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1968 Volume I

NATIONAL SAFETY CONGRESS
TRANSACTIONS

GENERAL SESSIONS

ANNUAL MEETING OF MEMBERS
CONGRESS BANQUET
LIST OF EXHIBITORS
GENERAL INDEX OF ALL VOLUMES

NATIONAL SAFETY COUNCIL
425 North Michigan Avenue
Chicago, Illinois 60611

56th NATIONAL SAFETY CONGRESS

Papers Delivered in the

GENERAL SESSIONS

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By REVEREND JOHN HONDRAS
Pastor, St. Andrews Greek Orthodox Church, Chicago, Illinois

Our Father in Heaven:

You know that when we hold in our hands and under our feet enormous power of a modern car, then to be careless or inattentive, thoughtless or aggressive, may mean a life, a life or death. We, too, know this, but we forget, we turn away.

Everyday we sally forth in our cars to maim and destroy each other in incredible numbers—we who supposedly love one another.

In the name of Christ, who was never in a hurry, we pray, O God, that thou wouldst slow us down for we know that we live too fast.

Give us on the road everyday control of mind and body that the highways may be safe for men, women and children. *Amen.*

MINUTES OF THE ANNUAL COUNCIL MEETING

The 1968 Annual Council Meeting of the National Safety Council was held in the Grand Ballroom of the Conrad Hilton Hotel, Chicago, on October 28, with Howard Pyle, President, presiding.

Following the presentation of the Colors and the Pledge of Allegiance, the invocation was offered by Reverend John Hondras, Pastor of St. Andrews Greek Orthodox Church, Chicago, Illinois. (Reverend Hondras' prayer is printed on the preceding page.)

Mr. Pyle keyed his opening remarks to the Congress theme "In Safety . . . It's Performance That Counts." He said, "We seek to prevent accidents that kill and maim and bring untold suffering and dislocation to the lives of people. How well we do that — in a word, our performance — is the measure of our success or failure. All the fine programs we put in place, all the rules and regulations we enact, all the penalties and exhortations are little more than empty words unless lives are saved, accident injury checked, and economic waste reduced."

Mr. Pyle continued, ". . . this is the time, in a world of expanding population, technical complexity and social tensions, to survey our efforts in the light of one meaningful yardstick — results," and he emphasized the need to ". . . activate program goals that achieve . . . direct our energies and resources toward visible and attainable objectives . . . go for performance, because this is what counts in safety."

Mr. Pyle 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: Brooks McCormick (Chairman), Werner C. Knoop, Frank E. Laderer, Edwin B. Locke, Miss Marion E. Martin, Norman C. Mindrum, and James F. Van Namee.

Mr. McCormick reported in behalf of the Nominating Committee, and read the report on nominations for Trustees, Members of the Board of Directors, and Officers. With these remarks and the filing of the complete printed report of the Nominating Committee, he moved the election of the Trustees, the Members of the Board of Directors, and Officers as named in the report.

There were no nominations except those presented by Mr. McCormick. Mr. Pyle announced that 31,772 proxy votes had been cast in favor of the Nominating Committee's slate, and no negative votes. 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 the Directors for 1968-69, 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 1968-69 is also printed on the preceding pages.

Mr. Pyle introduced the guests seated on the platform.

Mr. Pyle then made a presentation of medallions to ten retiring vice presidents: Mrs. Horace Dawson, Dr. Dewey F. Barich, Harry E. Foulkrod, C. Hunter Green, John J. Karol, Dr. Norvin C. Kiefer, John H. Schwarten, and Ben West.

Mr. Pyle cited the retirement of two longtime staff executives, R. L. Forney and W. G. Johnson. Mr. Johnson was called upon to address the group. (His remarks are part of these transactions in later pages.)

H. W. Champlin was introduced as the newly elected Secretary and Treasurer, succeeding Mr. Forney. H. Gene Miller was introduced as the new General Manager for Programs, succeeding Mr. Johnson.

President Pyle extended special greetings to those present from other countries. They were asked to stand and the audience welcomed them with a round of applause.

Mr. Pyle then mentioned special events and highlights of the Congress, and announced

the 1969 Congress would be held in Chicago, October 27-30.

John Lawlor was called upon for a special report on a milestone in the Defensive Driving Course program. (Mr. Lawlor's remarks are included as part of these transactions on following pages.)

President Pyle cited nine youth organizations that helped plan the year's Congress youth program. He asked for special recognition and the thanks of the membership for their safety performance. The following youth representatives were introduced: Dominic Lonero, Boys Clubs of America; Miss Marilyn Drew, Future Homemakers of America; Mark Kleeman, Red Cross; Enid Schlipf, 4-H; Robert Motel, Key Clubs International; Gregory Bush, Boy Scouts of America; Steve Baily, National Grange; William Boehm, Future Farmers of America; and Ken Ashby, Young Farmers and Ranchers, National Advisory Committee of the American Farm Bureau Federation.

It was pointed out that these young people represent a constituency of more than 11 million actively engaged American youth. Two youth delegates from Canada were also recognized.

Mr. Pyle then called upon Miss Patty Bowman, a senior at Harding College for a special address. (Miss Bowman's address and President Pyle's concluding report are included as part of these transactions on following pages.)

At the conclusion of the meeting, the delegates were invited to remain for a premiere showing of the new Defensive Driving Course promotional film entitled "A New Way To Drive."

H. W. Champlin
Secretary

FAREWELL REMARKS

By W. G. JOHNSON

It has been a great privilege to work for the National Safety Council for over 31 years. The Council is complex and interesting — perhaps more so than any other organization.

There is an *organizational dimension* to the Council's work — the privilege of becoming familiar with the different ways organizations operate.

Business, Universities, Church,
Youth, Labor, Farm,
Women, Government— National,
State, Local, Legislative,
Executive, Judicial

Associations of all manner and types —
Medical Legal Trade Service
Community Organizations

The *technological dimension* ranges from such mundane things as — ladders, knives and coffeepots to atomic energy and space.

We deal with *research organizations* at the cutting edge of knowledge; and most recently systems theory and application.

Our work has a *problem dimension* —

Grizzly Bear Problems, Walsh-Healy regulations, fund raising, product safety problems, ambulances, education, persuasion, evaluation, political science, organization, computers, Canoeing and Hunting — not last, nor least.

The *geographic dimension* to safety work — Maine to San Diego; Olympic National Park to Everglades National Park; (and all too often! —) New York and Washington, D. C.; Minneapolis (in the winter) and New Orleans (in the summer).

The *personal dimension* —

The kind of fine people who are here in this room — humanitarian; economic and efficient and capable; Purposeful — and to good purpose — And still good fun and great friends.

And the *horizons* of our safety work — Vast and challenging — yet just before us and attainable.

It has been *SIMPLY GREAT!*

REMARKS

By H. GENE MILLER
General Manager for Programs, National Safety Council

As Bill Johnson has rightly pointed out, there are many dimensions to the Council's work, all of which point up the importance of one of the Council's principal assets, namely, *continuity* — continuity of performance, continuity of activities, continuity of programs.

We are all going to miss Bill, but I assure you that his leaving will not give rise to any significant changes. We are not going to clean house and start all over again. We are going to build on the firm foundation which Bill has laid for us. We are going to move ahead and progress.

When I say there will not be any significant or disruptive changes when Bill leaves, I do not mean there will not be any changes. There will be changes. There would be changes even if Bill were not retiring, because change we must to meet the new problems and the new situations which arise, to take advantage of new methodology and new techniques for accident prevention.

Bill is leaving us with a rich inventory of feats accomplished and of plans and ideas yet to be accomplished. He has opened many doors for us, giving us new applications and new techniques for accident prevention. And I propose to take us through those doors, taking full advantage of all the techniques available so that we can use the best possible way, the capabilities that we have for accident prevention.

As I take on this new assignment, I am fully aware that the accident prevention movement would amount to little without the help and cooperation and energy, without the expertise and dedication which all of you people have for the safety movement. And with your continued help and cooperation backing up our staff here at headquarters, I am confident that the years ahead will be productive and significant ones in the cause of safety.

Bill, as you leave us, and in the years ahead as opportunities present themselves for us to get together and to work together, I hope we will all be wise enough to take advantage of these opportunities.

DDC GRADUATES REACH FIRST MILLION

By JOHN D. LAWLOR
Executive Vice President, National Vice President

The Congress theme — "In Safety . . . It's Performance That Counts" — is dramatically exemplified by the Council's Defensive Driving Course.

We are now able to say — and when I say "we", I mean literally thousands of working members of the National Safety Council family — that we have completed the training of the first one million graduates in the Defensive Driving Course.

What a significant accomplishment! One million! One million drivers have taken the National Safety Council's eight hour Defensive Driving Course through our joint efforts.

This is a lot of training. The work, imagination and dedication that made it possible spells outstanding *performance* on the part of a growing teaching force that ranges from coast to coast and border to border.

While it's true that one million drivers are only about one per cent of the total driving population, what a beginning toward an annual goal of more than a million graduates a year.

Also, one of the major attributes of this achievement is that it teaches us a lesson about ourselves — a lesson I hope we will all learn and learn well. When we work together in an organized way on common objectives — we can turn in a terrific performance — a performance that counts.

While the Women's Conference supplied the initiative to get this program off the drawing board, every Conference in the Council has been involved in making this idea a reality. Every department of the Council staff has also participated in one way or another in building this program to its present pace of production. Over 150 safety councils, private business and industry, the military and our federal, state and local governments have shared in this achievement.

The response of the general public has been both surprising and inspiring. It has been one of overwhelming approval. The record shows that, in the public classes, 95 per cent of the students who attend the first session stay with the course to graduation.

It's convincing evidence that a vast majority of the driving population want to drive better, and that they are willing to go to school for eight hours to learn better driving techniques. Sound factual information about better driving is welcomed when it is presented in an understandable, authoritative, and interesting manner. We are obligated to perform this service — to make this training course available to more and more millions of drivers.

Our goal must be — *every driver in America a defensive driver.*

In the words of Charlie Ferguson of The Readers Digest, who spoke about this program at the 1964 Congress Banquet — our mission is to make the techniques of Defensive Driving . . . "part of the national folk lore of driving — part of the common wisdom of the people."

It *can* be done! It's a big order, but it *can* be done.

Forty-six per cent of the training to date has been accomplished by 150 state and local safety councils. It's the largest single contribution of any group. We are especially proud of this fact because it shows that we have a flourishing volunteer safety movement at the grass roots level.

The outstanding Safety Council in DDC for the four year period with a total of 29,640 graduates is Baltimore Safety Council. Not far behind Baltimore is another outstanding Council which trained 26,286 persons in the same period. This is the Greater Tampa Citizens Safety Council. The next largest group of DDC trainers contributed almost one fourth of the total. This group is represented by the Armed Services and the United States Coast Guard.

You ladies and gentlemen represent a *very* important segment of the safety community. You have demonstrated in so many ways over the years that you are good safety citizens. We especially value your strong participation in community traffic safety programs wherever you have installations.

All the states have been involved in this program in one way or another, but the two

top states have been exceptional. The leading state in DDC is the Sunshine State of Florida with a training record of 93,514 persons. Very close behind Florida, with a record of having trained 93,160 persons, is the Commonwealth of Pennsylvania.

There are cases of individual excellence across the land, far too numerous to mention. To those dedicated instructors and instructor trainers who have labored so diligently go our deep and abiding gratitude.

We must also mention the progress made by our Canadian friends to the north with whom we have special arrangements for presenting the Course in the traffic environment of that country.

Finally, we must give credit to the staff professionals who have striven so mightily to make this Course what it is today — a national symbol of excellence.

Again, we want to salute all of you for a job exceedingly well done. This is performance that truly counts in the savings of lives and injuries on our highways and the reduction of dollar losses.

Remember — this is a continuing program. We must expand our efforts. This is our job and by working together we can do it better and quicker than it can be done in any other way — and it *must* be done.

BE SAFE—COMMUNICATE

By PATTY BOWMAN
Senior, Harding College, Searcy, Ark.; Past National Officer,
Future Homemakers of America

Although I haven't been re-elected, and I am certainly not retiring, I bet you didn't have too much difficulty in determining who the real Patty Bowman was at the head table this morning.

Let me tell you, it has never been so much fun being outnumbered by such charming and distinguished gentlemen as this morning.

The art of communication can sometimes be a most frustrating, enjoyable and yet all the while challenging task to undertake, especially for a woman. But the effectiveness of audio communications is of utmost importance. Whether you are trying to get from O'Hare Field to downtown Chicago or trying to explain to father the necessity of having the car at school this semester.

We are gathered here this morning because as youth and as adults, we realize that the way we communicate what safety means to us, to those who throughout the United States are not safety conscious, is of vital concern to this generation and to generations to come. We are here this morning to begin to answer that question, how can we, as youth and adults, working together, effectively sell safety? How can we say safety?

I want to be able to drive a car just like Bonnie and Clyde.

One more drink, honey, then we will go home.

Who needs a lifeguard in 90° weather.

How do we say safety? Safety is said in quite a different way by the realities of our times, realities that show us that both adults and youth must have a vital concern in the safety of our nation. For well over 500,000 men fight and die daily for the safety of our nation. At home, in the year 1967, we lost over 112,000 lives in accidents. And while we, the United States, spend over $70 billion in the defense of our nation, at home, the accidents cost us over $21 billion.

How can we say safety? You know, America's youth are trying desperately, believe it or not, to say something. We are trying to say, "Hey, I really am interested in the problems of poverty, unemployment, the spread of communism and racial riots." "Hey, I am really not an apathetic American youth who has to communicate my concern by not taking a bath, not shaving, and marching down the street with obscene signs."

We are trying to say, "Help us! Guide us! Give us your wisdom and show us how to lead purposeful and meaningful lives."

How can we say safety? We as youth realize that we are extremely fortunate to be living in the most properous and technically advanced nation in this world, a nation where economic, religious and educational institutions are designed to give each individual an opportunity for a better way of life. But you know, we also realize that being born into a democratic society demands that we appreciate the value of our lives, our children's lives and the lives of our fellow Americans.

But how can we say safety? Governor Pyle told you about my tour to Southeast Asia and the Far East. There were 15 of us in a college group in this USO tour, and at the close of the ten-week tour, there was certainly a renewed appreciation for the American way of life, and there was a responsibility that we felt as youth in guiding America and in guiding the countries overseas who were less fortunate than we in developing the safety habits.

For example, while we were touring Korea, it was not unusual at all to see bus, bicycle, pedestrian, ox-drawn cart collide. And you know, while we looked out our windows and our eyes just watched in unbelief, the Koreans seemed apathetic to all these fatalities surrounding them, because lacking the resources to develop a culture that could be genuinely concerned with the safety of the individual, they struggle. They struggle for a taste of the Western culture.

But we have the resources and we have the responsibility to be as advanced in our performance and behavior as individuals as we are in our technical know-how that has built this great society.

How can we say safety? The beautiful country of Japan was almost ruined for me my first day there, when I decided to take a ride in a Japanese taxicab. Now if you were ever in Japan and you take a ride in a Japanese taxicab, you will develop a genuine appreciation for the American woman driver.

That is very true. When I finished this Japanese taxicab ride I really felt like I had been in the 500, Japanese style, and I had no doubts I was riding with Parnelli. And it readily made me appreciate an article I read in the newspaper recently, that Japan is constructing miniature driving training courses which are just like our miniature golf courses in America. But in America we have super highways and we have interstates, and we have more and more public and official concern about the economic and human waste caused by accidents.

How can we say safety? This is a question in which all of us attending this conference are interested. As youth, we will take the message of safety back to our communities, our schools, our classmates and our families, for we have a responsibility not only to our country, but to you of the National Safety Council, who realize our potential as future leaders of this nation, and we can do it. We can take this message back and in our means we can make our projects for the promotion of safety as creative and rewarding as we want to.

America's youth are America's future, and we will begin when we leave this conference with the ideas that you have given us.

In conclusion, I would like to tell you a story, a very personal story. It is one of the things that happened when we were overseas.

It is very difficult sometimes for us to appreciate what America is until we have been where America isn't. We did a lot of hospital shows overseas, and at one of the hospitals in Japan there were boys being brought back from Vietnam — and I mean everything from two legs off to two arms off, all in the same ward — men who were dying and men who just might have had their toe broken. And we went in and we entertained these boys.

And a real stout Marine called a group of three girls over and said, "Would you come over and sing for a buddy of mine."

We went over and we found out this boy was 18 years old. He had a wife and baby at home, and he made the request for a song he wanted us to sing. The name of the song was, "Where Have All the Flowers Gone."

He was blinded in both eyes — this 18-year-old boy. He asked us to sing this song.

And I think youth today realize how fortunate we are to have the flowers of America, to have the opportunity to communicate and make America a safer place to live, just like our boys overseas.

So our challenge to you is — let us help you, let us work with you in making safety a reality.

PRESIDENT'S REPORT

By HOWARD PYLE
President, National Safety Council

Miss Patty Bowman — you are all-American youth at its best! We applaud you and your thinking because we are grateful for you personally and for what you represent. You asked the question, "How do we say — safety?" and you provided a stimulating and appealing answer for which we say, "Thank you! Thank you!"

As I listened to this charming and talented young woman my mind was drawn to the page in *Accident Facts* that, for me, reports the most intolerable information in the entire book. How I wish it were not so constantly there.

For children, aged 1 to 14 years, accidents claim more lives than the six leading diseases combined.

For Youths aged 15 to 24 years, accidents claim more lives than all other causes combined — eight times more than the next leading cause — and three out of four of the victims in this group are males.

Through it all — year after year — we keep our cool as though we didn't mind at all.

Of course, we are concerned, but not enough to be mad about it.

Righteous indignation is all over the place these days, but who have you talked with lately, or ever, for that matter, who was *angry* because of the road blocks that stand in the way of more safety for every man, woman and child in this country?

If you have talked recently with any of the many whose passion is building highways you have felt the impact of their deep irritation over the Washington order that has put a freeze on new contracts for highway construction. The explanation is simple enough, but many a highway enthusiast is mad about it just the same.

Scarcely two years ago traffic safety was being called the year's most popular crusade. Over and over we made it plain what we were certain it would cost to finance what was being mandated, and over and over the reaction was — "Would you put a price on human lives?"

Certainly not, but the fact remains that, in following through on what was so enthusiastically authorized, the financing has been in very short supply compared to the size and seriousness of the task.

Again, the explanation is simple enough, but in this instance few, if any, feel deeply enough about it to be mad about it.

Meanwhile, more Americans were killed in traffic accidents in August of this year than in any other month in our national history. The toll for the month was 5,280 men, women and children, a nine per cent increase over the same month last year.

Do you know of any one who was mad about it?

Nationally, we now know that for 12 months ending August 31 this year traffic accident victims totaled nearly 55,000 killed, with approximately 2,000,000 suffering disabling injuries.

If this were the result of the fighting in Vietnam, or lawlessness and violence in our cities, the citizenship of this country would be mad, mad!

Now you may be wondering — "but how do you do something about more safety, no matter how mad you may get?"

There is a solid answer to this question under way right now in the State of Washington. The Ladies Auxiliary, bless them, of the Washington State Medical Association, irritated over the state legislature's failure to pass implied consent legislation for more effective control of the drinking driver, went out after enough signatures to put implied consent on the ballot as an initiative measure.

I had an opportunity to watch these ladies at work on a recent trip to Seattle. They really mean business.

When this kind of public support for safety becomes a reality throughout the country, we will have a truly effective working constituency for safety and the roadblocks that are standing in safety's way will begin to disappear.

For this kind of action to be fully responsive to our national need, safety's professional

leadership must be felt in every corner of the country.

On page four of our Report to the Nation 1968, you can read the details that pertain to "a series of sequential meetings at summit and operating levels" that have been held "to clarify and organize the public support activities of cooperating national organizations, both volunteer and official. The objective — to encourage, by every available means, the adoption at all levels of government of present and future highway safety standards."

Many of you will be hearing from us later, asking you to energize your state and local citizens in behalf of this campaign.

Consistent with our own recognition of the need to develop a truly national demonstration of safer practices on every job — on the highway — in the home and in public places — our first million graduates from the Defensive Driving Course is typical of what can and must be done. Full implementation of the Home Safety Action program will advance the same objective.

Help from all manner of associations can assure the benefits of occupational safety among small employers and the professions. Promotion of more training in all areas of recreation will make more training available and public safety more universal.

Building on the sound program foundation that Bill Johnson has done so much to bring into being, Gene Miller is now developing an eight point continuation of our effort. Briefly it will follow this pattern:

1. *Problem Analysis.* More must be known about the accident problem in order to concentrate efforts where the problem is greatest. Thus far, there isn't enough manpower or money to attack successfully every facet of the accident problem. Therefore, countermeasures must be selective, and employed where they will produce the most safety for the money invested.

2. *Better Information, including Research.* This need is closely related to problem analysis, but is concerned more with in-depth probing of accident causes.

3. *Bridge the Gap between Fact Finding and Fact Use.* All the information in the world won't stop accidents unless it is put to use. The findings, especially research, must be translated into lay knowledge, and then into specific program activities. Model programs must be developed and tested. Success stories must be accumulated to show that accident prevention works.

4. *Program Evaluation.* Programs already in operation and new ones set up must be examined regularly and carefully to be sure they are accomplishing their objectives, and the cost of them justifies their continuance. With resources limited, cost/benefit analyses will aid in setting program priorities.

5. *Program Balance.* The resources available must be apportioned appropriately between fact finding and fact use. Expending a disproportionate amount of time and money on either one will not accrue maximum benefits. In addition, since accidents occur in many areas, the resources apportioned to each area should bear a relationship to the seriousness of the problem in each area.

6. *Innovation.* New ways to accomplish safety must continually be sought. People change, work methods change, environments change, so safety activities must change too, to meet new problems. Safety is not a popular activity, so new ways must be found to interest and motivate people in living the safe way.

7. *Involvement.* Accidents threaten everybody; safety must involve everybody. The manpower of the professional safety organizations must make the most of every possible multiplier to increase its effectiveness.

8. *Program to Completion.* Too many safety activities are started with too indefinite plans for their future. So, many of them stumble along or die, or even worse, *they* may perpetuate themselves with no specific goal in view. Again, with resources limited, the objectives of activities must be clearly in mind before they are undertaken.

As I complete my tenth year as president of the National Safety Council, nothing gives me greater pride and satisfaction than the certain knowledge that the Council is stronger today than at any other time in its history.

The growing numbers who believe in the Council and its work will provide close to nine million dollars for our use this year.

It would take thousands of letters of thanks to reach the many who are responsible for this expression of confidence. We have the feeling, however, that those who are

underwriting our work are not looking for letters of thanks. They want, instead, the kind of performance for safety that counts.

Hence the reason for the opening paragraph in the President's Letter on page three of our Report to the Nation 1968. Perhaps you have already read it, but I think it bears repeating here:

> "October is inventory and appraisal time for the National Safety Council. To this end we present our Report to the Nation 1968 and welcome the thousands of safety professionals and volunteers who will join us for a full scale review of the nation's safety problems during the 1968 National Safety Congress and Exposition."

During the 193 scheduled sessions that will keep us all busy while you are here, we will find out what is right about what we are doing and what is wrong about what we are not doing. We will do our best to determine what we *can do* about the challenges, and what we must *try to do* about the things that need to be done, but may be just a little beyond our current capabilities.

Please study the Report to the Nation 1968, and regardless of the frustrations that beset you keep the punch line of this true story in mind as indicative of the way things are in our time.

Not long ago it was my privilege to spend a day touring the Manned Spacecraft Center in Houston, Texas. The highlight of the day was the visit with five of the astronauts. I was fascinated with their ready answers to my many questions, especially the last one.

With the tragic death of three of their associates in mind, along with what I understood to be the demanding disciplines that surrounded them constantly, my question was —

> "You gentlemen have been on this assignment long enough now to realize exactly what you and your families are up against. Do you still have the same enthusiasm for the mission that you did when you started it?"

The silence was pretty heavy for a few seconds. Then came the answer. Through just a flicker of a smile the reply was —

> "Sir, the moon is still up there!"

For us — there are still lives out there to be saved — lives it is our responsibility to save.

INVOCATION

at the

National Safety Congress Banquet

By REVEREND MAGNUS P. LUTNESS
Director of Services to Military Personnel for the Lutheran Council of the United States
Washington, D. C.

Eternal Father:

Grant us the privilege of experiencing the exciting challenge of new ideas, and the wisdom to discern the collective knowledge of the past.

Give meaningful direction to the use of talents, and maturing appreciation for important values.

Perpetuate the legacy of freedom and the concern for justice.

Grant us the dignity of respect for our fellowmen; the capacity or gratitude; and the courage to work for a better world.

Magnify the results of this meeting in lives of our citizens.

This we ask in thy Holy Name.

Amen!

NATIONAL SAFETY CONGRESS BANQUET

The Banquet of the 1968 National Safety Congress was held in the Grand Ballroom of the Conrad Hilton Hotel, Chicago, October 30, 1968, with Dr. Dewey F. Barich, Vice-Chairman of the Board of Directors, presiding.

The invocation was given by Rev. Magnus P. Lutness, Director of Service to Military Personnel for the Lutheran Council of the United States, Washington, D. C. (Rev. Lutness' prayer is printed on the preceding page.)

Dr. Barich welcomed the Banquet guests to the 56th National Safety Congress.

He said that the dedication and commitment of members, delegates, and friends to a safer America was a source of real inspiration. And while many thousand lives had been saved and millions spared from injury because of the efforts of safety professionals, the task continued to grow, the work had just begun.

Dr. Barich emphasized the theme of the Congress "In Safety . . . It's Performance That Counts" and pointed out that each person in attendance had an assigned role in making this theme work.

Dr. Barich introduced the National Safety Council Executive Committee and special guests at the speaker's table, and then recognized the Council's Directors who were seated in a special section of the Ballroom.

President Howard Pyle was called upon to present Trustees Awards to the City of Lansing, Michigan, and the City of Toledo, Ohio.

This was the 9th year of a Trustees Award presentation to cities or states that excel in the field of accident prevention. The criteria for the award are based not only on accident rates, but the activities of public and private organizations and individuals.

There are three award groupings: State and cities of over 350,000 population, and cities from 50,000 to 350,000 population.

Lansing, Michigan qualified for the cities of less than 350,000 population. Mayor Max E. Murninghan accepted for Lansing. Their delegation of safety and community leaders was presented to the guests at the conclusion of Mayor Murninghan's remarks.

Mayor William Ensign accepted the award for the City of Toledo which qualified in the over 350,000 group. The Toledo delegation was introduced as a group after Mayor Ensign's remarks.

Musical entertainment for the Banquet was presented by the 5th Army choral group and the Bert Rose Orchestra.

The featured speaker for the Banquet was Art Buchwald, the nationally syndicated columnist. His remarks about politics and writing produced a most favorable response from the audience.

Dr. Barich concluded the meeting with an expressed hope that all of the delegates would be spurred to new efforts during the coming year.

PLAN NOW TO ATTEND THE

1969
1970
1971
1972
1973

NATIONAL SAFETY CONGRESS

OCTOBER 27-30, 1969 / CONRAD HILTON HOTEL, CHICAGO

The Congress is always a big week, a worthwhile week for the 13,000 safety people who attend.

At the '69 Congress you can meet other safety people, with the same problems and responsibilities as yourself. You can exchange views and ideas on accident prevention, health, hygiene, and fire prevention . . . on safety in industry, traffic, school, at home and on the farm.

You can see the largest of all safety equipment exhibits at the Congress . . . an opportunity for you to make well-informed buying decisions for your company.

This four-day educational program, planned and presented by the National Safety Council, can be your most thought-provoking, most worthwhile safety experience in 1969.

Make plans early to attend the 1969 Congress and bring the other people in your organization who have safety responsibilities.

FUTURE CONGRESS DATES	
1969	October 27-30
1970	October 26-29
1971	October 25-28
1972	October 23-26
1973	Oct. 29 - Nov. 1

NATIONAL SAFETY COUNCIL
425 NORTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60611

SAFETY EXPOSITION EXHIBITORS – 1968

Aden Supply Co., 4056 Plainfield Ave., N.E., Grand Rapids, Mich. 49505
Safety glasses.

Adolf and Company, 3453 W. Foster Ave., Chicago, Ill. 60625
Industrial clothing.

Advance Glove Mfg. Co., 901 W. Lafayette Ave., Detroit, Mich. 48226
Industrial work gloves and clothing.

Aetna Life Affiliated Companies, 151 Farmington Ave., Hartford, Conn. 06115
Safety films and safety pamphlets.

Ag-Tronic, Inc., 510 W. South St., Hastings, Nebr. 68901
Slow moving vehicle emblems.

Air Space Devices, Inc., 7716 Alondra Blvd., Paramount, Calif. 90732
A safety device for protection from falling when climbing.

Akron Brass Mfg. Co., P. O. Box 86, Wooster, Ohio 44691
Fire fighting equipment.

Alan Wood Steel Co., Conshohocken Road, Conshohocken, Pa. 19428
Abrasive rolled steel floor plate.

American Allsafe Co., Inc., 1245 Niagara St., Buffalo, N. Y. 14213
Drybrow sweatbands, nylon fan guards and related products.

American Chain and Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn. 06602
Sling chains and sling chain assemblies, wire rope slings and assemble-your-own wire rope slings.

American Industrial Safety Equipment Co., 3500 Lakeside Ave., Cleveland, Ohio 44114
Welding and cutting goggles, spectacles, welders' lenses, hard hats, visitors' spectacles, and goggle clips.

American LaFrance, 100 E. LaFrance St., Elmira, N. Y. 14902
Fire apparatus and fire fighting equipment.

American Optical Co., 14 Mechanic St., Southbridge, Mass. 01550
Head, eye, respiratory, protective devices; safety clothing; safety specialty products.

American Society of Safety Engineers, 850 Busse Hgwy., Park Ridge, Ill. 60068
Professional society.

Ames Publishing Co., One W. Olney Ave., Philadelphia, Pa. 19120
Industrial trade magazine publishers.

Ampco Metal, Inc., 1745 S. 38th St., Milwaukee, Wis. 53201
Hand tools of spark-resistant alloys for use in explosive or flammable conditions.

Ansul Co., One Stanton St., Marinette, Wis. 54143
Fire Protection products.

Antrex Corp., 4355 N. Avers, Chicago, Ill. 60618
Safety Talker Message Repeater, portable public address systems.

Apex Safety Products, Washington and Elm Sts., Cleveland, Ohio 44113
Safety hats and caps.

Arnar-Stone Laboratories, Inc., 601 E. Kensington Rd., Mt. Prospect, Ill. 60056
Americaine Topical Anesthetic.

Atlantic India Rubber Works, 571 W. Polk St., Chicago, Ill. 60607
Hand vacuum lifters.

Atlas Safety Equipment Co., Inc., 175-179 N. 10th St., Brooklyn, N. Y. 11211
Industrial safety belts, harnesses, and straps. Ladder climber's safety device. Sky Genie descent control.

Bacharach Ind. Inst. Co., 200 N. Braddock Ave., Pittsburgh, Pa. 19208
Gas analyses instruments Humidity and temperature indicators and recorders. Multi-gas leak detectors. Air flow velocity indicators.

Badger Fire Extinguishers-Powhatan Brass & Iron Works, Ranson, W. Va. 25438
Fire fighting equipment and supplies.

W. M. Bashlin Co., 119 W. Pine St., Grove City, Penn. 16127
Linemen's and industrial safety belts, slings, high voltage rubber gloves, sleeves.

Bauer Mfg. Co., 1505 E. Bowman St., Wooster, Ohio 44691
Ladders.

Bausch & Lomb Inc., 635 St. Paul St., Rochester, N. Y. 14602
Vision and audio testing equipment.

Beacon Falls Rubber Footwear, Beacon Falls, Conn. 06403
Industrial footwear, boots, shoes, pacs.

Bell Glass & Mirror Co., 1328 Flatbush Ave., Brooklyn, N. Y. 11210
Traffic safety mirrors.

Bell & Howell Co., 7100 McCormick Rd., Chicago, Ill. 60645
Motion picture cameras, projectors, and filmstrip projectors.

Best's Safety Publications, A. M. Best Co., Inc., Park Ave., Morristown, N. J. 07960
Safety publications.

Best Mfg. Corp., Menlo, Ga. 30731
Work Gloves.

Channing L. Bete Co., 45 Federal St., Greenfield, Mass. 01301
Scriptographic Booklets.

Big Beam, 290 E. Prairie St., Crystal Lake, Ill. 60014
Battery operated hand lamps, flashers, emergency lights.

Blaze Guard Mfg., Div. "Automatic" Sprinkler Corp. of America, 2026 - 83rd St., North Bergen, N. J. 07047
Fire products.

Bliss-Gamewell, 1238 Chestnut St., Newton, Mass. 02164
Fire fighting and safety equipment, portable spotlights, foam liquids and fire fighting chemicals, fire protection systems.

Boss Mfg. Co., 221 W. First St., Kewanee, Ill. 61443
Work gloves.

H. L. Bouton Co., Inc., 320 Main St., St. Buzzards Bay, Mass. 02532
Industrial eye protection, goggles, and spectacles.

W. H. Brady Co., 727 W. Glendale Ave., Milwaukee, Wis. 53209
Self-sticking markers and accident prevention signs.

Lester L. Brossard Co., 540 N. Michigan Ave., Chicago, Ill. 60611
Safety mirrors for industrial use. Liquid hand cleaner.

Stewart R. Browne Mfg. Co., 839 Stewart Ave., Garden City, N. Y. 11530
Portable explosionproof inspection lights.

E. D. Bullard Co., 2680 Bridgeway, Sausalito, Calif. 94965
Safety hats, caps, and accessories, industrial first aid kits, safety hoist hooks, vehicle alarms, air purifiers, and ear plugs.

CAH Industries, 10245 Pacific Ave., Franklin Park, Ill. 60131
Self-extinguishing waste receptacle.

Calgon Commercial Div., Calgon Corp., 7501 Page Ave., St. Louis, Mo. 63166
Hand cleaning products.

Cardox Div., Chemetron Corp., 840 N. Michigan Ave., Chicago, Ill. 60611
Fire fighting equipment and supplies.

Casco Products Corp., 512 Hancock Ave., Bridgeport, Conn. 06602
Hand-portable pressurized dry chemical fire extinguishers.

Casell Co., Inc., 1785 Tanen St., Napa, Calif. 94558
Emergency lights and barricades.

Cesco Safety Products, 2727 W. Roscoe St., Chicago, Ill. 60618
Safety glasses and lenses, cup goggles, special purpose goggles, welding helmets, face shields, respirators, plastic aprons, and hoods.

A. B. Chance Co., 210 N. Allen St., Centralia, Mo. 65240
Hot line maintenance and line construction tools. Hot line tools.

Charleston Rubber Co., 16 Stark Industrial Park, Charleston, S. C. 29405
Rubber, plastics, and rubber coated gloves, aprons and sleeves.

Chrysler Corp., 341 Massachusetts Ave., Detroit, Mich. 48231
Safety features in 1967 line of automobiles and trucks.

David Clark Co., Inc., 360 Franklin St., Worcester, Mass. 01604
Muff-type ear protection.

The Coca-Cola Co., P. O. Drawer 1734, Atlanta 30301
Coca-Cola served through the courtesy and cooperation of the Coca-Cola Bottling Company of Chicago.

Columbus McKinnon Chain Div., 160 Fremont St., Tonawanda, N. Y. 14152
Sling chains, hooks, and coupling links.

Converse Rubber Co., 392 Pearl St., Malden, Mass. 02148
Safety toe rubber footwear, industrial rubber footwear, protective clothing of rubber and neoprene.

Custom Materials Inc., 279 Billerica Road, Chelmsford, Mass. 01824
Static-free permanently conductive polyolefin.

Davis Emergency Equipment Div., 55 Halleck St., Newark, N. J. 07104
First aid kits, gas masks and breathing equipment, combustible and toxic gas analyzers, and protective hats.

Demp-Nock Co., 21433 Mound Road, Warren, Mich. 48090
Pressure sensitive plastic film lettering kit.

Den-Va Company, 62 Stanhope St., Brooklyn, N. Y. 11221
Nylon safety spectacles.

Detex Corp., 53 Park Place, New York, N. Y. 10007
Watchmen's clocks.

R. E. Dietz Co., 225 Wilkinson St., Syracuse, N. Y. 13201
Lanterns, torches, flashers, barricades, and safety equipment.

Dockson Corp., 3839 Wabash Ave., Detroit, Mich. 48208
Spectacles, goggles, face shields, helmets, hats, and respirators.

Dow Corning Corp., P. O. Box 7038, Greensboro, N. C. 27407
Sight Savers, lens cleaning stations.

Duff-Norton Co., 100 Pioneer Rd., Box 1719, Charlotte, N. C. 28201
Hand chain hoists.

E. I. du Pont de Nemours & Co., Inc., Centre Rd. Bldg., Wilmington, Del. 19898
"Nomex" fabric.

Duracraft Corp., 2630 S. 2nd W., Salt Lake City, Utah 84110
Gloves.

Eagle Mfg. Co., 24th & Charles Sts., Wellsburg, W. Va. 26070
Safety cans, cigarette-cigar butt cans, drain cans, drip cans, brass oilers.

Eastern Metal of Elmira, Inc., 1430 Sullivan St., Elmira, N. Y. 14901
Safety signs.

Eastern Safety Equipment Co., Inc., 36-12 Astoria Blvd., Long Island City, N. Y. 11103
Safety goggles and spectacles.

Eastman Kodak Co., 343 State St., Rochester, N. Y. 14650
Audio-visual equipment.

Edmont-Wilson, 1205 Walnut St., Coshocton, Ohio 43812
Coated and impregnated work gloves.

Electroline Products, 410 Schroyer Ave., S.W., Canton, Ohio 44702
Terminations, turnbuckles, and swivel products for use with wire rope and synthetic rope.

Electronic Specialties Co., 525 River St., Batavia, Ill. 60510
Warning lights, barricades, and accessories.

Elkhart Brass Mfg. Co., Inc., 1302 W. Beardsley Ave., Elkhart, Ind. 46514
Nozzles and other fire department supplies and fire fighting equipment.

Encon Mfg. Co., 4910 Augusta, Houston, Tex. 77007
Eye wash fountains, emergency showers, personal air conditioning equipment.

Erdco Engineering Corp., 136 Official Road, Addison, Ill. 60101
Gas vapor alarm systems.

Falcon Safety Products, Inc., 20 Stern Ave., Springfield, N. J. 07081
Fire alarms, sirens, horns, bells and other signaling devices.

Federal Sign and Signal Corp., 13625 S. Western Ave., Blue Island, Ill. 60406
Sirens, horns, bells, and warning lights for visual and audible signaling.

Fendall Co., 2222 Diversey Pkwy., Chicago, Ill. 60647
Spectacles, face shields, and cup-type and cover goggles.

Ferno-Washington, Inc., 6th and Pine Sts., Greenfield, Ohio 45123
Emergency patient handling equipment and accessories for the first air room.

Fibre-Metal Products Co., 5th and Tilghman Sts., Chester, Pa. 19016
Safety hats and caps, face shields, safety masks, welding helmets, headrest and combination goggles.

Fine Organics, Inc., 205 Main St., Lodi, N. J. 07644
Solvents, carbon removers, emulsion cleaners, polishers, and disinfectants.

Ford Division—Ford Motor Co., Box 658, Dearborn, Mich. 48121
Ford passenger car with safety features.

Foster Mfg. Co., In., 500 W. Battlefield Rd., Springfield, Mo. 65804
Safety air coupling, air blow gun, lock quick coupling.

Frommelt Industries, Inc., 465 Huff St., Dubuque, Iowa 52001
Wrap-around portable safety welding shield; portable welding screen.

Fyrepel Products, Inc., 951 Buckeye, Newark, Ohio 43055
High heat protective clothing and equipment for industry, space-military, and fire fighting agencies.

General Fire Extinguisher Corp., 1685 Shermer Road, Northbrook, Ill.
Fire Extinguishers.

General Motors Corp., 3044 W. Grand Blvd., Detroit, Mich. 48202
Automotive safety.

Glendale Optical Co., Inc., 130 Crossways Park Drive, Woodbury, N. Y. 11797
Eye and face protective equipment.

Globe Div. U. S. Gypsum, 101 S. Wacker Drive, Chicago, Ill. 60606
Safety grating, cable tray, channel and fittings, slotted angles.

Globe Safety Products, 125 Su[redacted]Place, Dayton, Ohio 45407
Resuscitators.

Goodall Rubber Co., Box 631, Trenton, N. J. 08604
Fire hose, hose couplings, nozzles, and adapters.

Intext Driver Testing Equipment, Pawnee & Oak Sts., Scranton, Pa. 18515
Driver testing equipment.

Interstate Rubber Products Corp., 908 Avilla St., Los Angeles, Calif. 90012
Traffic cone system for traffic control.

Iron Age Safety Shoe Co., 1205 Madison Ave., Pittsburgh, Pa. 15212
Work and dress-style safety shoes and safety rubber footwear.

Jackson Products, 5523 E. Nine Mile Rd., Warren, Mich. 48091
Goggles, welding helmets, face shields, safety hats and caps.

Jacobson Powder Pole, Box 507, Eugene, Oregon
Powder tamping pole.

Jomac-North, Inc., 863 Easton Rd., Warrington, Pa. 18976
Chemical and protective vinyl clothing and gloves, and terry cloth gloves and products.

Jones and Co., 861 Broad St., Providence, R. I. 02907
Full-vision visor goggles and replaceable lenses.

Jones & Laughlin Steel Corp., Penn St., Muncy, Pa. 17701
Wire rope and chain slings.

Junkin Safety Appliance Co., Inc., 3121 Millers Lane, Louisville, Ky. 40216
Interlocking barrier gate guard for power presses; safety shields for grinders; stretcher cases and stretchers.

Justrite Mfg. Co., 2061 N. Southport Ave., Chicago, Ill. 60614
Safety cans, bench cans, plunger cans. Oily waste cans. Electric lanterns and flashlights for use in hazardous areas.

Karel First Aid Supply Co., 4342 Ogden Ave., Chicago, Ill. 60623
Medical equipment for industrial hospitals and first aid rooms.

Kelley Co., Inc., 6720 N. Teutonia Ave., Milwaukee, Wis. 53209
Dockboards.

Keystone View Co., Market and Center St., Meadville, Pa. 16335
Occupational visual service, driver vision test service, and gas sensing and recording instruments.

Walter Kidde and Co., Inc., 675 Main St., Belleville, N. Y. 07109
Portable fire extinguishers, and accessories, Automatic carbon dioxide fire extinguishing system.

Kimberly-Clark Corp., N. Lake St., Neenah, Wisc. 54956
Industrial wipers, disposable industrial clothing.

B. F. Goodrich, Industrial Products Co., 500 S. Main St., Akron, Ohio 44313
Industrial rubber safety footwear, and protective clothing.

The Granet Corp., 25 Loring Drive, Framingham, Mass. 01701.
Coated fabric work glove.

Graphic Caution Systems Div., Diversa Mfg. Co., 4518 Lakeside Ave., Cleveland, Ohio 44114
Changeable letter safety sign panels.

A. E. Halperin Co., Inc., 716 Columbus Ave., Boston, Mass. 02118
Stretchers, first aid kits, and accessories.

Handgards, Inc., Box 1030, Pittsburg, Calif. 94565
Disposable plastic gloves and foot guards.

Haws Drinking Faucet Co., 4th and Page Sts., Berkeley, Calif., 94710
Emergency eyewash and showers.

Hazard Controls, Inc., Woodland & Yale Aves., Cherry Hill, N. J. 08034
Warning lights, barricades, signs, reflectors, cylinder clamps, lockouts, ladder shoes, can carriers, flags, and barrier rope.

Warren Heim Corp., 222 N. 5th Ave., Mt. Vernon, N. Y. 10553
Canvas buckets, bags, and protective covers.

Hild Floor Machine Co., Inc., 5339 W. Lake St., Chicago, Ill. 60644
Explosionproof vacuum cleaners and floor scrubbing and polishing machines.

Hilti Fastening Systems, 360 Fairfield Ave., Stamford, Conn. 06904
Power-assisted drive tools that fasten pins and threaded studs into concrete masonry and steel.

Hy-Test Safety Shoes, Div., of International Shoe Co., 1509 Washington Ave., St. Louis, Mo. 63166
Safety Shoes and conductive and nonconductive footwear.

