sell."

I said, "Let's forget the word sell. Could you solve problems? You're an auditor. Could you go to people and sit down and talk with them and show them how to balance their finances? If they need insurance could you tell them they need it? And if they could take a little off the top for themselves, could you tell them? Could you help them solve problems? Never mind selling."

Now of course, the perfect ending to a sales story is that this man is now making \$2,000 a month and his wife has a new mink coat. But, I don't believe it is true. However, it looks like he's going to have to quit his job and go at it full-time.

He has a wonderful story. He says, "All I want to do is help you solve your problems. If you have got one, you will want to know it and by the same token, if you don't have one, you will want to know the problem-solver."

It is a different idea from going into a selling situation as we salesmen know it, and boy, we have been brutal in this area, manipulating, technique stuff, charged personality. The idea of his going into a selling situation as a salesman was totally unsuitable, but this approach worked for him.

Teachers know this. They get so jazzed up with PTA and other problems. The only job is to help my Billy be a better boy.

Doctors forget it. I go on a trip, three days without sleep. Sometimes my eyes are bugging out. I think I have a rare oriental disease. I call a house doctor in a motel and I go right down and I am lucky, the waiting room is empty.

Does he follow me in and say, "Mr. Gove, I am going to help you solve a problem?" Does he say, "See those diplomas on the wall? They got me ready for you." Does he imply this?

No, I have to sit down with the nurse and she has a questionnaire. I am dying, but she has got to ask questions. "What

income bracket are you in? Any insanity in your family?"

All I want him to say is, "I am going to help you solve a problem." This is how we get through to people. You can forget everything else you know.

We had people in our plant at Minnesota Mining, and you wouldn't believe it, some of the snuff-chewing Swedes are rough. So, we have the University of Chicago Survey. We wanted to find out how come this guy is so rough? None of his employees ever had any grievances.

You would go to somebody and say, "Do you work for Paulson?"

"Do I work for him? Am I working for that son-of-a—?"

"How long have you been working for him?"

"Sixteen years. If you want to know anything about him, just ask me."

"Sixteen years? Why don't you ask for a transfer if you don't like him?"

I talked to a lot of guys and asked a lot of questions, and finally I find out that this guy is real tough, he eats his young, but he tells the truth. He is impartial and he works like hell himself.

It doesn't say this in management books. This ought to be page one, because this is what we talk about when we talk about our bosses, when we get together over a cup of coffee. We don't say, "He is not a very good scientific manager. He doesn't delegate authority."

We say, "He lies. He is a liar and you can't trust him." That is what we say.

So we say to this guy, "You don't want to move?"

He says, "Well, no, at least you know where you stand here."

But here is something you don't tell him. Paulson has had more foremen come out of his department than any other guy in the plant and the people who work there know it. They know this is the way this guy gets his big kick out of life. He won't make a big thing out of it because he has absolutely never been known to smile. They say he doesn't take a vacation like anybody else, he goes to Camp Lejeune in North Carolina for his vacations and teaches the Marines how to fight dirty.

But something is happening here. He is a problem-solver. He gives them a fight, but don't talk about any of his people. Don't talk about them to him or you are in real trouble.

Is there a management story here? I think so.

I came into Cincinnati the other morning about 4 o'clock in the morning and the airlines had lost my luggage. I guess when you travel as much as I, this is the worst thing that can happen to you. I went up to the senior night agent's desk and I buzzed the buzzer and this guy came out. He looked like he was in charge of Oven No. 3 at Buchenwald.

I said, "Did anybody find a piece of luggage with the initials BG on it?"

He said, "What's the matter, did you lose it?"

I said, "Not really, but you know, this is the way I open every conversation at this time of the morning."

"Where's your check?"

I said, "I have got a problem. The guy in Louisville who pulled my ticket, pulled the check for my luggage."

I thought: he was going to say, "Oh, you lost your check when you lost your luggage." Instead of that he said, (cross my heart and hope to die!), "What was the number on the check?"

I said, "I usually have it tattooed on my nose."

We tell our people that when this happens, never mind the vital statistics. Those can wait. Tell them you are going to help them. Tell them you are not even going to have your coffee until you help them get the luggage. Then write it down. Never mind who is to blame. Find the damn luggage first.

I think one of the squawks I had, working for a bag company, is in this problem-solving. I always knew what their problem was. This was the first company I worked for. I always knew their problems. Did you ever feel this way? I always knew what their goals and what their dreams and what their objectives were. They made no secret of this. We used to get it in a bulletin once a week and at the annual sales meeting it would be strung across the room.

"Let's get eighty-two in '41," and all that jazz and all the slogans.

Then the president would get up and tell us just exactly what was expected of us. We had to know what they were looking for. But you know, I always had the feeling that I knew what their problem was but they weren't taking the time to find out what mine was. I felt like going to them and saying, "Look, I will swap you. I will do this and you do this, and man, together we will make music. I will go where you want me to go when you want me to go."

All I want to say to them is, "I will break my neck to get you a bigger share of the market. I will go as far as I can go. I will tell you the truth when you ask me something. I will knock myself out because I know what your goals and your dreams are. But here is what I want you to do. I want you to tell me the truth when I ask you. I don't want to have to go to one of my suppliers and have them tell me about a new price increase or a policy change. You tell me. I can be trusted."

As I say, we have made a lot of mistakes as parents. We have two teen-age daughters and we think swapping is the only thing that has worked in our house. We used to say to Nancy, "Honey, this is the first time you have ever been a teen-ager, but don't forget, this is the first time we have ever been parents of one. We can have a lot of fun for a time or it will be murder. What happened to the neighbor's kid? Fifteen years old and love went out the window. The parents and kid are bickering all the time. Money, we have a lot of love and fun and laughs. We will swap. Here is a list of things we will do. We will be flexible. Here is a list of things we want you to do. We will tell you. And if we goof up, you tell us."