Illinois Glove Co., 7301 N. Lawndale Ave., Skokie, Ill. 60078
Industrial work gloves and lineman's gloves.

Industrial Gloves Co., 700 Garfield St., Danville, Ill. 61832
Industrial clothing and accessories.

Industrial Products Co., 2820 N. 4th St., Philadelphia, Pa. 19133
Industrial clothing.

International Film Bureau, Inc., 332 S. Michigan Ave., Chicago, Ill. 60604
Safety films available on a sales and rental basis.

Kimsafe, Inc., 4900 Campbell Road, Willoughby, Ohio 44094
Personal protection devices for industry.
Personal protection devices for employees in industrial plants.

Mathias Klein and Sons, Inc., 7200 McCormick Road, Chicago, Ill. 60645
Linemen's and electricians' hand tools, linemen's safety equipment, wire-pulling tools.

Knapp Brothers Shoe Mfg. Corp., 173 Spark St., Brockton, Mass. 02401
Safety shoes.

J. Kunz Glove Co., 2141 W. North Ave., Chicago, Ill. 60647
Leather and rubber work gloves.

Laerdal Medical Corp., 136 Marbledale Rd., Tuckahoe, N. Y. 10707
Training aids and equipment for resuscitation and first aid.

Lectric Lites Co., 2504 W. Vickery St., Ft. Worth, Tex.
Barricade flasher lights and traffic signs

Walter G. Legge Co., Inc., 101 Park Ave., New York, N. Y. 10017
Safety floor maintenance materials, Personnel and equipment grounding devices.

Lehigh Safety Shoe Co., First and Minor Sts., Emmanus, Pa. 18049
Leather and rubber safety footwear including conductive and electrical hazard shoes.

Libbey Products, Owens-Illinois, Inc., Box 1035, Toledo, Ohio 43601
Safety incentives.

Liberty Protective Leathers, Box 211, Clark Mills, N. Y. 13321
Leather gloves and mittens.

Link Group, General Precision Systems, Binghamton, N. Y. 13902
Driver trainer.

L. M. Lind Engineering, 4432 N. Kedzie Ave., Chicago, Ill. 60625
Safety guards.

Louisville Ladder Co., 1163 Algonquin Pkwy., Louisville, Ky. 40208
Fiberglass and aluminum steps, platforms, extension trestles, aluminum planks and stages, steel warehouse ladders.

Thom McAn Shoe Co., 67 Millbrook St., Worcester, Mass. 01606
Safety shoes.

Julian A. McDermott Corp., 1639 Stephen St., Ridgewood, Brooklyn, N. Y. 11227
Warning and safety lighting for municipal industrial and utility use.

Machinery Center, Inc., 1201 S. 6th West, Box 964, Salt Lake City, Utah 84110
Sala Safety Block.

Mars Mfg. Co., 350 5th Ave., New York, N. Y. 10001
Disposable garments for industry and hospitals.

Magid Glove Mfg. Co., Inc., 2201 W. Wabansia Ave., Chicago, Ill. 60647
Industrial gloves.

Marathon Rubber Products Co., Box 448, Wausau, Wis. 54401
Industrial and municipal protective clothing.

A. J. Masuen Co., Le Mars, Iowa 51031
Industrial first aid kits and supplies.

Martindale Electric Co., 1375 Hird Ave., Cleveland, Ohio 44107
Protective masks and refills, protective eyeshields, and electrical testing instruments.

Martin-Decker Corp., 1928 S. Grand Ave., Santa Ana, Calif. 92705
Safety tools.

Medical Supply Co., 1027 W. State St., Rockford, Ill. 61101
First aid kits and accessories, Resuscitation training aids, stretchers.

Meyer Mfg. Inc., Box 114, Red Wing, Minn. 44066
Safety products for the protection of person while climbing.

Milburn Co., 3246 E. Woodbridge, Detroit, Mich. 48207
Protective hand creams and related products.

Miller Allied Corp., 1418 Park Ave., Alameda, Calif. 94501
Material handling slings and adjustable lifting safety beams.

Miller Equipment Co., Inc., 13th and New Sts., Franklin, Pa. 16323
Linemen's safety equipment and accessories.

Millers Falls Co., 57 Wells St., Greenfield, Mass. 01301
Shockproof power tools.

Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh, Pa. 15208
Complete line of safety equipment for industry and mining.

Miracle Instrument Co., Inc., 1188 Grand Concourse, Bronx, N. Y. 10456
Safety self-ejecting lathe and drill press chuck keys.

Morrison-Pelsue Co., 2001 S. Bannock St., Denver, Colo. 80223
Portable ventilating and heating equipment.

Morton Mfg. Co., 5125 W. Lake St., Chicago, Ill. 60644
Safety grating.

Mott Corp., 500 Shawmut Ave., LaGrange, Ill. 60526
Safety mowers.

M-P Corp., 6466 Chene St., Detroit, Mich. 48211
Safety blade for rotary lawn mowers.

National Assn. of Fire Equipment Distributors, Inc., 604 Davis St., Evanston, Ill. 60204
Technical association.

National Fire Hose Corp., 516 E. Oaks St., Compton, Calif. 90024
Fire hose specialties for the industrial fire departments.

National Foam System, Inc., Union & Adams Sts., W. Chester, Pa. 19380
Fire fighting equipment.

Newco Mfg. Co., Inc., 3636 Main St., Kansas City, Mo. 64111
Wire rope fittings, miniature slings, and a miniature crane demonstrating various lifts.

Newton Glove, Inc., P. O. Drawer 271, Newton, N. C. 28658
Safety and work gloves.

Norris Industries, U. S. Highway #1, South, Newark, N. J. 07114
Fire extinguishers and fire fighting systems.

Northern Signal Co., 350 Tower Rd., Saukville, Wis. 53080
Flashers and barricades.

Occupational Hazards, 812 Huron Road, Cleveland, Ohio 44115
Occupational Hazards Magazine.

Ohio Medical Products, 1400 E. Washington Ave., Madison, Wis. 53701
Resuscitation and oxygen breathing apparatus.

Onox, Inc., 121 Second St., San Francisco, Calif. 94005
Skin-toughener solution for the treatment of athlete's foot.

Osborn Mfg. Co., 960 N. Lake St., Warsaw, Ind. 46580
Safety pliers, lockout devices, mufflers and stretcher cases.

Pac-Kit Safety Equipment Co., 1 Seneca Place, Greenwich, Conn. 06831
First aid kits and supplies.

Paralta Equipment Co., 105 Industrial Road, Hammond, Ind. 46325
Flashing lights, barricades, traffic cones, vests, flags, trouble lights, signs.

Patent Scaffolding Co., 11-11 34th Ave., Long Island City, N. Y. 11106
Aluminum scaffolding, rolling, and wood and aluminum ladders.

Pedley-Knowles & Co., 533 Second St., San Francisco, Calif. 94107
Safety and work nets of manila rope and plastic.

Pem-All Mfg. Co., 39A Myrtle St., Cranford, N. J. 07016
Fire extinguishers.

The Pioneer Rubber Co., 1939 Tiffin Road, Willard, Ohio 44890
Industrial gloves.

Pitman Mfg. Co., P. O. Box 605, Grandview, Mo. 64030
Hydraulic digger, derrick, and aerial devices.

The Positive Safety Mfg. Co., 1052 E. 134th St., Cleveland, Ohio 44110
Power press safety devices.

Power-Pak Products, 83 Clyde Ave., Buffalo, N. Y. 14215
Fire Fighting Equipment.

Prairie State Products Co., 3822 W. Lawrence Ave., Chicago, Ill. 60625
Industrial safety signs.

Powhatan Brass & Iron Works, Ranson, W. Va. 25438
Fire protection equipment.

Presslabs Dept., Holland-Suco Color, 491 Columbia Ave., Holland, Mich. 49423
Traffic markings.

Protectoseal Co., 1920 S. Western Ave., Chicago, Ill. 60608
Safety containers for the handling, storing and dispensing of flammable liquids.

Protexall Co., P. O. Box 307, Green Lake, Wis. 54941
Clothing.

Pulmosan Safety Equipment Corp., 30-48 Linden Pl., Flushing, N. Y. 11354
Respirators, eye protection, helmets, protective clothing, asbestos and leather gloves, safety glasses, first aid kits, and face shields.

Pyrotronics, Div. Baker Industries, 2343 Morris Ave., Union, N. J. 07083
Fire and smoke detection and alarm systems.

Racine Glove Co., Inc., Box 368, Rio, Wis. 53960
Safety gloves and apparel for industry and fire protection, safety specialty products.

Radiator Specialty Co., 1400 W. Independence Blvd., Charlotte, N. C. 28201
Traffic guides; cones, light, flags.

Rainfair, Inc., 1501 Albert St., Racine, Wis. 53401
Wet weather and safety clothing.

Ramset Fastening System, 289 Winchester Ave., New Haven, Conn. 06504
Low-velocity piston tool.

Record Industrial Co., 3301 Arch St., Philadelphia, Pa. 19104
Industrial safety shoes, work clothing and work gloves.

Red Wing Shoe Co., 119 Main St., Red Wing, Minn. 55066
Safety workshoes, oxfords, and boots.

J. C. Renfroe Sons, Inc., 1926 Spearing St., Jacksonville, Fla. 32206
Safety clamps for lifting steel.

Reviv-A-Life Resuscitators, 8335 S. Halsted St., Chicago, Ill. 60620
Resuscitation equipment.

Reynolds Televator Corp., 1104 Sixth St., Muskegon, Mich. 49440
Telescopic work platform.

Rich's Soft Cushion Water Bumper, 2117 Arden Way, Sacramento, Calif. 95825
Water bumpers.

Rite Hardware Mfg. Co., 4530 San Fernando Rd., Glendale, Calif. 91204
Air-conditioned helmet systems.

The Robbins Co., O'Neil Blvd., Attleboro, Mass. 02703
Safety incentives.

Rockford I. C. Webb, Inc., 301 N. Madison St., Rockford, Ill. 61110
Noise resistant ear protectors.

Rose Mfg. Co., 2700 W. Barberry Pl., Denver, Colo. 80204
Automotive seat belts. Industrial safety belts, lanyards, net, and ladder safety devices.

The Rucker Co., 747 Bancroft Way Berkeley, Calif. 94710
Electrical shock safety device.

Safeline Products, Putnam, Conn. 06260
Safety Clothing.

Safety Appliance Corp., P. O. Box 689, Tyler, Texas 75701
Protective foot coverings.

Safety & Industrial Net Co., 23 Edgerton St., East Hampton, Conn. 06424
Safety Nets.

Safety Box Toe Co., 812 Statler Office Bldg., Boston, Mass. 02116
Steel toes for dress, semi-dress, and work shoes.

Safety Clothing and Equipment Co., 1990 E. 69th St., Cleveland, Ohio 44103
Safety clothing and equipment for industrial workers.

Safety First Products Corp., 175 Saw Mill Road, Elmsford, N. Y. 10523
Portable stored pressure dry chemical fire extinguishers.

Safety First Shoes, Inc., 8th and Greenleaf Sts., Allentown, Pa. 18105
Safety shoes for industry, railroad, and military use.

Safety Guide Products, Borg-Warner Corp., 345 N. Third, Scottsburg, Ind. 47170
Highway warning devices.

The Safety Journal, Anderson, S. C. 29621
Safety publication.

Safeway Safety Products Corp., 918 Blackhawk Blvd., Rockton, Ill. 61072
Safety cans.

Salescaster Displays Corp., 1010 E. Elizabeth Ave., Linden, N. J. 07036
Illuminated moving message signs.

W. H. Salisbury and Co., 401 N. Morgan St., Chicago, Ill. 60622
Linemen's rubber protective devices.

Sawyer-Tower Products, Inc., 76 Stanley Ave., Watertown, Mass. 02172
Industrial protective, and safety clothing.

Schuberth Corp., 1205 Champlain St., Toledo, Ohio 43604
Safety hats and caps, face shields, accessories.
Helmets, safety hats and caps, safety goggles, and wrap-around protective goggles.

Scott Aviation, 225 Erie St., Lancaster, N. Y. 14086
Respirators, inhalators, and environmental protection equipment.

Searjeant Safety Products, 3111 Winton Rd., S., Rochester, N. Y. 14623
Press guards.

Seco Mfg., Inc., 4461 W. Jefferson, Detroit, Mich. 48209
Fire fighting equipment.

Seiberling Latex Products, 4500 S. E. 59th St., Oklahoma City, Okla. 73135
Industrial rubber gloves.

Sellstrom Mfg. Co., Highway 53 at U. S. 14, Palatine, Ill. 60067
Eye and face protective equipment.

The Servus Rubber Co., 1136 Second St., Rock Island, Ill. 61201
Rubber footwear of all types.

Fred Silver & Co., 145 Sussex Ave., Newark, N. J. 07103
Traffic Safety Mirrors.

Singer Safety Products, 450 N. Lake Shore Dr., Chicago, Ill. 60611
Gloves, portable welding screens.

Snyder Mfg. Co., Inc., 1458 Fifth St., New Philadelphia, Ohio 44663
Air suits, hoods, splash and dust suits, shoe covers, safety vests, flags, fabric and film laminations, and fiberglass containment closures.

Speakman Co., 301 E. 30th St., Wilmington, Del. 19899
Emergency eyewash and showers.

Standard Industrial Products Co. of Ill., 3527 Farmington Rd., Peoria, Ill. 61601
Dunking station smoking receptacles.

Standard Safety Equipment Co., 431 N. Quentin Rd., Palatine, Ill. 60067
Acid and chemically-resistant clothing.

Standard Signs Inc., 3190 E. 65th St., Cleveland, Ohio 44127
Industrial accident prevention signs and road work area protection equipment.

Starrco, Inc., 711 N. 9th St., St. Louis, Mo. 63101
Portable aluminum buildings.

Stephenson, Div. of Bangor Punta, Box 1000, Red Bank, N. J. 07701
Resuscitation equipment, Speedalyzer, Breathalyzer.

Stonehouse Signs, Inc., 5550 W. 60th St., Arvada, Colo. 80002
Accident prevention signs and tags.

Stop-Fire, Inc., U. S. 1 at Black Horse Lane, New Brunswick, N. J. 08902
Fire extinguishers.

Sure Plus Mfg. Co., 645 W. 120th St., Chicago, Ill. 60628
Mirrors.

Surety Rubber Co., North High St., Box 97, Carrollton, Ohio 44615
Safety apparel, gloves, sleeves, aprons, and specialized protective equipment.

Surty Mfg. Co., 4139 W. Kinzie St., Chicago, Ill. 60624
Press guards.

Survivair, Division of U. S. Divers Co., 3323 W. Warner Ave., Santa Ana, Calif. 92702
Self-contained breathing equipment. Wet pick-up vacuum unit. Voice amplifiers.

S. G. Taylor Chain Co., Inc., 3-141st., Box 508, Hammond, Ind. 46325
Alloy steel chain and fittings.

3M Co., Retail Tape & Wrap Div., 2501 Hudson St., St. Paul, Minn. 55119
Filter masks and industrial tapes.

Thruway Building Service, Inc., 247 W. 16th St., New York, N. Y. 10011
Safety flooring and stair tread.

Titmus Optical Co., Inc., 1015 Commerce St., Petersburg, Va. 23804
Safety frames, safety lenses and vision tester.

Trans Continental Electronics Corp., 865 Roosevelt Ave., Secaucus, N. J.
Safety shower—eyebath combination.

Tri-Trix, Inc., 6411 N. Mequon Rd., Mequon, Wis. 53092
Safety cones traffic posts.

Underwriters' Laboratories, Inc. 207 E. Ohio St., Chicago, Ill. 60611
An independent testing organization for public safety.

Unico Environmental Instruments, 150 Cove St., Fall River, Mass. 02720
Environmental health services.

Uniroyal, Inc., 1230 Sixth Ave., New York, N. Y. 10020
Safety footwear.

U. S. Forgecraft Corp., Box 387, Fort Smith, Ark. 72901
Safety hardware.

United States Safety Service Co., 1535 Walnut St., Kansas City, Mo. 64108
Industrial eyewear and hearing protection.

Velcro Corp., 681 Fifth Ave., New York, N. Y. 10022
The Velcro fastener.

Vestal Laboratories, 4963 Manchester, St. Louis, Mo. 63110
Skin cream.

Vinyl Plastics, Inc., 1825 Erie Ave., Sheboygan, Wis. 53081
Conductive flooring.

Wagner Sign Service, Inc., 3100 Hirsch St., Melrose Park, Ill. 60160
Changeable copy displays for employee relations and safety programs.

Watchemocket Optical Co., Inc., 232 W. Exchange St., Providence, R. I. 02903
Safety goggles, respirators, face shields and safety signs.

Welsh Mfg. Co., 9 Magnolia St., Providence, R. I. 02909
Respirators, safety spectacles, goggles, safety hats, faceshields, and welding helmets.

Western Drinking Fountains, Inc., 45563 Industrial Pl., Fremont, Calif. 95438
Eye wash fountains and drench showers.

Wheeler Protective Apparel, Inc., 224 W. Huron St., Chicago, Ill. 60610
Industrial safety apparel.

Whelen Engineering Co., Inc., 3 Winter St., Deep River, Conn. 06417
Emergency and warning lights, flashers, and beacons.

Williams Jewelry and Mfg. Co., 4544 N. Western Ave., Chicago, Ill. 60625
Safety plaques, trophies, awards, emblems, badges, and incentives.

Willson Products Div., Electric Storage Battery Co., 2nd and Washington Sts., Reading, Pa. 19603
Personal protective equipment for industry.

Wire Rope Corp. of America, Inc., 609 N. 2nd St., St. Joseph, Mo. 64502
Wire rope slings.

Wolverine World Wide, 9341 Courtland Dr., Rockford, Mich. 49341
Hand and head protection.

Worklon, Inc., 64 New York Ave., Huntington, N. Y. 11744
Special purpose clothing — acid-resistant, lint-free, static free and fire retardant.

Worksafe, Inc. 12 W. 31st St., New York, N. Y. 10001
Protective clothing.

Wyandotte Chemicals Corp., Wyandotte, Mich. 48192
All-purpose absorbant for grease, oil.

Young Fire Equipment Corp., Cemetery Rd., Lancaster, N. Y. 14086
In-plant fire truck and utility carts.

American Industrial Hygiene Association, 14125 Prevost, Detroit, Mich. 48227
Information about associations activities.

American Medical Association, Council on Occupational Health, 535 N. Dearborn St., Chicago, Ill. 60610
Occupational Health literature.

American National Red Cross, 17th & D Sts., N.W., Washington, D. C. 20006
Water safety.

Chicago Fire Department
Information on the work of the Fire Prevention Bureau.

Chicago Police Dept., Traffic Div.
Traffic safety.

Inter-American Safety Council, 140 Cedar St., New York, N. Y. 10006
Safety publications, visual aids, and films, in Spanish for industrial, highway, and home.

Prevention of Blindness Inc., National Society for the, 16 E. 40th St., New York, N. Y. 10016
Literature and information in industrial and vocational school eye health and safety programs.

U. S. Civil Defense, Room 11-D-477, The Pentagon, Washington, D. C. 20210
Fall-out Shelters.

Outdoor Power Equipment Institute, 400 Walker Bldg., Washington, D. C. 20005
Power mower safety.

U. S. Air Force Academy, Colorado 80840
USAFA Cadet Wing safety program.

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AEROSPACE SECTION

HUMAN FACTORS APPLIED TO ACCIDENT PREVENTION*

By DR. ALAN D. SWAIN
Staff Member, Systems Reliability Div., Sandia Corp., Albuquerque, N. M.

Two questions can be asked in attempting to improve the safety record in an industrial plant. One asks, "What safety rules are necessary to keep accidents at a minimum and how can we get our workers to obey them?" The other asks, "What work situations are there that foster accidents and how can we eliminate these accident prone situations?"

The first question characterizes the motivation approach to reducing accidents. Management tries to impress on the worker his (the worker's) responsibility for avoiding accidents and that freedom from accidents will result if he only obeys the safety rules. The Zero Defects approach is an example of the motivation approach.

The second question characterizes the situation approach to improving safety. Management acknowledges that it has the primary responsibility for safety and that accidents can be held at a minimum if accident prone situations are identified and eliminated before they result in accidents.

A systematic, rational approach to safety places primary emphasis on the situation approach because it has the biggest payoff—it is by far the most cost effective. Sufficient, but definitely secondary, emphasis is placed on the motivation approach because there are normally severe limitations on the amount that safety can be improved by attempting to change the worker rather than the work situation.

A safety program must set reasonable goals to be attained. Reduction of major injuries or damage from accidents is an ephemeral goal because an accident of this type is a relatively infrequent event, and it is often the result of many complex, interacting, and often fortuitous factors some of which, in a given accident, can never be identified. On the other hand, the identification and removal of accident prone situations (primarily those having a high potential for causing major damage to life, sight, limb, or property) is a more solid goal which can provide immediate and frequent reinforcement of the safety attitudes that the motivation approach has only limited success in fostering. And, of course, if the immediate cause of a potential accident is removed, so is the potential accident.

Thus, the keystone to a systematic, rational approach to safety is the identification of accident prone situations. Participation by workers and foremen and recognition of their necessary role by management are musts in a safety program that is to succeed. Techniques are available which can be employed in this endeavor.

Recent Human Factors Publications by Sandia Laboratories

1. Guttman, H. E. and Finley, B. H.; *Accuracy of Visual Spatial Interpolation*, SC-DC-68-2241, Sandia Corp., Albuquerque, N.M., July 1968.
2. Rigby, L. V.; *The Sandia Human Error Rate Bank (SHERB)*, SC-R-67-1150, Sandia Corp., Albuquerque, N.M., July 1968.
3. Rigby, L. V. and Edelman, D. A.; *A Predictive Scale of Aircraft Emergencies*, SC-DC-67-2854, Sandia Corp., Albuquerque, N.M., Dec. 1967.
4. Rigby, L. V. and Edelman, D. A.; *An Analysis of Human Variability in Mechanical Inspections: Summary*, SC-DC-68-2178, Sandia Corp., Albuquerque, N.M., May 1968.
5. Rigby, L. V. and Edelman, D. A.; *An Analysis of Human Variability in Mechanical Inspection*, SC-RR-68-282, Sandia Corp., Albuquerque, N.M., May 1968.
6. Rigby, L. V. and Swain, A. D.; *Effects of Assembly Error on Product Acceptability and Reliability*, SC-DC-68-3211, Sandia Corp., Albuquerque, N.M., July 1968.
7. Rook, L. W.; *Reduction of Human Error in Industrial Production*, SCTM-93-62(14), Sandia Corp., Albuquerque, N.M., June 1962.
8. Rook, L. W.; "Evaluation of System Performance from Rank-Order Data," *Human Factors*, 1964, 6, 533-536.
9. Rook, L. W.; *Motivation and Human Error*, SC-TM-65-135, Sandia Corp., Albuquerque, N. M., Sept. 1965.
10. Swain, A. D.; *System and Task Analysis, A Major Tool for Designing the Personnel Subsystem*, SCR-457, Sandia Corp., Albuquerque, N. M., Jan. 1962.

*This work was supported by the United States Atomic Energy Commission.

11. Swain, A. D.; "Reliable Systems Versus Automatic Testing," *Proceeding of the Ninth National Symposium on Reliability and Quality Control*, Institute of Radio Engineers, New York, Jan. 1963, 380-390. (Also SCR-582)

12. Swain, A. D.; *A Method for Performing a Human Factors Reliability Analysis*, SCR-685, Sandia Corp., Albuquerque, N. M., August 1963.

13. Swain, A. D.; "Human Factors in Design of Reliable Systems," *Proceedings of the Tenth National Symposium on Reliability and Quality Control*, Institute of Electrical and Electronic Engineers, New York, Jan. 1964, 250-9. (Also SCR-748)

14. Swain, A. D.; *THERP*, SC-R-64-1338, Sandia Corp., Albuquerque, N. M., Aug. 1964.

15. Swain, A. D.; "Some Problems in the Measurement of Human Performance in Man-Machine Systems," *Human Factors*, 1964, *6*, 687-700. (Also SC-R-66-906).

16. Swain, A. D.; "The Human Factors Approach to Reducing Production Errors," *Employee Relations Bulletin*, April 21, 1965, Report No. 949, 1-4. (Also SC-R-67-1044).

17. Swain, A. D.; *Safety as a Design Feature in Systems*, SC-R-65-991, Sandia Corp., Albuquerque, N. M., Sept. 1965.

18. Swain, A. D.; "Some Limitations in Using the Simple Multiplicative Model in Behavior Quantification," W. B. Askren (Ed.), *Symposium on Reliability of Human Performance in Work*, AMRL-TR-67-88, Wright-Patterson AFB, Ohio, May 1967, 17-31. (Also SC-R-68-1697).

19. Swain, A. D.; "Field Calibrated Simulation," *Proceedings of the Symposium on Human Performance Quantification in Systems Effectiveness*, Naval Material Command and the National Academy of Engineering, Wash., D. C., Jan. 1967, IV-A-1 - IV-A-21. (Also SC-R-67-1045).

20. Swain, A. D., Altman, J. W., and Rook, L. W.; *Human Error Quantification, A Symposium*, SCR-610, Sandia Corp., Albuquerque, N. M., April 1963.

21. Swain, A. D., Shelton, G. C., and Rigby, L. V.; *Maximum Torque for Small Knobs Operated With and Without Gloves*, SC-DC-68-2252, Sandia Corp., Albuquerque, N. M., June 1968.

HOW I MAINTAIN AN ACCIDENT FREE SHOP

By OBED A. GOOD

Machine Shop Foreman, Martin Marietta Corp., Aerospace Division, Orlando, Florida

Martin Marietta Corp., has three aerospace divisions: in Baltimore, Maryland; Denver, Colorado; and in Orlando, Florida. I am happy to be employed at the Orlando Division.

We at the Orlando Division have been honored to win the National Safety Council's Award of Honor; which we have held for two years in succession. I should also mention that we have placed second for the Safety Award among the Class "A" Aerospace divisions; and have set new records of operation without lost time accident. It was through the team effort of all our management and employees which made it possible for us to win this award for 1967.

For the past two years we have been using color slides in our safety presentation to all manufacturing management and supervision. Each month one member of a department is given the opportunity of making the presentation. He will tour the manufacturing facility, taking photos of unsafe and safe conditions. (Some of the actual slides were shown in the presentation.)

In these safety sessions, we discuss how we can correct the unafe conditions and how to prevent them from recurring in the future. We have found that a photo of unsafe conditions make a greater impression on the minds of our supervisors and that they will return to their work assignments looking for these unsafe conditions within their own departments.

Through the team work and cooperation of all levels of management and by showing slides in an attitude of constructive criticism, we pass this information on to our employees. Through the cooperation of our employees who make us aware of any problems which they see, and the willingness of management to listen, we can correct problems no matter how small they may seem.

We at the Orlando division say that Safety does not begin with the Safety Engineer, but with *all* the employees from the bottom to the top.

TITAN II LAUNCH FACILITY ACCIDENT BRIEFING

By COL. CHARLES F. STRANG, USAF
Directorate of Aerospace Safety, Norton AFB, Calif.

The Air Force is vitally interested in conserving Air Force resources and preventing accidents or mishaps. In spite of our safety efforts, accidents have occurred requiring detailed accident investigations. These investigations are conducted to determine the cause factors and corrective actions necessary to preclude future accidents of a similar nature.

One aspect of fire and accident prevention is to disseminate the lessons learned. The cause and methods of preventing the recurrence of accidents similar to the Titan II launch facility fire at Little Rock AFB, 1965, are of interest.

In this presentation I will show how, in fire prevention, it is important to properly identify the hazards involved in the use of materials and the need to recognize inherently hazardous tasks. I say this because the hydraulic fluid involved in the Titan II accident is not rated as a flammable fluid by National Fire Protection Association definitions. However, under certain conditions, it is flammable. Next, I will show how the degree of hazards for welding in an enclosed space is increased by the presence of hazardous materials. Finally, I will show why a hazard analysis, application of adequate safety standards, and work scheduling procedures are necessary.

The Titan II launch facility fire at Little Rock AFB occurred while the missile complex was undergoing a modification entitled *Yard Fence*. It took the lives of 53 workmen.

At the operational Titan II underground complex the center portion of the silo, known as the launch duct, contains the missile. The equipment area is outside the launch duct. There are nine levels within the silo, containing many varied pieces of equipment. The entrance into the cableway is located at level 2. The silo elevator, with a six person capacity, is located next to this entrance. The cableway at level 2 provides passage to the access portal area, and on to the launch control center. Normal access to and from the surface is up the stairs in the access portal area.

One of the purposes of the *Yard Fence* modification program was to increase silo hardening; that is, ability of the entire underground installation to withstand the effects of a nearby nuclear detonation through a "find and fix" program. This program varied from site to site and included the addition of structural steel reinforcements at various points of the hardness structure, to be accomplished by welding. Other modifications in the *Yard Fence* program included improvement and repair of the hydraulic and electrical systems, and modification of acoustical liners on the inside of the launch duct.

Yard Fence was initiated in November 1964, and the contract was let in January 1965. At the McConnell complexes, work was started in March and completed in June 1965. Work was initiated at Little Rock in June. As of the date of the accident, work on two complexes was completed and two were undergoing modification. Work on the site of the accident had commenced on 16 July. The R/V was removed; however, the missile and its fuel and oxidizer remained in the silo.

I would like to briefly set the stage for the accident:

The lunch hour was from 1200 to 1230 hours. At 1230, the workmen returned from above ground, and, presumably, by 1245 were all back at work. Information derived from work schedules and body positions indicated distribution of the men, by level as follows:

Level 1 — 1
2 — 12
3 — 24
4 — 8
5 — 1
6 — 4
7 — 4
8 — 0
9 — 0
1 in elevator — 5 — 6

The four man Air Force crew and five maintenance personnel were in the launch control center.

Mr. A., a laborer and one of the survivors, testified that shortly after 1300 hours he left the access portal area and went through the cableway to level 2 of the silo, in search of a mop and bucket. He went around the launch duct and approached a group of men standing around the top of the emergency escape ladder that extended vertically down to level 7. This ladder was used when the elevator was not operating. While he was standing here and facing outward at the one o'clock position, he stated that he heard a puff of wind. He turned around to his right, and looking in the direction of the water chillers he stated he saw yellow-colored flames reaching to the ceiling. They quickly subsided to a height of about four feet.

The men who were congregated around the emergency ladder made a rush for the ladder. A. realized he would not be able to escape in this direction and decided to reach the cableway by going around the launch duct through the area of fire. He could not have gone around the launch duct in the other direction, as the collimator room walls block passage. As he started, the lights went out. He made his way in the darkness, through fire and smoke, to the cableway and then on into the launch control center. He suffered numerous, but not severe, burns of the hands and face.

The other of the two survivors of the 55 people in the silo was working on level 1. He stated he heard or saw nothing. After the lights went out, he smelled smoke. He made his way down the ladder to level 2 and out the cableway. He wasn't overly excited—as testimony to this, he arrived at the LCC with both paint brush and bucket in his hand. He suffered from smoke inhalation, but no other injuries.

At approximately 1308 hours, the missile combat crew commander (MCCC) saw the "fire in Diesel engine area" indicator on his console illuminate. The Diesel engine is on level 3. The MCCC sounded the klaxon horn and made three announcements on the voice signaling system, ordering evacuation of the silo. Shortly afterward, several attempts were made by crew members to penetrate the silo. Initial attempts were turned back by the heavy smoke in the cableway and silo, and heat in quadrant III of level 2. It was stated that even with a flashlight, visibility was no more than a couple of feet.

I will not describe rescue operations in any detail except to point out that the investigation revealed most of the people on the four upper levels were probably dead within 5 minutes. Those on lower levels may have lived a few minutes more. The missile itself sustained no visible damage.

I will show how we can conclude that the accident was caused by a welder striking a temporarily installed high-pressure, steel-braided hose containing flammable hydraulic oil, causing the hose to rupture and resulting in a severe flash fire of relatively short duration. These facts lead to this conclusion: A rupture in a flexible hose was discovered near the floor of level 2. This hose was used in the contractor's temporarily installed flushing rig to flush and clean the HS-2 hydraulic system. (This system operates the silo blast valves and the movable work platforms in the launch duct.) The ruptured hose was a teflon inner tube covered by a steel braid. The rupture occurred approximately four inches from the attachment. Independent examination of the hose by two metallurgical experts of the Aerospace Safety Staff and the Materials Laboratory at Wright-Patterson AFB, confirmed this rupture to be caused by application of temperatures in excess of 2500°F., such as that created by an electric arc welding rod. Furthermore, the experts state it could not have been caused by an oxy-acetylene torch because there was no charring or burning of the teflon fibers.

The break in the steel braids was approximately 1⅛-inches long. The hose was carrying hydraulic oil under 500 psi.

The manufacturer of the hose, Tite Flex Corp., has stated that the teflon inner tube is sold by them as a low-pressure hose and rated at five psi. With the steel braid, they rate the hose at over 1000 psi. With a break in the steel braid as shown, they believe 500 psi would rupture the teflon lining instantaneously.

Examination of the floors of levels 2 and 3 showed large quantities of hydraulic oil spread around, particularly in quadrant 3 and 4 on both levels. Samples of this oil were laboratory tested and shown to be the same as that in use in the rig. Furthermore, measurements of oil remaining in the rig showed that approximately 90 gallons were missing. The temporarily installed flushing rig, for flushing and cleaning the hydraulic system, had a motor and

pump located at the top. A 1½-inch iron pipe extended to just above the floor of level 2. The flexible hose was connected at the floor level where the rupture occurred.

Our investigation then considered the possibility of welding being accomplished in the vicinity of the rupture. There was concrete evidence that welding was being done in this vicinity—in fact, within 14 inches of the rupture.

A welding machine was at ground level. An electrical line extended through a hole down to level 3 and looped back up to level 2. A stinger with welding rod was found, to which this line was connected. The ruptured hose was in the background. Triangular plates were being welded near the pressure line to strengthen the support of a can protecting a spring. One weld had been completed. Another weld was one-third completed. An expert welder examined the incompleted weld and stated that in his opinion, it was a very recent weld which had, of course, been subjected to ambient temperatures of around 1000°-1200° F.

Our postulation is that the welder first tried to make this weld from below. An expert welder tried this and stated that, although he could work from that position, it was very difficult. We postulate that the welder gave up and proceeded to level 2 to try it through the opening in the floor near the silo wall.

An investigator knelt in the place where the welder would have been on level 2, his left shoulder next to the silo wall.

The investigator placed his hands in position to weld the plate in question. The rod would have come extremely close to the rupture in the hose.

Examination of the fire pattern showed the fire centered around quadrant III of levels 2 and 3. The motor control center, MCC-1, in quadrant III at level 3, was severely burned. The MCC-1 receives, transforms, rectifies, and distributes all power in the silo. It is located directly under the rupture. The fact that power was disrupted throughout the silo within a minute or less of the initial flash indicates it was badly burned very quickly. Detailed examination of the MCC-1 showed that all identifiable short circuits were a result, and not the cause, of the fire.

The fire pattern was in complete agreement with our theory. A welder was scheduled to work on this hardness fix from level 3. His body was discovered on level 2 between the ruptured hose and the cableway. He could not have reached this position after the accident if he had been on level 3. This particular welder was the most badly burned of the victims. An autopsy showed that he had suffered flame inhalation. A welding mask and helmet identified as his, found between his body and the rupture, were saturated with hydraulic oil, as were his body and clothes.

So you can see that the fire resulted from a rupture in a high-pressure, flexible, steel-braided hose containing flammable hydraulic oil, which was accidentally struck by a welding rod. The solution to prevention is simple: do not permit welding operations in the vicinity of pressurized lines carrying flammable materials.

Hydraulic Hose Test at Edwards AFB. Arrangements were made by the Air Force for hydraulic hose rupture and fire tests to be conducted at Edwards AFB. The purpose of this test was to validate cause factors of the accident. The overall objective of the test was to demonstrate failure of the hydraulic flushing hose and subsequent hydraulic fluid ignition under conditions and environment known to exist at the time of the accident. Specifically, our test objectives were to determine:

a. Time and touch of welding arc contact in achieving a similar rupture to the failed hose.

b. Times between welding arc contact and hose rupture; and between hose rupture and ignition.

c. Oil spray pattern achieved from a hose rupture.

d. Ignition and temperature characteristics of hydraulic oil (MIL-H-6083).

The hydraulic flushing unit actually in use at the launch complex during the accident was airlifted to Edwards. Two static tests and 24 dynamic tests were performed.

Results.

1. For the two static tests, the rupture pressures of the hydraulic hose, were 375-381 psig and 275-285 psig, respectively. The flushing unit's operating pressure was 500 psig.

2. There were 16 hose ruptures achieved from the 24 dynamic tests attempted.

3. Subsequently, nine fires resulted from these ruptured hoses.

4. The sources of ignition were determined to be the electrode arc or hot metal droplets produced by the arc.

5. Hydraulic fluid spray burned intensely after ignition and maximum temperature of 2100° F. was obtained.

Test 22

Welder setting	127 amperes
Strands severed	140
Time-beginning of arc to rupture	0.69 seconds
Time-rupture to ignition	0.02 seconds
Total test time	21.8 seconds
Total current time	1.08 seconds
Total hydraulic oil used in 21 seconds	23.6 gallons

The *Yard Fence* program now exhibits a high state of safety awareness and outstanding enthusiasm. During recent years, the system safety engineering approach to the implementation of safety has been strongly supported by the Directorate of Aerospace Safety. As a result of developing this system safety concept, as well as from experience gained during accident investigation, safety is now being emphasized throughout the life of the system, from conception until the system is phased out. The Air Force now requires not only a safety analysis for each new system, but a suitable safety analysis for each existing missile system while undergoing modification.

Each analysis, which is a part of the management plan must contain, but is not limited to:

1. A breakout of the entire job by tasks and the evaluation of each task to determine the hazards involved.

2. Corrective actions necessary to minimize or eliminate any identified hazards.

3. A schedule to preclude hazards which could result from task overlap.

4. Manloading, based on egress, the existing hazard, and the minimum number of personnel required to accomplish the task.

5. Special precautions required, such as the identification of special protective equipment, the development of management's organization and controls, and special safety training required for a particular job.

The *Yard Fence* modification program is now complete; however, the lessons learned as a result of the Little Rock accident must be carried over to other modification programs. Each major modification or test effort must be analyzed early in its conception to insure that hazards are eliminated prior to causing a catastrophic accident.

SAFETY IN MANUFACTURE AND FLIGHT TESTING OF ROTARY WING AIRCRAFT

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The manufacturer of equipment used for public conveyance, as opposed to other types of products, has two objectives with respect to safety: the safety of the individual worker; and the safety of those who will use the finished product. In this effort the manufacturer of helicopters has a unique set of circumstances to cope with.

To accomplish the first of these objectives, the safety of the individual worker, we in the helicopter industry follow the fairly conventional techniques that have been developed over the years to reduce industrial accidents and their accompanying toll in dollars, time lost, and heartache. These techniques begin, of course, with the development of safety consciousness through continuing programs of education, training, personnel evaluation, and motivation, to name a few. To further illustrate to our employees that Kaman means business with regard to safety, our company underwrites all, or a considerable portion of, the employee costs of safety shoes, safety glasses, and skin

protective clothes and ointments where there are irritants in the environment. There are also first aid stations, a fully equipped dispensary, a medical staff, and a fleet of rescue and fire-fighting vehicles under the direction of a Safety Supervisor. This type of program, to protect the individual employee, is similar I am sure, to the safety programs in many manufacturing companies.

It is not my purpose to dwell only upon areas of safety as related to employee protection although these programs and the safety conscious attitude contribute immensely to our next goal, product integrity, which is safety. Our subject is helicopters, and my mission is to give an over-view of the techniques used in producing a safety-oriented product while maintaining safe practices technically, as it progresses from design through manufacturing and testing of the prototype, experimental or production product.

With the long-range goal of passenger and crew safety in mind, where in the life cycle of a new helicopter does the manufacturer begin to concentrate on safety? Does this concentration begin with the establishment and enforcement of rigorous quality standards, or with insistence on cleanliness (for example) in the manufacturing process, or does it depend on the pilot's going over the pre-flight check list just before first flight? The answer is that safety must be built into the helicopter and employees, including the flight crew, at each of these steps along the way, but the first step toward safety is taken at the very conceptual stage —product design. Safety of pilot and passenger will be inherent with design, and will be integrated with the development of all other system designs as the helicopter takes shape, first in the form of drawings, then wind tunnel models, and so forth. Let us call it design integrity. The very nature of the end article demands that safety be an integral part of the whole design concept. Many steps are taken to assure that this is accomplished as we move from preliminary to final design; far too many than can be covered here.

Basically, however, there are three main thrusts toward designing a safe end-item in the helicopter industry: first, is to build in reliability by designing and selecting the best, most thoroughly tested systems and hardware to be used in the helicopter; the second is to design the best system for doing the mission for which the helicopter is designed; third, is to design the helicopter, as much as possible, around the crew who are going to man it and its passengers. These concepts introduce the two relatively new fields, reliability engineering and human factors engineering. Actually, these are not so much new fields, as they are new names applied to old fields.

Let me touch first upon the main thrust of designing safety into the helicopter through materials and process engineering, whose duty it is to attain mechanical and physical properties required in various areas of applications in helicopters.

The environment in which helicopters operate demands that high criteria be established in the selection of the raw materials to be used in the product. The demands of flight have caused the aerospace industry, in general, to be one of the leaders in the development of new exotic metals and materials. Requirements at times are so unique in the manufacturing of helicopters that it is impossible to purchase materials direct from a mill or warehouse or a manufacturer of components, thus requiring special specifications by our materials engineers within Kaman Aircraft. As an example, in the helicopter segment of the aerospace industry special attention must be given to the rotor blade which is, in terms of conventional aircraft, both propeller and wing. The speed of tips of the blade approaches the speed of sound in normal flight regimes; thus, materials must be used in blade fabrication that will have the tensile strength and flexibility to withstand the aerodynamic stresses and centrifugal force of these high speeds, yet be relatively resistant to the corrosive aspects of sun, rain, hail, sand, salt spray, and other weather conditions. Research and testing lead to development of a blade combining the strength of metal with the resiliency and weather immunity of materials such as fiberglass. Testing is conducted, material specifications are established, and a newer, safer generation of rotor blades comes into being.

Two designs and operational concepts are used in the aerospace industry in general and the helicopter industry in particular to assure safety through reliability of the end product. These concepts are time between overhaul—TBO, and component life. All

major dynamic components, such as the blades mentioned above, the engines, and transmissions, based first upon theoretical studies, are assigned a certain number of flight hours that they may be used before they must be removed for overhaul. This at first theoretical time period is further proved by thousands of hours of running time on test rigs before the component is installed on a helicopter, and there it is further proved by flight testing. In addition to this, each dynamic component is assigned a life, using the same technique as described above; a life of so many flight or running hours with a major built-in safety margin beyond which the component may never under any circumstances be used again, regardless of how well it may appear dimensionally or any other way, after removal. At this point, for safety and reliability reasons, it is no more than scrap. So you see, from a theoretical and design point of view, proven by extensive ground and flight tests, the probability of in flight failure of any major dynamic component is extremely low.

This leads us to human error, and we move into the field of human factors engineering; the purpose of which, if I may over simplify, is to create an operating environment around the pilot and crew that is the most compatible possible with respect to their human assets and limitations, thereby reducing the chance of error. In helicopter design, the human factors engineer is, of course, highly concerned with the design of the pilot compartment and crewman stations. Are the controls located in a comfortable, untiring position relative to the length and shape of the typical pilot's arms, hands, legs, and feet? Are the instruments clustered, and shaped in such a way that they can be read easily and unmistakably? The instrument sun shield, for example, was introduced into the cockpit not only to take into account the effect of glare from the outside but to reduce the reflection of instruments in the plexiglass windows. The helicopter is used in an environment quite often close to the ground, thus exposing it to hazards such as trees, buildings, etc. It is therefore mandatory that visibility be of primary concern.

But human factors engineering is not limited to cockpit design. The location of steps and hand holds and of access panels for maintenance, as well as the location of lubrication points, is influenced by human factors engineering as to their ease of access by the mechanics and technicians whose function it is to service the helicopter. This application of human factors engineering to the physical placement of equipment on the helicopter reduces the chance that a necessary maintenance job will be inadvertently omitted or accomplished only half well because the mechanic found it too difficult. In most programs, a complete aircraft mockup is required to further assure the attainment of these goals.

Reliability engineering and human factor engineering; two important ways that safety is built into the helicopter during design.

In manufacturing, there are many critical areas where safety can be jeopardized and must be controlled. The correct tools and, in some cases, absolute cleanliness are essential to the safety of the final product. For example, an innocuous looking scribe line in the wrong area may cause fatigue of a component far before the normal life span is reached. A grease area in a bonded section can cause a void or corrosion to occur. The utmost lengths are taken to avoid such problems. Education, training, good working conditions, and modern equipment are of prime importance in these areas. As was stated earlier, safety consciousness has taught the employee to be alert to his own safety and to the safety of the final product. Such programs as Z.D. (Zero Defects) are instituted to do just that—reduce mistakes to zero. These programs not only keep safety in the limelight but do pay off in dollars to the manufacturers and the worker. Incentive programs such as suggestion systems are continuously being studied to further use all of the ideas of all of the employees in efforts to find better, less complicated, and safer methods of accomplishing the task.

In addition to design integrity and manufacturing excellence, in what other way do we assure that safety is built into the helicopter? Again, the human element must be taken into consideration, and it is the function of the quality control department to see that engineering's design criteria and manufacturing's processes are all brought together into the end product. Each detail of the manufacture, processing, assembly, and installation of each one of the many thousands of parts that go into one of our

helicopters is closely inspected by the quality control department to previous written specifications, as is the environment in which the work is done. Organizationally, the manager of the quality control department must be a part of top management to assure that matters of quality control receive the top attention and authority it must have to perform its most valuable function. This group has a very direct effect upon the integrity of the final product and most certainly on the safety of the flight crew in all test operations.

As the helicopter moves down its development cycle from design through manufacturing and continuous quality control, we come to the end item, ready for flight testing. However, prior to lift-off, its components and the helicopter have undergone many rigorous procedures and hundreds of hours of static and dynamic test have been conducted, hopefully far exceeding any limit to which the helicopter will be subjected during the initial flight tests. Electronic telemetry will monitor the helicopter on its test flight, along with constant air-to-ground and ground-to-air communication. Of course, up until the helicopter makes its first flights the only data available for use on the test fatigue rigs is analytical. Therefore, as soon as possible the actual true flight data is plowed into the many ground test rigs to enable them to operate with a real picture of what is happening. Thus, as has been stated before, one flight test is worth 10,000 pages of analytical data.

The pilot, of course, is aware that monitoring systems are installed in the aircraft which will constantly inform him of the condition of his aircraft regarding such things as engine temperature, rotor speeds, and many gages and caution lights will warn him of any unusual condition. The pilot himself puts into effect the final phase of the safety program as he conscientiously and meticulously checks off each item of his preflight inspection check list, and long before the first flight he has made himself aware of the emergency procedures and familiarized himself with the whole aircraft. The crew must keep in constant training throughout. There is always the danger of error or misshap in test flying, both human and otherwise. This is especially true as man ventures beyond the known into the unknown. Man will always do this and we shall strive to make it as safe as possible.

As you can see, safety is no accident, when it comes to producing a helicopter. Safety is part and parcel of design integrity. Standards of quality in aircraft are, in fact, standards of safety, and cannot be compromised in the aircraft industry. Tradeoffs are sometimes made with respect to speed vs. range, or altitude vs. range, but at no time is a compromise considered with respect to the safety of pilot, crew, and passengers.

By way of summary, let me relate the story of the young lad who saw a sculptor begin work on a solid granite block. As he passed by on his way to school each day, he paid little attention as he heard the sculptor chipping away at the block. Then one day his attention was caught by the emerging shape of a fully formed lion, and he exclaimed, "How did you know it was in there?"

I have been able to give you only a quick over-view of the techniques used to build safety into the helicopter. But just as surely as that lion emerged from the block of marble, under the skilled hands of the sculptor, the production helicopter emerges from today's production lines as safe a vehicle as the current state of the art permits, by full utilization of the techniques described above.

SAFETY IN THE LUNAR MISSION: THE LAUNCH

By JOHN R. ATKINS
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(The following is a summary of the commentary given during a showing of a series of slides depicting the facilities at Kennedy Space Center.)

The John F. Kennedy Space Center, located at Merritt Island, Florida, is the launch organization for the National Aeronautics and Space Administration. Approximately

23,000 civil service and contractor personnel are employed there. The installation covers about 88,000 acres of land.

This large, complex government installation is engaged in many aspects of operational, industrial, and research activities. Outside of the Union of Soviet Socialist Republics, KSC is the only organization engaged in launching manned space vehicles. Therefore, many of the operational functions of KSC are unique and require application of safety techniques not in common use. Although the industrial and research functions more closely resemble those in common practice, even there the use of new and often exotic materials poses special requirements.

Planning and conducting an effective safety program at KSC requires due reliance on the known, proven methods that have been effective in reducing accidents throughout American industry. But where unique or unusual hazards exist, special precautions are required.

For example, contractors working with cryogenic, hypergolic, or other uncommon materials possessing high hazard characteristics must plan their safety program at KSC with due regard for their mutual responsibilities. All activities under the jurisdiction of KSC are governed from a safety standpoint by KSC Safety Program documents developed or approved by the KSC Safety Office.

The rockets developed by NASA for its Manned Space Flight Program have evolved in size and complexity since Alan Shepard took his historic flight on May 5, 1961. The Apollo/Saturn V vehicle stands 365 feet high, while Alan Shepard's Mercury Redstone rocket was 83 feet high.

NASA has built Launch Complex 39 at Merritt Island as the launch site for its man-to-the-moon program. The vehicle assembly building where the 365-foot tall Apollo/Saturn V space vehicles are assembled and tested, covers eight acres of ground and contains 129,482,000 cubic feet of space. It is 716 feet long and 518 feet wide and is divided into a high bay area, 525 feet high, and a low bay area 210 feet high. The first stage of the Saturn V rocket is checked out in the high bay and the upper stages are checked out in low bays, then transferred to the high bay for stacking. There are eight checkout cells in the low bay and four separate high bays.

The four story Launch Control Center is the electronic brain of LC-39. All assembly and checkout operations are controlled from firing rooms in this building, which is about 3.5 miles from the launch pads. On the third floor are four firing rooms, one for each of the high bays in the VAB. Each firing room has some 450 consoles with controls and displays required for checkout processes. A high speed computer-link is provided between the LCC and the Mobile Launcher for checkout of the space vehicle at either the VAB or launch pad.

The Transporter, the largest known tracked vehicle in the world, moves the mobile launchers into the VAB for the rocket assembly and then moves the mobile launcher with the rocket out to the launch pad. It also transfers the mobile service structure to and from the pad. It is 131 feet long and 114 feet wide. There are four double-tracked crawlers, each 10 feet high and 40 feet long. Each shoe on the crawler track is 7.5 feet in length and weighs about a ton. Its maximum speed is about one mile an hour loaded and about two miles an hour unloaded. The top deck is flat, about the size of a baseball diamond.

The transportable launch platforms and umbilical towers (we have three of them) weigh 10.6 million pounds each and stand about 445 feet tall. The launch platform is a two-story structure, 25 feet high, 160 feet long, and 135 feet wide. The umbilical tower carries nine swing arms and related plumbing, equipment, and cabling. The swing arms provide support for the vehicle umbilical systems and access for personnel to the stages during checkout operations.

Two launch pads have been built at LC-39. Both are roughly octagonal in shape and cover about ¼ square mile. The center of the launch pad is a hardstand constructed of 68,000 cubic yards of heavily reinforced concrete.

The roadway upon which the Transporter travels is 131 feet wide, divided by a median. It is designed to support about 18 million pounds and has an average depth of seven feet. It runs from the VAB to both pads and is about the width of an eight-lane turnpike.

The mobile service structure provides 360 degree access to both the Saturn V vehicle and the Apollo spacecraft at the launch pad. It is 402 feet high and weighs 9.8 million

pounds. There are five platforms for personnel. The top three service the lunar module, servvice module, command module, and launch escape system. The two lower platforms serve the rocket.

The Transporter moves the mobile service structure to the launch pad from its park position, which is about 7,000 feet away. At about T-6 hours, the Transporter then moves the mobile service structure back to the park position, where it remains during launch. Even though the movement of the MSS begins at about T-6 hours in the count, the preparation for this move must begin much earlier, as many disconnections must be completed. These would consist of electrical lines, water pipes, high-pressure gas lines, structural connections, and many others, totalling about 365 disconnections.

The size and complexity of the launch vehicle that will send American astronauts to the moon, and the associated facilities—all monstrous in size and new in technology—account for the many new and unusual problems we in the KSC Safety Office must face. The vehicle at launch stands 365 feet tall and weighs over 6 million pounds. Her payload is 250,000 pounds for an earth orbit, and 95,000 pounds for a lunar mission.

To handle the job of safety at America's Spaceport, a safety office was established. As mentioned earlier, the size and complexity of the operations at KSC can cause a few out-of-the-ordinary problems. One specific example is the problems associated with hypergolic propellants. There are three types used at the Space Center: N_2O_4, UDMH, and MNH. These liquids are toxic, having a MAC of 5ppm for the oxidizer and ½ppm for the fuel. They are corrosive and hard to contain. The fuel reacts readily with oxidation and is susceptible to ignition from static charge. The fuel has a burning range from about two percent to 98 per cent in air. In short, they present serious hazards from fire and explosion.

Protection of personnel who are involved in operations with these hazardous liquids, is of great concern to us. We educate our people on these hazards by requiring that they complete training courses designed to familiarize them with the facilities and equipment used, the characteristics and hazards of the propellants, emergency egress routes, fire suppression systems installed at the launch complex, the use of hand-type safety items provided in special safety lockers at all locations where hypergolic propellants are handled. They are also trained in the use of air packs, gas masks, and SCAPE suits (Self Contained Atmospheric Protective Ensemble), fire extinguishers, and other special type

We have many other safety problems at KSC. We use large quantities of liquid hydrogen and liquid oxygen. Our liquid oxygen storage at Complex 39 holds 900,000 gallons and the liquid hydrogen tank holds 850,000 gallons. Although both these items present fire and explosive hazards, the primary hazard, I feel, comes from the large quantities handled.

There are 542 ordnance items in the Apollo/Saturn V space vehicle. They range in size from small pressure squibs to large ullage and retro rockets. Some of these items are installed in the VAB and some on the launch pad. All initiating items are installed at the pad.

We have high pressure gas systems that operate as high as 6,000 psi. Several miles of gas transmission lines are involved. The average monthly gas usage at KSC is 147.5 million cubic feet of nitrogen and 4.5 million cubic feet of helium. Here, again, the size of the systems and the quantity used constitute our reason for concern.

Escape from tall structures has always been and still is of serious concern to us. We haven't been able to devise an acceptable method of getting large numbers of people off our service towers quickly in case of emergency. During the Gemini Program, we developed what we called a slide wire device. The KSC Safety Office did the development and testing of this device.

Until the present time, ionizing radiation has not presented us with severe problems. We have a number of 100 Curie sources at KSC, used primarily for radiography operations. There are indications that in the near future our safety problems with this type hazard will increase. The first lunar mission will carry the Apollo Lunar Surface Experiment Package (ALSEP). The ALSEP presents some seemingly insurmountable problems to us on the ground. This experiment carries a fuel capsule containing 45,000 Curies of plutonium. The ionizing radiation from this substance is primarily that of neutrons and gamma ray. The emission rates are: 335 mrem/hr at one

and one-half feet, and 1204 mrem/hr at nine inches. The installation crew will receive their quarterly allowable exposure during the installation.

Our most severe hazard comes from thermal radiation. The skin of the fuel capsule remains at a constant 1350°F. The graphite cask attached to the LEM, in which the fuel capsule will be transported to the moon, will have a skin temperature of between 600-800°F. As you remember, MMH will burn at 382°F., so if we have a fuel leak, we have a fire. We are trying to overcome this problem by directing cooling air from the instrument unit, just below, thereby lowering the temperature of the fuel cask. Tests indicate that we can control the temperature of the fuel cask between 280-300°F, which is acceptable. This compartment will be inerted with nitrogen gas prior to launch.

I urge each of you to impress upon your design and manufacturing management that safety which is designed in is by far more desirable than safety which is implemented by procedural control. Be very careful that in your efforts to design in operational flexibility, you do not design out safety of operation. The safest equipment presently operating at the Kennedy Space Center is that which had safety designed in. KSC Accident Rate for last year was 2.33 for the contractors and .18 for Civil Service employees. The Center worked about 65,000,000 man hours during the year.

THE MANNED SPACE FLIGHT SAFETY PROGRAM

By PHILIP H. BOLGER
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The subject of safety for astronaut flight crews has been a prime requirement since the inception of the Manned Space Flight Program. It is a complex problem, and the methods which are currently employed are part of a broad spectrum of safety activities associated with the NASA space program as a whole. I will, however, attempt to concentrate on those considerations of safety activity dealing specifically with space flight and, in so doing, discuss the background of the safety organization, its personnel, procedures, and methodologies.

The NASA Office of Manned Space Flight has been developing an integrated safety program for its Manned Space Flight Program for the past eight years. This program had its inception in the Mercury Program, continued through the Gemini Program, and reached its present status as part of the Apollo lunar program. Originally, this safety activity was an integral part of the flight program since there was only one manned space effort, the Mercury Program, in existence. As the agency matured and grew in size from the original Space Task Group at Langley Field to several hundred thousand people, it became apparent that a safety organization had to be formed as a distinct entity. This was necessary to provide the continuity of safety activity as one program was completed and new ones started. The need for standards, guidelines, and requirements to insure continuous and organized attention to safety within such specific programs were further justification. When several space flight programs were being conducted simultaneously, a uniformity could be supplied by such a safety organization. In addition, the need for an independent evaluation of the safety posture of flight programs which was required for management visibility could be provided. Accordingly, the Manned Space Flight Safety Organization was organized in early 1967 to meet the agency's requirements as previously stated.

The management philosophy of the safety program centers on the theme that the functional safety organization has the responsibility for establishing the safety standards and criteria. These then form the safety requirements which line management is responsible to implement. Finally, the effectiveness of this implementation is evaluated through a system of surveys providing a needed feed-back to the safety organization.

A brief examination of the manned space flight safety organization illustrates the manner in which it is structured to provide for

the management of a safety program for the entire manned space flight organization including the headquarters, program offices, field centers, and their associated contractors. A safety director has been appointed at both the headquarters and field centers, reporting directly to the top management level. In each case, these safety directors have developed a working organization that encompasses all phases of safety activity and provides technical safety support to the entire spectrum of flight and research programs underway in the manned space flight organization. The system safety activities, which I will discuss later, are being managed by engineering personnel within their respective program organization who also have an added functional responsibility to the safety directors. In this manner, direct communication is maintained with top management, providing the desired visibility into the conduct of the safety aspects which are inherent parts of NASA's space flight programs. It also ensures a continuity of safety knowledge and uniformity of standards throughout these many activities.

Another important aspect of the Manned Space Flight Safety Program has been the selection of its management level personnel. A concerted effort was made to introduce people who have held positions of a comparable management level in program or other functional organizations. In this way, a broad base of knowledge of on-going flight and research program management was introduced into the safety program. The purpose of the selection of such personnel was to insure that the safety organization would be, speaking knowledgeably, recognizing the real requirements of safety activity and would put such requirements in their proper perspective with relation to the many others that NASA's programs must meet. In other words, the safety organization would recognize and operate within the same budgetary and schedule restraints imposed upon other on-going programs. It is also planned that an exchange of personnel could be effected between the safety and other functional and program organizations in order to provide a career development concept. This is felt to be of growing importance with individuals as they progress into higher management levels, supplying them with more options for advancement. Again, it had the additional benefit of supplying a base of knowledge of the safety discipline throughout NASA's manned space flight organization as these individuals move on to other areas of effort.

A prominent feature of the Manned Space Flight Safety Program has been the integration of the many diverse elements of safety activity into a single strong functional organization. NASA has adopted a breakout of its safety activity into four general categories: System, Industrial, Flight and Public Safety. These categories are, of course, supported by safety efforts in administration, research, and motivation. Within the safety polity established for the agency as a whole, this safety program has been developed to support the specific needs of manned space flight. Its elements are, therefore, designed to identify hazards inherent to such operations and to develop methods for controlling them. For this reason, a strong system safety effort has been developed.

System safety, as employed in manned space flight programs, is an engineering discipline utilized by program management to provide a sound risk control procedure throughout the life cycle of the flight system. This discipline uses various types of hazards analyses, both qualitative and quantitative, to identify potential hazards. It is especially important in such space flight programs to be able to realistically predict hazards and compensate for them prior to employment of the flight system. This is true because of the cost of these systems (i. e., Apollo, Gemini), the very stringent schedules, and the newness of the technologies involved. These programs are constantly pushing the state of the art. These factors prevent a primary reliance on collection and study of accident/failure data as a means of compensating for system deficiencies. The flight system must operate properly the first time. Therefore, we have been forced to develop means of prediction of hazards in order to meet such requirements.

In regard to the question that is constantly raised concerning the relationship of system safety and industrial and flight safety activity, I think a great deal of confusion exists. System safety, in this context, implies the application of engineering analysis techniques in the development of a specific system to identify and control risks. This discipline may apply to flight hardware or industrial procedures. It results in design or procedural

characteristics tailored to compensate for the conceivable, potential hazards. Resultant products or corrections of this nature, therefore, take the form of many actions, ranging from engineering design to improvement of standard personnel protection techniques. For these reasons, I believe system safety and industrial and flight safety can not be equated to each other or discussed in the same context; one concerns engineering techniques and methodologies, and the others concern the protection of personnel involved in fabrication, test, and flight operations. In other words, it would be like mixing apples and oranges. System safety is another tool that can be used in the industrial and flight environments.

The identification of potential hazards is the strongest tool we have available in ensuring safety in space flight. The conceivable hazards are the source of many design considerations and changes throughout the earlier phases of the development of manned space vehicles. As the system develops, however, more and more reliance must be placed on ground and flight crew procedures to ensure that identifiable hazards are controlled. For this reason, a set of criteria have been developed to clearly define the stringent safety reviews that must be made of all test, checkout, and flight procedures that are of a hazardous nature. The term hazardous is applied to all situations where an energy potential exists that could injure the ground and flight crews and hardware.

The hazards identified from the various analyses that are conducted in the manned space flight programs are combined with those which have developed or been identified from past space flight experience. These form the basis for a detailed series of possible procedures that could be employed by the flight crew in the event the hazardous situations occur. After these procedures have been developed, the flight crew conducts a long series of simulation exercises or drills in a space flight simulator. These simulators are both dynamic and static and are designed for normal astronaut training but possess a capacity for emergency procedure exercises. Once proven as practicable, the emergency procedures are formalized and become part of the checklist that the astronaut flight crew utilizes.

A final control of the risks associated with each specific flight mission is the development of launch and flight mission rules. These are mandatory flight and launch parameter limits that can not be exceeded without endangering the crew. A previously worked out procedure is associated with each of these red-lines so that an immediate response is provided in the event a limit is reached. The flight crew emergency and abort procedures, as well as the employment of the multiple redundancy of the spacecraft systems are compiled in the mission rules. The rules are reviewed and agreed to by all the groups included in controlling the mission: the astronauts, mission director, and flight and launch control teams.

Once the various steps discussed above for ensuring safety in space flight missions have been completed, a flight readiness review is held. This is the final management review of the readiness portion of every organization involved in a specific space flight mission. It is at this point that the decision is made to proceed with the flight and what steps are mandatory for completion prior to launch. This culminates the planning necessary to prepare a mission and to ensure its safe direction. The many safety considerations, commencing with the initial hazard analysis, are brought to a completed status or are judged as controllable or justifiable risks after all constraints have been judged.

The identification of hazards at the very conception of a space flight program also permits the timely development of an emergency system for incorporation into the spacecraft. As previously discussed, the first solution for a hazard is to improve the basic space system design to compensate for it. If this proves too difficult, a procedure must be developed to allow control of the risk. Finally, after these steps have been taken, a residual number of hazards or conceivable emergencies may well remain. It then becomes necessary to design and develop emergency systems specifically to control the residual emergency. An example would be the launch escape system on the Apollo spacecraft. Here it has been recognized that, despite every design consideration and launch and flight procedure, there still remains the possibility of an engine failure during launch. It was, therefore, necessary to provide a method for the astronauts to escape from the launch vehicle in order to make a safe abort and earth landing. This philosophy is extended to each phase of the flight, and every effort is made to assure the

capability for successful compensation for an emergency by the flight crew.

An additional safety feature of manned space flight programs requires that a new launch vehicle and spacecraft are exercised in unmanned configurations prior to manned flights. An extensive telemetry instrumentation system is utilized to record and relay performance and anomalies so that final adjustments can be made or hardware design can be verified. This process of unmanned testing is an inherent part of certifying that a system is "manned rated" and ready for flight.

This discussion has reviewed in general details the Manned Space Flight Safety Program, the organization developed to carry out this program, some aspects of safety management and personnel considerations, the development of the system safety discipline, the requirements for a creditable procedure for identification of hazards, and, finally, the use of data concerning potential hazards in the development and control of a space flight mission. It was not intended to cover in detail all aspects of this integrated safety program, but to dwell primarily on those which are most directly concerned with ensuring safety to astronaut flight crews during space mission.

AIR TRANSPORT SECTION

FIRE PREVENTION ON THE RAMP

By J. J. BRENNEMAN
Fire Prevention Engineer, United Air Lines, Inc., Chicago, Ill.

Shortly after placing orders for jet aircraft in the mid-50's, people concerned with aviation safety began to give serious consideration to the hazards which might be encountered in the handling of this new type bird. While considerable emphasis, and justifiably so, was placed on personnel hazards, which include ingestion, noise, etc., greater emphasis was placed on increased fire problems. These problems were occasioned by the fact that the aircraft was much larger and had greatly increased fuel loads at higher fueling rates. The under wing, hydrant type fueling systems were just then being designed.

The industry was concerned. Prior to this time, fueling rates were relatively low. The over wing method, using a fuel truck, was common, and the hazards were really not too different than what might be encountered at the corner gasoline station. The value of the aircraft was also less than half of the orginal purchase price of the new jets.

A Sectional Committee of the NFPA was set up to determine the safety features which must be incorporated into the high rate hydrant fuel system and also into the fuel trucks which were to be used for the under wing method of fueling. In the event that a spill did occur, The Sectional Committee was also charged with the responsibility of developing recommendations for the first aid type fire equipment which should be provided in event of a spill. Other committees took on the task of looking into possible hazards which might be encountered due to higher vapor release because of increased fueling rates. Drainage of the ramp also plays an important part since it can, if properly designed, limit the spread of a fuel spill and thus limit the number of people exposed, as well as dollar values involved.

The Committee recommended that deadman type attended controls be provided along with emergency shutoffs, so the size and amount of a spill could be limited to a reasonable value. Additional recommendations as to piping and sectional control valves were also included, along with recommendations concerning the vehicle containing the filter separators which act as the intermediary between the fuel hydrant in the ground and the aircraft receptacle. Similar requirements were applicable for tank type vehicles, which initially were the primary means of fueling the jets. These recommendations were adopted by the NFPA as Standard 407, and they are still in use today with only minor modifications.

Even with elaborate safety precautions during fueling, and methods of quickly shutting off the fuel available, the possibility of a large size spill still exists. During the days of piston aircraft fueled with aviation gasoline, the average fire protection in the way of first aid equipment on the ramp usually consisted of a 30 lb. dry chemical extinguisher or a 50 lb. carbon dioxide extinguisher. These units, while certainly effective, were felt to be too small to do the job. The committee recommended (and it was subsequently adopted) that a scale of protection based on fueling rates be provided. In most cases of jet aircraft, this required that a minimum of at least one 150 lb. dry chemical fire extinguisher, having a minimum UL rating of 80-B, be available for each jet fueling position. In a great many cases, because of even higher fueling rates, two such units were required. The extinguishers available at that time contained sodium bicarbonate base dry chemical as their fire extinguishing agent. While it was only a recommendation of the NFPA, most major carriers incorporated this scale as their corporate standard of protection and again, with only minor modifications, this scale is still in use.

There was considerable controversy during this time as to the extent of the combustible vapor envelope which might or might not exist around the aircraft during the fueling operation. If a vapor envelope

did exist, then serious consideration would have to be given to develop ground equipment which would not pose a source of ignition. One faction insisted that the vapor envelope could be expected to encompass an area within 200 feet of the aircraft vent points; while on the other end of the scale, some people did not believe that it existed at all. While only limited studies had been done up to this point, mainly within the United Kingdom, these studies seem to indicate that the large vapor cloud faction was correct. Unfortunately, however, studies that had been made projected the extent of the vapor cloud in a purely theoretical manner based on formulae used for the determination of smoke dispersion from factory chimneys. In order to bring the thinking to a more practical level, an extensive program was initiated to actually measure the vapor concentration under as many climatic conditions as possible to get a very large statistical base. During the course of this study, over 2,000 individual readings were made at various locations throughout the country, involving three types of fuel then in common use: gasoline; JP-4; and aviation kerosene. The results of this study were published by the NFPA and are basically incorporated in present Standard 411-M. Briefly the results were that the vapor cloud does not exist, but for only a very limited distance beyond the vent point of the aircraft.

Concerning ramp drainage, a concept was developed to limit the areas on the ramp served by only a single drainage inlet, whether it be of the trench type or single point type, to that area which would contain one large jet. Again, safety features were incorporated in the drainage system piping which would prevent the drainage system from propagating a fuel fire from one aircraft to another which might be parked along the terminal. Liquid filled traps, oil water separators, etc., were specified to limit such flame propagtion and also to minimize pollution in adjacent water ways and sewer systems. The recommendations were published as NFPA Standard 415 and have proved highly successful and are still in use today.

As far as I know, there has never been a jet aircraft lost, or even seriously damaged, where there has been a fire following a fuel spill and where the recommendations pertaining to fueling equipment, ramp drainage, and ramp fire protection equipment have been rigidly followed. For example, some years ago an aircraft was to be fueled from a tank type fueler at a station in the East. While the fuel vehicle complied with NFPA standards, an adapter had been placed on one of the fuel hoses to permit over wing fueling, using the under wing valve. While this in itself is permissible, it appears that the automatic deadman features in the over wing adapter had been rendered inoperative by using the static bonding wire to tie the adapter into the open position. When the pump on the truck was engaged to commence the fuel operation, fuel spilled on the still hot aircraft engine and ignition immediately occurred. The large extinguishers were available and were immediately procured by the employees fueling the aircraft, who in this case were station agents. Fire fighting operations commenced and were quite successful; however, some of the burning fuel had run under the aircraft, and the fire was inaccessible to the personnel involved in the initial operation. Employees of a well equipped adjacent airline noticed the problem and attacked the fire from one side of the aircraft while the fire fighting operation on the other side continued. The fire was extinguished with only minor smoke damage to the under side of the wing, and the aircraft was dispatched almost on time.

In another instance, the NFPA recommendations concerning safe guards to be incorporated in hydrant fueling systems were not rigidly followed. In this case, the deadman valve was located on the hydrant vehicle rather than in the pit in the ground. Thus, the length of hose connecting the fuel hydrant to the servicing vehicle could not be readily shut off. This hose failed in service, causing a rather large spill which ignited from an unknown source, and severe damage to the aircraft resulted from the ensuing fire.

From this record we can only conclude that these pioneers had thoroughly recognized the problems and had adequately dealt with them. As time went on, new extinguishing agents became available which increased the effectiveness of the first aid fire equipment provided on the ramps. Most notable of these was the advent of Purple-K dry chemical which, pound for pound, just about doubled the effectiveness of the same size piece of equipment. This was verified by

UL testing and listing, as ratings now of nominal 150 lb. capacty. dry chemical units are very commonly 160-B, as opposed to the 80-B rating before. Being advocates of giving a man the biggest club available to do the job, we adopted Purple-K dry chemical as our company standard and have modified all of our older equipment to effectively utilize the full capabilities and fire killing power of the new agent. While technically this modification voids the UL listing of the extinguishers, the modification program was done by the manufacturer's personnel. Personally, I am more interested in having adequate protection than I am in maintaining the legality of a label.

We are once again on the threshold of a new era. Orders have been placed for aircraft capable of carrying 500 passengers and aircaraft capable of supersonic speeds. The problems with these airplanes are not going to be too much different from what we are living with today. True, they will be on a larger scale, and there is a major potential loss of life or property in the event of a disaster, but due to the excellent ground work laid by the pioneers back in the mid-1950's, we have firm foundations to build on.

We re-evaluated the extinguisher protection required where the Jumbo Jet or SST was to be serviced and fueled. In line with our philosophy of giving our people the biggest club available, we are planning to provide a minimum of two 350 lb. nominal capacity Purple-K dry chemical extinguishers available to each fueling position. These exinguishers have a UL rating of 320-B. While larger units can be purchased, if you go beyond the point of a 350 lb. model you are pretty well limited to motorized units. In order to be effective, such units would have to be placed immediately adjacent and readily available to each fueling position. We do not feel that it is sound economics to provide such a motorized unit for each aircraft position at the terminal, nor do we consider it a good safety practice to provide only one large capacity motorized unit for each terminal ramp area. This is putting too many eggs in one basket, and could lead to disaster.

Specifications for hydrant systems and ramp drainage are based on what has been successfully proven in the past. I am sure that we will see some changes in the appearance of the equipment used to service this new aircraft, mainly due to sheer size of the airplane. However, in essence the function remains the same, and I feel that we should stick with a winner.

Protection is also changing with regard to aircraft hangars. Back in the early days of aviation, fire protection for hangars was always predicated on protection of the hangar structure, and only incidentally the aircraft contained therein. This was, mainly, due to the fact that the hangar was worth more than the airplane, and the insurance carriers only insured the building. As hangar protection evolved from the ordinary wet pipe sprinkler system with sealed heads to the open head deluge type system, the concept of hangar protection did not change. When the first jet aircraft hangars were constructed, this concept carried through. While higher water densities were required from the deluge systems, this was only to protect exposed steel structure from a fire of increased magnitude and, to my way of thinking, did little, if anything, to protect the airplane. We are now at a cross road. We can no longer ignore the fact that we must design protection systems into our aircraft hangars which will protect the aircraft and, incidentally, protect the hangar. After all, the airplane is our revenue producing instrument and, while it might be inconvenient, we can do without hangars. If we continue to follow the old concepts, we might be faced with the day when the aircraft is burned up and we have a beautiful hangar which is rather difficult to get off the ground.

Either foam making capabilities must be incorporated into the deluge system design (which is the approach which we have adopted and very successfully tested) or supplemental foam systems, either low expansion or high expansion type, must be incorporated to augment the water sprinkler system. Water alone is not effective on a flammable liquid fire, particularly of the magnitude which we might expect, and the foam approach, therefore, becomes mandatory. Essential in developing the design for fire protection in an aircraft hangar, the systems approach must be taken. The drainage system design must be related to the deluge system to remove excess water and flammable liquids, so the two systems complement one another, maximizing the effectiveness of each while minimizing cost.

GROUND SAFETY: THE DEVELOPMENTAL YEARS

By J. A. O'DONNELL
Manager, Ground Safety, American Airlines, La Guardia Field, N. Y.

If life begins at 40, the Air Transport Section can now claim to be alive. We are one year older than Jack Benny. Satchel Paige warns that you should never look back, because someone might be gaining on you. Let's take a brief look at what our section has done in those 40 years.

The National Safety Council formed a Committee on Aviation Hazards in May 1919, but it was not until the 1928 Congress that the first Aeronautical Safety Conference was held and the Aeronautical Section was organized. Capt. Emory S. Land of the Navy was Conference Chairman. The speakers discussed safety of passengers; the parachute in passenger flying; accident analysis; and Aircraft Accidents—Method of Analysis.

The list of chairmen of the section over the next dozen or so years is a real Who's Who in aviation: Edward P. Warner, editor of *Aviation* magazine; Col. Harry H. Blee of the Aeronautics Branch, Dept. of Commerce; Lester D. Seymour, president of American Airways; P. A. Wright, United Air Lines; Eddie Rickenbacker, Eastern Air Lines; C. R. Smith of American; and Major R. W. Schroeder of United.

Some of the ground safety topics discussed at those early Congress sessions were: fire hazards at airports; safety in aeronautical factories; safety at airports; airports and safety; safe airports; safety in airline operations and maintenance; airport supervision; and training mechanics for safe air transport service.

Shorty Schroeder was General Chairman in 1941 and presided at the Aeronautical Section's Congress session that year. On the program was Jack Curtis, of United, who was the first airline ground safety engineer. His subject was "Safety Begins on the Ground." Jack was a real salty character who always had a pet project going. He was sincere, earnest, and a tireless promoter of ground safety.

Jerry Lederer presided at the 1942 session, though his name first appeared on the Congress program in 1937 when he was Secretary and Program Committee Chairman. Jerry was an old hand at the aviation safety game when most of us were still breaking in. He knows everybody and really gets around. One time I was in Rome at St. Peter's Square at noon on a Sunday. The crowd cheered as the Pope came out to bless them. There was a short man standing next to the Pope, so I asked the man next to me, "Who is that?" He told me, "I don't know the guy in the butcher coat but the fellow with him is Jerry Lederer."

In 1943 the Council authorized the organization of an Aircraft Manufacturing Section. The members of the Aeronautical Section then voted to change its name to the Air Transport Section. I got into this business in early 1944 when Jerry was still General Chairman. My boss was Walt Johnson, who was the first full time ground safety man for American Airlines.

Jack Curtis became General Chairman in 1944, followed by Bob Bloomer, of TWA, Walt Johnson, and then Gil Tyler, of Pan American's La Guardia base.

I remember climbing around those big Boeing 314 Clipper flying boats with three decks and a hatch that you could open to work on an engine in flight. Gil and a dry chemical fire extinguisher salesman tried to rework a sand blast outfit into a big dry chemical unit. They used CO_2 as a propellant and the plumbing got frosted up. It never did work. We tried a lot of things in those early days. Sam Miller of Capitol and Russ Holdren of TWA's Intercontinental Division in Washington attempted to set a magnesium wheel on fire, so that they could try extinguishing it. They never did get the wheel to burn.

I got involved in taking voltage measurements of the static charge built up in a wheat blast unit used to clean engine parts. I had an instrument engineer with me, but I think that we got the decimal point off about two places.

We held the 1947 winter meeting of the Air Transport Section at Eastern Airlines' base at Miami. Sam Barker arranged transportation in a DC-3 owned by the Hollingshead Corp. We had a real good two-day meeting, but when we got out to the airport

on the third day for our trip home we were told that it was snowing up north. The captain thought it was better to wait it out in Miami, and we agreed. We were snowed in at Miami.

The Air Transport section always had a very active Engineering Committee, even in those early days. They produced material on ladders and workstands, qualifications for ramp vehicle operators, grounding of aircraft, and many other subjects. Some of these became *Data Sheets.*

Our newsletter ran to six mimeographed pages. We couldn't use pictures, but we did run some good articles. Walt Johnson was getting out the newsletter the first year I was on the job. One month he was on vacation and I had to do it. One item that I used warned that spraying carbon tetrachloride on spilled gasoline was only temporarily effective in reducing its flammability. Gil Tyler liked it and ran it in his company safety bulletin. Walt saw it in Gil's sheet and used it again the next month in the newsletter. Well, you can't win them all!

A year or two later, I became *Newsletter* editor and, in 1948, General Chairman. As General Chairman, I started a feature in the *Newsletter* called "Line Check." It was a monthly message from the General Chairman. "Line Check" lasted for years. Later, when I was again *Newsletter* editor, I used to threaten the General Chairman that if he didn't supply me with a "Line Check" each month I would write one myself and sign his name. This worked pretty good. I even got Des Carmichael of TCA to come through.

During the next few years our General Chairmen were: Des Carmichael, Trans Canada; Ed Lee, Eastern; Bob Potter, AA's Tulsa base; Hank Waterman, TWA; Joe Chase, Flight Safety Foundation; Hank Schilling, TWA; Luke Corbeil, Trans Canada; Skip Morris, Eastern; Gene Bertram, Northwest; and Dale Estell, TWA. In the last 10 years we have had Hugh Butler, Eastern; Norm Christoffel, United; Gil Teal, Public Service Research; Howard Warzyn, TWA; Harry Kuschmann, United; Bill Beirne, Alexander and Alexander; and Ralph Dee, United.

The section produced "Ramp Safety," the first Safety-graph slanted to the needs of a particular industry. It was very successful and sold well. Later, we produced a Safety-graph on "Aircraft Fueling," a data sheet on airport vehicular traffic control, and numerous posters suited to the needs of our members.

We published a 15 chapter *Aviation Ground Safety Handbook* a couple of years ago and recently added a 16th chapter to it. The section is working on a program of standardizing safety requirements for ground equipment and on the operation of hi-lift trucks around aircraft.

Our members have been very active on industry committees outside of the National Safety Council, such as those of the National Fire Protection Association, Air Transport Association, and the USA Standards Institute.

Airline ground safety engineers have always tried to keep abreast of developments. When the DC-6 was being built, my boss sent me to Santa Monica to find out what problems we would have with it in ground handling. One thing I remember learning is how to set up a berth. When we got our first airplane a couple of months later, I had to show our Accommodations Group engineers how to do it—safely, of course.

More recently, the Air Transport section has had meetings in Seattle, to preview the 747; Los Angeles, with a side trip to see the DC-10; and in London, with a visit to the plant where the Concorde is being built. You can be certain that it helps a lot to visualize a problem if you have seen the actual monster in the tin.

The introduction of jets into our transport fleet was done smoothly and with little or no apparent fuss, because it was carefully planned. The first jet transport I ever saw in my life was a Pan Am 707 that landed at Kennedy one Sunday morning in August, 1958 after a proving flight from San Juan. Nearly two years before that the airlines had a meeting in Miami to plan for the safe ground handling of jets. At that meeting there were about 100 people. Not one of us knew whether we would be able to start the engines at the gate or if we would have to tow the big bird out to the end of the runway and start engines just before take off. But we all learned a lot out of that meeting. We learned to recognize the problems, and we tackled them on an industry basis. The next September, when we met in San Francisco, we were much better informed. For

example, American had run test fires to determine just what kind of fire extinguishers we should provide to protect our fueling operation. We spilled different amounts of kerosene on concrete that registered 100°, lit it, and tried to put it out with different size and kinds of extinguishers.

We were concerned with our people handling energized 220 volt ground power cords, so we devised a means of keeping the power off until the cord was plugged in and a button on the generator was pushed.

Jet engines are noisy and we knew we would have to provide ear protection. We studied the problem and the Air Transport section produced a data sheet giving just the information needed to set up a hearing conservation program.

Sometimes you have practical operating problems when you try to be ultra conservative. For example, because of the stories we heard about mechanics being sucked into jet engines on military aircraft, the airlines early established a rule that no one should approach within 25 feet of an operating jet engine. This was safe enough, but operating people, who wanted to preposition equipment for arrivals and to be able to load bags of last minute passengers, asked if this was a hard and fast distance. We decided to find out. On a cold, windy night in March we went out on the hangar apron at Kennedy and took velocity readings. At first, we used a life line and held the velometer at arm's length. We found that even with engines operating at powers well above what they would ever be on the ramp we could approach safely within five feet of the intake, so we established 10 feet with the engines at idle, confirmed with the cockpit, as the minimum distance when following a published procedure, while holding the 25 foot rule for general use. There are many other instances where needless restrictions and safeguards have been set up, but members of our section have found that they could be mitigated without compromising safety.

Not the least of the advantages of membership in the Air Transport section has been the friendships that you make over the years, the opportunities to informally exchange information and to find out how the other fellow has handled a problem. The fact that our section has always been rather small has been an advantage. We get active participation by everyone.

Just being part of the airline industry during the past quarter of a century has been a very rewarding experience. In 1928, the domestic airlines flew about 10 million passenger miles. In 1944, it was over two billion. For 1967, the figure topped 75 billion. We are in a growing business. Does anyone want to guess what it will be like in another 40 years?

Sometimes when the going gets rough I take out my copy of the Air Transport *Newsletter* for January 1955 and read the "Line Check" that Hank Schilling wrote, his first as General Chairman of the Section:

"The other day, after a series of minor frustrations, I was glumly watching one of our painters renewing the strip of non-skid safety paint we use on some of our aircraft wings to prevent falls. A mechanic, preoccupied with his job, squeezed past the painter, slipped on the wet paint and started skidding toward the trailing edge. Fifteen feet below him, steel boxes, ladders, and other 'unsoft,' angular pieces of equipment . . .

"No, he didn't fall, but later that night—just as I had about decided to get a job on a slow, slow boat—my younger son pipes up (without warning) and says, "Pop, I'm gonna be a safety engineer when I get big."

"Somewhat apprehensively, I reached over to feel his head for soft spots, and then I noticed that my wife was actually beaming at me across the room! She seemed as pleased as tho the lad had announced his ambition to be a pilot or coffee salesman, or even to own his own butcher shop!

"Somehow, the wisecrack I had on the tip of my tongue didn't seem appropriate for the moment and I sat back to think some more. . . . Quite 'by accident' I had had a glimpse of my job through a new pair of eyes and saw the disappointments and the failures and the frustrations in their proper perspective. I finally grinned back at my spouse and told the boy, 'You might do worse.'"

NOW AND AHEAD

By JEROME LEDERER
Director, Manned Space Flight Safety, NASA, Washington, D. C.

In 1928, aviation was neither safe nor efficient enough for widespread public acceptance. However, the past 40 years has witnessed such improvement in safe and efficient operation that aviation has become essential to our economic viability, and it can get better. The obstacles to greater safety with present equipment are not so much technical as political, social, and economic. If the current fleet of aircraft were retained indefinitely, it is technically conceivable that the worldwide airline fatal accident rate could be reduced by some 50 per cent in perhaps ten years.

Aviation is a dynamic phenomenon; new types of aircraft will continue to be developed, with their accompanying safety problems. The SST, the hypersonic, the space shuttle, the Jumbo Jet, and VTOL are on the near and far horizons. The learning curve on new aircraft of the past has produced accident rates which cannot be tolerated in the future. The best hope to combat this is to apply as much systematic attention to the small but numerous and important details of design, operation, and human factors as to the solution of the major problems of structures, aerodynamics, power plant reliability, and performance. This technique is known as systems safety. The use of computer techniques throughout the entire technical area cannot but help this new discipline.

General aviation is in need of the development of design and devices that will remove the need for the high standards of pilot proficiency now required for safety, especially in instrument weather. The private pilot with professional training is a safe pilot, but at considerable expense in time and funds.

Thus, if the systematic management of risks is applied to operation and supplemented by greater industry participation in [illegible]ing the social and political and economic [illegible]blems, those of us concerned with aviation safety could ask for no more.

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TRANSACTIONS

AUTOMOTIVE and MACHINE SHOP; POWER PRESS and FORGING

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56th NATIONAL SAFETY CONGRESS

Papers Delivered in the

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AUTOMOTIVE AND MACHINE SHOP SECTION

THE MOST IMPORTANT WORD IN SAFETY

By G. E. MONTGOMERY
Executive Dir., Greater Detroit Safety Council, Detroit, Mich.

We've come a long way in safety since the National Safety Council was formed in 1912. Last year, 112,000 lives were lost in accidents in the United States, while almost 11 million were being injured. But, would anyone care to project what these figures would have been, based upon 1912 frequency and severity rates?

In 1912, among workers in industry, there were 21 accidental deaths per 100,000 workers. For the past few years, as you know, it has been around seven! Or to put it in other words, "In 1912 an estimated 21,000 worker's lives were lost while producing 100 billion dollars worth of gross national product; while last year, with a work force more than double in size and producing six times as much, there were 14,200 on the job deaths."

Yes, we've come a long way, but when we stop to think that in the few minutes it takes to read this paper, there will be one death and a number of serious (lost time) injuries, you will have to agree with me that although we have done a good job, it is not good enough—and will never be good enough until we have eliminated all accidental deaths and injuries.