I remember one thing Minnesota Mining did in all their training. We used to say, "We have 600 salesmen and we have 600 training courses. Every training course has a man's own initials on it." We try to give the guy what he needs. Could you imagine a blanket training course now?

Here is a real wonderful extrovert. He loves people and he gets the same manual everybody else gets and opens it up to page one and it says, "Be friendly."

He says, "If I were any more friendly, they'd have me on a morals charge." So the whole program becomes suspect.

I had a chance to check this concept out with Bishop Sheen. I was on a program in New York the same day that he was doing a Catholic Charities meeting in another part of the hotel. I raced from my meeting to hear the last 20 minutes of his talk, and, gentlemen, if you think he is great on TV, you ought to see him in person. This love and compassion and warmth just project like nobody's business.

And after the meeting we stood in line and I shook hands with him and I asked for a couple minutes of his time. He was very tired but he said, "Sit down and we will talk for a minute."

I told him right off the bat I was an Episcopalian and he didn't try to convert me, and I thought I would be fair with him and I wouldn't try to convert him either. I told him for the first time in my life, as a salesman and as a salesmanager with personnel responsibilities, being a little responsible to help people grow, if they want to, and I said, "For the first time in my life in this business I am holding my head a little higher and walking a little straighter because I am no longer being the seller of our relationship as a personnel-oriented popularity contest where you get people to do things for you, or to buy things from you just because they like you."

"I see people going into problem-solving relationships, each with a responsibility and each one aware of the responsibility that he has to make the relationship grow to make the relationship stay fluid."

"I feel better about the problem-solving attitude than I have felt about my concept since I have been in this thing, working with other people. Does it have the intellectual and the psychological and the

spiritual base that any idea needs to survive?"

He said, "Well, I am not much of a salesman."

I started to say, "No, just one of the best three or four in the world, that is all."

He said, "But I guess what happens in the relationship when we go in as a problem-solver, if you are going to be a problem-solver, you have to give, and we are all at our best when we give."

"So what happens? When you give, you feel better. When you feel better, your attitude improves and when your attitude improves, you get through to people. And when you get through to people, they do some of the things you ask them to do, and when you do these things back to the first party, you feel better."

Our minister had a fund-raising drive and it went over the top. At the opening vestry meeting, a very substantial gift was reported by a very generous parishioner. When the gift was voted on, someone in the vestry fund said, "No wonder this guy gives; he has got it."

And our minister said, "I wonder if he gives because he has got it, or if he has got it because he gives?"

What have we said so far? Time, habit—we can do something about the dimensions. Habit, energy, alertness, attitude. Attitude, going into a relationship, read all the books you want, I am convinced going into a relationship should be with the idea, whom can I help? How can I help this man grow if he wants to grow? That is the only foolproof managerial supervisory technique.

I want to talk about some of the things we talk about as salesmen tomorrow. But specific ideas. You will have some fun with it, I think. What we think about any relationships where we must persuade.

SESSION 3 — THE 'SWAT' CONCEPT

I want to say to Bill McLean of U. S. Steel, they gave me a question for you to answer that is a beaut. But I want to make sure I have got it in this frame of reference.

"Dear Bill, I think a good supervisor ought to get tough once in a while, pound the table, give his people the reason why it is better to do what he asks them to do now. I know guys that can do this and get away with it. Me, I raise my voice and the guy wants to try a judo hold on me."

We used to talk a lot about this. How is it some guys really move in there when the shoes must get out of the factory and things must be done, and get it done; and other guys, I don't know, there is something about them, they move in and they compound the felony when they ought to be tough.

I used to work around the country with salesmen and I think there is a partial answer to it, three of them. I would go into a town and I would work with a guy and I would try to pick his brains and find out how he was doing it. I would actually make calls with him, then take the things I found out from him back to St. Paul and build a story for all the people. There were no secrets. This is how some of the research and development out in the field started. It was good stuff. I would actually field work with the salesmen and listen to what they said.

Then one day my boss said, "I want you to go to New Orleans and work with Van Allen."

We had heard about this guy. He was a real character. They used to call him "Stuttering Van." He never sent in any reports. The back of his car was a mess. He didn't use his point of sales material. He was a slob.

I said, "Why don't you fire him?"

He said, "Hell, he's our best man. Let's soften him up a little bit, give him a \$50 a month raise."

I went to New Orleans and he picked me up at the airport and sure enough, he gave me the silent treatment. He didn't want any part of old Bill.

I took it as long as I could and I finally said, "I'm here to pick your brains, to see how you do it, and maybe pass along a few ideas that will help you. And incidentally, you don't have to act like this, because Chuck gave me permission to give you another fifty dollar raise. Don't say anything to the rest of the fellows."

He said, "Don't worry, I'm just as ashamed of it as you are."

And then we made a call. In those days we were selling Scotch Tape against string for packaging, you know. Even though most of you aren't in selling, you will understand the problem. Scotch Tape costs about a buck and a quarter and all the string you could carry away was about two bits. So we had to sell speed, convenience, and versatility.

So I walked in with Van and he made the pitch and as likely as not, the retailer would say, "Well, that looks pretty good, but I think I will stick with string."

And Van would say, "What's the matter? You stupid?"

He said, "When your wife washes her clothes, does she take them down to the river and beat the hell out of 'em? Maybe you had better get on the stick before it is too late."

I would edge to the door, you know. You won't believe this, this interview and others like it actually reached the negotiation stage before any blood was spilled. And then the retailer would make a fatal mistake. He would say, "You seem to be pretty sold on this and I guess I could swing for a trial order. How much do you think I need?"

Van would always look at him and say, "Don't you worry about this, Paul. This is the order form right here. You sign it and I will fill in the top." Then he said, "I want you to press hard because there are four copies."

Here is my reason for telling the story. I didn't know it then, but I do know it now, and I wouldn't go within 1,000 miles of New Orleans without visiting Van. He is one of my favorite people.

Van was the kind of a guy who would walk on his hands and knees over broken

glass at 3 o'clock in the morning to replace one of the little 15-cent cover plates on the dispensers. He had service built-in like patch pockets on a suit of clothes. It always seemed to me he was going one step further. "I will service that for you, Ruddy Boy, but I want you to serve old Van."

Over the years, here was a guy who, if the retailers were busy, he would probably go clean the window in the store. Here was a guy who, if they didn't wait on him when he first went in, if they were busy, he would start waiting on customers. Over the years he developed almost the license to get tough.

So, I know guys who do this and get away with it. I raise my voice, and—I don't know—this is such a delicate area. I think the most unattractive supervisors and bosses I ever knew in my life were guys you couldn't figure out; you know. They would be going along real sweet and gentle and nice with you. Then they would get hell from the home office and all of a sudden it would be murder.

There would be times I'd rather have the first boss I ever had, Harry Spore. When I go back to Boston, after I call my mother, I call him. He was tough, but he was tough all the time. We knew exactly where we stood. We knew if we lied to him he would throw us out the window. Everybody knew it.

Sure, we used to talk about him over coffee, like I said the other day. If you are going to be tough, be tough all the time; if you are going to be nice—I don't know. That is a delicate area.

A guy like Van would say it like this, "If you are going to pound a table, make sure you have got a solid table. If you are going to raise hell with your kids, make sure that, up to then, you have done your part."

Another note:

"Dear Bill, I have been a supervisor for three years. I get along. But how can one tell whether he is a good leader or not?"

We used to talk about this a lot in leadership. I know you have gone through this. It is kind of fun. How can you tell whether you are a good leader or not?

Our management used to talk about three

kinds of leadership. There are probably 303, but this should be a linear rather than a line consideration.

Kinds of leaders, autocratic and democratic and free rein. As I said, it should be linear in the sense that there are so many degrees. One guy is a little bit autocratic and he is a little democratic and he has probably got free rein. We used to say nobody is all autocratic, nobody is all democratic, nobody is all free rein, and it is a good thing, because the key word here, I think, is dependency.

You supervise according to a person's needs. Obviously, when you tell a man to put the helmet on and keep the gloves on, this is autocratic. He doesn't have to meet with the other guys and say, "Now the question is whether we should wear the goggles or not." You wear them because it not only protects you, it protects others as well. This is autocratic.

When we bring our new people in and give them a product to sell, this is autocratic. When we give them our price sheet, we say, "This we want you to know." Like MacFarland said, "We want you to be creative, but not with the multiplication table. Nine times two is eighteen, let it be. If you are going to fool around, not with the figures." When you figure discounts, this is autocratic. Dependency.

With new people just coming into the organization, we of necessity are autocratic. I mean, that the word comes from us, and this is it, no argument, no discussion.

Democratic, on the other hand, is supposed to give—that we make a premise, that we discuss it and, of course, Kennedy must make the final decision after we discuss it. So there is a little autocracy in democracy, isn't there?

Free rein—you don't look over the shoulders of your pure scientist. You don't dwell on research and these people we think don't need supervision.

So the answer to the question on leadership is, I think the key here is dependency. How much leadership do they need? When a first starts in an organization of course he needs it. So of necessity it is autocratic. And then we find as a man grows on the job, his dependency decreases and the need for supervision decreases.

As I say, what kind of a leader am I? I hope I am a little bit of all three of them. I sure as hell don't want to be autocratic, but at times I hope I have got the guts to say, "This is the way it has got to be, Charlie, and it has got to be that way right now." I hope I am not completely democratic. I hope I am not completely free rein. Again, that is the question, I think, the levels or degrees of leadership that we talk about.

I would like to say you could talk about this all day. There are even cute little tests we can pass around if we had the time, where you answer certain questions and it tells you what kind of a leader you are.

Just a fast review. We talked about habit, energy, alertness.

And I said attitude. When we are in any kind of a relationship there are two problems involved. There is my problem and that relates to selling. My problem as a salesman is how to get the order. His problem as a buyer is how to get something done for him. Now it seems to me that my success, the answer to my problem, is in direct relation to the answer to his problem, and when I emphasize mine I am a peddler. When I emphasize his, I am a pro. We talk about this, I guess, in all relationships.

Now I think we can have some fun. And then there is consideration, time consideration.

Communication! I have to tell you, if I get through to a guy, communication must be mentioned with time. We could talk for days on creating a favorable climate, for getting the things done in communication. We could talk about being a good listener. Dr. Nichols at Minnesota has a 3-day clinic on developing the facilities for listening. The good Lord gave us two ears but only one mouth. Maybe we shouldn't try to outsmart nature.

We could talk about cutting out details, getting to the core of the problem, identifying it, clarifying it, using alternatives, or compromise—bit things. But you know, these are abstracts. Getting at it personally, the reason why it is better to do something now than to delay it, why it is better for everyone.

So we have five little sentences that we

remember to use in all relationships where it took persuasion. I know it is bad teaching to put them all down, but I think you may have some fun and I think you may remember them.