Yes, we have come a long way—we have done an outstanding job! But all too often we are like a lady in the Detroit area who was stuck in the snow on a side road last winter. When the road patrol came along she was out in the road placing leaves and weeds and small branches under her front wheels. When the officer suggested it would be better under her rear wheels, she answered, "Oh, the rear wheels are spinning nicely, it is the front wheels that are not turning." Too often our wheels are spinning in our safety efforts.

And all too often we make mistakes like the lady who was explaining her black eye to her friends at the bridge club. "My husband gave it to me," she said. "But I thought your husband was out of town," replied one of her friends. "So did I!" was the answer.

And all too often, we only come close. You've heard the story of the little boy who came home from kindergarten all excited because he had won first prize. When his mother asked for details he told her there was a contest to see how many children could tell how many legs a hippopotamus had. "My answer was 'three' mother, and I won," said the boy. "Yes, but a hippopotamus has four legs," replied his mother. "Yeah, I know, but I came the closest!"

Some are in safety because it pays better than other jobs. Or because the working hours are so short, with never any overtime or weekends to worry about. Or because of the wonderful cooperation and recognition they receive from management and employees. There may be a few men in safety because they couldn't make a success of any other job—someone said there should be a safety department and because they couldn't do anything else right—they were put on the job. But there is only one main reason most of us are working in safety (whether you know it or not) and that is because we are interested in humanity!

What does the dictionary say about "humanity"? "Quality or condition of being human. The peculiar nature of man, by which he is distinguished from other animals. Quality of being humane; the kind feelings, dispositions, and sympathies of man; especially a disposition to relieve distress and to treat all creatures with kindness."

There are many good reasons for a safety program in any plant. Safe workers are better workers—happier workers and more productive workers—producing less scrapped parts. All of this, of course, means more money for the plant and for the management and (hopefully) for all the workers. But how many safety programs do you know of that are built on economics alone? Through

my work, I come in contact with more safety programs than most men, and I don't know of even one based on selfish reasons alone!

Charles M. Powell, president of American Agricultural Chemical Co., (whose company spends $350,000 a year on safety) said, "Safety encourages teamwork, develops initiative and alertness, minimizes human suffering, and results in lower costs in insurance and in reducing hidden costs resulting from lost time because of injuries." Russell De Young, president of Goodyear Tire and Rubber Co. (which invests over one million dollars a year in safety), states, "Safety saves lives and money." Champion Paper and Fibre Co., Hamilton, Ohio, spends $70 per year per employee on safety.

Many millions of dollars are spent on safety programs each year, and although the programs are often sold on economic reasons, you can't convince me that deep down in the heart of the most hardened executive the humanities are not helping to tip the scale.

I have a great love and admiration for safety directors and for all who are interested in the safety of their fellowmen. This is "The Humanities of Safety" in action. I love the dedication of safety people. I love the enthusiasm of safety people. They remind me of the ice fisherman who had no place to keep his worms from freezing, so he kept them in his mouth!

Those of you who are familiar with N.S.C. publications have no doubt read this description of a safety director, but it is worth reading often. It is one of the finest tributes to safety directors that I have ever read.

> Salient, salubrious, scintillating Sam Fife, former fearless, fighting editor of the *Safety News Letter* of the National Constructors Association, recently published the following definition of a safety director.
>
> Somewhere between the apple-cheeked innocence of the new office boy and the urbane worldliness of the board chairman, we find a delightful creature known as a safety director.
>
> Safety directors come in assorted shapes and conditions—mostly "out of." You find them everywhere—but mostly behind the eight ball. Goggle salesmen love them, litterbugs hate them, wives tolerate them, supervisors frustrate them, engineers ignore them, and the claims adjuster protects them.
>
> A safety director is sentiment with statistics on its tongue . . . experience with scars on its hands . . . imagination with a clipping service . . . and faith with its fingers crossed.
>
> A safety director has the appetite of an IBM machine, the energy of a chimpanzee, the curiosity of an old maid, the lungs of an umpire, the enthusiasm of a kid in an ice cream plant, and the shyness of a bull elephant in mating season.
>
> He likes slogans, posters, figures, questionnaires, tape measures, warning signs, newsletters, safety meetings, and limericks. He isn't much for clutter, clatter, waste, carelessness, other people's speeches or sharing his bulletin board.
>
> No one else is so early to lunch or so often at the coffee machine. When you want him, he's "somewhere out in the plant." When you don't want him, he's hovering over your desk with 117 ideas for jimdandy new promotions. No one else can cram into one desk drawer 17 red pencils, two slide rules, a first-aid kit, a swatch of bumper stickers, 11 safety posters, 14 decals, five rolls of reflector tape, and a pocket calculator.
>
> A safety director is a fabulous creature. You can keep him out of sorts, but you can't keep him out of your files. You can frustrate his desires, but you can't frustrate his drive. You can top his jokes, but you can't top his statistics. He's your conscience, your shadow, your alter ego, your father-image, your psychiatrist, and your despair. But when the accident figures drop, he's your pride and joy, your fair-haired boy, your prize executive (provided he doesn't expect a raise).
>
> And when you leave the job and break your leg in the parking lot, he can bring tears to your eyes with those tender sympathetic and understanding words, "You rat, you've ruined our safety record." (Construction Section)

Why are you in safety work? Let me say as kindly as I know how—but as force-

fully as I know how—"Unless you are in it because you have a soft spot in your heart for your fellowman—unless you have an interest in preventing injury and suffering and death to your fellowman—unless you really feel that you are truly your brother's keeper—get out of it.

The words of the apostle Paul in Romans 15:1-3 are most appropriate here: "We then that are strong ought to bear the infirmities of the weak, and not to please ourselves. Let everyone of us please his neighbor for his good to edification. For even Christ pleased not himself, but, as it is written, The reproaches of them that reproached thee fell on me."

The number one killer of us all, under the age of 37, is still with us, and last year he destroyed more physicians, more engineers, more attorneys, more artists, more toolmakers, more railroad men, more mothers, more fathers—and more children—than any other force. (This killer takes more children between the ages of one and 14 than the five leading diseases combined, and from 15-24 more than all causes combined!) No one can estimate how great this destructive force would be, nor how great the destruction might have been last year, if it were not for the work of the dedicated safety people and their associates!

Alfred North Whitehead, one of our great philosophers, gave one of the finest definitions of duty, which I would like to apply to safety, that I have ever heard: "Whenever it is possible for a man or a group of men to alter the course of events for another person or a group of people, therein does that man have an inescapable duty." Through the past fifty years and throughout all American industry, we have noted the manner in which the course of events have been altered for persons and groups of people, because of what you and those like you have done. When a man is conscious of his first and primary duty, then his course of action is clearly defined for him. And surely one of the marks of greatness among us is that, whenever we find a safety person, he knows what his primary duty is, regardless of the particular product, regardless of the manufacturing process, regardless of the problems of competitiveness, regardless of the sanctity of traditions. He knows his primary duty, and he acts accordingly.

You've no doubt heard this story, but it illustrates so perfectly "primary duty," that I would like to repeat it. One morning when Father O'Brien went out to his front porch for the papers, he found a dead jackass on his steps. He immediately called Kelly, who was head of the Sanitation Department and asked him to bury the animal. Kelly, thinking to have some fun, answered, "Why, Father, you will have to take care of it. Don't you know the first duty of the church is to bury the dead?" "That's where you are wrong, Kelly," answered Father O'Brien. "The primary duty of the church in the event of death is to notify the next of kin. And that is why I called you!"

The primary duty of safety people is to change the course of events! There are two fundamental principles that guide us:

1. The place where a man works and the place where a man lives have a great influence on his life.

2. A man can have a great influence on the place where he lives and works.

There isn't an industry represented in this Section that doesn't have a better safety record than was thought possible just a few years ago. Because of the effort you and your associates have made, these industries have become increasingly safer from year to year. Let no one be discouraged by the appalling fact of what is still happening among us. But let every man take heart by this simple truth—that there is in each individual the capacity for leadership whereby you are able to transform that place where you work into a safer place.

This calls for two forces if that leadership is to become effective. One is the knowledge of science and the other the enthusiasm of religion. All successful safety men have both of these forces incorporated into their very existence in a most rare and magnificant way.

1. The centrifugal force of science that increasingly is thrusting itself further and further into space, abandoning truths once held to be valid and finding new truths by which the penetration can be made, always recognizing that we shall now know less and less about the more and more that is around us. (It took thousands of years for the total knowledge of mankind to double—it is now doubling every eight to ten years!) This is the openness of mind of the safety

man who never feels that any mechanical device, any scienitfic approach is the ultimate answer,. but there is always the better way.

2. The second of these forces is that centripetal force of religion which constantly brings the energy of life down to a hard simple core of the value of man and his worth and increasingly causes us to realize one thing we do know amid all of our uncertainties, and this is—the way of reverence for life is the only way of survival.

In other words, we are speaking of the humanities of safety! In the blending of science and religion, our leadership must recognize that our first responsibility is to understand the attitudes of people and how, as safety men and women, we can actually change the attitudes of persons. For make no mistake, there can be no lasting improvement in the accident picture by science alone, nor by religion alone, but only by the blending of these two great forces in our understanding and in our leadership. It was Francis Bacon who wrote, "That which man altereth not for the better, time altereth for the worse."

In conclusion, permit me to give you my definition of safety. Safety is the company president and/or the chairman of the board, supporting every safety practice and every safety program. Safety is the plant superintendent or manager who cares enough to give complete job orientation to each new employee, and provides a work climate for all employees where production can be carried on without interruption from accidents. Safety is the foreman who cares enough about his workers to insist that they be given the very best instructions through both oral and written instructions. (He also insists on strict compliance with all company rules, including safety.) Safety is the company design engineer who understands the importance of designing safety into every building and every piece of equipment. Safety is the purchasing agent who insists on the best equipment (safety-wise) that can be found. Safety is the individual who is sold on the importance of looking after himself and his fellow employees so that injuries are avoided by all. He thinks safety and works safely under all circumstances. Safety is the salesman who concerns himself with his customer's protection and ensures that the customer gets the technical assistance to properly handle the commodity he buys. Safety is a part—and a major part—of every job properly done. Safety is every person on and off the job, working, playing, eating, sleeping, and living safely every day. Safety is a way of life—safety is a life spent in making safety suggestions, receiving safety suggestions, from the cradle to the grave, and living in accordance with the best possible information available regarding safety!

Oh yes, one more thing. The most important word in safety—humanity!

POWER PRESS AND FORGING SECTION

MORE PERMANENT CONTROLS

By FRANK HAUSMAN, JR.
Punch Press Specialist, Employers Insurance of Wausau, River Forest, Ill.

There are three basic ingredients necessary for instituting more permanent controls for safer power press operations. They are mechanical supplements, preventive maintenance, and personnel accountability.

Mechanical Supplements

Electric Starting Button Controls. The design of an electric starting button control should be such that there is no re-start in the event of an electrical power interruption, otherwise an unexpected stroke could occur. A spring-loaded solenoid valve should be incorporated in the circuitry so that all air pressures would be released from the controls, clutch, and brake when an electrical power interruption occurs, so the press would come to a complete stop. This should also include hydraulic fluid pressure.

Electric Button Actuating Controls are usually checked out for wear and shorts through a process of elimination. What should the frequency of such inspections be, as breakdown has been known to occur shortly after such an inspection? A more permanent control in this area can be instituted by incorporating time delay relays in the circuitry of the hand controls. The relays can be set from ½ second to about 7 seconds. If a hand control is shorted over the pre-set time, the controls are inoperative. Last, but not least, such a control requires less supervision of an operator, as a hand control could not be blocked over the pre-set time.

Jog or Inch Buttons. Injuries occur on set-up work when the equipment is equipped with only one jog button for inching the press. Dual jog buttons are a more permanent control, as both hands are occupied. All actuating hand controls should be recessed to lessen the possibility of accidental actuation by the operator's body, except emergency stop buttons.

Stroke Selectors. The absence of locking provisions on stroke selectors of pneumatic friction clutch presses has resulted in accident and injury as a result of the press being put on continuous stroke when hand controls were in use. A more permanent control than a locking provision would be to incorporate circuitry so the hand control power is off when the stroke selector is on continuous stroke.

Rotary Cam Limit Switches. The locking of the sprocket of the rotary cam limit switch of some presses, especially older ones, requires frequent inspection to ascertain that the set screw over the Woodruff key has not loosened up from vibration. Some years ago, a serious injury occurred on a large press when the Woodruff key disengaged, despite the fact that the set screw was inspected every two weeks. A more permanent control in this area can be instituted by putting a set screw in the face of the sprocket and the shaft. The thread depth should be about 1/32 of an inch longer than the set screw, so the thread can be peened over the top of the set screw to keep it from loosening up. A still more permanent control is dual rotary cam switches, in parallel but separated mechanically, as drive chains have been known to break, come apart, and shaft breakage has also occurred.

Solenoid Air Valves. Dual solenoid air valves are preferred to a single solenoid air valve, as the safety factor is much higher. One failure of a single solenoid air valve could result in an unexpected repeat stroke. On the other hand, with dual solenoids, both would have to fail simultaneously in order to produce an unsafe condition. A more permanent control than just dual solenoid air valves would be those that are monitored, as failure of one is difficult to detect and it is not impossible for the other to fail at a later date.

I have known of cases where the press was actuated for hours after an accident to try to make the air valve malfunction again, and all was in order, as the foreign particle that lodged on the valve seat had been ex-

pelled out of the exhaust port right after the unexpected repeat stroke. I have also known of cases where the press stopped at the top of the stroke but about four seconds later cycled of its own accord, as the result of slow leakage of the air valve because of a foreign particle. It took that much time for pressure to build up to a point in the little air cylinders to engage the clutch.

Presses with Separate Solenoid Air Valves for the Clutch and Brake. Such presses should be equipped with electric pressure switches between the air supply, between the solenoid and the clutch, and between the brake solenoid and the brake. Consequently, if the connection between the solenoid and the clutch ruptured, there would be little or no ram droppage.

Rolling Key Clutches. Clutch failure on older presses with rolling key clutches has occurred, as a result of cotter pin breakage despite periodic inspections. A more permanent control in this area can be instituted by providing the clutch latch with a holding bracket. The bracket is bolted to the press in front of the face of the clutch latch. The clearance between the bracket and the face of the clutch latch should be at a minimum. Consequently, if cotter pin breakage did occur, the clutch latch could not pull out far enough to cycle the press.

Pin Clutches. The clutch latches on some presses do not incorporate a positive stop. Unless the brake is properly adjusted to the weight of the punch, an unexpected re-cycle could occur. The use of a brake adjustment indicator would be very helpful as one could tell at a glance where the crankshaft was stopping.

Clutch Latch Return Springs. Some presses are equipped with a tension clutch latch return spring. When such a spring breaks it is completely ineffective. A compression spring with a bolt through it is far safer, as it may still be effective in the event of one breaking and usually does not fail until it breaks in several more places. A press may be equipped with a clutch latch spring enclosed in a housing. Spring breakage on such installations is difficult to detect. Providing such presses with an additional spring hooked to clutch latch linkage or foot treadle would reduce the possibility of clutch failure, as the additional spring can be inspected more readily.

Preventive Maintenance

The use of inspection forms insures a complete inspection and revals the condition of the equipment. Copies of completed inspection reports should go to a responsible person such as the shop superintendent. It is advisable to keep repair records. Repeated failures of the same part may indicate that an engineering change in material or design is needed. Inspection records should indicate the interval of time between separate breakdowns of a part; replacements can then be obtained in anticipation of need.

Jams and overloads should be reported immediately, because damage may have resulted. The working portions of die tools should be kept in good condition so that work load is at a minimum.

Non-destructive periodic testing will pinpoint defects far in advance of breakdown. A magnetic particle test or dye penetrant check will detect cracks and surface defects that are otherwise undetectable. Even new parts should be checked before they are installed. Testing equipment, such as a dye penetrant kit, is relatively inexpensive, and testing could be scheduled to take advantage of slack or vacation periods.

Accountability Responsibility

How does one make personnel more accountable and responsible? One way is to make use of a signed safety set-up check list. Another is by color-coding dies to indicate the guarding requirements. Consequently, all concerned could be on the alert for infractions.

DEVELOPMENT OF A BETTER MACHINE OPERATOR

By OWEN R. STANLEY
Div. of Personnel, Industrial Relations Dept., Fesco Div., Columbian Carbon Co., Pittsburgh, Pa.

In a discussion of the development of a better machine operator, some definitions are in order. Development means gradual changes, whereby progress is shown into a higher state. Better machine operator means an employee who, theoretically, meets the objectives of his organization by consistently performing his assigned duties in an effective manner. Hence, what you have in theory is a good sound employee on the production team. To maintain a machine operator or any employee in this satisfactory state depends upon complex human relationships. In other words, there must exist a harmonious working atmosphere where an employee is capable of meeting some of his needs, as well as those of his company.

The onus for success in the workplace is placed squarely upon the shoulders of the manager-supervisor. People are our problems and it's up to the supervisor to handle it. Yes, I am saying this and more. No doubt, there are top management people conditioned to handling people problems as well as the personnel department. However, we lack depth. I have found, in most cases, the front line supervisor is promoted from within because he knows machinery or production, but he knows little about people. Practical reality demands there be additional training, self education. I have found it to be an unending struggle of getting grass root supervisors to recognize, accept and endeavor to adjust outmoded thinking on people problems. The supervisor must be equipped with real skill and a better understanding of human factors in order to maintain productive morale of the group. This is just good business.

Employees are no longer looked upon as servants who must be grateful for everything they receive from a master. The framework has moved from a master-servant relationship to that of an employer-employee relationship. Each employee is recognized as having certain inalienable rights as a free man. The employee can now express himself freely without fear of losing his job.

At the same time, the modern employee is caught in a web of industrial forces he neither controls nor fully understands. Because of the confusion, he often demands more protection and fringe benefits. Employers often imagine, in their confusion, economic benefits will bring about more harmonious relationships they seek. They don't, and so suspicion and misunderstanding continue to abound. One outstanding business leader expressed this as follows; "I believe the root of nearly all human relations problems is misunderstanding; either self-misunderstanding or misunderstanding of the motives of other people." Thus, the need is clear to improve our human relations in business. This is demonstrated in a recent survey of business leaders asked to state what single ability was most needed to succeed in business. The answer invariably came back, "The ability to get along with people."

The management man of today is a man manager just as surely as a work manager. The action management of today must meet the objectives of producing and selling goods and services at a profit, but underlying this objective is recognition that the goal of work is satisfaction of human needs. The challenge to top management as well as to any successful manager is to think clearly about developing business practices that enable people — our most valuable asset — to achieve the optimum use of their capabilities and gain the fullest enjoyment of the fruits of their labors.

In this tricky arena of human relationships, we are dealing with all kinds of people which make up any one business place. We can note differences, but there are also common factors that apply. For instance, we are seeking a way to get through life with the least amount of conflict. Most individuals are striving toward adjustment. We want an atmosphere where things are relatively satisfying. We seek to avoid pain and move toward comfort and recognition. Thus, the result is a person conditioned by his environ-

ment, similar in motivation and responsive to praise and recognition, yet different in aptitudes and accomplishments, sometimes impulsive and unreasonable enough to be unique and different.

Every workplace must be approached and viewed with its problems as it exists today. We accept employees here and now, with and without their problems. Regardless of existing conditions, the emphasis must be in gradually developing to a better stage in human relations in business.

Human relations is recognized to be a broad subject, but my intention here is to highlight three important areas toward successful development:

1. Give your employees the proper tools to work with.
2. Do not make snap judgments of people.
3. Maintain a constant program of reconciling people to work.

1. Give Your Employees the Proper Tools to Work With

A supervisor must help the employee develop by building close personal relationships. This means proper orientation and training, a good first impression. A supervisor should avoid personality clashes. Respect the employee's work, his special skill or talent, his long service, his loyalty. Each person wants to be evaluated in terms of what he is; his contributions. He wants to be respected according to his own self-concept of success. Building close personal relationships (mutual trust) takes time and patience, but is well worth the effort. Move toward democratic leadership where the "we" is important. Democratic leadership is founded on the principle that participation and individual involvement makes work more meaningful for people.

Under democratic leadership, you develop the group, and there is more group centered action in the solution of problems. Group participation makes the employee feel he is part of the company. This type leadership creates more mutual respect among workers. Members of the group have a greater sense of responsibility toward the job and each other. Free exchange of feelings and opinions tends to relieve fears, dispel criticism, and change unfriendly attitudes. There is sincere two-way exchange, give and take, at the grass roots of the organization.

In the long run, the democratic method not only means greater job satisfaction for employees, but should result in higher production. Under such employment conditions, the quarterback supervisor will have an easier time motivating such human drives as loyalty, initiative, and enthusiasm.

The importance of people can further be illustrated by reference to average hiring costs, fringe benefit costs, and separation costs per employee. On an average basis, total cost has been estimated between $1,500 and $2,100, broken down as follows: hiring costs — $250; fringe costs — $1,500; separation costs — $350. Hiring and maintaining an employee is an expensive investment. It pays to attract and hold good employees.

2. Do Not Make Snap Judgments of People

One of the practical problems of working together is that we like to simplify things. If not simplifying things, we are in too much of a hurry to get the job done, speed becomes habit. We allow ourselves to characterize or catalog other people by one characteristic: "Tom is after nothing but money." "Dick is a sour-belly, a griper." "Harry is over-sensitive, lacks discipline."

Frequent generalizations of people may draw us into the web of bias or prejudice. In other words, we just skim the surface. Judging people merely on the basis of appearance or one value is, again, costly and misleading. A good man could thus be frustrated and sqeezed out of the organization. There is a great need for better relations in all of our dealings with others. There are no short-cuts. All people are different. Any working atmosphere is composed of a cross-section of different people, and looking at such factors as intelligence, interests, habits, temperament, mental health, and aptitudes gives us a keener appreciation for the uniqueness of each person.

3. Maintain a Constant Program of Reconciling People to Work

The biggest problem faced in America's industrial society is reconciling the ever-increasing and exacting demands for production efficiency with the hopes and drives, desires and aims, interests and wills of people.

The demands upon management are greater than ever before, due to the remarkable ad-

vances of physical and chemical sciences; increases in the volume of business activity; the external influences of inflation; the cold war; added government regulation and intervention; the broader social responsibilities which enhance the necessity of better understanding of social trends and human needs; and the increasing cost of operating a business with adverse influences on profits.

Industry must strive to bring about a realistic and practical adjustment of the needs, interests, and expectations of employees to the economic realities we face. Responsible managements must then determine objectives and organize and motivate people to accomplish the over-all objective. This must be done through a high order of administrative skill. Results are analyzed and management's plans adjusted accordingly. A primary objective is to remember people in planning, coordination, and adjustments.

Can you recall the times your attitude has gotten you into trouble? The times you forgot to remember what you know about others? Certainly, I can remember times when I rubbed people the wrong way. The times when I was stubborn, short tempered, crude, impatient, arrogant, rude, indifferent, and inadequate; when I knew good logic and common sense about people should have prevailed. There is opportunity for each of us to improve our business sense in the area of human relations. Gradually, as you succeed with one person, you'll try another, and it will become easier to develop your industrial atmosphere into better human relations. This again assumes two and two are four and that you are genuinely interested in building better relationships with your fellow man.

To help insure my own development in human relations, I have borrowed a check-list to remind me of logical principles:

Remember people like to talk about their achievements and their disappointments! Evidence a genuine interest in the things a person hopes and expects to do.

Remember people like to be encouraged! Practice the development of a positive attitude toward life's problems. Don't be known as a person who sees lots of trouble.

Remember people like to be consulted! Ask for their opinion and for their help. Assume every man knows more about his specialty than you do, and be sure he knows you believe this to be true.

Remember people like to be respected! Be careful to accord every person the full title and the full respect due his position. Nobody lightly forgives one who underrates them.

Remember people like a choice! When you try to sell an idea, present an alternate even though it may be directed to the same objective. When a person is allowed to make a choice, he has a stake in the proposition.

Remember people act abnormally under censure! Embarrassment is a great hate producer. Make allowances for a fellow in a tight place; help him to save face, and cover for him if you can properly do so.

Remember people like to be remembered! A sure way to a person's good regard is to quote exactly something he said or did and comment on it favorably. The converse is likewise true; to forget a name or an occasion you should remember is inconsiderate.

Remember people like praise but they do not like flattery! Be sincere. Praise the deed or the motive.

Certainly, human relations is the key to advancing our most potential asset — people. This revolves around three focal points of development. First, give your employees the proper tools to work with. This means proper orientation, training, and associating them into the work group by developing close personal relationships between employee and supervisor. The move toward democratic leadership brings about more harmonious relations by group participation and involvement. Consequently, you will have a healthier employee, a healthier organization.

Second, do not make snap judgments of people. Don't allow yourself to gauge a person by appearance or generalize them into a one-value mold. Get to know them well enough by such unique factors as intelligence, interests, habits, temperament, and skill. Constantly strive to associate factual knowledge in place of bias or prejudice.

Third, maintain a constant program of reconciling people to work. Strive to remember people in all things as the most effective way to build better human relationships. Only in this way will your most important asset — the machine operator, the supervisor, the leader — achieve optimum efficiency and satisfaction in their work.

THE 3 R'S OF PRESS RELIABILITY AND SAFETY

By CHRISTOPHER ZEILENGA
Mgr. of Product Reliability, Verson Allsteel Press Co., Chicago, Ill.

Out of necessity, we have made tremendous progress in the past two decades with inventions in many fields. In electronics, we have solid state devices, lasers, and integrated circuits, to name but a few. In the field of automation, we can find completely automated factories and processing plants. In any field we care to explore, we find that out of necessity we have invented solutions to problems. Has our progress been as dramatic in the field of safety, where a great necessity exists?

The cliché says that Necessity is the mother of invention. In case you haven't met the other members of the family, let me introduce you to brother Production and sister Safety. As is the case in all families, there is friction and occasional fighting. Sad to say, the outcome of these family quarrels and fights is not settled justly because father Industry very often gives preferred treatment to brother Production. Sister Safety, who has their welfare at heart, is sometimes disregarded. Brother Production thinks she makes mountains out of mole hills. Father Industry too often thinks she has expensive tastes and hinders the development and progress of brother Production. I am afraid that her only fault is that she is too soft-spoken and has never developed a good communication link with the father. It is unfortunate. No, it is a calamity, because if brother Production and Sister Safety could only be reconciled, the whole family would profit.

Let us hope that through conferences and safety meetings in the plant we can make safety more vocal. Possibly we can make sister Safety heard over the noise of Production. Although group effort is often required and final approval of a program may have to be given by another person, it is you who can define the problem. It is you who can push relentlessly for changes in methods and procedures. Your company recognizes to some degree that something requires doing in the field of safety for your plant. You are Mr. Safety. To the extent that you fail to do your job, the National Safety Council has failed and your company has failed.

I hope there is recognition of the need to reduce minor, disabling, or fatal industrial accidents. If the necessity is not better understood, and if it does not prompt you to seek a solution, and to take action, then for you industrial accidents will not diminish. We must be able to see what has been developed from the experiences of others, too many of which were sad experiences. It is sad to say, but too often true, that we do not learn too well from the experience of others. But we must. We cannot wait for accidents to awaken us to the reality that a hazard exists. Before an accident occurs, we have to recognize the hazard and determine what suitable devices and what modifications in procedures will prevent its occurrence. We have to realize that what has happened in someone else's shop can happen in our shop, and that in time it *will* happen in our shops unless we take every reasonable step to prevent it.

An equally sad situation exists when an accident report states that the accident was unpreventable. The report may not have *said* that it was unpreventable. It may have stated the facts as they appeared to be, identified the part that broke, indicated the error on the part of the operator, and explained reasonably well how or why the accident happened. But if the operation was continued in the same manner after the accident, with no procedural changes, no hand tools provided, no guarding added, then the accident was not analyzed in depth. Only superficial reasons were given. No one put a finger on the real problem. The operation was left as a hazardous operation. Will there be another accident? Oh, yes, there will! Soon, another part will break, or someone else will make a mistake.

Since the odds are in their favor, it is likely that the next time something wears out or breaks no one will get hurt, at least not seriously. It may be a near-miss. Isn't that a lot of consolation! That is Russian Roulette. Let us be convinced that accidents are primarily the result of the way equipment is used. When will we learn that accidents, for the most part (nine out of ten or better), are preventable?

What is a preventable accident? We could borrow a definition from the National Safety Council's driver improvement course, "A preventable accident is one in which *you* fail to do everything you reasonably could have done to prevent it."

Could we have used the word *possibly*, instead of reasonably? There is always something you possibly could have done to prevent an accident. Yes, possibly you could have stayed home, or not turned on the machine. We are not suggesting that you stay at home or that you do not run the machine, but there are things you *reasonably* can do to eliminate or reduce hazard.

Two things are necessary before we can make progress in reducing accidents:

1. We must believe that most accidents are preventable.
2. We must recognize the hazards that exist.

I am going to assume that we can agree on the premise that accidents are preventable and discuss hazards.

There are two types of hazards:

1. Functional hazards, defined as hazards which arise from the normal functioning of the machine.
2. Malfunctional hazards, defined as hazards which arise from abnormal functioning of the machine.

Malfunctions for the most part would cease to be hazardous *if* we eliminated functional hazards, or provided adequate protection against functional hazards.

Functional hazards are those that exist because the operation exists. For example, a knife or a shear must be sharp to perform its function, but the very sharpness of the knife and the closeness of the two-blade shear create a functional hazard. A hammer, because of its very nature and use, is a dangerous instrument; therefore, its use represents a functional hazard. We know these better as "Point of Operation Hazards."

Functional hazards are basic hazards and, therefore, every attempt must be made to eliminate the hazard without adversely effecting the operation. If we are to be realistic in light of the facts that operators do become careless, that machines are not always maintained as they should be, and that machines and components have limited life due to normal wear and tear as well as abuse, so that malfunctions may occur, then our objective must be to "provide a system that eliminates the functional hazard so that malfunctions of man or machine are not hazardous." To the extent that you are successful in meeting this objective, your program will be a success.

If we, however, recognize that we cannot always reach the objective (even though we may have tried, and may believe we have been successful), we must also make every attempt at eliminating or reducing malfunctions of man and machine as a necessary back-up system. With these thoughts in mind, I would like to propose a safety program based on the 3 R's.

1. Restrict
2. Restore
3. Retrofit

They are as basic to safety as reading 'riting, and 'rithmetic are to ordinary life. They are listed in order of importance.

Restrict is defined as "to limit; to confine; to restrain within bounds." This is exactly what we mean when we speak of press operations. We must limit the use of the press to safe prescribed procedures. We must confine the work area so that access to the point of operation is positively restricted. We must restrain the operator from performing unsafe acts by every means possible. All of our efforts should be interpreted by the operator to mean "Restricted—Keep Out."

Obviously, we are back again to the same old problem of functional hazards in a press room which is the point of operation created by the use of the tools and dies in the press. When we analyze each of the measures that are taken to reduce press accidents, we find that they all attempt to "keep hands out of dies." This, then, becomes the obvious rule.

We must go directly to the source of the problem. We must restrict the access to the hazard point. We cannot rely on unfailing reliability of the man or the machine. Die guards and safe processing of the product must be the rule rather than the exception. It is the only effective way of solving the basic problem.

The builder of a general purpose press cannot predict what dies will be used, what parts are going to be produced, and what handling problems will be associated with

production. Everyone who knows will agree that die guards and part handling have to be tailored to suit each operation. The die shape, the geometry of the part, its size and weight, and the operation to be performed on the part are all factors that must be considered before any suitable guards and handling means can be devised. We must conclude, then, that die space safety becomes the responsibility of the individuals who plan the tooling process. The job is only partially completed when the dies are designed or made to perform a function and a press is selected into which the dies are to be used. Too often, the aspect of safety, if considered at all, is given consideration after all other work has been completed and production is about to begin. Undoubtedly, many tooling processes would be planned differently if safety was designed into the process. As much planning should go into the safety of making the part as goes into the flow of the material through the shop.

The user has the ultimate responsibility of safety in his shop. He must decide that it is to be safe. He must decide what must be provided. He must decide who is to do it. It is important that we put this responsibility of die space safety in its proper perspective, since it is the only sure way of eliminating die space accidents. We must recognize that only when insufficient attention has been given to the safe processing of material through the press at the point of operation does malfunction of man or machine become a hazard. The user must, therefore, restrict the operation by limiting the use, confining the hazard area, and restraining the operator.

The second of the 3 R's is *Restore,* defined as "to repair; to rebuild; to revive." It also finds expression in the term *maintenance.* We normally think of maintenance in two distinct categories: breakdown maintenance and preventive maintenance. These differ only in degree and final objective.

Breakdown Maintenance we recognize as unscheduled repairs required to put a machine back into operation. Many repairs of this type are a minimum effort to bring the equipment back into production at the least immediate cost in loss of production and out-of-pocket expenses. This type of maintenance often leaves much to be desired to make the machine reliable. Too often, it is a kiss and a promise, with the promise unfulfilled. Unfortunately, with too many shops this is the only maintenance that really exists. A good preventive maintenance program is sorely needed in many shops.

The third of the three R's is *Retrofit.* You have seen the term in various trade journals. It appears for the first time in the latest edition of *Webster's Unabridged Dictionary,* defined as "a modification of equipment to include the changes made in later models." The word comes from *retro* which means "to go back," and *fit,* which means "to equip." For our purpose, we could define the word "to go back to older models and re-equip them with controls and accessories used on current models."

If we speak of retrofitting generally, we can find more than one justifiable reason to retrofit production equipment. It is most generally considered from the standpoint of increased productivity with the resultant decrease in manufacturing cost and/or product improvement. Some retrofit programs make it necessary to strip a piece of equipment down to its basic components and then re-equip it with the latest electrical and pneumatic controls and measuring and read-out systems. I recommend that you back up your safety programs of restricted use and good preventive maintenance with a retrofit program, primarily as a safety back-up system. You will also gain everything that improved reliability can offer.

Retrofit maintenance is a program geared not to maintaining the status-quo, as in preventive maintenance, but to industry changes to postpone or prevent obsolescence. Obsolescence occurs when a machine cannot adapt to modern methods, and its productivity cannot match its modern counterparts or is not capable of producing to the same level of accuracy and precision or does not have the same capability as new equipment. Obsolescence also occurs when the reliability of equipment is below present day acceptance. This can be true even if the equipment is maintained in like new condition, because yesterday's like new reliability may not be acceptable today.

Small and relatively inexpensive machine tools are often not good candidates for retrofitting programs when the cost to retrofit is compared to the cost of a new machine, but if we should consider a press for retrofitting we find that a different situation exists compared to other types of machine

tools. Press controls are a small fraction of the total cost of the press (possibly 5 per cent, and not more than 10 per cent). It can be readily seen that it would be possible to update several machines for the price of one new machine. This would in many respects have the same effect as having "new-like" equipment.

There are old presses in use today, basically sound and quite productive, that could be equally as reliable as a new press in spite of the fact that a number of physical improvements in press construction have been made over a period of years. These old but sound presses, with new pneumatic and electrical controls with all of the associated hardware, could make the machine better than new, as it relates to control reliability.

Why am I placing emphasis on new machine controls? Because a machine malfunction by its very nature indicates that normal control of the machine was lost. It is important that we use every means to reduce the probability of injuries, bearing in mind that a machine malfunction may allow a hazardous act or operation to cause an injury. I am speaking of actual machine malfunctions, not presumed. Often, when a personal injury occurs, for lack of good explanation or because of hesitancy to blame someone, the machine is blamed, so that not all complaints of machine malfunction are valid. However, considering that many of the complaints may be valid, a review of the controls on your machine requires serious consideration for improving machine reliability.

In order to better see what can be done on older equipment, we will list the changes that have taken place over a period of years and place them into a time frame. We will be able to see from this time frame which machines fall into which category, and we will have a better understanding of where they may fall short of today's standard practices.

To know specifically what changes should be made to his equipment the user will have to determine if the equipment is unaltered and then request the builder to make recommendations to update the equipment, based on his original records. Years ago, a large percentage of the presses built were equipped with positive clutches and drag brakes. This was very common construction until the late 1930's. Some presses are still constructed with some form of positive clutch.

The old machines that were equipped with mechanical clutches were normally tripped by a foot pedal. Once the press was tripped it made one cycle, providing that the foot pedal was released before the cycle neared completion. If the foot pedal remained depressed, repetitive strokes resulted. The press would stop only after completion of the stroke in which the pedal was released. Some machines were later equipped with a mechanical anti-repeat latching system which permitted single stroking only, barring any malfunction of parts. Starting in the 1930's, electrical clutch controls were developed for controlling the operation of pneumatic clutches and brakes. The brakes were spring set and pneumatically released. The clutches were spring released and pneumatically engaged. These first machines employed only simple basic electrical control circuits. These electrical circuits to a great extent duplicated the functioning of the mechanical clutch system. Many of these used a single relay, a single push button or foot switch, a single solenoid direct acting valve, and a stop-on-top cam operated switch.

When someone saw the possibility of using two hand controls in place of the foot operation or single hand operation as a means of reducing hand injuries, this feature became quite common. This began to find use in the late 1930's. When the advantage of limiting the stroke to a single cycle, even though the push buttons were held depressed, was seen, the anti-repeat feature was added in the early 1940's. Also, at that time the use of rotary cam limit switches began to find acceptance. They are used almost exclusively today.

When it became apparent that clutch valve relay maintenance was lacking, a second clutch relay was introduced so that at each stroke each relay would back-up and check the other relay to guard against repeat stroking. This was introduced into clutch control circuits in the mid-1940's. In the late 1940's, pilot operated air valves became available. The lower in-rush current permitted their utilization on control voltage. These pilot valves proved to be considerably more reliable and responsive than the direct acting type. Because of their improved performance, they are used exclusively today. With the advent of the pilot operated valve,

with its lower operating power, it became possible to relocate it in the circuit so that it also became dependent on the rotary cam limit switch. Many circuits incorporate this feature for the additional reliability that it offers.

After the mid-1950's many clutch controls discontinued the short function that required only momentary depressing of the hand buttons. Under some circumstances, the short function gave an operator sufficient time to beat the stroke of the press if he disregarded his own safety. The short function has been disconnected on many machines that were originally equipped with that feature.

In the mid-1950's dual valves were introduced. They did not receive wide acceptance at first; some of the earlier models were considered troublesome and too sensitive. Dual valve development, however, continued. Many models are now available, and their use has been standardized with many builders and users of press equipment. It has been found that under certain circumstances they offer considerable protection against repeat stroking or other erratic action that otherwise might occur with the use of a single solenoid valve.

From the foregoing, it becomes obvious that a [illegible]ying degree all machines in the field can be retrofitted. Some machines may only require a double valve. The older the machine, the greater the need. Another factor should also be considered: the older the machine, the more cycles it has run and the poorer the controls have become, due to normal wear and tear. New controls not only give full life expectancy once again, but also give a longer life expectancy than once we could expect. Depending upon the age of the present controls, one might expect up to several times greater life.

If we were to analyze the changes made in clutch control circuits, one fact stands out clearly. Clutch controls have been made more and more reliable, but they are depended upon too often to do the job intended for die guards. If we consider the fact that the objective of complete die guarding is not always satisfactorily met, then, logically, efforts to prevent machine malfunction becomes a necessary back-up requirement. We will have to recognize that in many respects a good preventive maintenance is lacking, in addition to ineffective guarding. I believe this two-fold management deficiency is sufficient reason to consider seriously the desirability of a retrofitting program. My only fear is that the shop that does not guard effectively may also be the shop that does not exercise preventive maintenance effectively and may be the most difficult to convince that retrofitting is necessary. Safety is a state of mind.

How serious is the need? The *Ninth American Machinist Inventory of Metalworking Equipment*, published June 10, 1963, indicated there were 290,000 mechanical power presses in use, of which 271,383 were single action and double action presses. Of these, 118,485 were then 10 to 20 years old and 150,975 were 20 years or older. Brought up to date, this means that out of 271,383 presses in 1963, 169,460 or 62 per cent, are now 15 years or older. We must conclude that all machines 15 years or older require new clutch controls, including the electrical clutch control panel, the clutch valve, and the hardware used in conjunction with it.

Since the machines equipped with mechanical clutches would also require extensive drive changes, it may be found economically unfeasible to make the conversion. The only real solution is complete die space guarding. On those machines that require only new controls, the cost is nominal and offers a reliable back-up system to a good safety program of guards, hand tools, good maintenance, and meaningful operator training.

SAFE BENCH PRESS AND RIVETING OPERATIONS

By HENRY GAGLIARDI
Supt., Feeder Operations, Standard Control Division, Westinghouse Electric Corp., Beaver, Pa.

Inasmuch as our division uses hundreds of bench presses and a like number of various types of riveting machines, we consider our division somewhat of specialists in this field. In addition, we are as far advanced in the field of safeguarding bench presses and riveters as any manufacturing plant in the country. For this reason, our division was extended the invitation.

To start this session. I would like to have you study and analyze this series of slides showing some of our small bench equipment. As you view these slides, evaluate how you would plan operator protection for each piece of equipment.

Slides 1 through 8:

#1 Tubular Riveter
#2 Solid Riveter
#3 Air Ram Staker
#4 Air Squeezer
#5 Air Impact Press
#6 Air Riveter
#7 Dual Riveter
#8 Rotary Staking Press

Now that you have viewed these 8 slides, how many were able to plan operator protection. Did I go too fast?

Not enough time is being spent on equipment prior to its being placed into production. In fact, many plants actually wait until an accident happens before any protection action is started. We disagree with this approach, and to protect our division, our policy procedure was established to prevent any single piece of equipment from being installed and released for production before it is adequately safety-planned and protected to prevent injury to its operator.

We want to tell you how you can establish and control policy to give your employees the same protection as we have built into our safety program.

Three control steps are vital for any successful safety program to be fruitful and lasting:

1. Past and present experience—yesteryear history and today's trends and facts.
2. Policy—your company's position.
3. Pilot planning—future safety programming.

Past Experience and Present Trends

Over the past 15 years, our division concentrated its greatest accident prevention effort in the direction of heavy power presses. We guarded very heavily for operator protection. Our safety planning effort has reflected a successful, progressive, favorable trend in our records.

If you were to evaluate your past records on plant experience, what would you find? Where have you concentrated your effort and what were your results? Do you realize the high potential probability factor in accidents happening if you continue operating bench power equipment without safeguarding each piece of equipment with some type of operator safety protection?

Several years ago our safety policy committee took time out for a short safety brainstorming session. The subject was, "Where should we concentrate our safety planning effort for the next two years?" The concensus of the policy committee was unanimously directed toward bench power equipment and riveting machines. At this time, five years later, I want to confess it's the best decision the safety policy committtee ever made, because it has contributed heavily in our operator protection safety program and has helped retain our low frequency and severity record.

Policy

Our division's safety program and control has been successful for the past 20 years because of one major reason—management's full support of our safety policy program. Management has solicited union support of our safety policy, they have published many control regulations, they back the safety policy committee 100 per cent in plantwide administrative control. No safety program can be successful unless it is supported 100 per cent by management. There is no in between position; if you want results from

your safety control effort, you must have full management support.

Twenty years ago, a safety policy committee was appointed by the general division manager to make and administer plantwide policy as well as its control. The works manager is chairman. The safety supervisor is secretary. Committee members are the manufacturing manager, industrial relations manager, planning and systems manager, superintendent, equipment supervisor, all general foremen, works engineer, shipping supervisor, and the captain of plant police. We meet monthly, for one-half to one hour. Our agenda is specific and to the point:

1. Roll call—absence must be by request.
2. Reading and corrections of previous minutes.
3. Review all cases of:
   A. Medical treatments—cause and corrective action.
   B. Lost time accidents—cause and corrective action.
4. Review corporate reports.
5. Review "open safety dockets" and action progress.
6. New "safety dockets" considered and action planned.
7. Future planning—open discussion.
8. Other recommendations.
9. Closing.

The safety policy committee is highly respected as the authority for plantwide control. The hourly, salary, and tool makers unions give the committee full support on safety control administration.

Since 1950, the safety policy committee has sponsored the training—through safety observer training school classes—of 542 people. Of these, 494 are still on the active plant payroll. Our safety policy committee solicits their constant aid in supporting the control of plantwide safety policy. We welcome all comments written or oral from the past graduates of our safety observer training classes. Their remarks are acted upon by the committee at each monthly meeting and, through loop communications, the safety supervisor advises them of action taken on their recommendations.

How does the safety policy committee tie in with bench press and riveting equipment? Earlier, I mentioned a brainstorming session decision made by the policy committee. This decision resulted in the following policy procedure being written. This procedure has forced safety device protection for every bench press or riveter put into the manufacturing area prior to its start-up. The policy is brief and clear:

"All tooling or equipment which is purchased, self manufactured, or developed to perform a task, which has in its general construction a hazard, is to be tagged by the maintenance department and will not be placed into production until properly and safely guarded.

"Furthermore, any reuse of present equipment or tooling which necessitates a redesign, change or rearrangement, must be tagged by maintenance immediately upon its installation. (Examples — controls changed from air to electrical, hand control to foot control, relocation of hand controls, slide fixtures to stationary, etc.)

"Before all such equipment or tooling is released for production, it must be reviewed by the safety supervisor, equipment supervisor, and manufacturing section supervisor. After such inspection, the safety supervisor will remove the tag and release the equipment for production."

We follow this tagging policy religiously, to insure against the slightest breakdown in policy control. If any segment of policy control is not supported and administered 100 per cent, the entire safety program will gradually collapse. If you adopt a tag system and hold firm on an adopted tag control policy, you can eliminate the source which breeds industry's most serious disabling injuries and high-cost medical cases due to accidents.

Our safety policy guidance rules are very specific when it comes to guarding all of our equipment. I would like to mention the few which directly control bench equipment and riveters. These control guides could apply to heavy power presses as well.

1. On presses where barrier type protection is used; the barrier guards should be transparent if at all possible, the barrier should enclose the point of operation, it should be mounted in such a manner that it cannot be removed without a tool, and all barriers must be interlocked and in place or the machine will not operate.

2. Where air gap space exists between work point material and tool or press ram; tooling must be designed to eliminate hazardous air gap space between the tool and operation point that would allow fingers or hands being trapped during the operation.

3. On machines using button control protection devices, the pushbutton must be wired to include a fail safe electrical circuit, provide for single stroke only, and must have a release-to-reset added safety factor.

When installing pushbuttons for hand operation on positive clutch presses, guideline rules for safety require locating the buttons high enough or far enough that, after the operator has tripped the controls, he can't move his hands to the pinch point until after the ram descends to the bottom of the stroke. On friction clutch presses, the pushbutton control circuit should be designed so that the operator is required to maintain pressure on both buttons until the stroke has bottomed.

(There followed a series of slides illustrating safety problems confronted in the production and assembly of various items, and the solution of those problems.—Ed.)

I hope that by now each of you have received the message — that we must start now to constantly plan and provide protection devices for all small press and riveting equipment. To help in your planning for safety protection devices, I suggest a fool proof plan.

I'm sure most of you do some development in your plant, but do you do it prior to placing a product into manufacturing?

We have a manufacturing pilot laboratory which is staffed by our industrial and manufacturing engineering personnel. In this pilot lab, all small presses and riveters are debugged prior to being released into the manufacturing sections. The safety supervisor, the tool and equipment supervisor, along with the line foreman who will use the new piece of equipment, plan for operator safety protection as the machine is developed for production.

Another important facet in operator safety is proper training. At the time our piloting lab develops the operation, proper safety restrictions are specified. The line supervisor must convey the operation safety procedures to all persons who will use the equipment, and he must follow up to make sure the training instructions are clearly understood and being followed. All guarding is in vain if training is not properly directed.

This pilot lab procedure could be the insurance factor that your safety program needs to motivate positive results.

As I close, I remind each of you of these safety program control facts:

1. If your safety program is to survive, it is mandatory to administer policy control at all times — without exception. Any infraction of a safety rule is cause for disciplinary action or dismissal.

2. Operator protection on small power equipment is just as mandatory as protection on heavy power equipment.

3. Your strongest check point to serve as a safety promotion guide is your past and present experience.

4. If your policy structure is weak, you had better start now to strengthen it. To establish and retain respect, solicit help from everyone in the plant for their 100 per cent support. From top management, union officers, and all the way down to the janitor — safety is everybody's business, and control demands the full support of all.

5. Give serious consideration to providing protection as part of a new piece of equipment prior to its release for production. Even consider a pilot laboratory development approach such as we have adopted, and let the safety supervisor, line supervisors, and equipment supervisor plan the operator's safety protection.

7. All of our protection efforts will go in vain if an operator is not properly trained.

If these seven reminders are adopted and made part of your safety program, along with the protection devices for your small power presses and riveters — you will blast off a motivating force which will result in your safety program reaching a new horizon in operator safety through protective performance.

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THE MECHANICS OF BACK PAIN

By MARVIN W. NELSON, M.D.
Orthopedic Surgeon, Racine, Wis.

The spinal column is an engineering masterpiece. It is subject to immense stresses, yet stable, resilient, mobile, adaptable, supportive, and protective. The back is the site of one of the most frequently encountered disorders in clinical medicine. It is estimated that as high as 65 per cent of the population will experience low back disorders sometime during their life span. About 400,000 workers suffer disabling back injuries each year in the United States, and nearly $400,000,000 is expended annually for related indemnity and medical cost.

The basic spinal unit consists of two intact vertebrae joined by an intervertebral disc, two posterior articulations, and a number of ligaments. Forces exerted on the spinal column are of different magnitude and direction, such as compression, flexion, extension, rotation, or combinations of these. It has been shown experimentally that, in general, compression forces produce fractures and rotational forces produce dislocations. This explains why a person falling from a height landing upright usually sustains a fractured vertebra, while a worker rotating to his right or left and flexing to pick up an object may develop nerve root pressure that may result in back pain and sciatica even though the object he is picking up is minimal in size and weight.

In the child and young adult, the nucleus pulposus (disc) consists of a gelatinous viscous liquid substance. As long as it is normally hydrated it will maintain its turgor. If it becomes dehydrated, as in most of the adult population as a result of previous mechanical insults, then disc prolapse occurs. We refer to this as low back syndrome, disc syndrome, or mechanical back ache. This explains why a relatively minor injury can cause a severe and incapacitating disc syndrome. Unfortunately, the subsequent injury is considered the cause, not the preceding mechanical insults and injuries which, in reality, are the real causes.

There are many causes of low back pain. In general, the mechanical causes constitute over 90 per cent of the cases that we see; of these the vast majority are due to disc disease.

Structural defects or anomalies are common and constitute a structural weakness in the low back which make the individual more susceptible to disc pathology. Transitional vertebra, spinal bifida, spondylolysis, and spondylolisthesis are the most common. Obesity causes excessive back stress and strain which can result in disc pathology. Poor posture, resulting in back stress and strains, such as in pregnancy, temporarily adds its burden to the back. Arthritis may be a contributing cause. Extrinsic factors such as improper beds, chairs, or shoes are factors in producing back pain. Excessive movements, particularly in strained positions, jolts, pushing, pulling, lifting, falls, and previous athletic or physical combat injuries contribute to the susceptibility of disc pathology and resultant back pain.

It is, therefore, most important when employing an employee to establish an accurate record of the worker's medical history. It is also important to establish an accurate record and medical description of any existing deformities or abnormalities which may be considered important in the event of an accident on duty. It is also important to protect workers with physical defects from undertaking work which might be detrimental to themselves or in which they may endanger other employees, property, or the public. An employer can then and only then best place a worker in an occupation for which he or she is fitted. Attention to the above will markedly decrease low back pain resulting from on the job personal injury.

Back ache or functional stress appears most frequently in the lumbosacral and the sacroiliac regions where the mobile spinal column is anchored to its fixed pelvic base. This back ache is commonly referred to as lumbosacral strain or sacroiliac strain. This form of back ache can be differentiated from others by the negative neurologic examination and the normal x-rays. The most common finding in sacroiliac strain is unilateral discomfort when localized strain is placed on the involved sacroiliac joint. These two conditions are functional and self limiting.

Back pain, sciatica, and stiffness are the common symptoms of disc pathology.

A pain may range from a mild ache to an excruciating sharp pain. It may begin gradually or suddenly. It may be continuous, intermittent, or recurrent. It usually is aggravated by bending, stooping, standing for long periods, sitting for long periods, sitting in low soft seats, or lying on a soft sagging bed. Heavy lifting, repeated lifting, pushing, and pulling will also aggravate the pain.

Sciatica is the result of nerve root irritation (radiculitis). This pain radiates into the buttocks, the posterior portion of the thigh and the leg, the dorsum of the foot and toes and, occasionally, into the groin and scrotum.

Stiffness is secondary to muscle spasm.

Listing or tilting to one side or the other, limitation of motion, deep tenderness and pain on percussion in the lumbosacral area, pain on motion of the lumbosacral spine, pain on placing the sciatic nerve on tension, such as performing straight leg raising, sensory deficit in the foot and toes, and decreased or absent tendon reflexes are the common signs found in disc pathology.

X-rays of the lumbosacral region will detect anomalies, arthritis, and a narrowing of the disc space, and will also help to rule out other conditions such as fracture, dislocation, infection, and neoplasm. Spinal puncture with chemical evaluation of the spinal fluid is very helpful in ruling out spinal cord tumors. Myelography may demonstrate a defect in the flow of the column of iodized oil which helps confirm and locate disc pathology, but this procedure is not altogether reliable.

There are as many different treatments as there are back complaints, any of which may be helpful. The important aspects of treatment should be related to the particular patient and his or her presenting problem, and should not be haphazard or stereotype.

Rest is probably the most important single treatment we have to offer. Bending, lifting, pushing, and pulling should be eliminated completely. When bed rest is required, it should be complete and continuous until the pain has subsided. Placing the bed in a so called "Williams position" helps to flatten the lumbosacral angle and relax the spini erecti muscle. Rest is commonly two or three weeks in duration.

Traction is of questionable value. It may help to fatigue the spini erecti muscles, thus being of some value. The use of traction does help to keep the patient in bed.

Supports are of value to the patient with weak muscles or to the obese patient. When the abdominal, spini erecti, glutei, and quadriceps muscles are weak, lumbosacral support should be used for short periods or until proper exercises have begun to restore the normal tonicity of the muscles. In the obese patient support should be used to hold the pendulous abdomen along with weight reduction and proper exercises.

Analgesics, muscoskeletal relaxants, and tranquilizing medications are helpful in the treatment of disc pathology. Aspirin or codeine for relief of pain is usually adequate. Muscle relaxants for relief of muscle spasm and tranquilizers for control of anxiety are helpful. Heat in the form of wet heat, hot compresses, intermittently, and short wave diathermy followed by massage will help to relieve discomfort but should not be continued over long periods because of hyperemia and eventual fibrosis of the muscle. Manipulations are indicated in the mechanical low back problem without sciatica when there is evidence of malalignment of the lateral articulations. Manipulation should not be used in disc pathology with sciatica because of the possibility of increasing the pressure on the nerve root.

After the acute phase of disc pathology has been successfully treated, proper exercises are the most important treatment for mechanical back problems. Flexion exercises are to be done gradually and for short periods, increasing them daily until a proper level is reached, and then continued indefinitely. Exercises will return normal muscle tonicity to the abdominal, glutei, and quadriceps, while stretching the contracted spini erecti and the hamstring muscles. Faulty posture is corrected by proper exercise regime. Education regarding the proper way to lift, sit, lie in bed, get out of bed, etc. is of great value in preventing recurrence. Surgery is indicated only after failure of adequate conservative therapy in patients who demonstrate irretractable sciatica and abnormal neurologic findings.

Now that you have a basic understanding of the most common low back problem, mainly mechanical low back ache, let us go on to a discussion of how industry can help to decrease the occurrence of this problem

and how industry can help treat the problem when it occurs.

The most important role industry can play in this whole problem is to see that workers are placed in occupations where they are fitted. The only intelligent and successful way to do this is to subject a prospective employee to a rigid pre-employment examination. It is a proven fact that the intelligent execution of a good pre-employment examination and proper classification markedly decreases on the job personal injury resulting in mechanical back problems. It is industry's responsibility to maintain safe working conditions and to establish and teach safe working techniques.

Once the employee has sustained an injury resulting in disc pathology, it is extremely important to get him or her back to work as soon as physically possible. This will mean in the great majority of cases returning to work with some limitations or restrictions. It seems to be extremely difficult for industry in general to accept a worker back to work if he or she cannot go back to the job which they were doing prior to the injury. I am well aware of all the problems industry faces when trying to find employment for employees with physical limitations, but it is well known that the longer an employee remains off a job the harder it is to get him back to work. This, of course, increases the medical disability payable and ultimately increases the permanent disabiltiy claims and settlements.

There has been great confusion when establishing permanent disability and arriving at an estimated percentage loss of function. I refer to the Medical Society of North Carolina: *Guide to Permanent Disability Evaluation of Industrial Accidents:* 1960. Disability is the total of ability, motivation, and impairment. Ability refers to the inherent capacity of the individual, including his physical status prior to the injury, his skills, training, education, and experience. Motivation relates to the patient's drive, often determined by socioeconomic factors, and should not be confused with true emotional or mental changes arising from an injury. Impairment is loss of function of the body and relates only to medical consideration. Disability is the total of all factors, medical and non-medical, that diminish the individual's capacity for every day activities and for gainful employment.

It is the physician's responsibility to evaluate permanent loss of function and to accurately translate this loss into percentage figures. It is the responsibility of the physician and industry to evaluate the affect of impairment on the individual and, if there is disability, institute a program of rehabilitation early.

References

1. Roof, Robert, Oswalry, & Liverpool; "A Study of the Mechanics of Spinal Injuries," *Journal of Bone & Joint Surgery,* 42-B, 810, 1960.
2. Howorth, M. Beckett; "Management of Problems of the Lumbosacral Spine," *Journal of Bone & Joint Surgery,* 45-A, 1487, 1963.
3. Martinat, Edwin H.; "Evaluation of Permanent Impairment of the Spine," *Journal of Bone & Joint Surgery,* 48-A, 1204, 1966.
4. Nelson, Marvin W.; "Oh, My Aching Back." Vulcan Materials Co. Accident Prevention Meeting, Chicago, Ill. Dec. 1961.
5. Nelson, Marvin W.; "Pre-employment Examination and Standards of Classifications." 12th Annual Ready Mixed Concrete Association of Wisconsin, Milwaukee, Wis. Jan. 1962.

EMPLOYEE SAFETY INDOCTRINATION

By F. J. ROGERS
Mgr., Adm. Services, Gypsum Assn., Chicago, Ill.

The safety education of employees both new and old is a never ending process which many times leads the person responsible for discharging these duties to his wit's end.

For the new employee, safety education should begin at the time he is hired. The first lesson, as we all know, can make the greatest impression on a new employee. It is easy for a man to jump to wrong conclusions. A person who is handling the indoctrination has an excellent chance to establish a good relationship with the new man. He

can get him off to the right start. A new man coming to work begins to learn things, to form opinions, and he does so whether the employer makes an effort to teach him or not. To develop the proper safety attitude in the new employee, company safety policy should be reviewed and safety rules and practices discussed. Management's interests in the employee's safety should be impressed upon the mind of the new employee and tangible evidence such as safety guards, scheduled safety meetings, award programs, etc., should be emphasized in support of management's position. Company safety practices, covering such areas as required protective equipment, reporting all injuries, and 100 per cent adherence to established safety rules while on company property should be presented to the new employee not only in the best interest of his personal safety and welfare, but also for that of his fellow employees.

People, generally, do have an interest in accident prevention. This interest is a natural manifestation of the law of self preservation. However, the inclination to follow established habits, good or bad, and the tendency to take short cuts, will nullify this interest in safety. Carefully planned indoctrination programs will greatly assist in the elimination of many bad habits. The employee must be convinced that safety is an important company objective. Safety should not be just a number of "don'ts" or handing out a rule book. The company objective for safety should be presented in the manner that leaves no doubt in the employee's mind that he will be required to work safely as a part of your industrial team. Impress upon him that good safety requires full cooperation from each and every employee. Put him in the proper frame of mind so that he will begin his job with a desire to work the safe way.

The indoctrination period is an ideal time to establish a friendly attitude with the employee which will carry over into the job instruction process, for it is a principle of learning that people learn faster and appreciate what they have learned when they want to learn and their minds are prepared for the learning process. Instructing an employee in the technique of doing a job safely is the most important phase of safety training. To tell someone to be safe or not to get hurt certainly is not the answer to accident prevention. The employee must be trained to see the hazards involved in doing a particular job. He must be shown exactly how to do the job and what to look for when doing it. He must be taught to think and to be alert to any unusual circumstance that may arise. Preparing him to know step by step what he should do helps eliminate the unsafe act or procedure.

As the employee's knowledge and skill increases, he becomes a better and safer individual. However, the supervisor's job is not finished at this point. He must continue to implant in the employee's mind certain facts, suggestions, and the like to keep the employee constantly alert to the hazards ever present on the job.

Now we know some of the things that we have to do to make any indoctrination program effective, but how do we tackle the real safety selling job and impress the importance of safety on the mind of the employee during the indoctrination phase and also provide continued training for the veteran employee? There are many ways to accomplish this task; we in the gypsum industry make effective use of visuals. To keep safety constantly before the employee's eyes is our goal. We do it with handouts, safety campaigns, award programs, decals for hard hats and lunch boxes, semimonthly safety bulletins and newsletters, monthly safety posters, film strips, and our latest visual addition, "Safety Zone." "Safety Zone," a 16-mm sound color movie, was produced in the gypsum plants, and the stars of the film are actual mine, quarry, and plant workers. The film is 27 minutes in length and depicts hazards to safe working practices that your employees come in contact with everyday on the job. The purpose of this film is to point out these hazards and show the worker how to avoid them.

We feel that "Safety Zone" has many uses, including training new employees in safe working habits during their orientation, reminding veteran employees of potential hazards, and corrective action for employees who have experienced accidents. "Safety Zone" was designed to augment the present safety programs of our member company plants. This film reflects preventive and corrective action vital to every plant safety program.

In developing "Safety Zone," the association safety committee expressed concern over the continued use of the film in the plants. To overcome this fear and promote the use and continued use of this visual aid in the plant safety program, a promotional kit was developed for distribution throughout the industry. This promotional campaign was intended to make the plant safety personnel aware of the availability of the film and of ways to perpetuate its continued use with plant personnel.

A safety director's guide was prepared as part of the promotional kit for use by the individual responsible for safety training in the plant. This guide was prepared as an aid to simplify the presentation task for the meeting leader and make it easier for the employees to understand the safety messages contained in the film.

DUST CONTROL IN CRUSHING AND SCREENING OPERATIONS

By R. M. HAGERMAN
Group Manager, Houdaille Construction Materials, Inc., Montclair Heights, N. J.

How many of us have said the following: "Tell the inspector that the white stuff coming out of the stack is steam," or "quick, turn on the water sprays, here comes the inspector," or "why do you want me to spend money on that floor? Nobody ever goes in there." Those days are just about gone.

Federal, state and local laws all over the country are forcing each company to stop polluting the air. Sooner or later, depending on the locale, we will all be doing something to reduce or eliminate pollution, which is exactly what many of you at this convention have been preaching for years.

There are three basic ways of controlling dust in a process plant: suppression, collection or washing. The decision, on which system or combination of systems to use, will be based on the following: effect on products, physical and chemical properties of the material you are processing, physical condition of the plant, marketability of collected material or disposal of collected material. Disposal, in some urban areas, may pose as great a problem as dust collection itself.

Suppression Suppression by the use of water sprays with or without a wetting agent is the most economical method of dust control.

If your plant or even a portion of your plant can operate efficiently with moist and sometimes sticky feed without adverse effects on the products, then this system will probably work for you.

The system normally consists of a storage tank for the wetting agent, water supply, a mixing valve and pump connected by pipelines to the spray nozzles. Spray nozzles of various types and number are required at most points of transfer to do a good job of suppression without wetting the stone excessively. Additional control is required, when it is necessary to prevent the sprays from working when there is no feed. This can be controlled by a solenoid valve at each or multiple spray points, actuated by a load sensing device. There may be a starvation switch on the belt, a probe in the crusher or bin, a roller arm to sense the load on a conveyor or they may be interlocked with feeders, equipment control, etc.

Possible problems that may be created by such a system are:

1. Freezing of material in winter.
2. Freezing of system lines in winter.
3. Screen blinding.
4. Coated products (Out of Specification).
5. Material build-up in crushing chambers.
6. Material build-up in transfer boxes, under crushers, etc.
7. Material clinging to conveyor belts.
8. Additional clean up.
9. Additional wear to equipment.
10. Frequent clogging of spray nozzles.

Most of these can be corrected by engineering methods but the cost of these changes, must be added to the cost of the pollution control system.

Crusher. Sprays are required at the point where material is introduced into the crusher and at the crusher discharge. Control of the sprays can be regulated by a simple starvation switch on the conveyor or feeder transporting the feed to the crusher.

Screens. Sprays are required at the feed point to screens and possibly at certain discharge points depending on the local condition.

Collection. Collecting dust is not simply made up of hoods, ducts, collector and a fan. It is an engineered system designed specifically for each installation. It must be this way or it won't work effectively.

Hoods must be designed for the convenience of the operator, the repair and maintenance personnel. If not, you will find that your investment was wasted, as the men will not replace the displaced parts and the system will not work. The engineers who are designing the system, must work with the plant people until the design satisfies their requirements.

Control around crushers is relatively simple, there are two essential points of exhaust: the feed end and the discharge end. Since most crushers have a distributor box and a discharge box, these are made tight with easily accessible inspection doors and the exhaust ducts can be attached in such a manner to prevent build up of material and result in the least wear. Additional enclosure is provided in the feed chutes, around moving parts, over conveyors, etc. by installing canvas or rubber flaps. The volume of air exhausted must be sufficient to handle the free air entering these areas and have sufficient velocity to remove the particle size desired. If the velocity is too great then excessive erosion of the ducts will result.

Dust control around screens is more difficult since all parts of the screen must be accessible for the frequent changes that are necessary. Multiple deck screens add to the difficulty. Provision must be made at either end to insert screen cloth, the top should have removable panels and the sides must have multiple hinged doors or removable panels to get at the tension bolts.

Another method is to seal the screen room and exhaust from this, but inspection, maintenance and repairs is then performed under adverse conditions. Everytime a move is made, it is followed by a cloud of dust. If under these conditions an attendant is required, the only alternate is an isolation booth, vented and heated with outside fresh air under positive pressure.

When the man leaves the booth to inspect, he is supposed to wear a dust mask. My experience has shown that the only time they are on, is when someone is inspecting the area. In my opinion, room exhaust is far from being satisfactory. At the end of the duct work and hoods is a fan and "collector" which may be any of four basic types:

1. Mechanical
2. Scrubber or wet collector
3. Fabric Filter
4. Electrostatic precipitator

Washing. By washing the stone at various stages in the process, all the particles that would normally pollute the air are carried away with the wash water.

A prerequisite is a supply of water and space large enough to provide adequate settling basins. Water can be re-used but it must be free of solids, otherwise sprays will clog. Filtration or screening can be provided but it is expensive.

In some deposits materials are present that will not settle out and must be treated with flocculents. This is usually a nominal added cost, but it should be checked before proceeding.

Possible problem areas to be considered:

1. Freezing in bins.
2. Freezing water lines.
3. Additional wear on screen cloth and wear plates.
4. Certain types of material may build up in crusher chambers when crushing wet materials.
5. Drainage problems around plant.
6. Electric control and motors in these areas must be of the type that moisture will not effect.
7. Screen opening changes are necessary when changing from dry to wet, due to changes in cloth thru put.

Washing is usually accomplished on screens, although sometimes it is necessary to remove sticky material in log washers prior to screening.

Most types of screens can be converted from dry to wet by the addition of spray bars. Top deck bars can be independently suspended about 12"-18" above the screen. Second and third deck bars can be independently supported thru holes cut in the screens if gyration is minimum. If the screen gyrates excessively (check start and stop cycle) then spray bars are mounted to the screen and a hose connection is made to the water pipe.

Spray bars are usually 1½" to 3" pipes with holes drilled at 3 to 6" spacing depending on height from screen. The use of flat spray nozzles depends on local conditions. Water is usually introduced with the feed. This wets the material prior to reaching the spray bars.

The number of spray bars and the pressure (normally above 40#) will depend on the material, tons per hour etc.

Fines passing the final screening must be flumed or pumped away depending on the physical layout.

Again depending on the type of operation, this slurry may or may not be further classified by use of sand sort tanks, sand clones and/or screw or rake classifiers before transporting the waste product to the settling pond.

Does the waste have a possible economic use? I've heard that the slaughter houses here in Chicago get rid of everything but the pig's whistle and I'm beginning to think this is true of the aggregate industry.

The fine material that results from washing or collecting is growing in demand. If it is (+) 200 mesh-⅛" it can be classified into a manufactured sand or used as is, to produce dense aggregates. If it is (—) 200 mesh it may be used for bituminous concrete filler, roofing shingles filler, paper filler, filter media, agricultural lime, etc. depending on the chemical properties of the rock being processed.

If you study the economic possibilities, maybe the picture will not be 100 per cent black.

Case Study For an existing plant such as the one I'm now at, which has a capacity of 600 tph, the cost of the three basic control systems would be as follows:

Suppression	$ 10,000
Washing	97,000
Collection	600,000

Let's study the situation at my plant and see why we made the decision we did.

The plant is a crushed stone operation, planned to produce specification aggregates from hard limestone. The original plant is about 30 years old but it has been added to and altered, much like Topsy, to satisfy market changes. There were a few sprays on certain transfer points, a 15,000 cfm capacity collecting system with inadequate duct work and hoods. The dry system was connected to about half the equipment but only had capacity to handle about one quarter of the equipment efficiently.

A survey was made, by a firm that does turn key work on pollution control, and they estimated the cost to revise the existing system and add sufficient equipment for complete, satisfactory dry collection at $600,000.

We had an abandoned section of quarry that is always partially water filled, requires frequent pumping to maintain the water level and we had a disposal or settling pond area.

A study indicated we would require from 2100 to 2900 gpm to wash the water on eight screens. Another three screens must remain dry, due to the type of products produced.

Two 2400 gpm pumps were purchased, that would pump the water to the spray nozzles at a pressure of 70#. The pump location was 900 feet distant from mill and all new piping was installed with valves on each spray bar system to regulate the flow. Four hundred feet of flume was installed to collect the screen thrus and convey the slurry to the re-located sand sort tank and screw type classifier. The entire change cost $57,000 including labor and materials.

Due to the nature of some of the products we produce, part of the circuit must remain dry. Dust is controlled at several transfer points with water sprays and the balance of the dry circuit is serviced by the existing dry collector.

In summary then, we use all three basic dust control systems; suppression, washing and collection.

We are not completely satisfied with our control but we have come a long way and expect to modify and improve in the next few years until *we*, not the government, are satisfied.

PREVENTING QUARRY ROCK FALLS

By R. M. BELLIVEAU, PE
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Rock falls from quarry faces have been the concern of operators and safety men from time immemorial. However, the fact of the matter is that this danger to workmen and equipment has been created, often without cause. Seventy-five per cent of rock falls are created, unknowingly and unwittingly perhaps, but nevertheless created. Safety is a byproduct of good operation. By operation I mean engineering and planning for the disposition of men and equipment. The better the operation the better the safety record; the efficiency and productivity of an operation can be judged by its safety record.

All that safety can do in the case of mishaps which occur in an existing operation is to determine the causes and develop a holding action. If and when the causes are determined, then it is the duty of the safety people to promote alertness in the operators in order to guard against future possible occurrences and thereby minimize anticipated effects.

At this point, safety depends on the responsibility of the operator—the mine or quarry superintendent—to devise the safest possible method of continuing production at an acceptable cost. At this point, too, the safety supervisor must give the operator all the benefit of his experience to evolve the safest possible method for working under difficult conditions. For the safety supervisor to sit back and criticize is to avoid responsibility and this attitude will make a bad situation worse. The prevention of slides from quarry walls does not begin with the first fallout. It begins with initial planning for a new quarrying operation.

Quarrying tends to favor high faces for no apparent good reason, where open pit mining does not. High faces of 50 to 100 feet and higher are certainly more susceptible to slides and rock falls than are benches of 50 feet and lower. Actually, benches of 30 foot height should be accepted as a standard of quarry design.

Geology and Ground Conditions

The composition and disposition of ground material in place is a function of geological investigation and the quarry engineer should be given the benefit of an analysis before proceeding to work out mining and operating plans. It is the responsibility of safety to promote the services of geologists to determine the type of ground before operations are begun on the assumption that the orebody is monolithic and without cracks, shears, fissures, or faults and that the results of blasting will yield a smooth backwall without any overhang of chunks or boulders partly imbedded in the face.

Hang-ups because of irregularities in the face, some of which act as shelves to retain broken material, will come down piecemeal as the result of water and wind action, disturbances caused by digging machines at the toe of the face, and by nearby blasting. The irregularities of the material in the face of a bank are formed because of the pronounced geological structure or are induced by faulty drilling and blasting.

The geological attitude of the material being quarried must be determined with respect to bedding, dipping, jointing, and faulting. The waste which surrounds the merchantable material must be disposed of separately from the ore. This waste usually consists of material much different in composition than the ore and of itself could cause much trouble in maintaining its place in a face without serious slips and falls. Good limestone, trap rock, or other rock materials suitable for use in the construction, cement and lime-making industries are preferred when they possess a high degree of density. Materials which have a formation consisting of bedding planes and jointing, although appearing to have a uniform structure, do contain stress lines which will cause the material to collapse and fall out under pressure.

Included in the geological appraisal, because it should precede the planning of the operation, is drainage. Next to vulcanism and diastrophism, the action of water on the crust of the earth is the most pervasive. Water courses are formed by water seeking its own level in exploiting the weaknesses in the earth's crust; this applies to all flows

of water, from gigantic rivers to babbling brooks. The action of water on material is to erode it and wash it away, always downwards.

The action of water on high faces is especially destructive and prejudicial to safety. Water flowing down a high face will dislodge small stones and rubble and, depending on the height of the face, a small stone striking a man below could be fatal.

Assuming that the high face is stable, the displacement of small chunks can be controlled by cyclone netting tacked on the face. This is expensive and is not sufficienty effective to be generally accepted.

If blasting opens fissures behind the face and run-off flows down into them, this water will eventually work its way through the broken materials along bedding planes, lubricating clay, bentonite and other materials, which will turn into skidways for overburden to slide on. Bad slides usually follow heavy rains or occur in the spring as melting snows and frost action provide water to seep deep into the disturbed material behind a blasted face.

Planning

Planning a Quarry—Engineering

Following the geological evaluation of a deposit and the determination of the lithological characteristics of the material to be mined, we can then plan the quarry, taking all the operating advantages from the knowledge obtained from this appraisal.

The dimensions of a quarry are limited by the ownership of the land. Sometimes this is of no concern because ownership extends far beyond the limits of the mining area. The volume of material to be mined, the rate at which it will be extracted, and the anticipated life of the processing plant will establish the depth and extent of the pit to produce a required tonnage of plant feed.

The next step is a consideration of what slope the walls of the quarry will take for the planned depth. If the material lies flat or consists of ledges having a vertical attitude and is of competent rock covered by a layer of farm dirt, it will allow a steep face to be maintained. This will rarely occur, as quarry practice usually follows the custom of taking down a quarry floor in lifts of 50-60 feet. This method of developing a quarry is the popular one and it has the disadvantages of promoting all the practices which are inefficient, costly, and unsafe.

Now, if we are fortunate in having the attitude of the ore ledges lying at a convenient angle of, say, 50 degrees, we can follow the slope of the footwall all the way down by establishing our main haul road on the hanging wall. Following the footwall will provide us with a safe slope to maintain a face which will stand up without slides, providing we make provision for benching every 30 feet, more or less, depending on the height of bench we have established as an operating specification and on the character of the material we are about to mine. The width of the main haul road, which should normally be located on the hanging wall, will provide a slope for this side of the quarry. The greater the width of the haul road, the flatter the overall slope it will create.

Determination of height of bench comes next; this involves a number of considerations. First, there is bench height with relation to the dimensions of quarry length, width, and depth. Then there is production—how many tons per hour per shift and per day must be produced to meet plant feed requirements, plus the waste material which must be moved concurrently? This will determine the size of the equipment and in some cases the type of equipment, especially the drilling equipment. With particular respect to fallouts from quarry faces, there will be a maximum height of bench which can be accepted according to our geological appraisal.

The overall slope, the height of bench, the production schedule, and the width and grade of the haul road are factors of equal importance in considering the maximum height of face to be selected. The juggling of these factors to obtain the best possible economic formula will also result in the best possible situation with respect to safety. There is no order of priority for these factors. The only absolute requirement is that they must all be given consideration.

The quarrying technique of carrying high faces accepts, for no good reason, the danger and difficulty of controlling backbreak resulting from blasting operations. The higher the face, the more difficult it is to control backbreak; the further away from the face backbreak occurs, the greater the tonnage of material left in place which is fissured and faulted to a dangerous degree, thus inviting

slips and slides; this material cannot be dug but must be drilled and blasted. These situations cause efficiencies to drop and operating costs to increase, thereby losing all economic advantage of a high face while creating safety hazards.

Breaking ground demands some consideration in order to establish a technique which will yield maximum efficiencies with maximum safety, directly and indirectly. The ideal blasting practice is to break all of the material in the area of one blast to the desired fragmentation and lay it in place so that it can be dug, not swept up. That's the direct efficiency which leaves behind a clean face and no backbreak. That type of blasting will be safe and will promote safety in the other operations of loading and hauling.

For benefit to be derived from an average quarry, it is my opinion that benches of over 50 feet should not be used unless required by special considerations such as the production of dimension stone (which is improbable). In ordinary operations the product of the quarry is crushed and the ideal result of blasting is to break the ground so that the largest chunks will pass through the crusher. A 30 foot bench is recommended.

Planning the Operation

Operational planning is the last step in making a quarry in which the stability of the walls is one of the important considerations. Operational planning is a function of production and consists of two main items:

1. Determination of the maximum rate of production to meet the demands of sales or of the processing plant.
2. Selection of the equipment to fit the operation.

Having laid out a quarry by establishing its three-dimensional boundaries to yield the maximum tonnage of economic material, chosen the overall slope for the most desirable height of bench and width of haul roads, established criteria for breaking ground economically and digging broken material at maximum speed, we can plan the operation by first selecting the equipment to meet the production schedule.

The choice of equipment and its adaptability to working safely under high benches is a function of management, who are responsible for the ability of the equipment to meet this requirement. Such responsibility is not sufficiently emphasized.

The largest equipment is not always the most efficient or the safest. Using excavators of a height which can trim a bench up to its crest is an impossibility because of the quarry custom of mining high faces.

In rock material high faces always pose a danger. By high faces I mean anything over 50 feet. High faces are the result of a deliberate selection of a mining method; therefore it is important that we give some consideration to this matter. If there is one cause of accident in open cut mines which should never be classified as a trade risk, it is the cause due to slides and rock falls. They are created hazards and, if ways and means of preventing them have not been developed, then resulting accidents should be charged against supervision.

In order to provide an excavator with the capability of scaling a face, the crest of the working bench must be of a height which it can reach; if an excavator can comb a face to the full height of the bench, fallouts will be reduced to a minimum. This automatically rules out front end loaders where they are expected to work at the toe and under benches. However, with benches of 50 feet and under (preferably 30 feet) there is little difficulty in obtaining a blast which will leave a clean face, thereby permitting loaders of short reach to operate with safety. It should be evident that high quarry faces and loaders of short reach are a poor combination for the operator's safety. In order to be safe, the short boom shovels and short reach loaders should not be committed to work under high faces.

Drilling and blasting of high faces offer a much greater likelihood of error than the shooting of low benches. Operators who have had the experience of working in several quarries under difficult operating standards have proved this time and again. The low bench does have the built-in safety factor that it can be made operationally safe in any type of ground. For people who are dedicated to operating high benches, it would be wise to start with 25 foot benches, then, when the material is found to be competent, double up to 50 feet.

Blasting is an art which requires "feel" for the job in addition to a command of the rules and statistics in the *Blaster's Handbook*. Blasting is the one operation in quarrying which contributes most to rock falls. Therefore, blasting to obtain a clean face must be

the primary objective. The determination of a drilling pattern and selection of an explosive charge of proper strength and speed for a given type of rock is an art which, when enlisted on the side of safety, will reduce rock falls from quarry walls to a minimum.

We have presented some aspects of open pit mining or quarrying which will prevent slides and falling rocks from mine faces but we have not touched on what to do about a created situation when the expected cannot be anything else but the worst. There are many techniques for preventing accidents from falling rocks; the most common is to scale the banks. For this job there are as many approaches as there are quarries. The danger of rock falls can be reduced by scaling. This is a dangerous operation which intensifies with the height of the face.

Making a ragged face safe to work under is a matter of improvisation. There are no rules which can be made to apply to these situations. However, tools are available which will lift a cage capable of accommodating one or two men with some equipment. For high banks which are beyond the reach of equipment working from the bottom, workmen must be let down on ropes or in bosun's chairs to dislodge loose and threatening rocks with bars—sometimes with a stick or two of dynamite to remove the overhang. All this is very dangerous business and the only effective antidote is to reduce the height of the face so it comes within the reach of equipment. Benches of a height of 50 feet can be reached by equipment such as cranes, with a bosun's chair, or by a digging head such as a Gradall machine.

The best and most effective way to scale a bank is to keep the bench height to a maximum so that the digger or the loader can comb the face right up to the crest. That's the sure way and that's the safe way.

Conclusion

We have now come to the part of our discussion which should, like a mathematical equation, come to the sign of equality calling for an answer to the sum of the factors which we have considered:

1. Rock falls are man-made. They are caused by deficient planning and inefficient operation.

2. Slides are usually the result of areas of weakness in a quarry wall caused by disturbances in the ground which break the continuity of rock formation. These disturbances are usually described as faulting, dipping, bedding, jointing, folding, etc. Blasting will disturb these formations and induce slides.

3. Operating practices are responsible for most situations which result in slides and rock falls in quarries and open pit mines.

4. Rock falls and slides of banks may be minimized if not altogether eliminated by proper engineering and operational planning of a quarry or open pit mine. Good geology and mining engineering will produce these results if used at the beginning of an operation.

5. The cost of mining high benches is greater than that of mining benches of 30 feet maximum height in a well-designed operation.

CONTROLLING ACCIDENTS INVOLVING COMPANY-OPERATED VEHICLES

By DEAN W. WARD
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The cement quarry and mineral aggregates industry is blessed with virtually every conceivable type of company-operated motor vehicle. We utilize the highly sophisticated and commercially available truck units of all descriptions and from there down through various forms of special shop-built equipment. Further, because of the nature of our industry, we are blessed with practically all types of exposures or operating environments. Exposures vary from the construction job site atmosphere—the field or quarry

operations—to the in-plant or around-the-plant environment, and include the highway and freeway-type driving exposures as well as the driving environments of our city and rural streets and roads. The industry is involved in the operation of all kinds of fleets, from the automobile sales fleet operating as individual units with little supervision, to the large truck fleet such as the cement or aggregate hauls that are production-geared and usually well-supervised and controlled.

The term "company-operated vehicles" does not describe our full exposure. Persons with responsibility for safety within companies must also be concerned with employees who in most instances are required to drive their own personal automobiles to plant or work areas. They are exposed to accidents en route. Because of the location of plants and facilities, we are challenged with providing safe parking areas and safe in-plant roads and traffic patterns for this large and rather important fleet of "non-company-owned vehicles."

Vehicle accident control then, as it applies to all exposures, as it applies to various types of vehicles connected with operations, has too often been neglected. The neglect is most noticeable within the industry where production-type fleets are not in evidence, where cement delivery units or aggregate hauling fleets are leased operations and handled by outside contractors. The sales fleet (sometimes numbering more units than other vehicles combined), the large personally-owned automobile fleet of employees and the in-plant service vehicles* are segments of the fleet often neglected, at least from the accident control standpoint.

From the standpoint of direct cost in case of an accident, the highway or street-use vehicles that are registered do represent our biggest problems. These are the areas where our greatest safety concentration is necessary, where accidents can involve liability-type claim action that results in high cost settlements and can cause subsequent increases in insurance premiums. In-plant vehicle accidents can be costly too, but the public is not usually involved, and from a direct cost standpoint they are usually less expensive.

Those who are responsible for the safety efforts within their companies should recognize that regardless of size or type of operation all vehicle-type exposures present problems that need to be considered as a part of the safety or loss control activities. A formal type of fleet safety program may not be essential when dealing with only the small in-plant and special vehicle-type fleet and concerned only with employee traffic and parking as such. However, most of you are involved beyond this with production truck-type fleets and need an operating fleet safety program that compliments and is part of company safety activities. It is this organized type of fleet operation that I will discuss now. This is the area where we can apply organized loss control efforts, and it is the area of most concern from a loss and direct cost standpoint.

In essence, certain basic points or requirements are common to all successful fleet safety programs. The extensiveness of the program selected for operations depends on type and size of the fleet, exposures, and type of organization. However, an effective program will include certain essential points: these make up what I refer to as a "Minimum Fleet Safety Program." This minimum program when applied to operations and made a part of the organization will give control over the accident-producing elements involved in fleet operations. This, after all, is what we are after. It will enable you to realize a decrease in the indirect operating costs of fleet operations and it will reduce more direct insurance costs. It will be a positive aid in eliminating the causes of accidents. A company with such a program will help our entire industry in the area of safety by setting an example of safe driving that the public will notice and that other truck fleet operators will want to follow.

The Minimum Program contains seven essential points:

1. *Driver Selection.* Hiring the right man for the job. This means proper selection of drivers, determining as much as possible about them prior to hiring. Make a visual check of the applicant and of his driver's license. Unless a driver applicant is properly licensed in your state to operate the type of vehicle that he is being considered for, the

*In-plant service vehicles include quarry-type heavy-haul equipment, welding trucks, water trucks, drilling rigs that are mounted, mobile truck cranes, and personal transportation items such as scooters, pickups, scouts, jeeps, etc.

man cannot be considered. A visual check of the instrument or license itself is important; determine if it is the applicant's, if it is valid, if it is current. Duplicate it with your office copy machine, and file the copy with the driver's application form and other employee record material.

Upon completion of your driver-type application form, you should review it with him, specifically asking him about his fitness and background for the job. Call at least two of his previous employers for references or write them. Ask for specific information about the driver applicant's attitude, his driving record, and whether or not he would be rehired by his previous employer and, if not, why not.

All states now have a system whereby you can obtain a licensed driver's accident and traffic violation history. In Texas, for example, the Highway Department heads up this bureau and a *Motor Vehicle Report* can be obtained from them by filling out a special form and mailing it to Austin, Texas with a small fee. The information required on the Texas form in order to obtain the driving record of the employee is: his driver's license or permit number, his full name as it appears on the license itself, and his birth date. It is for this reason that I earlier suggested that a copy of the licensing instrument be made for the files; this information would be available at all times. Further, it will enable you to determine when the driver's license expires, and you may want to keep a follow-up or tickle-type file of these expiration dates on all of your drivers so that you can recheck to find out if they have been properly licensed upon renewal. No driver should be permanently hired unless you first receive and review his driving record.

A physical examination of each driver before he is put on the payroll is recommended. Determining whether or not a prospective driver is physically fit is important. The type of physical examination should be discussed with the company doctor so that he understands that it is for an employee or prospective employee that will be driving a motor vehicle.

2. *Driver Training.* New drivers should be given an actual road test by one of your expert drivers over a planned route that contemplates most of the hazards of driving. To supplement the actual road test, especially where a large fleet is involved, a training course with backing, parking, and maneuverability obstacles can be set up in a yard or in a paved area. This practice course can be utilized to check out and train new drivers and to refresh older drivers periodically as a part of company procedure. Attitude and physical skill in operating the vehicle are important considerations to be evaluated by the expert driver who accompanies the new driver or the older driver being retested. Formal road testing should be required. The obstacle course testing procedures are useful but not mandatory. The expert driver accompanying the student should submit a written report, brief but in enough detail so that it can be evaluated: this history should be made part of the applicant or employee's file.

Driver training is an area where those who have the safety responsibility can and should participate strongly. Any prospective or veteran driver needs to be refreshed periodically on the laws, regulations, emergency procedures, and the frequent hazards of driving with which they are involved each day. It is recommended that these items be covered individually with the new applicant before he is given the responsibility of actual driving. Further, all employees who have driving responsibilities should have these items brought to their attention in a formal-type driver safety meeting at least annually. The insurance carrier's safety engineers, members of the Highway Department and others are ready, willing, and able to assist you with these meetings.