"I have an idea."

"What do you think?"

Now you are selling a guy on safety.

"Don't worry, I will take care of the details."

"Others did this. And here is what they told us"—and

"I suggest—"

In good advertising, particularly industrial advertising copy, you will see those five ideas running through them. I don't mean we used these words, we can think of other words easier than these.

You know, they say there is a difference between an idea and a gimmick. Bruce Barton said the difference is that a gimmick attracts attention, but an idea always promises somebody something.

We use these five little sentences in all persuasion in every relationship. They keep us alert to it and they help us remember. It is a kind of a birdie on the shoulder thing, you know. Notice one thing about them, each one of them commits us to do something.

In selling if I go to a guy and say, "I have an idea," I had better have one. It commits me to have ideas.

What commits us to listen? You know you can talk all night about people listening, but if I get in the habit of saying, "What do you think? How do you feel about this?" I would like to know your thinking on this, then I am committed to listen.

Over-simplified? Maybe. We use it, we like it.

"Don't worry, I will take care of the details." Aren't these wonderful words? You go on a vacation and the babysitter is there and you think of the 10 or 15 things that have to be done and she says, "Stop worrying. Have a wonderful time. Forget it, we are going to forget you, and we will take care of everything."

You leave for the Safety Congress. You have 150 details and your secretary says, "Mr. Smith, will you forget it? I will handle everything for you."

We must use all problem solving analogies and case histories: "Here is what happened in Fort Wayne, Indiana, at the International Harvester Plant. They did this, and out of this safety experiment, here is what they told us, and then based on what they told us, I would like to suggest that we do this." Five sentences. Let's go through them.

"I have an idea." Like I say with my company, I have some ideas I would like to share with you. This commits us.

My daughter married an ex-football player, weighs about 230 pounds, has to clench his fist to keep from walking on his fingers.

A lovely boy, I have got a new granddaughter, a little baby about a year old.

My son-in-law went into the printing business and he had no selling experience and down in Miami printers were awfully tough. He didn't know how to sell. He would go into a customer and the customer would say, "How much is it?"

He would say, "Don't louse me up. Do you want to buy this printing?"

So finally we built him a little sales talk. Now he said, "My name is Jim Winslow. I know you are buying from someone else and I know you are happy because I have seen the work they do. But from time to time I would like to come in and give you some ideas. Ideas I pick up outside from trade journals or from competitors and other salesmen. I want you to try these ideas. If they work, you will sell more of everything and if you sell more of everything and if you use more printing, all I would like is a crack at the printing. Right now I don't deserve any of your business. Give me a chance to earn some of it."

And in safety, here are some ideas we have tried out. Here is what they do. This persuasion.

"I would like to have your opinion." A GE dealer in Phoenix sells refrigerators and appliances. People come in and shop him. They take the model numbers off the top of his stove and then go to a discount house and try to get the clergyman's discount.

Before they leave his store he says to them, "Thanks for coming in here. I know you are going to shop around, but before

you make your final buy, come back and see me again. Here is why. You can buy this refrigerator any place in town, but if you buy it some place else, you don't get me with it. But go ahead and shop around. And to show you my appreciation for your coming in here first, I have a little gift for you." And he goes in the back room to a freezer and gets a half a gallon of ice cream and says, "I want you to have this." Now how much shopping around are you going to do with a half a gallon of ice cream? What do you think?

You know, some people would have you believe that if you give a guy a big smile and come on big with the personality bit, you have it made. Nothing could be further from the truth. About the highest compliment that we can pay another person is to listen with understanding, to ask for his opinion and then listen. Probably that is the highest compliment.

We used to use this if someone said, "I will think it over." We would always say, "All right, if you want to think it over, but the thought occurred to me while you are thinking it over, you might have some questions come up and I won't be here. So, do you have any objection if we think it over together now while I am here?"

We have been talking about time and I am not going to go into that any further.

"What do you think?" Another thing, the toughest job I ever had to do was the thing they called delayed reaction, you know, because I am a blabbermouth. I am a compulsive talker, as you can well see.

So the boss always used to say, "Bill, don't feel that compulsion to talk when somebody says something. Wait a little while." Here is a good tip. He said, "Ask another question. That will give you time to get your poise, give you a chance to answer the first one."

When someone says to you, if you are trying to sell a gross of something, "Can I buy it in half a gross?" Don't say, "Yes, you sure can." Then he can still say, "I will think it over." Ask another question. You are trying to sell a gross. You are asked, "Can I buy it in half a gross?"

Say, "Do you want it in half a gross?"

He says, "Yes."

"Well, you've got it in half a gross."

Communication . . . What wonderful words, "Don't worry, I will take care of the details," are. You know life insurance people do that, and they are the real pros.

They said, "Mr. Gove, if you get hit by a truck, Mama gets this. If you get hit by a buffalo, she gets this. If there is a buffalo driving the car at the time you are hit, double indemnity. Now if you outsmart us and live to be 65, you have got this, and all you have to do is deposit this amount each month. There is nothing to it. We take care of all the details."

Direct mail people do this. They say, "Tear off the top of your neighborhood grocer and send the bum in now. Don't delay, the contest closes at midnight. There is a bonus for your prompt decision. All you have got to do is put a little X in the square where it says 'bill me.' Send no postage. Send no money. We take care of all the details. Don't worry."

Wonderful words of communication.

Now I don't know what the psychological significance of this quote, "Don't worry, I will take care of the details," is, but I know how effective the use of these words with the right spirit is.