In addition, all fleets should utilize part of their regular and normal safety meetings by injecting some type of training in each of them. Training, in this sense, should be directed at the known problems or noted trends as are pointed out by accident studies and accident history of the specific company. For example, if intersection-type accidents are noted as the major problem, an appropriate training session on intersection-type accidents should be held; there would be no point in discussing freeway driving. Training and re-training are vitally important, and training sessions should be carefully planned so that they reflect an organized effort that will encourage drivers' attendance and participation.

When any new driver must be put on the payroll immediately following the interview and reference check he should be told that he will be driving on a probationary status until he successfully completes the road test and until the *Motor Vehicle Report* is returned and reviewed. This means that when a driver must go to work before all references and detailed information concerning his past driving record have been accumulated, that he realize that he's not considered a permanent driver. When this information does arrive, call the employee in and discuss the findings with him. Failure to meet with him will indicate lack of interest on management's part and will allow the driver to operate according to his own desires without expecting safety direction from the company.

3. *Accident Reporting.* All drivers should be given special training on how to report an accident, what to do and what not to do at the scene. Doing things right immediately following an accident is extremely important. Examples of some procedures that should be understood from a safety and legal standpoint are as follows:

a. Stop at once and investigate.
b. If necessary, have someone call an ambulance or doctor.
c. Do not admit liability even if you are at fault.
d. Do not give a written statement to anyone unless they can prove they are a representative of your company.
e. Do not discuss the accident with anyone at the scene of the accident other than the police. Answer only questions asked by them.
f. A report should be filled out at the scene of the accident, using the forms available in the Glove Box Packet supplied by most insurance carriers. If such forms are not available, a regular insurance company accident report should be kept in all vehicles and the drivers instructed to complete this at the scene.
g. Report the accident to your office immediately.
h. Get names, addresses, license numbers, and phone numbers, if possible, of all witnesses whether they are in your favor or not.
i. Do not move your vehicle until cleared by the police. This is very important.

4. *Accident Investigation.* A designated person or persons within the company should investigate each accident. This employee would be responsible for reporting to top management on what really caused the accident by determining the causes and contributing conditions. Top management should then take an active part by correcting any situation brought to light that would reduce the possibility of or prevent such a recurrence.

For example, if investigation shows the accident was caused by the driver violating a safe driving rule, the driver should at least be talked to in private by management so that active participation by management is in evidence. If a contributing cause for the accident was found to be faulty equipment due to improper maintenance, management should openly review its maintenance procedures with those responsible.

5. *Safety Maintenance.* Vehicles should be regularly inspected for wear and defects so that they can be maintained in top operating efficiency. The important thing is how they are inspected and how often. Of particular importance are steering, brakes, and lighting system; these items, at a minimum, should be set up to receive regularly scheduled inspection and maintenance.

Preventive maintenance programs should involve the driver as well as the garage shop employees. First, a daily or weekly *Inspection Check Sheet* should be developed and the driver required to thoroughly inspect his vehicle each day after completing his regular day's run, using this check list form. The driver, by this method, is helping the maintenance department control and correct defects in his vehicle. The check sheets should be reviewed by supervision and immediately turned over to the maintenance department, which can make the necessary repairs. Secondly, the garage needs to maintain a record on each vehicle indicating designated times that the vehicle will be called in for a regularly scheduled preventive maintenance checkup. These records should indicate what repairs were made on the vehicle, the date, and the nature of those repairs. Records such as these can also be used to assist management in keeping costs controlled, spot-

lighting trade-in times, major repair times, etc.

6. *Safety Meetings.* It is suggested that a safety meeting be held at least once each month with all drivers. As pointed out under *Driver Training* all meetings should be well-planned. Each meeting should remind drivers of their responsibilities, of the company's interest in safety, and should serve to educate and improve them in their driving skills. Films, safety literature, posters, etc. are available from the insurance carrier and many other sources. In addition, the insurance carrier can help with the organization and planning of meetings.

7. *Incentives.* Some form of incentive plan designed to reward drivers who produce a no chargeable accident driving record over a one year period is suggested. A variety of such plans with proven effectiveness are in existence; again, the insurance carrier can help select one that will best fit your organization.

An accident review committee headed by management is usually essential when any incentive program is put into effect involving chargeable or non-chargeable accidents. A committee is necessary because it is difficult for one man to accept the responsibility of judging whether an accident is or is not chargeable based on the facts of each individual case. The driver involved in an accident should be made to appear before the committee to explain his side of the story, without exception.

Incentive programs need not include money or expensive prizes. Purchasing awards that cannot be duplicated in the stores but are specific custom-made awards for the drivers from the company are very effective. One example of an extra and inexpensive award is a lapel pin honoring the driver for the number of years he has driven without a chargeable accident. These are available through the National Safety Council. There are wallet-sized cards honoring the driver for [redacted] record. All such incentives are worthwhile. They can be made even more meaningful by proper presentation to the drivers from management at a dinner meeting, for example, or an award banquet where the drivers are honored by management before other employees.

This completes the Minimum Program. The important first step in establishing a workable fleet safety program such as the one just reviewed is to have management's support and authorization to have such a program and put it into effect. Unless it is done with management's support, the program will not succeed. Once a company sets its management safety policy, the program should be drawn up to fit in with the company's individual operating techniques. Then, it should be thoroughly explained to present employees and the responsibility for its administration made clear. Each company will need to set, at the same time, its own policy on discipline relative to safety rules and regulations. This policy, once set, should be enforced by management with no exceptions.

Automobile sales fleets or company cars operated by sales and management-type employees are not usually in one specific area where meetings are feasible, nor are these employees hired because of their driving ability. Such fleets cannot usually be controlled through such an organized program. However, these types of fleets, which are common to our industry, represent a large exposure and should not be completely ignored. A monthly or periodic letter can be developed and mailed to all such employees at their homes. Another method is to obtain safe driving pamphlets and other such printed material from the insurance carrier or the National Safety Council for mailing to the drivers' homes. Occasional safe driving reminders in letter form from the top operating executive are also good means of control. Even when these vehicles are scattered in various areas of the country, these controls may be instigated. Further, certain responsibility for safety can be delegated to the supervisors of these employees.

In-plant vehicles, such as heavy-hauling units used from the quarry to the plant, utility vehicles, winch trucks, etc., where assigned to a specific operator, can be controlled through many points of the program I have outlined. When vehicles are operated by any and all employees without specific assignment of duty, the task becomes more difficult to control. Control in this case will depend on the plant manager and his supervisory staff, observing not only the attitude of those who operate the vehicles but their performance in and around the plant area proper. Plant rules and disciplinary action are required and are a good means of con-

trolling in-plant vehicle operations from a safety standpoint.

I have not mentioned public image or good public relations. These, I think, are an important plus that our industry and companies gain from a well-operated fleet safety effort. Well-maintained units, properly loaded, inspected, and cleaned of loose rock will keep aggregate hauling units from spilling on the public highways. Inattention to spillage problems breaks windshields and annoys members of the general public using those same highways. It is a black eye to our industry and does nothing to enhance our public image. So, too, is the ready-mix truck guilty of spillage and leaving the tell-tale product on the streets for the public to see and drive over.

Long hours behind the wheel can be a serious problem, and every effort should be made to control this exposure. Our industry is in some cases controlled by I.C.C. regulations in this regard, but not in all instances. The I.C.C. regulations are, however, realistic, and even though the company may not be subject to their requirements on driving hours, physical standards, etc., such standards are worth consideration and can be made a part of management policy where the need dictates.

Employees driving to and from work are a safety consideration even though an accident during these times on their part may not involve the company legally. Such an accident may, however, prevent them from returning to work and it may seriously impair the production or management team. Letters, mailers, pay envelope pamphlet stuffers, bulletin boards, and even the company newspaper or house organ can be used to encourage safe driving of employees and to point out management's interest in this regard. This area should not be overlooked by those of you who have safety responsibility.

Highway and traffic safety is being emphasized today more than ever. We hear about federal and state safety efforts, more safety through enforcement, and strides in highway engineering and design that tend to make our environment safer. Such items are in the news every day. At the local level, there are driver-training courses in the public schools and other training schools that are aimed at improving drivers and encouraging safer driving. The news media is encouraging safe driving practices; there are increased research grants from industry and government for studies such as crash-testing. There are new developments in packaging the passenger to make him safer in the event of an accident, and these innovations are evidenced in today's newer automobiles, with more devices expected in future years.

Legislative action for better laws is spilling over into requests and insistence on improved enforcement, training, vehicle inspection, and physical examinations. Today's fifty thousand-plus deaths per year due to highway accidents makes traffic safety an area where great improvement is needed. This toll surpasses the number of fatalities in industry, and the figure is not receding.

Our exposure is great and we, as safety professionals in our industry, should contribute all that we can toward the prevention of accidents on our highways and streets. Our industrial safety efforts have been effective, we have done a good job in our industry, and we are continuing to improve it. We have the know-how in fleet safety as well. If you have not done your part in establishing a thorough and effective fleet safety program, I urge you to begin now and suggest that the same basic industry know-how that has made our industrial program successful be applied to fleet safety efforts. Program for safety, back it up by management support, and you will be able to control accidents that involve company-connected vehicles.

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CHEMICAL SECTION

SIZING RELIEF AREA FOR POLYMERIZATION REACTORS

By W. J. BOYLE, JR.

Production Supvr., Lustrex Div., Monsanto Co., Springfield, Mass.

In 1965, a study was initiated to determine if improved methods could be developed for calculating emergency relief area for polymerization reactors. This study resulted in the development of a general method for calculating required relief area for batch polymerization reactors. The method can be tailored to fit almost any batch polymerization reaction (or any other temperature-dependent exothermic chemical reaction) for which reaction rate, liquid viscosity, liquid density, batch size, and heat capacity are known or can be determined.

This report is intended to help design engineers to more realistically estimate required relief area for polymerization reactors. It cannot be overemphasized that, although the emergency relief line may be called upon to function very infrequently, the safety of operating personnel and equipment will depend entirely upon it during many emergency situations.

The typical approach for calculating relief area for reactors began by assuming that vapor was to be vented. An adequate relief area was assumed to be one which was "large enough" to vent vapor at a rate such that the internal pressure in the reactor did not continue to rise after the rupture disc burst. Yet, experience has shown that in some cases, even when three or four times this vapor venting area was provided, reactor pressures continued to rise above the set pressure of the rupture disc. The vapor-based calculation had taken into account catalyzed reaction rates, densities, heat capacities, etc. and seemed quite exhaustive. However, when relief areas based on vapor venting relieved batches in large production reactors, some rather obvious inconsistencies were encountered.

It became evident to the author after studying actual emergency rupture relief situations that the venting of vapor was quite unrealistic for three reasons:

1. In actual case histories, polymerization kettles containing up to 4,000 gallons of reacting monomer and water were relieved of their contents (completely emptied) through the emergency relief line in from three to eight minutes. However, if the entire contents had vaporized out this vent, it would have taken 20-30 minutes.

2. A large quantity of liquid (monomer, polymer, and water) was splashed down to the ground in the area surrounding the relief vent. It was witnessed that this material came out in liquid slugs, and not as vapor.

3. The internal pressure of the kettle continued to rise after the safety disc had ruptured.

It appeared that a better assumption might be that 100 per cent liquid was venting. Of course, this could not be completely true since vaporization must occur continuously to maintain the vapor pressure in the kettle. But if the per cent liquid that was venting was much greater than the per cent vapor (90 per cent liquid by volume), the above assumption would provide a good basis for design of relief area for polymerization reactors.

A search of the literature for available methods of calculating relief area based on liquid venting indicated that no suitable method for reactors containing viscous syrups had been developed. Some simplified methods were found that were nearly independent of viscosity. These methods assumed that venting would take place in the highly turbulent flow region of Reynolds numbers. While this assumption may be acceptable for reacting liquids having viscosities approaching that of water, it is not

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applicable to viscous liquids that will almost certainly vent in the laminar region.

A more reliable method for sizing relief area was needed to design against dangerous overpressure. The rupture of manholes, sight glasses, etc. on polymerization reactors could result in spewing flammable or explosive monomers into confined areas.

Deriving Venting Equation

For fluids flowing in a pipe of circular cross section and doing no useful work, the basic flow equation is:

$$\int_{P_1}^{P_2} V\,dP + (Z_2 - Z_1) + \frac{V_2^2 - V_1^2}{2g} = -W_e \qquad (1)$$

V = specific volume of fluid, ft.³/lb.
P_1 = upstream pressure, lb./ft.²
P_2 = downstream pressure, lb./ft.²
Z_1 = upstream elevation above datum plane, ft.
Z_2 = downstream elevation above datum plane, ft.
V_1 = upstream velocity of fluid, ft./sec.
V_2 = downstream velocity of fluid, ft./sec.
W_e = energy losses, ft.
g = acceleration of gravity = 32.2 ft./sec.²

If the density is assumed constant over the temperature range involved (an average density estimated), then:

$$\frac{P_2 - P_1}{\rho} + (Z_2 - Z_1) + \frac{V_2^2 - V_1^2}{2g} = -W_e \qquad (2)$$

ρ = density, lb./ft.³

If the upstream velocity is assumed negligible (the reactor contents assumed to be stationary with respect to vent flow up the relief line; this is a good approximation), then:

$$\frac{P_2 - P_1}{\rho} + (Z_2 - Z_1) + \frac{V^2}{2g} = -W_e \qquad (3)$$

V = reactor venting velocity, ft./sec.

$(Z_2 - Z_1)$ is the vertical distance of the vent piping above the reactor. This takes into account the potential energy loss, which may be considerable for long vent pipes.

The pressure difference (driving force) should be taken to be the rating of the relief device, usually a rupture disc, if it is desirable not to generate internal pressures much above this rating. $\Delta P = -(P_2 - P_1)$. This ΔP may be taken closer to the maximum rated working pressure of the reactor if (1) this rating is significantly higher than the relief device rating, (2) there is a good operating reason for doing so, and (3) these higher pressures can be tolerated safely. (The rated pressure of the relief device will usually be set at or slightly below the maximum rated working pressure of the vessel.)

If inert gas pressure on the reactor contributes to rupture disc failure, this gas pressure should be subtracted from the burst rating to obtain a more accurate driving force, ΔP. The inert gas will vent off in the first few seconds and probably will not contribute significantly to the venting rate.

$$\frac{-\Delta P}{\rho} + (Z_2 - Z_1) + \frac{V^2}{2g} = -W_e \qquad (4)$$

The energy losses, W_e, are due to liquid friction in the vent piping and the sudden contraction as the liquid enters the relief piping from the large reactor:

$$W_e = \frac{4fL}{D}\frac{V^2}{2g} + Kc\frac{V^2}{2g} \qquad (5)$$

f = friction factor
L = equivalent length of vent piping, ft.
D = diameter of relief area (vent pipe), ft.
*Kc = contraction coefficient

The final equation is:

$$\frac{-\Delta P}{\rho} + (Z_2 - Z_1) + \frac{V^2}{2g} = -\left(\frac{4fL}{D}(6) + Kc\right)\frac{V^2}{2g}$$

Rearranging to final form:

$$\frac{\Delta P}{\rho} - (Z_2 - Z_1) = \left(\frac{4fL}{D} + Kc + 1.0\right)(7)\frac{V^2}{2g}$$

*Kc = .41 for Reynolds numbers > 10,000 (turbulent)
Kc = .50 for Reynolds numbers > 10,000 — 2,000 (transition)
Kc = .55 for Reynolds numbers > about 2,000 (transition)
Kc = 1.10 for Reynolds numbers > below 2,000 (laminar)

Where $Rr >> Av$ Ar = cross sectional area of reactor
Av = relief area

DEVELOPMENT OF CLOTHING FOR PROTECTION FROM THERMAL HAZARDS

By W. P. BEHNKE
Senior Research Engr., E. I. Du Pont de Nemours & Co., Inc., Wilmington, Del.

Two important considerations of a protective clothing development are accurate determination of the exposure condition, and development of analytic techniques that describe performance of protective systems in terms that relate to the end use conditions. Protective clothing may be separated into those areas where non-flammability is the major requirement and those where the garment must insulate the wearer from a high temperature environment. Methods of evaluating systems with convective, conductive, and radiant energy exposures are discussed. Data developed in this study permits design of comfortable, durable clothing of Nomex®, high temperature resistant nylon, that will protect the wearer from a hazardous exposure for any given length of time.

For over five years we in du Pont have been searching for applications of the unique combination of physical properties exhibited by our recently commercialized high temperature resistant nylon, trademarked Nomex®. This fiber has outstanding fire resistance, insulative properties, and can be used to prepare comfortable clothing with outstanding durability. We initially determined that the protective clothing market could be broadly divided into three areas: the first, where flame retardance is the major requirement and the second, areas where unusually high insulative protection is needed, resulting in "men from Mars" type suits. The third area, where protection against moderately high temperature environment is required, yet without the bulk and expense of the latter garments, appeared to be especially suited to the physical properties of our fiber.

Very early we learned that the type and degree of exposure for any use situation generally is poorly defined, and the performance expected from a given protective system is generally not known. Thus, we found little background information to build on, but on the other hand we felt that our work could make a valuable contribution to the protective clothing field.

An accurate laboratory evaluation of the performance of protective clothing requires exposures similar to those expected in use. Temperatures of exposures are often quoted, but this represents only the potential to transmit heat. The type exposure—convective, radiant, or conductive—and the amount of heat transmitted must also be known to adequately define the hazard. Heat can be measured in units of calories per square centimeter per second and may be thought of as the rate at which quantities of heat pass through an opening one centimeter square. An example of the inadequacy of temperature to measure exposure levels is given in Table I, which gives data on two common energy sources. A Bunsen burner with a seven inch (17.8 centimeter) luminous flame has a temperature of 1700°F (927°C) and a heat flux of 1.2 calories per square centimeter per second. When air is provided, the temperature goes up to 2,300°F (1260°C) for an increase of about 33 per cent. The higher temperature and the increased velocity of hot gases provide a heat flux of 2.1 calories per square centimeter per second, or nearly double the previous source. A 480°F (249°C) hot plate, which is a conductive source, is sufficient to transmit the same flux (2.1 calories per square centimeter per second) as the 2,300°F Bunsen burner flame. The use of heat flux is essential in evaluating the performance of protective clothing, since the skin or tissue is damaged when its temperature reaches a critical level, and the temperature rise of the tissue is caused by the amount of heat striking it.

The tolerance of human tissue to incident heat was determined by the Navy at the U.S. Naval Air Defense Center at Johnsville. Here a number of volunteers were subjected to radiant energy for various times and exposure levels, and the point of threshold pain and blister or second degree burn determined. These curves quantitatively describe information which we all know by experience and intuition; i.e., a low level of heat flux may be tolerated for a much longer time before pain or blister occurs than can a higher level of exposure. These curves

Calculating Venting Time

The first step involves calculating the time required to vent the reactor completely of its contents. Begin by assuming some vent diameter D, that seems reasonable for the reactor involved. This diameter will be checked for adequacy in the remainder of the calculation.

The venting velocity V in feet per second will next be solved for by a trial and error procedure. Assume a velocity and solve for the Reynolds number, Nre. The viscosity of the reacting liquid must be known in the operating range of temperature, shear rate, and conversion, or be determined experimentally.

$$Nre. = \frac{DV\rho}{\mu} \qquad (8)$$

Nre = Reynolds number

μ = liquid viscosity, lb./ft.sec.

Based on the Reynolds number, choose the correct value for the contraction coefficient, Kc. From the plot of friction factor vs. Reynolds number, read the value of f. If the flow is in the laminar region (Nre <2000), the friction factor may be found directly from:

$$f = \frac{16}{Nre} \qquad (9)$$

Substitute f and Kc into equation (7) and solve for velocity V. When this calculated velocity matches the velocity assumed in determining the Reynolds number, the correct V has been found.

Convert this initial liquid velocity to a flow rate Q in gallons per minute.

$$Q = \frac{(V\ \text{ft./sec.})\ (\frac{\pi}{4} D^2\ \text{ft.}^2)\ (7.48\ \text{gal./ft.}^3)\ (60\ \text{sec./min.})}{} \qquad (10)$$

Divide this flow rate into the total volume of the batch in the reactor M in gallons to obtain the time required to completely relieve the batch at the initial venting rate V.

$\frac{M}{Q}$ = minutes required to relieve a reactor with relief area of diameter D. (11)

Determining Rate of Temperature Rise

Now that time required to vent the kettle has been calculated, the rate of temperature rise of the out-of-control reaction should be determined. Comparison of theoretical plots of adiabatic temperature rise with actual batch plots of uncontrolled temperature rise shows close agreement. Some heat will be removed by the kettle jacket and some by vaporization, but this becomes relatively less important as the reaction rate increases. The assumption that all the exothermic heat of polymerization goes into raising the batch temperature (adiabatic system) is therefore slightly conservative and sufficiently accurate for purposes of estimating relief area.

$$\frac{dT}{dt} = \frac{Wm \times \Delta H \times R}{Wb \times Cp} \qquad (12)$$

T = temperature, °F

t = time, minutes

Wm = total amount of monomer(s) in batch, lbs.

ΔH = heat of polymerization for monomer(s), BTU/(lb.) (100% converted)

Wb = total weight of batch, lbs.

Cp = average heat capacity of batch over temperature range involved, BTU/lb.°F

R = conversion rate, $\frac{\%\ \text{conv.}}{\text{hour}}$

Next an equation relating the log rate of conversion and the temperature is needed for the particular polymerization reaction.

$$\log_e R = a\,T - b \qquad (13)$$

a = constant

b = constant

Solve equation (13) for R and substitute this expression into equation (12).

$$dT = \frac{Wm \times \Delta H \times ce^{aT}}{W_b \times C_p} \qquad (14)$$

c = constant

Combining all the constants in equation (14) into a single constant K gives:

$$\frac{dT}{dt} = K_1\, e^{aT} \qquad (15)$$

Integrating and solving:

$$\Delta t = -K_2\,[e^{-aT_2} - e^{-aT_1}] \qquad (16)$$

Δt is the time required for the adiabatic temperature rise from T_1 to T_2. The reaction will become explosive (instantaneous pressure rise) when $T_2 = \infty$. By letting $T_2 = \infty$ in equation (16), the time required to go from any temperature T_1 to explosive conditions can be calculated.

$$\Delta t = K_2\, e^{-aT_1} \qquad (17)$$

Plotting Pressure vs. Temperature

Next, the relationship between the temperature of the batch and the total reactor pressure should be plotted on vapor pressure paper (semi-log paper will suffice if vapor pressure paper is not available). Since the total pressure is approximately equal to the sum of the partial pressures for multiphase systems, the total reactor pressure may be calculated by adding the vapor pressures of the main constituents.

Do not include any inert gas pressure on this plot. Since this gas will vent off in the first few seconds, its contribution to the total pressure will be quickly lost.

Completing the Relief Area Check

The temperature at which the rupture disc will fail may now be determined by reading the temperature corresponding to the disc rating (psig) from the vapor pressure-temperature plot. Be sure to subtract any inert gas pressure from the rated burst pressure. Now refer back to the Δt vs. T plot. From the time on the ordinate corresponding to the temperature at rupture disc failure, subtract the calculated time it will take to vent the reactor completely of its contents (from eq. 11). Read the value of the final temperature from the abscissa corresponding to this net time. This is the highest temperature that the batch could reach if it completely relieved as liquid at the initial venting rate V.

From the pressure-temperature plot read off the reactor pressure corresponding to the final temperature. This is the highest pressure that can be generated in the reactor as the batch relieves through a relief area of diameter D and a vent line of length L.

Compare this final pressure with the rated working pressure of the reactor. If pressures of this magnitude can be handled safely, the relief area $\left(\frac{\pi D^2}{4}\right)$ checked is adequate. If this relief area proves inadequate go back to the beginning, try a larger diameter, and repeat the calculation. Once the graphs have been plotted for time-temperature and pressure-temperature, additional calculations can be made quickly.

It has been assumed that the entire contents of the kettle will vent at the initial venting rate V. If any additional temperature (vapor-pressure) rise occurs after disc rupture, the venting rate will increase. If the temperature begins falling after disc rupture, the venting rate will decrease, but this is positive indication that the reaction is under control. This assumption is, therefore, conservative.

Liquid Venting Method

A detailed comparison between venting conditions predicted by the liquid venting method and several case histories in polystyrene manufacture supported the validity of the assumption that liquid venting calculations would give a realistic description of actual emergency conditions.

Required relief area was then calculated using both liquid and vapor venting assumptions. In every case, the vent size calculated by assuming liquid venting was much greater than that arrived at by vapor venting calculation and was consistent with what the Factory Insurance Association recommended in their *Engineering Bulletin No. N-53*. For example, for a 4,000 gallon polymerization reactor, the liquid venting calculation might indicate a six-inch diameter relief line was required to handle all emergencies. For the same set of conditions, the vapor venting calculation might indicate a two-inch diameter relief line was adequate. So, although a design engineer provided two or three times the diameter indicated by the vapor based calculation, the reactor emergency vent could still be under-designed.

For design purposes, any relief area calculation method should be conservative and contain a factor of safety. The vapor venting method certainly was not conservative. However, it was not apparent whether or not the liquid venting method was conservative.

The actual extent to which the vaporization might cause the venting liquid to be foam-like was not known. The possibility existed that the effective viscosity of the two-phase venting system might be greater than the viscosity of the pure liquid. This was predicted theoretically by Taylor. If this were true, then the liquid venting calculation could indicate a relief area that was actually less than that actually required.

In contrast, equations for foam modulus derived by Kerner predicted that the viscosity of a two-phase system would decrease with increasing gas volume. However, the generation of vapor in the kettle would greatly increase the effective volume to be vented. This increased volume could be of

greater importance than the viscosity decrease.

A search of the literature on two phase flow indicated that no work had been done which could be applied to predict the behavior during venting of the highly viscous syrups encountered in mass polymerizations (100,000-300,000 centipoises). Consequently, some experimental work was necessary to insure that the liquid venting method was conservative.

A small bench scale reactor (about one quart capacity) was set up as a prototype to the larger production equipment. The experimental setup contained the following additional equipment:

For the first trial, a syrup made by dissolving polystyrene in ethylbenzene (48.7 per cent solids) was used. The syrup was heated until the internal pressure of the reactor reached 55 psig. Nitrogen was then introduced to burst the rupture disc and begin the venting. The actual time to vent the reactor was one minute 22 seconds (see Table 1). Venting was considered complete when syrup stopped coming out of the relief interval the batch temperature, pressure, and rate of venting.

TABLE 1

Reactor Venting Experiments

Trial No.	*1*	*2*	*3*
Syrup Type	*Ethylbenzene-PS*	*Ethylbenzene-PS*	*Styrene-PS*
Burst temp, °C	213	180	150
Burst pressure, psig	55	40	38
Viscosity at burst, lb./ft-seconds	1.08	1.80	.672
Total weight of syrup, lbs.	3.85	3.34	3.27
Weight of vented syrup, lbs.	1.82	1.79	1.20
Actual time of venting, seconds	82	90	42.5
Calculated time of venting based on weight of syrup that actually vented, seconds	123	274	73.6
Calculated time of venting based on total syrup charge, seconds	261	515	202

1. An insulated vent line ¼ inch in diameter and 4.12 feet in total length.
2. A one-inch safety head containing a 50 psig (at 72°F) rated rupture disc.
3. A stirrer.
4. A baffle containing a thermocouple.
5. A pressure transducer mounted on a reactor dome nozzle.
6. A catch bucket hanging from a load cell.
7. An electric heating mantle.
8. A Sanborn four channel recorder.

By using a syrup of known viscosity, the actual time required to relieve the reactor could be compared against the time calculated from the liquid venting method. For the method to be conservative, the actual venting time must be less than the calculated time.

Using the thermocouple, pressure transducer, and load cell connected to a Sanborn recorder, the small reactor was instrumented to continuously record over a known time line. This occurred simultaneously with the batch pressure reaching zero.

Based on the weight of the total syrup charge, the calculated venting time was four minutes 21 seconds. Based on the weight of syrup that actually vented, the calculated venting time was two minutes three seconds. Thus, the liquid venting assumption appeared conservative.

In the second trial, the ethylbenzene-PS syrup was again used. The reactor was heated until the internal pressure reached 40 psig. Nitrogen was then introduced to burst the rupture disc. The actual venting time increased slightly to one minute 30 seconds. The calculated time for venting based on total syrup charge and on the amount that actually vented, respectively, was eight minutes 35 seconds and four minutes 34 seconds. For this trial, the liquid venting assumption appeared to be very conservative.

In the final trial, peroxide-catalyzed partially polymerized styrene syrup was used. By using a polymerizing syrup that would evolve heat, a realistic evaluation of the

liquid venting calculation method under actual emergency conditions could be accomplished. The actual venting time was 42.5 seconds. The calculated venting times were three minutes 22 seconds (total charge) and one minute 13.6 seconds (amount vented). Consequently, all three trial experiments had shown the liquid venting method to be conservative.

The vented syrups came over into the catch bucket as liquid. Very little vapor was evolved until venting was almost complete. After the reactor returned to zero pressure, some vapor was observed to be released intermittently into the catch bucket for a period of about 30 seconds. This vapor release provided additional cooling of the remaining reactor syrup.

By careful weighing of the reactor and the pail before and after venting and comparing this with the weight of vented syrup recorded by the load cell, all but one to two per cent of the syrup was accounted for. Most of this one to two per cent weight loss was stuck to the inside of the vent line, the stirrer and the baffle. This meant that the weight of syrup that was lost as vapor was negligible, and essentially all of the syrup that vented was relieved as liquid.

In summary, the reactor venting experiments highlighted two basic points which gave strength to the author's liquid venting calculation method:

1. Basing calculation of required relief area on the assumption that the batch will vent as liquid, using the batch pressure at rupture disc failure as the driving force, is conservative (contains a factor of safety).

2. Since it was observed and verified gravimetrically that the syrups did indeed vent primarily as liquids, the liquid venting assumption provides a good description of the real venting situation for viscous syrups. This is true only providing these syrups normally exist in the liquid phase at atmospheric pressure; for example, liquid venting will not be the case for vinyl chloride monomer, which is a vapor under atmospheric conditions.

The question of what is the quantitative effect of the two-phase relationship on the viscosity of the venting system has not been answered. The experimental work described here has only scratched the surface. Since understanding the two-phase effect on viscous flow will certainly lead to more accurate sizing of relief area, it is hoped that others will undertake more detailed studies.

When the reactor contains viscous partially polymerized syrups, venting will almost certainly take place in the laminar region of Reynolds numbers. The calculated rate of venting may be nearly proportional to the viscosity because of the large friction factor term:

$$\frac{4fL}{D} >> (Kc + 1.0) \qquad (17)$$

The confidence in the resulting accuracy of the relief area estimation will obviously be only as good as the confidence in the viscosity data. The viscosity data should be used in the range of temperature, conversion, and shear rate that will be encountered in actual emergency relief.

There are several possible testing methods and apparatus that will give accurate viscosities. For the purpose of estimating required relief area, a simple rotational viscometer (Brookfield viscometer) will give adequate data. As indicated by Otto and Metzner, the data obtained from the rotational viscometer can be adjusted to compensate for non-Newtonian behavior. Also, this data can be extrapolated to higher temperatures.

An attempt has been made to include only enough detail in this report so that an engineer involved with reactor design of relief area can study the proposed method and know quickly what steps must be taken to perform the calculations. Since this method takes into account such process details as vertical height of the vent piping above the reactor, volume, viscosity, and density of the reacting mass, and reactor temperatures and pressures, it can be applied to a wide variety of batch reactors.

It is suggested that at least initially design engineers calculate required relief area using both the liquid and the vapor venting assumptions. Calculating relief area by both methods will confirm which method is more conservative for each process.

It should also be mentioned that it is general practice to include a factor of safety in the relief area finally specified in the reactor design. This specified relief area should be two to three times the area indicated by design calculation.

alization that fire protection against life and property can be solved, and an aroused government concerned with the real fire hazard in the flammable characteristics of textile materials. Death from fire ranks third behind traffic accidents and falls as the chief cause of accidental death and injuries in the U.S.A. The Public Health Service estimates that 150,000 people annually suffer injuries due to fires involving wearing apparel. In 1967, during Fire Prevention Week, President Johnson noted that Congress had been asked to amend the Flammable Fabrics Act to save the thousands of lives lost each year because of flammable clothing and furnishings. As we now know, legislation was passed authorizing the Secretary of Commerce to prescribe new standards as needed to end or minimize the unreasonable risk of fire which textile fabrics may present to the public. This is only a partial answer, and organizations such as the National Safety Council, Public Health Service, and the Information Council on Fabric Flammability must continue to work hard to educate the public on the hazards of flammable fabrics.

Good burn prevention can succeed at the local level by consistently practicing safety habits. Safety personnel must make the worker aware of his responsibility for avoiding habits that result in death and injuries caused by flammable fabrics. Technically, it would be possible to protect the worker against all job hazards. The worker's efficiency, however, would be greatly diminished and a compromise, therefore, is essential. Since we are talking about work clothing, safety, efficiency, and comfort must receive first consideration. When selecting fire retardant protective apparel for use in a hazardous environment, certain desirable characteristics are needed. The following characteristics are among those that should be insisted upon:

1. The fire retardant fabric used in the garment should not contribute to the worker's injury through burning, afterglow, or melting when exposed to fire, convection and/or radiant heat source.

2. During exposure to ignition, the charred area should insulate against heat, and it should remain intact without shrinking to afford the worker additional protection.

3. The fire retardant garment should be comfortable to wear under normal use conditions in hot or cold climates.

4. The fire retardant treatment should be durable to laundering or drycleaning throughout the useful life of the garment.

5. The fire retardant cotton should be able to absorb moisture and be antistatic.

6. An important property of Roxel® fire retardant fabric is that the material is bacteriostatic. This property is still effective after 50 commercial wash cycles. A medical test involving 330 people and 3,000 days of exposure showed that Roxel® fabrics did not contribute to skin dermatitis or allergies.

Statements that durable fire retardant clothing is expensive are usually based on a comparison of the price of the treated garment with an untreated one. When you compare the price of fire retardant clothing with the price of some of today's easy care apparel you may well regard fire retardant garments as a low cost form of accident insurance. It should be mentioned that the use of protective garments made from fire retardant fabrics does not guarantee that burn injuries will not occur to the wearer. The use of fire retardant fabrics, however, will greatly minimize the after effect of such incidents and could possibly save a life.

There is an estimated annual requirement for about four million fire retardant garments in the chemical, steel, and non-ferrous industries. To fill this need, improved fire retardant cotton materials are rapidly becoming commercially available to manufacturers of protective clothing who have advanced their technology concerning functional garment design. However, these developments apparently are not enough, because the familiar burn-pains are still with us. We are in need of responsible leaders from safety organizations, government, and the medical profession to show us new direction and to see that the benefits of fire retardant cotton clothing are made available to the consuming public in the shortest possible time. The rewards could be tremendous.

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have been used extensively in correlation of our data and the development of protective systems.

I would like to outline some of the procedures which we have developed to evaluate clothing systems under different exposure conditions, and describe some of the basic variables. In classifying thermal hazard, the fabric itself can be a hazard. In this case, nonflammability is the primary safety requirement of the garment. Examples of this type use are garments worn in hyperbaric chambers and other high pressure environments, and pajamas in nursing homes and hospitals where patient smoking presents a flammability hazard. We have recently completed a detailed test series with the Underwriter's Laboratories using a wide variety of fabric weights and weaves which are applicable to protective clothing. A clothing manufacturer may now obtain an Underwriter's Laboratory label to identify fire resistant clothing of Nomex®. In addition to permanent fire resistance, garments should be comfortable, have pleasing aesthetics, and offer high durability. A garment which combines these properties and has a satisfactory cost performance characteristic will be accepted in this market and contribute significantly to wearer safety.

For much higher levels of exposure, the garment still must be nonflammable but here we ask that it also insulate the wearer from the hot environment. To analyze the garment variables which determine insulative protection, the exposure must be classified as convective, such as burning fuel; conductive, as in handling hot objects; or radiant, as experienced by a foundry operator. Tests are then required to simulate each of these conditions and determine fabric performance.

The first type exposure I will discuss is convective, which is the transfer of heat by hot gases. To measure protection provided from a flame (convective source), a copper disk is used to simulate human tissue and skin. There are several requirements for accurate measurements. First, the disk must be adequately insulated from the surroundings except for the surface which is exposed to the heat source. The temperature rise that occurs upon exposure must be accurately measured, and the amount of heat which is absorbed must be proportional to that in human tissue. We feel that we have successfully accomplished these requirements by imbedding our copper disk in an insulating material and attaching four thermocouples just below the surface of the disk. These four thermocouples then give us an accurate average measure of disk temperature. The surface of the disk is "blackened" with a flat paint to give an absorption coefficient approaching that of human skin. From the amount of heat required to raise a unit weight of copper to a given temperature (the heat capacity) and the known weight and temperature rise of the copper disk, a measure of the heat which is transmitted to the disk is determined. When this is related to the area of the disk and the time, we then can calculate a heat flux which characterizes the exposure.

In this particular test the copper disk is first exposed to the flame from a Meker burner which has a temperature of about 2,500°F (1,371°C). The temperature rise of the disk is used to calculate the available heat flux of about 1.9 calories per square centimeter per second. This level is a realistic level for most exposures to flash solvent fires, such as a gasoline spill in a race car accident. The fabrics under study are then used to protect the copper disk and the above procedure is repeated. The temperature rise of the disk is determined, and simple calculations establish the amount of heat blocked by the fabrics under test. We have chosen the term protective index (PI) to describe this value. For example, a protective index of 90 would indicate that 90 per cent of the incident heat is blocked from the wearer, or, only 10 per cent is transmitted through the protective system. This gives us a direct comparison of various fabric systems. Using the amount of heat transferred and the tissue damage curve, the amount of protection in seconds for different values of protective index can be determined. This curve permits us to establish the protective index that a clothing system must have.

Finally, we show the primary variable which appears to control the protection from convective exposure. Considering all of the materials tested, the fabric thickness appears to be directly related to protection. In this case the charring and puckering of fabrics of Nomex® when exposed to flames cause an increase in effective thickness, giving a higher level of protection for a given initial thickness.

Next, I will briefly discuss the work we have done in developing protective clothing

for conductive exposure. Special factors must be considered in conductive tests. First, the pressure during use distorts the fabric and changes the useful life of the system. Next, exposures are normally short, as for instance the time required to move a hot object, and the classic steady state tests for thermal conductivity are not practical for this type of an evaluation. The duration of our exposures are generally from five to ten seconds maximum. Finally, the test facility must have an emitter which is large enough to maintain the test temperature (heat flux) throughout the test.

In the conductivity test, the heat source is a hot plate with copper distribution plate on top. The heat flux sensor is the copper disk assembly previously described. This test is also run with the heat source on the bottom so that any convective transfer which occurs through the fabric system will also be detected by the sensor. This is the more severe position and is a conservative approach to testing. Finally, a weight is placed on top of the sensor assembly to provide a pressure consistent with the anticipated end use. Comparison of the temperature rise of the sensing disk with various thicknesses for a variety of different type fabrics shows that the primary variable is fabric thickness, and the specific type of material tested is of minor significance. This indicates that the primary insulating material is the air which is trapped within the structure, and those materials which are most able to maintain a thick structure and trap the most air will provide the best insulation. High temperature resistant, low density fabrics of Nomex® fiber have performed well in this test at temperatures exceeding those found useful in most other materials.

The data from this test can also be used to calculate the useful system exposure time. Using this procedure, we have developed a variety of protective gloves.

Finally, our work with radiant exposures has led to some interesting observations. In the equipment used to test for radiant exposure, the heat source is six T-3 quartz infrared bulbs mounted in a water cooled transite box. The fabric system under test is mounted directly in front of these bulbs, and a detector similar to the one used in our other test procedures is used to monitor the heat which is transferred by the protective system and to set the exposure level. Here we must decide whether the garment in use will be designed to protect for a catastrophic exposure such as a massive molten steel spill; or for continuous exposure, as in a casting operation; or for a combination of both. Next, depending on exposure conditions, the need for a reflective coating such as aluminum or gold must be determined. Finally, if such a coating is required, additional problems of wearability and durability are presented to the protective clothing designer.

We have studied a large number of fabric types and protective systems and have developed what we feel is a new concept in protective clothing for use with radiant exposure. What happens when a Nomex nylon system and a flame retardant cotton system are exposed to a radiant energy source of 0.8 calories per square centimeter per second? The Nomex® nylon system consists of three layers: an outer layer of a natural colored 10 ounce per square yard duck material over a five ounce per square yard herringbone which would represent a man's shirt, and these two fabrics over the thermal knit underwear which would be used in a high exposure condition. Because of the mass of the system, no heat flux is transmitted for the first thirteen seconds; after that time the amount of heat transmitted gradually increases, until at about 12 minutes the system is stabilized and heat flux of 0.081 calories per square centimeter per second is being transmitted to the sensor or skin. In comparison, a similar system of flame retardant cotton, exposed to the same radiant exposure, transmits approximately the same amount of energy for the first three to five minutes, at which time the temperature of the fabric exceeds the degradation point of cotton, the material begins to smoke, and the thermal underwear, which was not flame retardant, is actually ignited and is glowing. Identical fabric systems can behave quite differently, depending upon the high temperature stability of the material used. When the heat transmitted is too high for the material in use, we must then resort to increasing the reflectivity of the outer surface to reduce the amount of energy which is absorbed by the fabric system. A common way of doing this is to glue an aluminum film to the surface of the fabric. This may or may not be protected by an outer layer of a clear film. The aluminum film reflects approximately 85 per cent of the incident energy.

We have studied a wide variety of aluminized fabrics and find that the heat transmission characteristics are determined by the aluminum film and not by the thickness or the weight of the base material (Table II). Fabrics weighing as little as 7.7 ounces per square yard have approximately the same level of heat transmission as those which weigh 24 ounces per square yard. A primary requirement for this base fabric is high temperature resistance, because these fabrics are always the outer layer and are subjected to the highest temperatures of the fabric system. Customarily, heavy asbestos and glass fabrics have been used. The advance we feel we have made to protective garments for radiant energy exposure is the use of a lightweight highly flexible garment worn over under garments specifically designed to provide insulation from the hot outer layer. This allows the best utilization of material for the particular requirement. Typical protective systems of Nomex® might include a coverall or shirt and pants worn over insulating underwear, or an aluminized jacket and overalls over underwear. We have made these systems of Nomex® weighing seven pounds for the total garments, which gives protection equal to that of a 23 pound asbestos garment.

I have tried to describe some of the work which we have done over the past years in our study and development of protective clothing. We feel that we have developed useful techniques to design clothing specifically for use in exposure to convective, conductive, or radiant energy, and that these garments can be specified for a given exposure condition. Furthermore, protection to provide time for a man to escape the hazardous condition can generally be offered. We recognize this whole subject to be very complex and there are many exposures which we have not studied, but with the background that we have been able to develop over the years we can handle a wide variety of exposure conditions and develop durable, wearable protective clothing systems for them.

TABLE I

Temperature/Heat Flux Comparisons

Heat Source	*Temp.* (°F)	*Heat Flux* (cal/cm² sec.)	*Time (sec.) to Cause:* *Pain*	*Blister*
7 inch flame no air	1700	1.2	.46	1.3
7 inch flame with air	2300	2.1	.22	.65
Hot Plate	480	2.1	.22	.65

TABLE II

Comparison of Heat Transfer Through Aluminized Fabrics

Item	*Heat Transfer cal/cm² sec.* 0-1 min.	5-6 min.	10-11 min.
Exposure 226 cal/cm² sec.			
Al-Nomex®	.031	.035	.031
Al-Asbestos	.029	.039	.039
Al-Rayon	.024	.031	.031
Al-"Fiberglas"	.015	.024	.024
Exposure .325 cal/cm² sec.			
Al-Nomex®	.039	.047	.047
Al-Asbestos	.031	.039	.047
Al-Rayon	.039	.039	.047
Al-"Fiberglas"	.024	.031	.031
Exposure .83 cal/cm² sec.			
Al-Nomex®	.059	.070	.070
Al-Asbestos	.062	.099	.100
Al-Rayon	.070	.097	.078
Al-"Fiberglas"	.047	.062	.070

Note:
7.7 oz./yd.² Rip stop Nomex® Gentex aluminization
24 oz./yd.² T-1000-1 Asbestos Gentex aluminization
16.2 oz./yd.² T-1004 Rayon Gentex aluminization
16 oz./yd.² "Fiberglas" 3M aluminization

SAFETY SHOWERS FOR WINTER USE

By CHARLES A. BUEHLER
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More maintenance dollars have been expended and valuable engineering man hours ineffectively used to obtain reliable safety showers and eyebaths than most plant managers would imagine. In addition to the aggressive environmental conditions found in most chemical plants, there is often the freezing problem. The apparent initial cost of a safety shower is too frequently a factor in its selection and design. Not because company management knowingly fails to provide the necessary money for safety equipment and protective devices for the protection of its employees, but because the project engineer may not request sufficient funds in the project to build a reliable shower system. It is inconceivable to many that the simple process of providing water to a given area or spot through a manually operated valve should cost so much or require the time of an engineer to work out the details. When several shower heads are required to service a multilevel structure, the problem is sometimes given more engineering attention, and elaborate systems incorporating circulating pumps, heat exchangers, and several automatic controls are provided. Too often, however, one or more of these components do not operate. This results in a loss of system reliability.

The writing of this paper was prompted by circumstances which existed in my company a few years ago. A solution to the emergency safety shower problem was requested by management. Engineering standards were needed which could be used by project engineers who had often been required to "re-invent the wheel" each time a new chemical plant or manufacturing department was built.

Systems and standards were developed which are now used by several companies in this country and abroad. This was possible through the cooperative effort of my company and a manufacturer who became interested in the safety shower problem.

Defining the Problem. A survey of safety shower installations and failures was made in several plant locations. This survey indicated some problems which had to be solved before a reliable safety shower could be built.

Showers had frozen (although many had been equipped with various kinds of heating systems) for the following reasons:

1. Non-uniform heat distribution, particularly at valves and headers.
2. Thermostats and electric heating cables failed in corrosive atmospheres.
3. Heat losses exceeded available heat input as a result of deteriorated or wet insulation.
4. Weep holes in self-draining underground valve shower systems plugged due to rust or corrosion, and water left standing in the riser pipe formed ice plugs.
5. Steam traps failed or strainers plugged on regulated steam traced systems.

Water temperature had sometimes exceeded safe upper limits; in some instances boiling water was encountered. The reasons varied:

1. Thermostat contacts welded closed due to corrosion.
2. Insulated steam tracers were used without temperature controls.
3. Thermostats were located improperly and hot spots developed along the line.

Equipment and material deficiencies were detected:

1. Valves did not remain drop tight in cold weather, allowing ice plugs to form in the shower heads.
2. Insulation and weatherproofing needed constant maintenance. Lack of immediate attention resulted in frozen showers.
3. Hot wire or cable tracers were not suitably insulated or protected, hence corroded rapidly at insulation jacket leaks.
4. Thermostats failed, due to corrosion of capillary and bulb parts.

Although reliability of operation was of prime importance in developing a standard safety shower, other factors had to be considered: the safety shower had to require minimum maintenance attention; it had to be economical to purchase and install; it had to

be pre-engineered to simplify project design.

Although improved reliability of safety shower operation was the prime objective in this program, the study indicated that the cost of maintaining showers was significant. The repair of a safety shower was very often done on an emergency basis. The cost of repairing emergency showers in a single plant was reported to be upwards of $50,000 a year.

Pre-Standards Designs. Control of water temperature to prevent freezing or scalding under nonflowing or stagnant conditions was recognized early in the study as the most difficult of the problems to solve. The surest way to prevent freezing was to bury the water line. Several years prior to the start of our project, a shower was designed to eliminate the need for heating. This shower is supplied underground, and has an underground valve through which water flows through a normally dry standpipe to the head. After each operation the standpipe drains through a weep hole into the soil. Many showers of this design have been used in our plants throughout this country. However, this design has several deficiencies:

1. The shower is limited to ground level installations or, at most, one level above ground with an extension on the valve handle.

2. The time delay required for water to fill the dry standpipe before discharge begins on the second level is undesirable.

3. Plugging of the weep hole, caused by rust and corrosion, which prevents the standpipe from draining.

4. Ice films build up in the piping and head during cold weather testing.

5. Poor soil drainage is often encountered in chemical plant areas. This has resulted in: (a) improper standpipe drainage and freezing; and (b) chemicals from repeated spills at loading docks entering the standpipe through the weep hole and being discharged on personnel when the shower is operated.

Plant Tests and Studies. Four systems for controlling shower temperatures were built and operated by plant maintenance personnel at one of our major plants. A fifth system was built at another plant. Two other types of safety showers which had been in operation in the plants for several years were also investigated. A brief description of each of the systems and the results obtained follows:

Test 1. Electrically Heated Shower By Means of Induction Coils, Thermostatically Controlled, Insulated. Ten 110V, 60 cycle prewound induction coils were spaced one foot apart along the 1½ in. diameter shower piping from the supply header to the shower head. Standard thickness weatherproofed fibrous glass insulation was applied over the outside diameter of the coils. Temperature was controlled by a single thermostat. This was built to duplicate a typical underground supply shower, except that the valve was located overhead and operated with a pull handle.

Uniform heat distribution was not achieved with this arrangement. An appreciable improvement could not be obtained by rearranging the position of the coils. Since the system did not live up to the predictions of the manufacturer who furnished the induction coils, the test assembly was shipped to them for checking in their shop.

The number of coils was increased from ten to thirteen and a slight change in position was made. The results of this arrangement were entirely satisfactory. Water temperatures were within 2° to 7° of the thermostat setting on different test runs. Variations in temperature were limited to only 7° F. Power consumption was low, approx. 100 watts for a temperature rise of 50° F above ambient.

Test 2. Mechanically Circulated, Electrically Traced with Copper-Clad, Mineral Insulated (MI) Heating Cable, Thermostatically Controlled, Insulated. Two 110V, 300 watt metal sheathed cables were used. One cable was used to trace a section of pipe at the shower head and valve and another cable for a section at the supply header. A return line extended from the shower valve to the supply point, forming a closed loop. A small water circulating pump continuously circulated the water in the loop. The temperature was controlled by a thermostat which controlled the current to the heating cables.

Although the mechanically circulated shower gave more uniform temperatures than the induction heated system, it was decided that the pump could be an additional source of trouble thus, in effect, reducing the reliability of the system. Also, as a shower system became more spread out and the number of heads increased, the cost of additional pipe and insulation for the return loops would make such an installation uneconomi-

cal and heat losses on the return loop would become appreciable.

Test 3. Warm Jacketed Pipe, Steam Tracer Heated. A sheet metal jacket similar to a stove pipe was supported concentrically on the winterized piping with spacer rings. A single steam tracer was strapped to the pipe with a spacer between. The heated air was confined around the piping by the metal jacket, creating an above-freezing ambient condition inside the metal jacket.

Temperature readings were not taken on this installation. The design was considered to be impractical for longer horizontal runs of piping. Maintenance costs were expected to be high and installation costs were estimated to be higher than for other systems being tested. This system froze during the first winter's use.

Test 4. Electrically Traced with Metal Sheathed Heating Cable, Thermostatically Controlled, Insulated. Shower piping, valve, and head were traced with two 110V, 300 watt metal sheathed cables and insulated. Temperature was controlled by thermostat.

Shower systems of this type had been installed in the past. The water temperature in the test shower varied 45° F. This is too much to allow sufficient control to prevent freezing or overheating.

Test 5. Insulated Steam Tracing, Insulated Pipe, No Temperature Control. A parallel run of insulated copper tubing steam tracing was strapped to the shower piping, valve, and head. Standard insulation was applied over the pipe and tracer.

An attempt was made to limit the heat input from the tracer to the stagnant water line so that the temperature rise over ambient would not exceed 50° to 60° F. No provisions were made to shut off the steam when the outside temperature exceeded 50° F with the result that the water became too hot during periods of widely fluctuating temperatures. Reliability of the heating system was dependent on steam supply to the tracer and a properly functioning steam trap. This was not as reliable as an electrical supply and thermostat. This test shower froze during the first winter's operation.

Test 6. Multilevel-Multihead Loop, Continuous Mechanical Circulation, Steam Heat Exchanger, Automatic Temperature Control. Water is taken from the loop supply header when a shower head valve on the loop is opened. Discharge pressure at the head is developed across a small orifice in the loop between the last shower head and the city water supply line. When there is no shower demand the loop is full and the water, heated by steam in a small shell and tube exchanger, is circulated continuously by a pump. The circulation rate is determined by the orifice described above. The pump is sized to provide the total required head to the showers at the upper levels during flow, in addition to its function as a forced circulation pump. This has been found to be necessary in some of the older departments where city water pressure is low. The material list for this loop shower system appears to rival that of a manufacturing facility. Automatic controls include steam shut off on excessively high temperature, low water presssure alarm, and low water temperature alarm. (Reliability is reduced and maintenance costs increase as more and more mechanical equipment and instrumentation is added to a safety shower system). Four continuously circulated loop shower systems were examined in one of our larger plants during a period of time which included three winter seasons. At least one freeze up occurred in three of the systems each winter. The fourth system had only one freeze up during the entire period. Various reasons were found for these showers freezing which included pump and steam trap failure and the temperature control valve sticking closed.

Test 7. Electrically Traced and Insulated, Plastic or Lead-Covered Cable, Thermostatically Controlled. Shower piping, valve, and head were parallel or spiral traced with electric resistance cables; and insulated. The temperature was controlled by a thermostat which in some cases was built into the cable.

Many attempts have been made in our plants to design and build a simple low cost shower winterizing system using one of the many corner hardware store varieties of heating cables available today. Some designers went a little farther and attempted to improve on the thermostat. These systems have generally failed to keep stagnant water lines from freezing or overheating.

In the long run, more installation and repair money has been spent on some shower systems in a two or three year period than would have been spent on an improved design such as induction heating. After observing several of the older cable traced

RESPIRATORY PROTECTION FOR OPERATIONS AND RESCUE WORK

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One problem that is common to the chemical and petrochemical industries is the provision of adequate respiratory protection for personnel working in or around hazardous gases, a problem that also confronts many other widespread and diversified manufacturing operations. I will confine my remarks to the problems presented by hydrogen sulphide in the petroleum industry and specifically to operations in Alberta, Canada.

A brief review of some of the properties of hydrogen sulphide may help to emphasize its lethal potential. Hydrogen sulphide is a colorless gas, heavier than air (specific gravity 1.189) with a characteristic odor of "rotten eggs." It burns readily with a blue flame and produces sulphur dioxide, a highly irritating gas. It is also explosive within the limits of 4.3 per cent to 46 per cent with air and is soluble in water and alcohol. Hydrogen sulphide occurs as a by-product of many chemical processes involving production of viscose rayon, synthetic rubber, dyes, and leather. It is sometimes found in mines and commonly in sewers and in the products of putrefaction. It is found in the petroleum industry wherever "sour" crude oil or "sour" natural gas is produced, and probably nowhere as abundantly as in the Alberta oilfields.

Continued exposure to low concentrations of less than 100 parts per million of hydrogen sulphide is irritating to the mucous membranes of eyes, throat, and lungs; concentrations above 100 parts per million cause progressively acute symptoms, and at over 800 parts per million unconsciousness results and the respiratory system is paralyzed immediately. Death quickly follows if rescue and resuscitation are not carried out promptly. The maximum allowable concentration, formerly set at 20 parts per million, has recently been reduced to 10 parts per million. While hydrogen sulphide may be detected by the sense of smell in concentrations as low as one part per million, the nose is not a reliable indicator since exposure to over 15 parts per million for a short time can result in complete loss of smell. The only reliable method of determining the concentration of hydrogen sulphide is by using one of the many types of detectors available, and during this operation protective breathing equipment must always be worn.

To give you some idea of the magnitude of the hydrogen sulphide problem in Alberta, I would refer to the gas analyses published by the Alberta Oil and Gas Conservation Board. Of 300 fields listed in this report, 124 contain hydrogen sulphide in concentrations varying from traces over fifty per cent by volume. One field not listed is reported to contain over 80 per cent. You will notice that I said per cent, not parts per million. If we take .08 per cent, or 800 parts per million, as a lethal concentration, over 1/3 of our oil and gas fields have the potential for killing unprotected personnel.

Oil field operations may be classified broadly into two divisions, production and processing. Production includes the drilling and completion of oil or gas wells, and provision for transmission of the products to either gas processing plants or oil storage and distribution facilities. Oil is taken from the wells through a gathering system to tank farms or batteries. Here, gas in solution is separated from the oil and sent to gas plants or flared, depending on the quantity recovered. Unfortunately, all hydrogen sulphide is not removed and enough can accumulate in the storage tanks to present a serious hazard to personnel switching or gauging these tanks. Where hydrogen sulphide is present in any amount, the only positive protection for personnel is self-contained breathing apparatus, and wearing of this apparatus is mandatory inside the firewalls, on tanks, and at any other location where hydrogen sulphide may be present.

The processing of natural gas containing hydrogen sulphide is accompanied by certain potential hazards. In any process involving the handling of toxic gases in closed systems under high pressures, there is always the possibility of the working atmosphere

becoming contaminated from gas leaks at flanges, valves, compressors, or through rupture of gas lines caused by corrosion or other line failures. Hydrogen sulphide can be encountered in routine maintenance and repair procedures involving opening of piping systems, pumping equipment, and entry into vessels. For these reasons personnel must be provided with adequate breathing equipment not only for emergency situations but also for routine maintenance and operational procedures.

Breathing equipment in gas plants are of two types; air supplied work masks and self-contained breathing apparatus. Work masks are used for planned operations such as repairs to equipment or work inside vessels. Air for these masks is supplied from the instrument air compressor and is piped through a separate system to various outlets throughout the plant. The work mask is connected to these outlets by air hoses of from 50 to 150 feet in length. Each work mask has incorporated in the assembly a small emergency air cylinder and full facepiece, both mandatory by Alberta Workmen's Compensation Board regulations. The work mask has the advantage of unlimited air supply, light weight, and small bulk, but limits the distance and choice of route in which the user can operate.

The self-contained breathing apparatus is the familiar half-hour back-pack type with full facepiece. This unit affords greater mobility than the work mask and is better suited to operations of short duration and rescue work. Masks of this type are placed at strategic locations throughout the plant and are mounted on racks or "elkhorns" in order to be immediately accessible. While it would be impossible to perform the day-to-day operation of a gas plant without these types of breathing equipment being used periodically, it would be impractical to require employees to wear breathing equipment for a full eight-hour shift. Although these units perform satisfactorily, they were primarily designed for rescue operations. At best they are hot, heavy, and uncomfortable. There is a need for equipment suitable for wearing over prolonged periods with comfort and protection for the wearer. Such equipment is possible, as demonstrated by the life support systems developed to sustain man in space. More research is required to develop present breathing equipment to more adequately meet the demands of prolonged use under widely varying requirements of work and temperature.

In any gas plant processing sour gas, there is always the inherent danger of hydrogen sulphide suddenly escaping to atmosphere through leaks or line breaks. Since it is impractical to protect personnel by the continuous wearing of breathing equipment during a shift, and because of human error, it is inevitable that at some time an employee will be knocked out by hydrogen sulphide. His survival depends on how quickly he can be rescued. Because the victim's breathing has invariably been arrested, immediate resuscitation is mandatory. There are now two choices of action. Either remove the victim to fresh air and revive him by artificial resuscitation or take a mechanical resuscitator to him and apply it at the scene. Obviously the mouth-to-mouth and Holger Nielsen methods of resuscitation are precluded in an irrespirable atmosphere. Since the success or failure of a rescue operation of this nature is dependent on the time elapsed between discovery of the victim and treatment, it is necessary to resuscitate the victim as quickly as possible. For this reason, it is more effective to take a mechanical resuscitator to the victim than to take the victim to the resuscitator.

A few years ago most mechanical resuscitators were relatively bulky, heavy and difficult to carry through process areas, especially up stairs and ladders. It was felt that a small resuscitator that could use the air supply being carried by the rescuer in his breathing apparatus would be very desirable. At that time, to my knowledge, none were available commercially. Most resuscitators had the controls and operating mechanism in the carrying case and did not lend themselves readily to modification. One type of resuscitator did appear with the operating mechanism at the facepiece, and was connected to the regulator and oxygen supply by a hose with a quick disconnect fitting. The supplier of this equipment agreed to experiment with connecting the resuscitator head to the self-contained breathing apparatus.

The chances of recovery after breathing has stopped and artificial respiration has started are inversely proportional to the elapsed time: the longer the delay in starting artificial respiration, the less chance of the victim recovering. There is roughly four

minutes to start resuscitation for a fifty-fifty chance of revival. After five minutes without oxygen, there is a possibility of permanent brain damage. This clearly indicates the need for quick rescue action and a minimum delay in getting resuscitative equipment into operation.

We started the experiment with a conventional oxygen type mechanical resuscitator. It differed from other resuscitators at the time in that the second stage regulator and controls were located adjacent to the face mask, and the hose connecting the resuscitator head to the manifold outlet was equipped with a quick disconnect fitting. There only remained to attach the resuscitator head and hose to the self-contained breathing apparatus.

The type of half-hour self-contained breathing apparatus first used in the experiment had a nose cup inside the facepiece in a more recent modification to combat winter fogging and freezing conditions by directing the exhaled breath away from the facepiece lens and out to atmosphere through an exhalation port.

The pressure relief device was removed and a three-way block assembly was connected where the "pop valve" was formerly located, by a short pipe nipple. The three-way block was then fitted with two quick disconnect fittings to receive the resuscitator head connection and one for an auxiliary air hose line. The pressure relief valve was also replaced in the three-way block. A check valve was incorporated in the three-way block and so regulated that as long as the air pressure in the supplied air line was slightly greater than the pressure in the low pressure regulator, air would not be drawn from the back-pack cylinder and thus conserve this air supply.

Frequently, the transportation of a victim requires the resuscitator head to be left unattended while moving the victim and stretcher through confined spaces, or lowering from vessels. The possibility of the resuscitator assembly falling off the victim's face at such times is apparent. To prevent the facepiece falling from the victim's face during transportation, the facepiece and resuscitator head were connected by a short length of corrugated breathing hose. The mask was secured as before with head straps, and in addition the resuscitator head was anchored to the victim by means of an alligator clamp.

The self-contained breathing apparatus complete with resuscitator head adds very little weight to the breathing apparatus and provides mobility and use in any location the rescuer can reach. The speed and ease with which this resuscitator unit can be made operational can be a critical factor in the successful resuscitation of an asphyxiation victim.

While the air supplied work mask equipped to use the resuscitator head is not usually a first choice in rescue operations, it could be used if located nearer to an accident scene than the self-contained breathing apparatus. In actual practice, the resuscitator head, in its carrying bag, is taken to the location of planned operations where it is available should the necessity arise.

In time, other manufacturers introduced their adaptation of resuscitation units to breathing apparatus.

This then is the story of how the need for specialized resuscitation equipment was satisfied in one particular location. While not perfect, it has fulfilled expectations and operated successfully on numerous rescue occasions. Like most other pieces of similar equipment, there is always room for improvement.

Joint Session with Occupational Health Nursing Committee

THE NURSE AND CHEMICAL PLANT SAFETY

By ELEANOR H. MORT, R.N., M.N.
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It is difficult to talk for or about industrial nurses in general. Our experiences and responsibilities vary so tremendously. The nurse in a chemical plant has very little in common with the nurse who works in a bank or office building. At least in this group we are all involved with the common problem of how to work safely with chemicals, but even within this category there is a wide variation in the duties of the nurse. In a recent survey on occupational health nurses conducted by the Public Health Service of the Department of Health, Education and Welfare—with 9,471 nurses responding to the question on the extent of their medical direction, less than 25 per cent indicated that they work with a full time physician. About 42 per cent have a physician part time, and 33 per cent have no doctor present regularly. Even the 42 per cent who have a part time physician have very little medical direction. The busy physician who visits the plant for an hour or so a day does not have time to really get acquainted with the plant or its problems. Thus on the one hand we have relatively few large well-organized industrial medical facilities with full time medical direction, where the role of the nurse is similar to that of the nurse in the hospital. The doctor gives the orders and the nurse carries them out. On the other hand there is a much larger percentage of industrial nurses who work with very little medical direction and who comprise the only full time medical representatives on the health and safety team.

In the January 1968 *Safety Newsletter*, David Smith, chairman of the Chemical Section of the National Safety Council, stated that the level of safety in the chemical industry has shown no improvement over the last five years—it even shows a slight worsening. I don't know how that compares with other industries, but it certainly indicates that everyone in the business of handling chemicals had better adopt the Avis motto and try harder!

Theoretically everyone believes in safety. It's like believing in motherhood, America, and a hot lunch for orphans—as they say in that song from "Hello Dolly"—or being against sin! It cannot be achieved, however, by telling people to "be careful!" Safety has to become a way of life, and if you are trying to teach people to think safety and work safely and live safely—then safety must be maintained consistently in all areas, at all times, by everyone.

In any plant the basis of a good safety program is:

1. Sound engineering
2. Preventive maintenance
3. Good housekeeping
4. Adequate job training.
5. A good medical program.

In a chemical plant each of these things is doubly important because of the nature of the materials involved.

Safety begins on the drawing board. A chemical process which is not enclosed, or is lacking in such essential safety features as proper ventilation and adequate scrubber systems creates unhealthy working conditions both inside and outside of the building. This necessitates costly protective equipment and warning systems which are a poor substitute for safe engineering—and results in excessive injuries and illness, loss of production, high overtime costs, and low morale. Invariably this is also accompanied by excessive absenteeism and sick disability, plus a rapid turnover of personnel. The health and safety of workers in a chemical plant fundamentally depends upon skillful engineering.

Preventive maintenance is the second essential ingredient of a good safety program. Maintaining equipment in a safe working condition in a chemical plant is at the same time more difficult because of the corrosiveness of the materials being used—and more vitally important for the health and safety

of the workers. Lack of proper maintenance results in frequent injuries, and in potentially hazardous working conditions at all times. It is unrealistic to think that men can be trained to work safely under these conditions.

Good housekeeping is an integral part of safety anywhere, and poor housekeeping in a chemical plant is doubly hazardous.

In the May 1968 issue of *National Safety News* there is an excellent article by E. W. Gustafson, employment and plans specialist for Procter and Gamble, on the importance of cleanliness and orderliness. In it he states "eventually a department or work area and its safety record will look like the man who supervises it.

"With rare exceptions, the supervisor who has unclean and disorderly areas also has poor accounts, excessive finished product deviation, poor adherence to policies, high costs, dishonest time practices, unreliable operation, needless injuries, and all the other indications of poor supervision."

Mr. Gustafson presents a step by step plan for achieving cleanliness and orderliness, but without first having preventive maintenance good housekeeping is impossible.

The fourth basic essential of a good safety program is adequate job training. This is an area in which the nurse may be of some help, although she frequently sees the person because he has already gotten into trouble as a result of inadequate training. The nurse can provide a valuable line of communication between the men in the plant and the safety department. She is very often the first to pick up clues which may indicate some lapse or breakdown in safety procedure, and can some times alert the safety department to potential trouble before it actually develops. By talking to a man about his job and asking enough questions to find out where he works, what he does, and how he does it, she can sometimes learn more about the whole process than could be observed by a visit to the area.

On the other hand the nurse also has many opportunities to communicate to the workers the reason for and the importance of safety regulations. Most people understand the need for hard hats, safety goggles and steel toed shoes—but very few people know much about chemicals or their effect on the human body aside from the fact that some burn your skin, and others make you cough, or make your eyes water. A knowledge of just a few basic facts about chemicals and anatomy would make many of the rules which are necessary for the preservation of health in a chemical plant more meaningful, and also help to impress everyone with the necessity for good personal hygiene. If there can be said to be any one outstanding principle governing the safe handling of chemicals it is cleanliness.

The importance of a thorough shower every day, and frequent changes of work clothes, including underclothing, cannot be stressed too often or too strongly. Wearing clothing, gloves or shoes contaminated with chemicals is dangerous. Depending on the nature of the chemical, it can result in a primary irritation or burn, some chemicals can cause a contact dermatitis, others invoke a violent systemic allergic reaction — and a great many can be absorbed readily through the skin resulting in serious damage to the vital organs of the body.

People who work in chemical plants should also be made aware of the danger of ingesting chemicals by eating or smoking with chemicals on their hands. They should be provided with a clean place in which to eat, and facilities for washing their hands.

The danger of absorbing or ingesting harmful amounts of chemicals is not nearly so great, however, as the danger of inhaling them. The skin covering the human body is about 1.5 square meters, and with proper protective clothing the amount of exposed skin can be reduced to .25 of a square meter. Ingested chemicals are filtered through the liver, which acts as a detoxifier; but chemicals inhaled into the lungs go directly into the blood stream, and are carried unchanged to all parts of the body. It has been estimated that if the human lung were spread out in a single layer it would cover about 100 square meters—or more than 66 times the area of the skin covering the entire body. Obviously, preventing toxic materials from entering the body through the lungs, and protecting the lung surface itself from irritation, is one of the most important considerations involved in working with chemicals.

In her book *Occupational Health Nursing* Mary Jane Brown says, "The potentialities of an adequate occupational health service cannot always be stated in dollars and cents.

However it can be purchased and it has recognizable values:

Improved health
Improved human relations
Improved employee morale.
Decreased compensation costs
Reduced medical absenteeism."

In the August 1966 *Journal of Occupational Medicine,* Dr. Emerson Day maintains that a good medical program results in:

50% reduction in compensation costs
30-40% reduction in turn over
30-40% reduction in absenteeism
45% reduction in accident frequency
63% reduction in occupational diseases
80% reduction in lost time

A good occupational health program rests on the combined skills of medicine, nursing, chemical and safety engineering—but the scope and success of the program are dependent upon the physician—his training, his interest, and his ability to formulate the medical policy that others are to follow. Without full time medical direction the rest of the occupational health team has to "try even harder."

Nursing in a chemical plant is a demanding and challenging job. It requires the assimilation of a whole new body of material —totally different from anything taught in nursing school or learned in the hospital. In order to become an effective member of the occupational health team in a chemical plant the nurse must first familiarize herself with the various areas of the plant, and learn what they use and make in each building. When this includes a large number of chemicals, the intermediate substances formed at various stages, plus dangerous by-products which may evolve under certain circumstances—the task is a staggering one. In addition to this it is necessary for her to learn the effects of all these chemicals on the human body, become well enough acquainted with toxic symptoms to be able to recognize any suspicious complaints — and know the proper first aid treatment for any and all injuries which could occur. The tremendously rapid development and use of new chemical compounds makes this a never-ending learning process.

The job of the nurse in a chemical plant requires not only continuous learning—but continuous teaching as well. In many cases, where injuries from chemicals are concerned, every second counts. By teaching proper First Aid at every opportunity—to individuals, at safety meetings, or in formal classes —the nurse can hope to educate enough people so that when an emergency arises, either the man himself, or someone with him, will know exactly what to do—and do it fast. In the case of stoppage of breathing from hydrogen sulfide, or carbon monoxide, or electric shock if no one is there to start rescue breathing within four to six minutes the chances of recovery are poor. If chemicals come in contact with eyes, the only thing that will decrease the severity of the burn is water—fast. The best eye doctor in the world could not do any more if he were there when it happened.

From our experience we are convinced that water is the most effective First Aid for chemicals on the skin also; but we have found that trying to change the habits of people who have been using neutralizing agents for years is most difficult. Chemical engineers also have great faith in neutralizing agents. We try to convince them that this is time consuming and could be dangerous. The most important thing is to remove the chemical from the skin as quickly as possible, and water is usually the most accessible. Going for the neutralizing solution wastes time. There is always the possibility of using the wrong thing, and even when it is the right one, the chemical reaction which takes place on the skin produces heat which can cause further damage to the already injured tissue. One of the most dangerous things that people use is alcohol to remove phenol. Phenol will dissolve in alcohol—but both the phenol and the alcohol can be readily absorbed through the unbroken skin! Putting the phenol in solution in alcohol greatly increases the absorbtion rate into the system which could be lethal.

If phenol on the skin is flushed quickly with water—then alternately scrubbed with soap and immersed in cold water for about 15 minutes, eventually the blanched appearance of the skin will disappear, the numbness and tingling will subside, and no burn will result. If the areas are still white after 2 or 3 scrubbings and cold soaks, they can be swabbed with alcohol, which should then be quickly flushed off with water.

The repeated scrubbing with soap and soaking in cold water is a tremendously effective treatment for most chemicals. Those that are volatile and relatively insoluble in water can be treated with alternate cleansing with soap and fanning, until the skin irritation subsides. Prompt and proper treatment of chemicals on the skin carried out for an adequate length of time can make the difference between no injury or a deep, incapacitating, slow healing burn. Most First Aid instructions relating to chemicals merely say "flush with water." They should also include "cleanse thoroughly with soap." This mechanically removes a great deal more of the chemical faster than water alone. The third step should read: "immerse in cold water—or apply cold compresses." This appreciably slows down the penetration of the chemical deeper into the tissue.

Many so called chemical burns are not chemical burns at all but thermal burns. Phosphorus on skin or clothing will not do any damage—so long as it is wet—but when it dries out it burns, producing so much heat that it will cause a third degree burn on hands even through rubber gloves, and cause clothing to burst into flames. Hot caustic or a hot acid combine a thermal burn with the corrosive action of the chemical. Some chemicals even when they are not hot, react violently with perspiration on the skin or the fluid which they withdraw from the tissue, rapidly generating an enormous amount of heat.

I don't know how many of you are using the cold water treatment for burns, but I certainly hope it has been more widely adopted in industrial medical facilities than it has been elsewhere. This treatment was written up in the *Journal of the American Medical Association* as early as 1960. Dr. Alex G. Shulman of Los Angeles, the author of that article, spoke on the same subject at the National Safety Congress in Chicago in October of 1962. The September 1963 issue of *Industrial Medicine and Surgery* contained a paper entitled "The Treatment of Burns with Ice Water, Phisohex, and Partial Hypothermia" by Dr. Iung and Dr. Wade of Hurley Hospital, Flint, Michigan. This paper was originally presented at the 22nd Annual Scientific Session of the American Association for the Surgery of Trauma in October of 1962. In it the authors state, "when a burn occurs, not all the damage is produced at once. The pathological process continues. There is engorgement of the injured vessels with increase in transudate into the interstitial spaces. A large number of cells are killed instantly by the immediate insult but a great number are only partially damaged. The membrane of these traumatized cells becomes more permeable with resultant intracellular accumulation of fluids. As a result of this, many cells undergo necrosis. The final outcome is an external loss of water, electrolytes and proteins. We believe that the cold application can slow down and even stop this sequence of events by producing vasoconstriction, by decreasing capillary permeability, and by reducing the oxygen demand of the cell with resultant drop in cellular metabolism." In their summary they conclude "the advantages of this method are:

1. Immediate pain control
2. Decrease in the amount of intracellular fluid accumulation, and decrease in external fluid, protein and electrolyte losses
3. Prevention of infection
4. Expeditious healing of injured tissues.

We believe that the cold treatment reverses some of the pathological chain of events."

In spite of all this—and after all these years—so far as I have been able to ascertain, this miraculous new treatment for burns has not been adopted by the Armed Forces, is not taught in First Aid classes sponsored by the American Red Cross, and it is not used by the majority of doctors. I was recently asked by our local Red Cross chapter to view a new First Aid training film just produced by a leading drug company. I advised them not to buy it—or to use it even if they received it as a gift. There was not one single mention in that entire film of the use of cold water for burns.

Since 1961 we have been using the cold water treatment on thermal burns, chemical burns, electrical burns even brush burns and sunburn—with amazing results. The effectiveness of the treatment depends first on the speed with which it is initiated—and secondly on the continuation of the cold soak or applications for a sufficient length of time—which may be from 30 minutes to as long as three days.

One of the best results we have ever had involved a heavy cotton work glove which ignited and burned on a man's hand before

systems in one of our larger plants, the following reasons for failure have been noted:

1. Insulation and weather jacket damage or deterioration at fittings, valves, and power connection points.

2. Freezing at points of damaged or inadequate insulation.

3. Freezing of valves and ice plugs in the heads because of low heating capacity or improper installation of heating cables.

4. Cracking of lead and plastic sheaths due to chemical attack.

5. Burnouts due to spot overheating of cables when heat conducting cement washes out or has not been provided to conduct heat from the cable to the pipe.

6. Non-uniform heating in stagnant lines resulting in freezing or high spot temperatures.

7. Failure of thermostats not given sufficient protection from corrosive fumes or materials.

Evaluation of Shower Systems. After considering the deficiencies in the systems tested and studied, the decision was made to standardize on the induction heated shower and eyebath system for areas subjected to freezing temperatures.

Induction heating has several advantages over other heating systems:

1. Heat is generated in the pipe, not in the coils or wiring. Thus, we can expect the electrical system to have a long life; no electrical insulation deterioration or burnouts.

2. Since the pipe is in effect the heater, heat input per unit of length is uniform.

The induction shower system, being uniformly insulated and jacketed with a heavy PVC covering as protection from water and corrosive materials, loses heat uniformly. It may therefore be assumed that a temperature reading at any point is a representative temperature of all other points. This permits the use of a minimum number of thermostats for a multi-level multi-branch shower system. Water, although non-flowing summer or winter, will be held to a fairly uniform temperature throughout the system.

Multi-level multi-head systems now being built incorporate several refinements based on field experience feed back made as recently as May 1968. An important change is the type of thermostat now used. It can be easily replaced by a single craft without the need of disturbing insulation or piping. The eyebath is better insulated, including the strainer body and the valve.

The bulb and capillary temperature sensing element was discarded for a direct acting element after a bad run of thermostats caused a number of costly shower failures. Aside from these failures, which were no fault of the basic design, the performance of these safety showers suggests that we have solved the problems previously listed and have achieved:

1. Close control of water temperature in a stagnant line.

2. High degree of reliability.

3. Greatly reduced necessity for maintenance or inspection.

4. Weather jacket and insulation resists mechanical damage, attack by corrosive materials, and protects the heating system from these plus moisture.

5. Complete protection for the thermostat.

6. Most efficient transfer of heat from the heating surface (pipe) to the water.

7. Uniform heating of all parts of the piping system.

8. Eliminated deterioration of the heating system due to overheating or accelerated attack by chemicals on hot surfaces. (Heat is generated in the pipe, not the coils.)

9. Heated showers and winterized piping can now be purchased completely prefabricated and engineered for a single head, single level, or multihead, multilevel layout.

10. Factory fabricated systems are more economical to purchase and install than job site fabricated systems.

11. Engineering and drafting time formerly spent on showers and eyebaths is now available for the dollar producing end of a project.

12. Overall safety in the operation is improved.

The appearance of the prefabricated and shop assembled induction heated safety shower is better than field fabricated systems. Quality of manufacture and substantial construction instills confidence in the user of any items of safety equipment.

he could pull it off. Fortunately it was winter and he was outside, there was a snowbank there—and most important of all —*he knew what to do.* He thrust the severely burned hand into the snowbank—with immediate relief of pain. Following this prompt initial cooling the hand was immersed in cold water for 16 hours then dressed with a bland ointment. For the next few days the hand was soaked in cold water several hours a day. There was no recurrence of pain and no swelling. In two weeks the hand was healed. Without cold water a burn such as this would have required eight weeks or more of slow painful healing, very probably entailing costly hospitalization and skin grafting.

We also had a severe burn across the instep when a man's foot slipped down into a pan containing steam condensate. Without cold water treatment this type of burn almost always results in a lost time accident of several weeks. The man is unable to wear a shoe because of the swelling, and unable to walk because of the pain. In this case—after about 12 hours of cold soaking the man was back doing his regular job at seven o'clock the next morning. The burn healed completely in two weeks.

It is so simple and so miraculously effective. It requires no special equipment. Cold water is immediately available almost everywhere—at home, at work, on a camping trip—unless you happen to be camping in a desert. It relieves pain instantly—and has a built in timer. If pain recurs when the injured area is allowed to return to normal body temperature further soaking is needed.

The initial appearance of a severe burn is frequently deceiving. As Doctors Iung and Wade stated in their report, not all the damage is done at once. The pathological process continues—and from our observation all burns—whether thermal, chemical or electrical follow this same pattern for about three days. Even though the pain has subsided, the longer the injured area is kept cold during this period the better the results.

As the cold water treatment of burns gradually becomes better known and more widely used, burn ointments and salves will become obsolete. Frequently no dressing at all is needed following the use of this treatment. When a protective dressing is necessary a mild bland ointment will prevent the injured area from becoming dry and uncomfortable between soaks. In the case of extensive burns where the patient must be taken to the hospital, surgeons urge strongly that no grease or salve be used. Dr. George Collentine, Jr., director of the hospital burn unit in Milwaukee, stated in the March 1968 issue of *Industrial Medicine and Surgery,* "we wish patients would come to us with a simple application of the cleanest cold, moist cloth available, period, exclamation point, that's all. There isn't anything that will give more comfort, prevent further contamination of an easily infected wound, and will interfere less with the definitive management at a place of final treatment than a cold, moist cloth."

The nurse can become a useful member of the occupational health team by diligent learning and constant teaching: and the widespread knowledge and use of proper First Aid can appreciably lessen the severity of an injury, but it does not eliminate the accident, or change the conditions that caused it. The occupational health team as a whole can only help to implement the basic program which exists. Too many people think that safety is the job of the safety department, just as they regard selling the business of the sales department or developing new products the responsibility of the research group. Psychologically it might be a good idea to change the name of the safety department to something else. Safety cannot be achieved by any one group. There is no magic formula. No posters, parties, prizes or other gimmicks will bring it about. It can only be accomplished by a firm policy based on the sincere conviction that an initial investment in safe engineering, preventive maintenance, good housekeeping, adequate job training and a good medical program more than pays for itself—and when strict adherence to these principles is demanded at all times of every group and every individual.

PREVENTION REQUIRES TEAMWORK

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In today's society, no group can be isolationists. We must pool our efforts and resources to achieve our ultimate goals.

Our present daily living is enhanced by the products which chemical engineers have made possible through research, ingenuity, and perseverance. Those of us who are concerned with the employee's health are indirectly making a contribution to this overall effort for better living. Even though our work differs greatly, there is some degree of similarity. We are all concerned with the proper performance and maintenance of the machines involved in our work.

The human machines about which industrial nurses are concerned are extremely complicated and have intricate systems with complex functions; for example, the nervous, circulatory, glandular and digestive systems. Man has yet to build a comparable machine.

In your man-made machines, you are concerned with the efficiency of valves, joints, pipes, pumps, and the proper temperature of the operation. We have similar problems and concerns with comparable human parts. In both types of machine, protection and maintenance are essential for smooth operation and maximum output.

If we are successful in our job of human engineering you will then have healthy, alert operators for your machines. Incidentally, these human machines are essential because of their sense of hearing, sight, smell, taste and touch—you have not been able to duplicate these and they are essential for the production of man-made materials. There is one very important difference between the human and man-made machine—you can prepare a formula, process it through a machine and get a duplicate of your results from repetitive performances. In the human machine, there is extreme variation in both the reaction and reaction time.

One human machine will respond favorably or tolerate a certain chemical while another will react violently to an equal amount of exposure to this same chemical. We human engineers must constantly be alert to these "extreme reactors" in order to be prepared for emergency action. Some human machines react adversely to a simple medication such as aspirin or even to the pollens in the air. The American Medical Association recently gave additional emphasis to this problem of adverse reactions to occupational exposures by setting up a registry prepared by a special committee on occupational toxicology. Doctors and nurses in industry are urged to report all adverse reactions, giving specific information that will enable further research into the area. Your awareness and cooperation will certainly help to make this study a success which will enable us to better cope with this problem.

The effectiveness of the health services team depends upon its awareness of the chemicals involved and the amount of human exposure. In evaluating the extent of the hazard we in the medical field need to know the following:

1. What chemicals are being used?
2. The toxicity and physical properties of these chemicals:
3. The probability of absorption by an individual.
4. The time and concentration of the exposure.
5. What control measures are being used?

You have access to and can furnish much of this information. For this reason we welcome this opportunity to be with you today to explore areas of common concern and ways in which we may more effectively work together. Quite frankly, *we need your help* and we think you need ours. The area in which we can all make our greatest contribution is that of PREVENTION.

The Procurement personnel could tell us what chemicals are purchased and the Plant Manager could tell us that they will be used to manufacture a certain product; but only you can supply the needed information regarding combinations, concentrations, processes and length of exposure of these chemicals. Presently this is our Achilles heel in the early diagnosis of adverse reactions. If we are to exercise preventive measures, we must know where and to what extent hazards exist

as well as to keep a constant vigil for early signs and symptoms of toxicity.

If I may suggest, the following are specific areas in which your cooperation is invaluable:

Identification

Education

Environmental and personal safety

In *identification* the following information would be most helpful:

1. What chemicals are involved in the manufacturing process?

2. What are their concentrations?

3. What is their threshold limit value or maximum acceptable concentration in the air (USASI)?

4. Are all containers adequately labeled?

5. In the occurrence of adverse reactions or toxicity, would the mode of entry be by swallowing, inhalation, or skin or mucus membrane absorption?

6. What would be the very early symptoms of toxicity?

If you are not aware of these things, may I suggest that you request this information from the supplier, particularly if it is a new material. The significance of such early warning signs as dull headache, nausea, nervousness, excessive fatigue or cough could go undetected unless we are aware of these exposures. You can be our first line of defense by being alert to any apparent physical or behavioral changes in an individual. A change in color or personality or complaints of dizziness, sneezing, visual difficulties, cough, inertia, tremors, or pain could be warning symptoms. We urge you to alert the Medical Department to the possibility of any chemical exposures and to send any employee with vague or persistent physical complaints to us for evaluation.

If you are "tuned in to our frequency" you will see to it that any employee with such complaints is referred to us for early diagnosis. Be certain to communicate even vague suspicions of toxicity to us and explain the reason for your concern. This is being a humanitarian, not an alarmist. It is very much better to err on the side of safety than to be sorry later. Believe me, we in the field of industrial medicine welcome the assistance of non-medical personnel in early detection of physical peculiarities of fellow workers and setting in motion appropriate steps to prevent serious trouble. With your cooperation, early diagnostic tests along with prompt action may avert many potential tragedies.

Regarding *education*: Intra-departmental educational programs are extremely important. Knowledgeable as you are I fear that even you are sometimes guilty of complacency. There is an old cliche that familiarity breeds contempt; may I add that it can also breed disaster. You have an obligation to yourself and to your subordinates to exercise safe practices and insist upon the same performance by others. These chemicals do look quite harmless, and it is difficult for people with minimal training to realize their dangerous potential. Chemical engineers should develop a sixth sense—a constant awareness of danger both immediate and long range. Safe practices and the wearing of adequate protective equipment should be both practiced and taught. Remember, makeshift safeguards are frequently inadequate and should not be used. Men do not become immune to the effects of toxic chemicals. On the other hand, they may become acutely sensitive, and there isn't anyone too big or too tough to be affected.

Another reminder is that maintenance personnel are people. They, too, are susceptible to exposures and should be protected. Their knowledge of the danger involved cannot be compared to yours; therefore, it is your responsibility to protect them. Indifference on your part could result in serious injury or death. You could be just as guilty in this way if someone died as if from your reckless driving someone was fatally injured. This is a nightmarish thought, but it is true.

Related to this problem is another responsibility which is presently being given more emphasis — the causal relationship between work exposure and chronic disease. I now come to my third area—*environmental control.*

I feel that a check list would be helpful in seeing that safety within the department is adequate, and the following questions should be asked:

1. What regulations, codes or standards are applicable and have they been met?

2. What are the threshold limit values and toxic hazard ratings of the chemicals involved?

3. Is toxicity data and fire hazard information available and properly publicized?

4. Is there a written procedure for the safe handling and storage of materials?

5. What about dust control, clean-up after spills, and waste disposal?

6. Are the ventilating and exhaust systems adequate? If hood enclosures are needed, are they adequate? Are filters used to reduce air polution?