Now in the time we have, let's see why it has been suggested this way. "Others did it, they told us—" Testimonials, cases, cases of problem-solving, as old as problem-solving. Here is the reason why this happened over here.

You do this all the time. You build from past experiences, you build safety records from past experience, past history. A doctor doesn't say, "We treated this guy for three and a half years for jaundice before we found out he was a Chinaman."

I will admit Aetna Life Insurance had a cute bit. They had a little book you can carry in a pocket and it has all the answers to life insurance in it. Somebody says, "I don't need life insurance." And you can look in this little book. One of them said, "You can't get to first base with me," and they had these answers categorized and the salesman said, "It isn't a question of whether I can get to first base with you. It is a

question of, when you are dead, can your wife get to first base with the butcher, the baker and the candlestickmaker?"

I suggest these are wonderful words. Now you see, we are communicating. These are some of the high points of communications broken down. "I suggest"—many times that is about all it takes in persuasion, all it takes based on the history of, "We found this out about it."

"I would like to suggest," then suggest something specific so he has to make his mind up on a specific consideration.

Will Foster of the Borden Company said one of the best milk salesmen they ever had in New York sold more milk by mistake than the others did on purpose. He had no teeth. He would go up to the housewife and say, "You had better buy Borden's milk. You wouldn't want your kids to look like this, would you?"

Van Allen, with all his stuttering, would pass them the pencil. Someone said, "Don't light pressure me with this pencil thing."

He said to them, "To hell with you, use your own pencil."

"I have an idea—what do you think—don't worry, I will take care of the details—others did it—here is what they found out—they told us." There again, communications as a dimension of time.

You can't do anything about the clock. You can control your verbal, your communication habits.

Habit, I am going to repeat, relegate to habit the irritating details so they won't take so much of your time. Free yourself for conscientious effort. Energy, waste one, waste the other. Alertness, staying alive; attitude, going into the relationship with the attitude how can I help this other person solve a problem if he needs me?

Communication—

I have a gimmick for you.

What do you think?

Don't worry, I will take care of the details.

Other, did this.

I suggest.

SESSION 4 — YOU ARE BETTER THAN YOU THINK YOU ARE

We were talking about something while we were up here and I am going to chat with you a minute. I had about 51 people come up and give me notes during the week and you know, over 40 of them carried this theme, "Well, you see, I try all these things, but with some people nothing works." Or, "What do you say to a guy when you want to sell him on the idea of safety but he says 'I have been doing this for 20 years, Charlie, don't come up here and bug me with this. If I want to wear the hard hat and goggles, I wear them.'"

Then it seems to me, Bob Butler said that this then becomes a supervisory problem. This is not a safety problem at all. What do you do when this guy is a half hour late every morning? What do you do when he starts making a pass at your secretary? You know, these things happen. This is a supervisory problem.

First, I would guess, it would seem to me, that if you are a safety man, you go to the guy's immediate boss. You don't go to him, do you? You go to his boss and say, "There are some of the things he has been doing. Let's watch it."

In school we say if the kids aren't doing the job, the teacher has got to share part of the blame. We have a teacher who says, "I never give A's." I told my wife we had better check her out. Maybe she is not getting an A for teaching either. So this is bothering her. I don't know what the answer is.

Here are some of the problems. Oh yes, one guy was kind of cute, he said, "Let me show you how this works for me. When I say I have an idea, the guy says, 'What do you want me to do now?'" When I say, "What do you think?" he says, "I think it is going to take a hell of a lot of time, or, 'I don't like it.' When I say 'Don't worry, I will take care of the details,' he says, 'Are you kidding? You damn well know you can't take care of the details. You won't even be here. We will have to take care of the details.'"

So this whole theme was, "I am doing all these things that I am supposed to be doing, but I am not getting the people very safety

conscious in my plant." I have to say this, somebody is getting somebody safety conscious, otherwise how come 10,000 people are getting together here?

People are always squawking to me about the airlines. Look, somebody got me a quarter of a million miles in the last year with a minimum of problems and I spend half my life in airplanes. Somebody got me from here to here. Of course, once in a while you fly when the pigeons won't even take a chance. You put a quarter in the insurance machine and you get a Hershey bar.

Do you suppose there is nothing here? Do you suppose when we say, "I tried these things and they don't work," do you think psychologically maybe this lets us off the hook? Do you think so, John? Maybe, but I don't. But if you are not getting through to your people on safety, maybe that is something for you to think about.

I have to mention here, too, remember about 25 years ago when the truckers were really fighting it out with the railroads, you know, the railroads were doing every thing they could to give the truck people a bad image. They were fighting them. For every mile of highway they were able to get they had to fight for it, right down the line. The railroad had an axe to grind and they were fighting every inch of the way, squawking.

And remember, all of a sudden you started to change your mind about the truckman. First of all, he was a big goon, a bad actor, and he drank and he fell asleep on the job and all that stuff. All of a sudden he is the guy that dims the light so you can get ahead on the hill, he gets the reputation of being the best driver in the world. He helps you if you are out on a lonely road and have a flat tire.

They have a movie called, "Knights of the Road," and do you think this happened by accident? No, no, no—design. Here is how they did it.

Every time a good report would come in on a truck driver about his driving or helping someone on the highway, up it went on the bulletin board. The American Trucking Association would feed this material out.

What happened? They told these guys they were good for so long that they got good. Today a truck driver knows he is the best driver, knows he has the best safety record because people so long have been telling him he is good.

Maybe we ought to think about this. They talked in this conference about changing roles. They said the reason marriages break up is that the guy identifies himself as a husband and he goes into the relationship and he isn't about to change.

In our business we talk about changing roles with the purchasing agent. We call our purchasing agent—if we could just change places with him once in awhile. We know for instance, when he buys he has to submerge his taste and buy for someone else. He likes red trucks, he buys green, if the company specifies green. He has a lot of pressure on him. If he buys too much the comptroller gives him hell. If he buys too little, the sales force give him hell. He is right in the middle. He wants a seat at management's table. He thinks buying is important; he is in constant conflict.

How nice it is when we as salesmen walk in and say, "Charlie, I know the problems you have and my job is not only to sell you stuff, but to help you solve some of your problems."

Changing roles. "I know you have been on this job for 20 years, you have done a good job. I know how you feel about wearing your helmet and hard shoes. What the hell, I'd feel the same way if I were you."

Oh yes, there is one more here, I think, somewhere. It says, "Setting personal goals seems to me the most important thing we as salesmen can do. Yet you seem to play down the importance of this. How do we know it when we get there if we don't know where there is?"

I don't to play down the idea of setting personal goals. I just mean a lot of times we let our goals get in the way of the job at hand. That is a problem that at times we have in selling.

My boss, Al Drew, with Beechnut years ago, had a point system and when we reached 300 points we got a bonus for the month and it was a very, very important part of our income. So the thirty-first of

the month Al would call and say, "How did you do, Bill?"

I said, "What do you mean, how did I do? I got them."

He would say, "How many?"

I would say, "Three hundred seven."

He would say, "Congratulations, that's a boy. This is eight months in a row, isn't it?"

I would say, "Don't make a big thing out of it. I always get them."

That was the thirty-first. The next morning he called right around breakfast and said, "Hi, Bill."

"Hi, Al."

"How many points have you got?"

And you would just start to say 307 and all of a sudden it would occur to you this is the next day and you ain't got none. The next one you get will be one.

Now there is a tendency to shoot for that 300 and say, "Boy, look at it," and you get to the middle of the month and you only have 75 and you panic and push and it shows in your relationship to people. So every month he would say, "You do all the things that you did, put up the display, point-of-sale material, tell your story, make the number of calls, quality calls, and then your goal will take care of itself."

The only point I make is, too many times we let our goals get in the way of our job at hand. If we do all the things every day in this safety program, every day the things we know that we should be doing, the rest takes care of itself.

Again, back to what do you say when they don't ring for your safety ideas? I think most of the time most of these people need a little reassurance. Look, I like this example. You buy an automobile. You move away from the dealer. You have a brand new car. You should be on Cloud 9. But are you?

Maybe you are saying to yourself, "Maybe I should not have swung for those extras. Maybe I should have hung on a little longer and gotten a better deal." Maybe you say, "Gee, that 1933 Essex I turned in, that wasn't a bad car, burnt orange, had nice lines."

All you need is a little reassurance. All you need is for someone to come up to you

and say, "I see you have a new car. Where did you get it?" And you tell him. And he says, "No wonder, that is the best place in town to buy automobiles."

But this doesn't happen. You walk into a guy by the name of Cecil. Now there are Cecils in the safety program too, aren't there? You know, Cecil comes along and sees the car and he kicks the tires and says, "Where did you get it?"

"I bought it from Jim Moore, the dealer."

He says, "What's the matter? You crazy? You know what Jim stands for."

You say, "I guess it is short for James."

He says, "Exactly, Jesse James. This guy is a direct descendant. I could have got this car for you for \$400 less than you paid for it. The guy I do business with loses money on every deal."

You say, "How does he stay in business?"

He says, "He juggles the books."

Reassurance! Do it this way because this is the way it is being done now. People don't want to be different.

What do you say to them when they say, "I have been doing it this way for 20 years and I don't want to change"? That is your problem.

What do you say when the teacher says, "I can't get these kids to go along with me"? That is her problem.

Don't ever forget this. If everybody were as safety conscious as you are here, all 10,000 of you, they wouldn't need you. If everybody did this regularly and automatically like they brush their teeth, like they put their pants on in the morning, we wouldn't need you. They don't, so they need you. And that is why you are here.

Back with Minnesota Mining, we used Scotch Tape for packaging in industrial applications and once in a while we would come out with something new. I was in on the promotion of a new thing called butcher tape. It was an acetate fiber tape that was used to seal hard to wrap Kalama-zoo vegetable parchment paper in a butcher shop.

What happened? We had a real problem because when the butchers wrapped the package, most of them left their greasy finger print and it wouldn't stick. Well, it was murder. Because I was in on the

promotion, the company always said, "Bill, we want you to go out and take care of these people." Hundreds of people with problems all over the country. Now we had a choice. We could have gone back and when the guy said, "This damn stuff doesn't stick," we could have said, like Van, "What's the matter? You stupid? Why the hell don't you wash your hands?" Or, if you had the weight, you could wrestle with the guy.

But I think there is a story here. Instead, we would go into him and say, "I am no. a bit surprised you have this problem, getting this darned stuff to stick. Every butcher we know had the same problem. But you know, we found out that if the butcher would take the tape and hold it in the middle and leave the two adhesive flap ends open and then seal it, they had no more problems."

In other words, it wasn't, do this because I say so. Here is what happened in a similar situation.

Remember, I told you the opening morning I went to this communications conference. This is the idea. You can forget everything we have talked about here, but stay with me for the next 10 or 12 minutes.

As I said, I knew this guy was saying something I could pass on to you, something that would be meaningful, something I hadn't heard before.

I had a chance to have lunch with him, and I said, "Boy, this is rough. I generally work with people who get together in conferences and conventions and they want to do better and be better and take a bigger bite out of life and you have given me nothing I can tell them."

He said, "Well, you ought to talk about change. When people get together to pick each other's brains, make no mistake about it, they are talking about change."

And I thought, this morning, sure we are. We are talking about getting through to the guy who doesn't have a good safety attitude, aren't we? Isn't this the reason we are here, to get people to feel the same way about safety as we feel? This is change. This means he feels this way and now he has got to start feeling another way. Change. A very delicate thing.

But Batson, the Englishman, said, "If we are going to talk about change, we

must remember this. A person doesn't change because someone asks him to change. A person doesn't change because of pressure to change. A person doesn't change because he has a tremendous desire to change. You people in America have been working that desire thing to death. A person doesn't change because he has a positive attitude toward change. Persons change because they experience change. Somehow they are disciplined or forced into a situation of change and they change then, and only then."

I think a neighbor of mine jumps up in the morning with that attitude. He sings in the bathtub. He plays an inspirational record in the morning before breakfast. Then he looks in the mirror and says, "You can do it. Everything in the world that man can conceive, man can do. You can be chairman of the board of your company."

You know his problem? The bum never leaves the house.

Eddie Rickenbacker had all his people in Miami Beach for a convention, 161 of them, their luggage had been delayed. These are airline people. Their luggage was in Baltimore and in Albany and Charlotte and Boston. They had to scrounge around as we do and pick up toothpaste and toothbrushes and shaving stuff and have the one pair of pants they had on pressed.

At the opening meeting Rickenbacker looked over the rostrum and said, "See what I mean? I have been yelling at you, I have been sending you—every week on the week—a bulletin, saying 'don't lose their luggage. If you lose it, we lose them.' Apparently this didn't make any difference. Now, how the hell do you like it? How do you like it?"

He had deliberately delayed their luggage. Eddie Gilchrist in Miami told me, "Up to this time when somebody would lose a piece of luggage, they would walk up to me in the airport and say, 'I lost my luggage.' I felt like saying 'Well, don't bother me with this foolishness.'"

"Now when it happens, it is something different. Now it is under my skin. I know how it feels when it is under my skin. There is a real, real difference."

I told you about my son-in-law. He would tell a good story about printing.

but he had an intellectual quarrel with asking people to buy. He would stop. My boss used to have a word for this kind of salesman. He said, "He is very colorful; he is yellow."

I gave him 50 books on how to ask people to buy, stress urgency, give them reasons why it is better to buy now than it is to delay, and it meant nothing to Jim. He said, "If they want to buy, they will buy."

I said, "They won't. You have got to ask them."

Finally I went out and made some calls with him. I said, "After you tell your story, simply say to him, 'If it is all right with you, we will send this along.'"

The first guy he said it to, he said, "If it is all right, we will send this along."

And the guy said, "Go ahead."

I thought we were going to lose him. I thought he was going to say, "Don't be hasty, Charlie." Now he has got more nerve than an abscessed tooth. Now he has got it under his skin. Now it has happened to him.

We don't know how it will be until after it happens.

I used to work for Minnesota Mining. I had one customer in Portland, Maine, who supported me there, and boy, I had them locked up, you know. We played golf together on Saturdays, and my wife and his wife played bridge all week. You know, nobody was going to move in on me. One day I came into this jobber's place on Saturday morning and as far as the eye could see, was competitive merchandise. I was out and this other guy was in.

There I was, I was dead. And in a thing like this, your worthwhileness, your life's blood is at stake. I have to report this to the home office and I am on a bonus basis and I am out of business. As far as I can see it is competitive merchandise. He has to sell this before he even gets back to mine. You can't even see my stuff.

Some guy came up from Boston and gave them the clergyman's discount and he swung for it. I went across the street and bought a cup of coffee to get my poise back. I was shook, you know. Finally, I

went over and said, "How could you do this to me? I work with your salesman, I am in here every day, I check and rotate your stock, I put on sales meetings. Some stranger comes and puts me out of business. Why?"

And do you know what he said?

He said, "I never thought this meant this much to you."

Do you know why he didn't? I never told him that this meant that much to me. I was so preoccupied with being a big shot, walking in Saturday morning, checking the stock, taking the order, playing golf with him, seeing that the wives got along pretty good, it never occurred to me to establish any kind of a grownup relationship in a business way with him.

After that, every week we sat down and I said, "We are swapping, Buddy. This is what I have been doing. This is what you have been doing. You haven't been doing this. I haven't been doing that. Let's get back on the stick, Charlie. Let's go."

But it took this experience to get me back.

Five or six notes said, "Don't kid yourself, Bill. Sure it is all right for you to come on with this inspirational jazz and say people get safety under their skin. Don't kid us, the reason we are so safety conscious is because it is just good business to be safety conscious. Why don't you forget all this jazz? It is all right to appeal to people's self-interest."

Well, I guess it is, but I get a little concerned about this. Most of the Madison Avenue stuff we read about appeals to the worst in people, self-interest, vanity, keeping up with the Joneses, what other people will think. This to me is the worst in man that they are appealing to.

But ask yourself this: The greatest movements of all times have succeeded because they have appealed to the best in people. Christianity, for instance. The good Lord didn't get His disciples together and say, "Here is what is in this for you, Buddy, if you go along with me."

He probably said, "Look, everyone will think you are crazy. They will stone you. They will think you are nuts. You will not in your lifetime see any positive effect of the work you do. But do it, because this whole philosophy shows how one man

should not toward another man. It has got to be good."

So what happens? Ten or twelve ignorant fishermen sold this great story, appealing to self-interest?

No, I don't think so. Appealing to the best in them. The truckers appeal to the best in men. You are good. You help people on the highway. You flash them by. You are a damn good driver. You appreciate the value of safety.

So after a while, what happens? The trucker said to himself, "I am a good driver. I have a good safety record. I help people. You are damn right I am good."

During World War II, of all the zillions of words we heard in speeches, what is the line you remember most? What Churchill said, "Blood, sweat and tears." That got to be the most significant line that came out of the war. Did this appeal to people's self-interest? It did like hell.

He said, "We will promise you nothing but blood, sweat and tears." He rallied the country, y' see. He didn't say, "I think if we do this we will beat the Germans. If we do this, our taxes will be lowered and then we will go there and move in on them and take their industries and then we will be able to cut that out."

He said, "There is nothing I can promise you. I give you nothing."

In this church fund-raising drive we went through, we promised them nothing. We didn't say, "We want you to give." We said, "We want you to give until it hurts, because if you are just giving off the top and it ain't going to hurt you, we don't need you. We have got to have the people that bleed a little bit if we are going to build this."

So we get in a medium middle class family and an average subscription is \$1,700. You think they didn't bleed?

The inaugural address, how many words? Seventy-two thousand words in Kennedy's inaugural address. I don't care how you feel about him, but there is the one line you remember: "Think not what the country can do for you; think instead what you can do for the country."

I don't know, I am not going to say

1961 National Safety Congress

how he meant that or anything, but I say, isn't it funny that was the headline after the address. All the other things he talked about—but that was the headline.

I am convinced that you are here, not for self-interest. I have got to believe this, otherwise I have wasted my time. I have

got to believe that you are here not for self-interest, but because safety really means something to you. This is the way one person should act toward another person.

If this is over-simplified, I have wasted four mornings. I hope I haven't.

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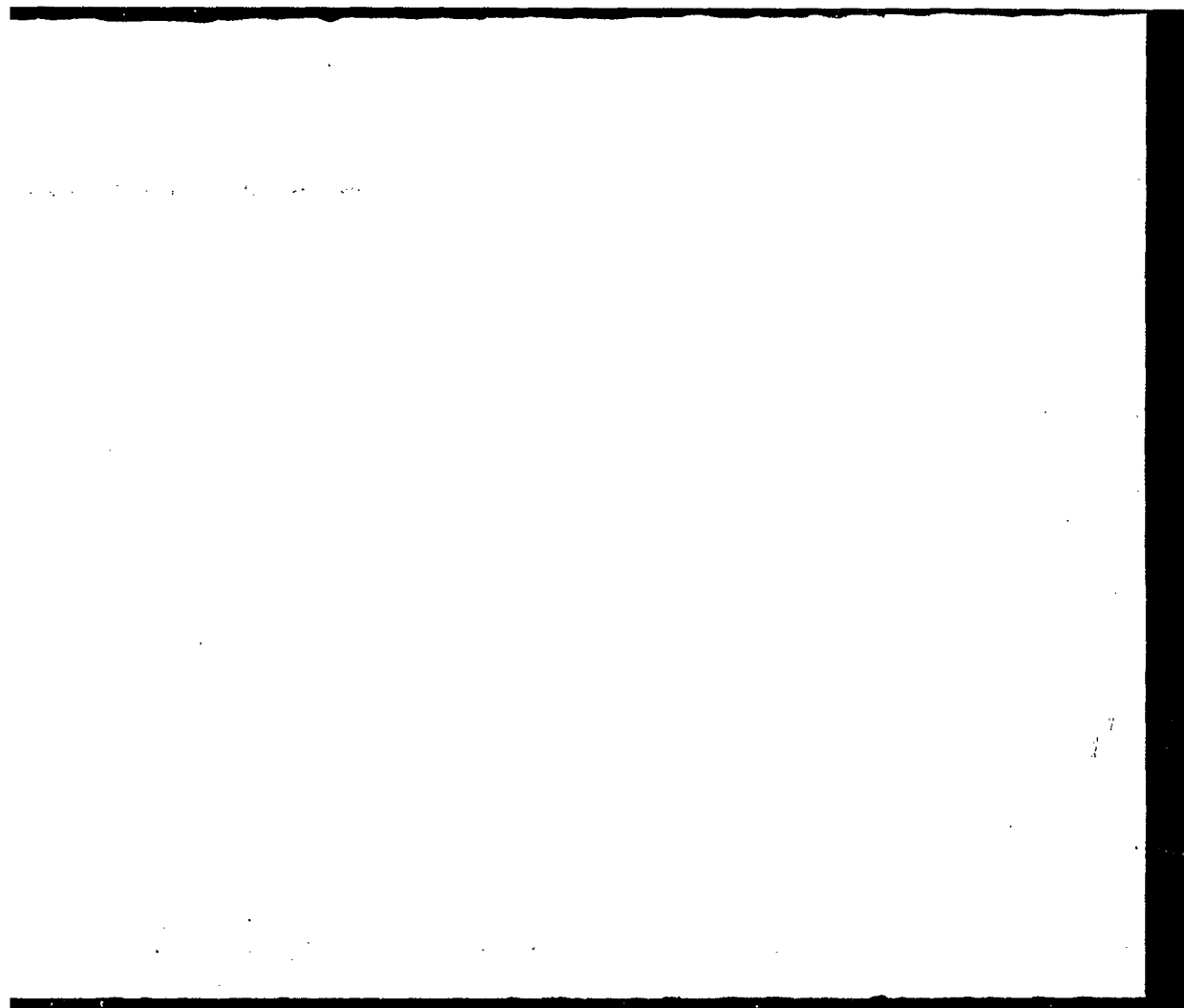
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