7. Does the plant layout minimize exposure?

8. Are sanitary facilities adequate—including those for food, drinking water, and showers?

9. Is the plant well equipped with safety appliances such as showers, masks, respirators, eye fountains, and ventilating fans? Are safe operating procedures outlined and enforced?

10. Is there an emergency or disaster plan, and is it reviewed periodically?

11. Are the nursing and medical personnel involved? Do you invite the plant nurse to attend your departmental safety meetings? Do you alert the medical personnel to any addition of materials or changes in processing?

Another item worthy of mention from the toxicologic point of view is, could you use a less toxic chemical? For example, petroleum spirits instead of carbon tetrachloride or isopropyl alcohol rather than methyl alcohol. In our use of drugs in medicine there is a term for using a more potent drug than necessary—"Never send a man to do a boy's errand." Think about it. This could be one way of minimizing exposure to extremely hazardous chemicals. The prevention of exposure beyond individual tolerance is important from both a humanitarian and a production point of view.

Another aspect that should not be overlooked is COST. To give you an idea of the proportions of this problem, let's consider contact dermatitis as an example. Seven out of ten industrial disease claims paid by compensation insurance companies are for temporary disability for dermatitis. The dollars involved in the direct cost of this "skin problem" annually is over one hundred million dollars. One out of every four employees is exposed to some skin irritant and approximately one per cent develop dermatitis. We are talking about 600,000 cases. These are very conservative estimates. With new materials and processes being developed daily, it is not difficult to visualize the enormous proportions of this one aspect of the adverse reaction problem. Contact dermatitis is the least dangerous of these reactions. Internal injury from inhalation, ingestion or absorption of a dangerous chemical is much more serious and the prognosis is less favorable.

Another important factor is that early detection of disease due to these insidious processes is not as readily observed as in an obviously irritating condition such as dermatitis. This is unfortunate because the damage to an internal organ is not only much more serious, but often irreversible. History has recorded millions of tragedies due to exposure to dangerous chemicals and the majority could have been prevented. The list of hazardous materials grows longer each day; however, we no longer need to bear the "physical mark" of our trade or profession. While the list of hazardous materials has increased, so has our knowledge of proper handling, protection, prevention, early diagnosis and treatment. Our greatest hurdle is that of communication—of being informed. It is to this point that I would like to direct my closing remarks.

Chemical engineers have the reputation of having keen, inquiring minds. Would you please keep the following thought in mind: "The health engineering departments need the close cooperation of the chemical engineers and the importance of close communication and flow of information regarding the many hazards involved in your work." The medical personnel can, in turn, be more effective in protecting the employee. This includes you as well as your fellow workers. Bearing in mind the increased hazards of environmental pollution and radiation, the day may come when teamwork is essential for survival. Why not begin NOW in our places of work?

AN INTEGRATED APPROACH TO OCCUPATIONAL HEALTH MANAGEMENT

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The term "occupational health" denotes the complete effort on the part of a wide variety of specialists to safeguard the health of working men and women. These individuals work in a wide variety of establishments, governments, teaching, research institutions, and industry, as well as in voluntary organizations such as the National Safety Council. Each of these people approaches the problem from a different view-point. This report is restricted to those people working in industry, particularly those working in the chemical plant.

The occupational health team in the chemical plant consists of three groups:

The occupational medicine group consists of physicians, nurses, x-ray and laboratory technicians, and other paramedical and clerical people.

The occupational safety group consists of the safety engineers, safety inspectors and their assistants.

The industrial hygiene group consists of industrial hygiene engineers, chemists, laboratory technicians, and people from other engineering and science disciplines who assist in various special instances.

This team is augumented by individuals from other plant departments whose primary function is in some other field, but who must maintain a constant awareness of safety in their work.

The process engineer must give safety a high priority in designing equipment and specifying materials. The plant engineer takes safety into account in designing and in building water supply and waste disposal systems. Lastly, the line supervisor, without whose constant efforts no safety program can be maintained.

The thesis of the occupational physician as part of a team would not have held 30 or 40 years ago. At that time the physician rarely functioned as a part of an industrial organization. He was more likely to be a surgeon who saw trauma cases in his office or at best, one who came into the plant a few hours a week to hold a "sick-call" type clinic. His responsibility was to suture lacerations, repair hernias, reduce fractures, amputate severely injured parts, and otherwise treat injured employes. He was either a completely independent practioner or one who, because of a retainer, was a sort of honorary employe who rarely was regarded or regarded himself as a part of any team.

Gradually over the years, the concept of preventive medicine has assumed a greater importance with priority being given to the prevention of injury and disease rather than repair.

There are many companies whose small size does not justify a full-time physician as a part of the organization. Perhaps my remarks should be directed more so to the industrial giants with an elaborate staff organization. What I am attempting to define is ideal relationships which, after all, should be the goal of all of us. These concepts must, of necessity, be modified to fit individual situations, but even in a small company that has no physician in its employ they still apply.

It is entirely practical to make an arrangement with a local physician to render most, if not all, of these services without his being even a half-time employe. It is good practice in all occupational medical situations for the physician to familiarize himself with the problems and requirements of the industry to whom he provides service. My own company has a number of small pesticide plants. A couple of them have less than ten employes. While I can provide overall supervision of their health affairs, they are dependent on physicians in the community in which they are situated for their every day medical needs.

In my experience, the closest and most continuing relationship of the medical unit has been with the safety department. This is not unique with me. It is shown by the

organization charts of more and more companies who are combining the two groups into a "Health and Safety" department. With the chemical exposures of our modern technology, it is indeed difficult to demonstrate the boundaries of each one's responsibility. Since the interactions of disciplines are obvious in combined departments, my comments will apply to those situations where separate departments exist.

The physician has many opportunities to reinforce the effectiveness of the safety supervisor. In the performance of preplacement physical examination, the physician makes a judgment of the congruity of job demands and applicant abilities. The principal purpose of the examination is to evaluate the ability of the applicant to do the job in question without undue hazard to himself or others. One would not approve as a truck driver an applicant with tunnel vision due to glaucoma, although it were corrected to acceptable visual acuity. On the other hand, he could probably do certain assembly jobs with no problem. A logical extension of this concept is the periodic health appraisal. Here the doctor must, at times, recommend a job modification or change of assignment for an employe who has developed a health defect. A person whose blood pressure has become significantly elevated should not be permitted to continue work that requires climbing. The company can continue to benefit from his valuable skills, however, on a ground-level job.

The physician performs an epidemiologic function for the safety supervisor. By carefully noting the time, place, and mode of injury, as well as equipment and people involved, individual accidents can be better investigated and a pattern of injury can be developed. A disproportionate number of a certain type of injury at a given place or time identifies a safety problem that demands solution. It can be done very simply with 5x8 or 3x5 inch cards that have certain data written in the center and holes for punching out around the edge.

Of course, this is not new, but often the simple things are overlooked these days. Naturally, any sort of information may be punched along the edge. Different color cards may be used for disabling injuries, hospital cases, etc.

Using this sort of data processor, the physician can easily determine the incidence of eye injuries, for instance, and subcategorize them by type of work, by plant area, or other parameters. This approach will also identify individuals who have a higher rate of injury. Since the identification of a problem is a significant step towards its solution, the value of this type of information is obvious.

In some cases, it is advantageous to have someone alert the safety director as soon as an injured employe arrives in the medical treatment unit. If doing so does not impede medical treatment or place a burden of harrassment on the patient, there should be no objection to the safety director interviewing him right in the medical department before he is sent home or is taken to the hospital. The doctor's judgment should prevail in the selection of this approach. Information about the accident obtained at this time is frequently better than that obtained at a later date, and the safety department has the opportunity to investigate the situation while the conditions that surround the accident prevail.

The third component in the industrial health triad is industrial hygiene. This is a multi-disciplinary group composed of people with a very wide scope of backgrounds and interests. The first industrial hygienists were usually trained in one of the engineering fields or in chemistry. In this industry, chemical engineering is probably the most commonly seen background. More recently, specific graduate training programs have been instituted in a number of universities to develop experts specifically in industrial hygiene. This is so broad a field, however, that for one individual to become expert in all its sub-areas is indeed an accomplishment. For this reason, people trained in specific fields are still needed in industrial hygiene programs. This is patently true if health physicists are considered part of this group. These are scientists trained in the field of ionizing radiation as it applies to human health. The ever widening use of radioactive materials in chemicals has made their work more and more important. For convenience, they are grouped with the industrial hygienists here, but in many organizations they form a separate unit.

The physician, as a result of his epidemiologic approach to occupational disease

and injury, identifies processes in areas where an evaluation of the environment is needed. This evaluation may take the form of a noise-level survey, or a determination of the level of atmospheric concentration of a vapor or dust, or the level of ionizing radiation measurement. Among other things, the industrial hygienist checks air flow characteristics of mechanical exhaust ventilation systems to assure himself that the direction and volume of air moved is sufficient to carry unwanted substances from the breathing zone of the worker, as well as the general atmosphere.

Often the industrial hygienist will make a routine survey of a plant or area, checking noise levels or sampling for a specific contaminant, such as carbon monoxide, solvent vapor or silicon-containing dust. The results of his survey are evaluated with the physician's assistance to determine whether a health hazard exists.

The doctor may assist the hygienist in evaluating various parameters of human physiology. With modern telemetric instrumentation, it is possible to measure many responses such as body temperature changes, heart rate, and oxygen consumption while the employe is performing his usual duties. Similarly, it is possible to take an electrocardiogram and evaluate the ability of the heart to respond to various stresses. If this is done while the hygienist is recording the levels of physical or chemical substances in the worker's ambient air, a much more accurate judgment as to the need for any engineering changes in equipment or personal protective devices for the employe can be determined.

In conjunction with the plant engineers, the physician is concerned with the water supply and waste disposal systems of the plant. Frequently, it is advisable to channel the flow of employes going to and from work in a particular direction so as to insure their using proper personal decontamination procedures. In many plants, for instance, there is use of double locker rooms with a shower room between them. The employe coming to work leaves his street clothes in the "clean" locker room and then goes to the "shop" locker room to put on his work clothes. Going home he reverses the procedure placing his work clothes in a container for laundering and then showering before resuming his street clothes. This prevents his carrying any toxicant home on his clothing and terminates any absorption thru the skin.

Emergency shower and eye irritation fountains are important first-aid devices in the treatment of chemical spills and splashes. For most effective use, they should be properly located throughout the plant with easy access for those who may need them. The doctor should review layout plans for new installations to insure their most advantageous locations.

The process engineer consults with the doctor on the biologic effects of materials to be used in manufacture or formulation of the plant's products. The latter provides him with advice and information on toxicity and biologic response to the chemicals whose use is contemplated. The design and arrangement of machinery usually can be modified in the planning stages so as to minimize any hazardous exposures to the plant personnel. One of the basic principles of hazard control is the substitution of less hazardous materials for those whose potential for injury is greater.

Other aspects of the industrial physician's work have a positive effect on plant safety. Counseling is one of them. Anything that improves the employe's general health helps make him a safer worker. When the doctor discusses a health abnormality as prosaic as overweight and motivates the employe to lose his excess poundage, he has probably decreased the likelihood of injury a bit. Similarly, advising a worker of a need for a new eye glass prescription points out a potential negative influence on safety.

Skilfull and proper treatment of industrial injuries and diseases decreases the duration of morbidity, and, thus, enhances one aspect of the safety picture, namely *severity*.

Summary

Outlined here, in some detail, are the efforts of the industrial physician in the general field of accident prevention using the chemical plant as a specific milieu. Assumed is an ideal staff organization in a company large enough to justify staffing the various individual activities which contribute to employe health and safety. In this situation, the physician relates to these various other experts in the discharge of their specific responsibilities. He works most closely with the safety engineers and the industrial hygienists. In various special situations, he pro-

vides advice and technical assistance to line supervisors, process engineers and plant engineers. In some instances, his activities reach outside the plant itself when he advises product development people on potential hazards to users of the goods the plant makes. Briefly traced is the development of occupational medicine to this point from its beginning in the surgery of trauma. It is only by this concerted effort on the part of all who are concerned with the welfare of the employe in his work situation that the goal of all in the prevention of accidents and illness can be achieved.

HANDLING CRYOGENIC FLUIDS IN THE LABORATORY

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The use of cryogenic fluids has broadened and increased sharply in recent years as a result of expanded research and development applications and the advances in space, missile, and electronic industries. A considerable amount of safety information has been developed for the safe handling of these fluids and this has been well documented in the literature. Reference to some of the literature is included in this paper.

The objective of this paper is to present some of the general safety practices particularly related to the handling of liquefied atmospheric gases, H_2 and He, in laboratory operations.

Properties of Liquefied Atmospheric Gases

Safety in the laboratory handling of liquefied atmospheric gases, as with other chemicals, is primarily a matter of knowing their properties and taking reasonable precautionary measures to minimize hazards.

Potential Hazards

The properties of these fluids present the following potential hazards:

1. The fluids are extremely cold and in contact with the skin produce an effect that is similar to a severe burn.
2. The low temperatures have a drastic effect on the properties of materials. Many kinds of steel lose almost all ductility and impact strength at these low temperatures.
3. These fluids will inevitably vaporize to gas with an expansion of 700-800 times in volume at atmospheric conditions. Adequate relief must be provided wherever liquid can be trapped.
4. The ultra low temperatures of liquid helium and hydrogen will solidify all other gases. These solidified gases could plug small openings and cause pressure failures.
5. The released gases from these liquids present additional potential hazards. Thus:
   a. Oxygen enrichment increases the fire potential.
   b. Inerts like N_2 and Ar are non-life supporting and present an asphyxiation hazard.
   c. Hydrogen is flammable.

Personnel Protection

The extremely low temperatures of cryogenic fluids can cause skin injury similar to high temperature burns. Contact with the cold gas vaporizing from the liquid or with cold equipment or piping can produce the same effect. Delicate tissues such as those of the eyes are most vulnerable to exposure to cold gas or liquid.

Eye protection is a must when working with cryogenic fluids. Wear a face shield or safety glasses that provide protection against splashes. Safety spectacles with side shields are the minimum protection recommended for laboratory operations.

Avoid contact of any part of the body with liquid or uninsulated cold equipment or piping at cryogenic temperatures. Wear clean, dry gloves when handling cold equipment. The gloves should fit loosely so that they may be thrown off quickly if liquid should splash or spill on or in them. Asbestos gloves are preferable, but leather gloves are satisfactory.

Use tongs to withdraw specimens or objects immersed in liquid.

Cryogenic Hardware and Design Considerations

In assembling laboratory systems for cryogenic operations, it is essential to consult with someone thoroughly experienced in low temperature work.

The materials used must possess certain physical properties to qualify them for use at these extremely low temperatures. Ordinary carbon steels, for example, lose almost all their ductility and impact strength at these temperatures and become extremely

Helium. Helium is in a class by itself. The liquid will solidify all other gases. As with hydrogen, the problem of backflow of air into liquid helium systems is critical. It is the major safety hazard with liquid helium and hydrogen handling.

Because of the general nature of this paper, the highly sophisticated procedures necessary for the safe handling of this unique cryogenic fluid will not be covered here. Only personnel completely familiar with these complicated procedures should attempt laboratory work with liquid helium.

Conclusion

As with other chemicals, cryogenic fluids can be handled safely in the laboratory if their properties are known and reasonable precautionary measures are taken to minimize the hazards related to the properties.

Bibliography

1. Neary, R. M.; "Air-Condensing Cryogenic Fluids", National Safety Congress Transactions, Chicago, Illinois, 1963.
2. "Precautions and Safe Practices for Handling Liquefied Atmospheric Gases", *Technical Bulletin F-9888-G*, Union Carbide Corporation, Linde Division.
3. Zabetakis, M. S.; "Safety With Cryogenic Fluids", Plenum Press, New York, 1967.
4. "Liquid Oxygen" National Safety Council, *Data Sheet 353* (Revised), 1959.

FERTILIZER SESSIONS

CAN YOU STOP?

By RICHARD D. MONTGOMERY
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Can you stop a loaded 1,000 gallon anhydrous ammonia nurse tank weighing approximately four tons, a loaded dry spreader weighing four or five tons, or a loaded 1,000 gallon solution nurse tank weighing five or six tons while they are being towed at 35 or 50 mph? There is no doubt that this equipment can be stopped, but stopping it safely under an emergency situation while it is being towed with a light pickup truck is another matter.

We are relatively new in the retail fertilizer business, but after only one year of operation, in which time we had rolled several nurse tanks, it became very apparent that the towing of this equipment could create a hazardous situation. We were concerned not only about the safety of our own employees, but the safety of our customers and the general public as well. The incidents that were experienced had not resulted in personal injury or any large liability claims, and only in one case was there a release of product; nevertheless, a potentially disastrous condition was there.

After appraising the problem, it was mutually agreed that we would establish safe towing speeds. We contemplated 35 mph, which if nothing else, at least sounded like a safe speed. But we had no basis for this figure, and if we were going to establish and enforce such a rule, we needed additional information. We conducted two days of tests that involved 1,000 gallon anhydrous ammonia nurse tanks with both wagon and tandem style frames, 1,000 gallon solution nurse tanks, four ton dry spreaders, 420 gallon solution applicators, and 300 gallon anhydrous ammonia applicators. The tests first involved the equipment being towed while empty, then loaded, on two types of dry road surfaces — gravel and asphalt. The asphalt surfaces were coarse, in that the asphalt had not bled through over a period of time, which would have made it smooth and slippery. Experienced drivers were used, each of whom had several years of experience in towing this type of equipment. To tow the equipment, we used ¾ and one ton pickup trucks with no weight in the bed. The mileage on the ¾ ton trucks was 1,100 and 1,400 miles, and on the one ton truck 11,000 miles; therefore, brake lining and drums were in good condition. The primary purpose of the test was to see how far it took to stop this equipment during an emergency stop, while traveling at various speeds. We started out at the slower speeds, then increased speeds in increments of five miles per hour. (At this point, a film of the tests was shown.—Ed.).

We found that towing this equipment at speeds we normally consider to be safe is most certainly an invitation to a disaster. In most cases, at speeds of 30-35 mph the towing vehicle could not control the direction of the equipment being towed. In fact, jackknifing occurred in most cases, and many times the pickup truck was pushed to a point where it came to rest sitting crossways in the road. This too, points out an additional hazard.

For equipment towed by the ¾ ton truck, braking distances in feet were:

Equipment		*MPH*	*Distance in Feet* *Asphalt*	*Stone*
Spreader	Empty	35	45	66 (JK)
	Full	35	160	(OC)
420 Gal. Sol. Applicator	Empty	35	83	(OC)
	Full	35	95	No Test
	Full	30	56	88

(Continued on next page)

Equipment		*MPH*	*Distance in Feet* *Asphalt*	*Stone*
Solution Nurse Tank	Empty	30	58 (JK)	70 (JK)
	Full	20	60	81 (SJK)
	Full	25	125	150 (SJK)
NH_x Nurse Tank (Wagon Style Frame)	Empty	25	No Test	48
	Empty	30	59 (JK)	No Test
	Empty	40	105 (OC)	No Test
	Full	25	90 (SJK) (OC)	95 (SJK)

Note: JK—Jack-Knifed; SJK—Severe Jack-Knife; OC—Out of Control.

As can be readily seen, it takes a considerable distance to bring this equipment to a fast stop. These drivers knew when and where they were going to start stopping, so to be realistic you would have to add additional footage for reaction time. Using an average time of ¾ second to go from accelerator to brake pedal, you would have to add 33 feet at 30 mph, 38.5 feet at 35 mph, and 44 feet at 40 mph.

From these tests, we established what we feel to be maximum safe towing speeds. For dry spreaders, all applicators, and anhydrous ammonia nurse tanks, the speeds are 20 mph loaded and 25 mph empty. For solution nurse tanks, 15 mph loaded and 20 mph empty. This is in line with the various SMV emblem laws in most states.

The immediate reaction is, "That's ridiculous, we don't have that kind of time," "Too slow," or, "You are not being reasonable." But if you were to analyze the average distance from the plant to your customers, you would no doubt find it to be less than 10 miles, so when you consider the difference between 40 and 25 mph for a distance of 10 miles, you're talking approximately seven minutes. I can only ask, "Is the seven minutes worth the chance?" We don't think so!

So far this year, we have experienced one accident while towing this type of equipment. While traveling at 20 mph on a dirt road, towing a loaded four ton new spreader behind a ¾ ton pickup, the front wheel on the left side of the spreader locked and came off. The erratic action of the spreader forced the truck into a ditch 84 feet from where the wheel came off. The spreader turned over, but the truck remained upright. Injuries were a bruised shoulder, arm and leg; a bruised hand; and a laceration of the chin requiring six sutures. What would have happened if the speed had been 35 or 40 mph? I don't know, but considering what can happen at these higher speeds, a fatality would not have surprised me.

We do not consider ourselves experts in the field of establishing safe towing speeds, and we do not wish to convey that thought, but if, as a result of our work in this area, we have stimulated your concern to the point that you take a serious look at this potential hazard, our mission has been successful.

TRUTHS ABOUT AMMONIUM NITRATE

By A. F. DYER
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Since the close of World War II ammonium nitrate has become an economical source of nitrogen in the agricultural industry. Prior to the war, ammonium nitrate had long been known as a potential fertilizer, but the lack of sufficient production limited its broad application in the agricultural industry. However, with the increasing demands brought on by the war, the United States Government became a major producer of ammonium nitrate. When the military demand for ammonium nitrate declined, the Army ordnance plants were put to civilian use. Thus, substantial quantities could be produced and more widespread use of the product was possible.

Ammonium nitrate, as originally produced, was unsuitable for direct agricultural application. It was highly hygroscopic and deliquescent and would readily cake into a solid mass. In order to alleviate these difficulties, wax coatings were added to ammonium nitrate fertilizers. The development, however, brought on problems which were not apparent at the time.

In view of these difficulties, the industry conducted a program in product improvement and handling. This program was successful in developing a product of entirely different physical characteristics, consisting of uniform size pellets coated with small amounts of inert material. Research was also conducted on the proper methods of car-loading, ship-loading, and warehouse storage. These findings, combined with the extensive know-how obtained from our many years of marketing, have enabled industry to not only market an improved product but to recommend safe warehousing practices.

However, the unfortunate incidents which occurred at Texas City, Brest, and Oppau have focused public attention upon the handling, transportation, and shipping of ammonium nitrate which at the time was a wax-coated material. Immediately after the Texas City incident, the U. S. Coast Guard put into effect much stricter regulations for the handling and transportation of ammonium nitrate.

As a result of these incidents, the Secretary of the Treasury directed the Coast Guard to organize the Interagency Committee on the Hazards in Transportation of Ammonium Nitrate. The Committee was made up of representatives from the Ordnance Corps, Bureau of Mines, Bureau of Explosives, National Bureau of Standards, and the National Academy of Sciences—National Research Council. Also, assistance from interested organizations, such as Association of American Railroads, as well as many university authorities and industry experts was enlisted. The Committee's objective was to study every possible aspect of the characteristics of ammonium nitrate, to evaluate suggested proposals for insuring safety in transportation, handling, and storage, and to recommend a national policy in conformity with these objectives.

The industry has also conducted additional independent studies on ammonium nitrate and as a result has developed a product which has improved safety characteristics as well as improved quality, making it entirely safe to store, handle, and transport, and satisfactory for application with the customary farm machinery.

Fertilizer grade ammonium nitrate is an oxidizing material and can support combustion if involved in a fire with combustible materials. With simple precautions, fertilizer-grade ammonium nitrate is stored safely at the plant, in distributors' warehouses, or on the farm. The burning rate of paper or polyethlene bags and any combustible dunnage such as paper, wood, etc., will be increased by the presence of ammonium nitrate. So long as the products of reaction escape freely and the back pressure of the gaseous products does not rise excessively, burning combustible material in contact with ammonium nitrate will not lead to an explosion. As in the case of any oxidizing agent which stimulates the burning of combustible materials, ammonium nitrate deserves common-sense treatment during transportation, storage, and use.

As a result of the successful handling of millions of tons of this material, the U. S.

Coast Guard and the Interstate Commerce Commission are now convinced that the present fertilizer grade ammonium nitrate (which both agencies classify as an oxidizing agent) can be handled safely and have relaxed their requirements for the shipment of this product. Also, many municipal authorities are rewriting their regulations governing the handling and storage of ammonium nitrate in view of the characteristics of the improved product and industry's more complete knowledge and understanding of the product.

Further evidence of the safe handling and storage of ammonium nitrate can also be found in the industries that manufacture the product. Phillips Petroleum Company has warehoused amounts ranging from 50 to 7,500 tons in over 40 locations around the country. The industry, as a whole, has warehoused and shipped over 13,000,000 tons since Texas City (and the annual rate today is over one and one-half million tons per year) with excellent experience. This is a testimonial in itself of the excellent safety-record of the industry. Probably few other classified or regulated commodities can boast of a safety record as good as this.

In the land transportation of ammonium nitrate, there has never been an incident where it has been known to cause any unusual difficulty in case of derailments, fires, or handling even when the material was subjected to intense fire from the other goods involved. Similar results have been experienced with ammonium nitrate stored in warehouses where it has become involved in fire started in other stored goods. In no case has there been any unusual difficulties as a result of the presence of ammonium nitrate, nor has there been any explosion of ammonium nitrate in warehouse fires.

One other fact that has received much publicity lately is the widespread use of ammonium nitrate as an ingredient in blasting agents. The manner in which this subject has been handled in the trade-press and in advertisements has resulted in a great deal of misunderstanding regarding the properties and characteristics of ammonium nitrate fertilizer. Ammonium nitrate is not an explosive. Ammonium nitrate is relatively inert in itself. When blended with the proper proportion of diesel fuel or other sensitizing ingredient, and primed with a detonator, it is useful in blasting operations. However, it should be emphasized that the ammonium nitrate must be sensitized first. In actuality, it is only one of the components rather than the sole ingredient as is commonly inferred in the dramatic type of article where the technical details are either left out or ignored.

When ammonium nitrate is compounded with fuel (or diesel) oil, nut hulls, carbon black, or other similar substances it is classified by the ICC as "nitro-carbo-nitrate." It no longer has the properties of ammonium nitrate fertilizer and should not be referred to or treated as such.

In view of the seasonal nature of the ammonium nitrate market and the ever increasing use of the product, it is becoming more and more necessary to acquire additional warehouses and storage facilities. The vast experience gained through the years in the safe handling of millions of tons of this material has been instrumental in the modifying of municipal regulations permitting greater latitude on storage requirements. However, it must be remembered that the precautions which have been developed through the years for the safe handling of ammonium nitrate must be observed. This knowledge can be summarized in the following recommendations.

General. These recommendations apply to both bagged and bulk storage.

1. Fertilizer grade ammonium nitrate may be stored in either a warehouse or a storage structure that is capable of ventilation or is of a construction that will be self ventilating to permit escape of products of decomposition and heat in event of fire. Wooden structures are permissible.

2. Allowable height or depth of stored material is limited by the pressure setting tendency of the product. However, in no case should the ammonium nitrate be piled or stacked higher than 36 inches below the rafters of the roof or supporting and spreader beams overhead.

3. Ammonium nitrate should never be stored in an area subject to contamination by organic chemicals, flammable liquids, corrosive acids, chlorates, permanganates, finely divided metals, or sulfur. It is especially important that such reactive materials should not be stored either above or below the ni-

trate, since accidental breakage of containers might permit mixing, with consequent danger of fire.

4. Ammonium nitrate should not be stored in close proximity to steam pipes, radiators, and similar sources of heat.

5. Floor drains into which molten nitrate could run during a fire should be eliminated or plugged. If stored directly on a concrete floor, it is advisable to cover the floor first with a moisture barrier, such as a plastic sheet.

6. Spilled material should be cleaned up promptly and removed.

7. Observe "No Smoking" rules.

8. Open flames should be prohibited adjacent to ammonium nitrate.

9. Fire hydrants, exterior of the storage spaces and conveniently placed, with adequate hose available, and capable of extension to all parts of the storage, should be provided if the warehouse or storage structure is located in a built-up area.

10. Warehouses or structures used for ammonium nitrate storage should be clean and be maintained in good housekeeping order.

11. Explosives should not be stored with fertilizer grade ammonium nitrate unless the storage facilities are designed and approved for the storage of explosives.

Bagged Storage

1. Bags of ammonium nitrate fertilizer should be stored not less than thirty inches from the storage building walls. Good warehousing practice dictates that bagged ammonium nitrate should be stacked to facilitate accessibility. Walkways of sufficient width to permit foot traffic should be provided at reasonable intervals around the stacks to allow inspection of stock. These walkways should be kept clean. Width of main aisles should be governed by the requirements of the material handling equipment used.

2. Bagged fertilizer grade ammonium nitrate may be stored on dry, clean concrete floors, or on wooden pallets or dunnage on any type of clean floor.

3. A broken or cracked bag containing uncontaminated fertilizer grade ammonium nitrate may be salvaged by placing it inside a clean, new slipover bag and closing securely.

Bulk Storage

1. Since ammonium nitrate is a hygroscopic material (which tends to absorb moisture) it must be protected against contact with damp surfaces and exposure to humid atmosphere. Buildings and structures used for bulk storage should be dry and free from water seepage. Atmospheric exposure can be reduced by covering the material in storage with a plastic sheet.

2. The warehouse may be sub-divided by partition walls into any desired number or size of bins. In determining arrangement and capacity, so as to minimize caking of the ammonium nitrate, consideration should be given to the materials handling equipment, temperature and humidity in the warehouse, the length of time the nitrate is to be stored, etc.

3. Pressure setting is a factor affected by humidity and temperatures in the storage space and by pellet quality. Temperature cycles through 90°F and high atmospheric humidty are undesirable for storage in depth.

4. Due to the corrosive action of ammonium nitrate on galvanized iron, copper, lead, and zinc, they are not recommended where ammonium nitrate may come in contact with them. Wooden surfaces in contact with ammonium nitrate should be protected against impregnation. Steel should be protected with two or more coats of paint which is resistant to ammonium nitrate, such as epoxy or polyvinyl chloride based paints.

5. Bins should be clean and free of materials which may contaminate the ammonium nitrate.

In Case of Fire

1. Use air-supplied or oxygen-breathing apparatus if entering the fire area.

2. Open all windows and doors.

3. Apply large quantities of water, sufficient to quench the flames in the same manner as required to extinguish any similar Class A burning material. Do not use steam, dry chemical, or inert gas extinguishing mediums, as they are all very ineffective extinguishers for this type of fire. Fire involving ammonium nitrate (or any other oxidizing material) can not be extinguished by blanketing — it must be cooled.

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JOINT CIVIC LEADERSHIP SESSION WITH FARM, RELIGIOUS, WOMEN'S AND YOUTH CONFERENCES

THE HEART OF SAFETY

By ERWIN D. CANHAM
Editor in Chief, The Christian Science Monitor, Boston, Mass.

I am deeply persuaded that this conference of religious leaders is working at the very heart of the problem of safety.

We can and must have laws, rules, and regulations which establish and enforce safety standards. We can and must maintain pressures, self-imposed as well as imposed from without, to bring about the structural and mechanical conditions which will promote safety. We can improve designs and perfect devices.

But everything we do in these and many other areas of safety work will be unavailing unless there is a far deeper awakening in the human heart to the sacredness of human life and our individual responsibility to safeguard it.

Our attitude toward the sacredness of life is singularly paradoxical. Nowadays, we are quite ready to spend tens of thousands of dollars to save one human life in a hospital. We will spend similar thousands to prolong or preserve a single human life over years and decades of incapacity.

But on the highways, to take the most flagrant of our areas of heedless irresponsibility, we endanger and we destroy human life with a profligate irresponsibility which through history is only exceeded by the ruthlessness of the most extreme despot toward his luckless slaves and subjects.

Recently, many of us have renewed and deepened our sense of shock at the crimes of our time by reading Robert Conquest's masterful compilation of Stalin's lethal policies which led to the death of some thirteen million people, by political purges and indirectly. It is a horrifying figure, comparable only to Hitler's systematic destruction of Jewish lives.

But over a similar length of time, an appalling number of Americans have lost their lives through our collective guilt — our irresponsibility on the highways. If we add in other preventable deaths by accident, the statistics become even more horrifying.

In 1967, deaths by accident in the United States totalled 112,000; happily, a reduction of 1,500 from 1966, but still a horrifying figure. To this total must be added injuries to 10,700,000 people. The money cost of these accidents was no less than $21,300,000,000. If you project these figures over the quarter century during which Stalin's death toll of thirteen million people was amassed, you will reach a total of nearly three million people killed and 267,000,000 people injured. Since our rate has been rising, the actual totals were lower. But unless the remedial measures at which we are working so hard are more effective, the projection of the figures ahead is still more appalling.

It can be said — however cynically — that the toll on the highways is part of the price we pay for the motor age, regrettable of course, but compensated by various great advantages. It is true enough that the motor has altered nearly all the conditions of American life, that some of the alterations are clearly for the better, and that some of the death toll would have been unpreventable without restraints that would have been nearly intolerable.

Whatever extenuations may be presented, the fact remains that the price we pay for the advantages of the motor age is far too high. It reflects a heedlessness and an irresponsibility which can be prevented.

And so, we must work much harder than ever to awaken in American thought and emotion the respect for individual human life which will quicken within each of us the inner restraints that could reform our whole highway behavior.

The mesmerism which leads us into reckless driving is part of the same mesmerism

which would impose a mass society upon us. We are living at an extreme point in the development of mass regimentation. The industrial revolution, beginning a century and three-quarters ago, led us steadily into this regimentation. Mass production, mass distribution, mass communication, mass thinking, all followed.

Finally, when the motor age dawned and Henry Ford led the way with a mass-produced and mass-marketed inexpensive car, the motorist began to think as a mass man. It was, again, a curious paradox, since possession and operation of the automobile also fed the ego of the individual, giving him potency beyond his natural strength, evoking something of the centaur in him. In my observation of car drivers, I have seen some of the most gentle men turn into some of the most ferocious drivers. Once more, paradox. These considerate, gentle persons need to awaken to their responsibility behind the wheel.

Our society needs to be aroused from the mesmeric sleep of mass regimentation. There must be an awakening to individual responsibility. Can we not arouse in the consciences of men a greater degree of consistency toward the sacredness of human life?

A sense of respect for every other person is the basic answer to the evils of a mass society. It is the essence of freedom, on which our nation is based. But we negate it by our customary behavior on the highways. We are untrue to ourselves, as we permit an impersonal recklessness to dominate our decisions. Once more the paradox is evident, since this irresponsibility affects those nearest and dearest and most precious to us as well as to the individuals involved "in the other car."

A good deal of the present malaise so manifest in the world, especially among young people, is a revolt against the mass regimentation of modern society. We are unlikely to change the terms of reference of modern life. It will still be highly efficient to utilize the motor car, to require great highway systems, to operate mass production and mass distribution in order to serve people effectively.

But we can change our own attitudes as we take advantage of large scale operations. We can remember that society does not exist in the abstract, but that it is composed of individuals, and what is important and sacred about society is not the system but the man — God's man.

I have heard it said that one of the best precepts for safer driving is to assume that every other driver is a congenital idiot. This may have some cynical and practical virtue, but is it not also valuable to know as well as to assume that every other driver is God's precious child, made in His image and likeness, entitled to the fullest respect and consideration?

The emotional state of loudly expressed fury against other drivers, which many of us permit, does no good whatever. It does harm as it sprays the poison of anger over our sense of judgment and restraint.

There are many other habits and attitudes which are still more lethal. The most familiar, of course, is drinking. Here, too, a visible lack of consideration for others is central to the problem. Drinking is selfishness and self-indulgence. Under the mask of sociability, it is profoundly anti-social. If we are able to arouse in individuals some sense of the total irresponsibility of the drinking driver we will have made the greatest possible contribution to safety. This kind of awakening can have part of its roots in fear, but fear is not enough. Responsibility must be more positive. It must rest upon a conscious respect for the individual birthright of others. A basically religious awareness and motivation must be stirred.

Another heart-breaking aspect of death on the highways, closely related to the drinking driver, is the reckless driving of youth. How poignant to all of us are the human tragedies reported every week-end in connection with young people on the highways. They will not be reached and prevented by prohibitions or external restraints. Young people must realize themselves the folly of suicide and murder, brought about by the mixture of irresponsibility and alcohol.

How can we stir a sense of responsibility within young people? Here, again, an awareness of social obligation is crucial. Young people have often a strong social sense. They want to do things together, they are very ready to perform acts of social service, they want to belong and to relate. This social sense must emerge as a sense of respect and recognition of the individual significance of every other person. The awakening comes

only from within, kindled perhaps by spiritual truths and analyses which it is our responsibility to share.

As one whose main roots are in journalism, I hope I can convey to you a deep respect for the role and responsibility of the religious leader. You are indeed at the heart of the matter. You can help rescue modern mass society from many of its mesmerisms. You can free man from domination by the machine. You can aid man to realize and manifest the dominion over the material universe which is his God-given birthright.

The problem of safety is so much a problem of attitudes, of states of mind. And we can get at and heal a state of mind through spiritual awareness. Merely psychological tinkering is not enough. There is no other real base for a sense of total human responsibility than the recognition of man's inheritance from God.

Religion is of supreme relevance to all our problems today. I congratulate all of you for your concern. You are enlisted in a noble cause and your tools are good, effective, practical tools as well as divinely inspired tools. You and I have great opportunities which we should recognize more fully than ever before, for the need and confusion of humankind is greater than ever before.

I would say, "More power to you," but that is not true. You already have an inheritance of infinite power. The challenge is to understand it and to use it.

to school in another direction by bus, and the family may shop or handle business at another town fifty miles away. In spite of this, proportionally more rural homemakers than city homemakers today are involved in community affairs. In some rural counties of Oregon, Idaho, and Wyoming, over half the total county population of families were recently involved in county wide community improvement efforts.

With a higher educational level, the rural woman today may be employed away from the home (in the bank, an office, a store, or school). Instead of hoeing the garden and feeding and dressing chickens, she may find she's better paid for her time in the local cannery or freezing plant. Industry has moved to the country also. We all know, too, that rural areas are being engulfed in megopolis areas (Boswash, Chipitts, Sesan).

Commercial production now can out-strip the efficiency of home production in both dollar returns for time spent and, sometimes, in quality of goods produced. Such commercial production and work off the farm may offer more or less creative satisfaction for the housewife, but society now shares a lessening of guilt feelings about women working away from the home. Today we understand that the quality of homemaking and the amount of time that women spend in the home are not necessarily synonymous

Educational programs find the rural woman asking less for skills of home production and more on buymanship, human relations, and communications, and on ways of managing time (as she divides it among managing, operating the home, working on a job, and serving in community activities) to make the community a better place to live. Recent studies among all women find them telling us that their greatest problem is time management. Our research shows that the homemaker today is still spending as much time at the job of being a homemaker as before, even with her improved equipment. In today's modern farm homes, clothes and bedding are being kept much cleaner.

But entirely new problems are being faced in relation to health, sanitation, and health hazards. In earlier days, the kerosene can, the lye can, and a few home medical supplies were some of the greatest hazards in the home except fire. Today, the farm home may contain 260 or more different chemicals. Problems arise about when to mix or not mix them, when to store or dispose of them.

From the hand powered clothes wringer and egg beater, we have moved to a multiplicity of powered equipment which add hazards, for rural homes today, like the city homes, are equipped with powered equipment of all kinds. However, many rural homes were never adequately wired for all the equipment that is operating there. With the advent of rural electricity about 25 years ago, old homes were wired for a limited use of home equipment (often, a stove and refrigerator received special wiring) and it was anticipated that only a radio, iron, and electric lights would be used. Few thought that the average family in the country today might be "turned on" at a stove, refrigerator, deep freeze, water pump, washer and dryer, television set, and hair dryer, all at the same time. Improper electric wiring may be replacing the overheated stove as a source of danger in rural America today.

Scientific knowledge has advanced a great deal in understanding of human relations. Mrs. Rural Homemaker is aware of this and is concerned with being "in the know" on how to conduct effective committee work, how to get along with her married partner, how she can do a better job of helping her children develop to their greatest potential. She is more aware of the importance of experiences children have in their formative years and their bearing on her children's personality, their physical and mental capabilities, and their eventual chances of success or failure.

WOMEN'S SESSIONS

RURAL HOMEMAKERS—YESTERDAY AND TODAY

By LORETTA V. COWDEN
Program Leader, Div. of Home Economics, Federal Extension Service,
Washington, D. C.

Margaret Mead has said that perhaps the greatest change that has taken place in the world recently has been the *rapidity* with which we change. We all know that there is a multiplicity of outside influences affecting rural homes, as well as those in the city. Most of you are aware of these influences, but perhaps reviewing some pertinent ones will help us centralize our thinking.

The influences we will focus on are: isolation, mobility, community influence, educational level, and national orientation and population balance.

Isolation.

With today's mechanization and vastly improved highways, transportation, and communication media (such as the radio, television, and rural telephones) rural families are no longer isolated. Gusty winds of modern communications bring the world into the home and in effect have blown [redacted] walls around the family.

Some of you can picture the farmstead of 50 years ago—before mechanized equipment for travel, before radio, before television (although a very few had telephones and running water). There was no electricity or good roads to reach the small rural towns, scattered 10 or 12 miles apart, until much later. The farm family in those early days had to be pretty self sufficient. They produced most of their own food, they produced their own fuel for horsepower transportation. The food, of course, was prepared from the raw state and preserved for the winter months. Ranchers (in Montana, where I came from), stocked up such items as flour, coffee, sugar, kerosene, and lye for six months' needs. This home food production included butchering, canning or curing their own meats, making their own cheese and butter, growing and storing their own vegetables and fruits.

It was not uncommon for the farmer to do most of the shopping for the family, simply because a ten mile trip to town by horse and buggy was not easy for mothers with small children. Many isolated Montana wives got to town only two or three times a year. They used the mail order catalogs to buy the yard goods from which they produced clothing at home. The family was not only a producer of goods but also of its own recreation. Families read together, played checkers, or simply worked together in the hand labor required to produce goods. By contrast, in some respects today's modern farm and home equipment isolates the family members from each other, leaving less for families to do together.

In addition to disadvantages of location, often the early day farm families were less advantaged because of lower incomes. However, they did not feel it as much, because their neighbors were in the same situation. They were not affected by the outside world of radio and television, constantly motivating them to want a multiplicity of other goods and services. Today's rural family is much the same as the city family, except there is still a higher proportion of low income in some areas; more elderly in rural neighborhoods, as younger people move to cities and more elderly tend to stay in same rural areas and, by geography, for some a shortage of community facilities such as medical services and care facilities.

Because of limits of transportation, families used to socialize mostly with close neighbors. They learned to get along with their neighbors and developed an interdependence with them. Today this is less evident, and it takes a concentrated effort to get people together to plan for and develop the community services that will make the rural community a better place in which to live. This breakdown of community connections often spreads out to several communities, with a greater diversity for various family member's interests. A family may go in one direction to church, the children go

A RECENT DEVELOPMENT FOR URBAN HOMEMAKERS

By MRS. ASHER YAGUDA
President, National Council for Homemaker Services, Inc., New York, N. Y.

In our mobile, urbanized society, families often live many miles from relatives and close friends. What happens to them in times of crisis? Too often, children are uprooted from their homes and cared for elsewhere; the chronically ill, the handicapped, and the elderly must seek refuge in institutions.

But it need not be this way. The help once provided by relatives can be given today by a homemaker-home health aide. A homemaker is a "homesaver"—a mature, understanding, and professionally supervised woman who likes people and is trained and experienced in looking after children, managing a household, and giving personal care to the ill and aged.

Homemaker services are built on several premises—among them, that the family is important in our society, and that community life is strengthened when home life is strengthened. This means that those of us who carry responsibility for provision of the service are committed to working closely together to benefit those families who are in need.

Homemaker service is not a new service—actually, it is forty-five years old in this country. It is interesting to note that the service grew in ten year leaps. Beginning in 1903, Family Service Association for the improvement of conditions of the poor in New York City supplemented nurse's services by "lifting temporarily the simple everyday domestic burdens from sick mothers."

Ten years later, in 1913, the work of the visiting housekeepers in Detroit was started by the Advisory Committee of the Associated Charities. In 1923, the Jewish Welfare Society of Philadelphia recognized the need for a staff of "motherly women" to act as housekeepers in homes where the mothers were temporarily incapacitated. This program was considered to be the first organized homemaker service in this country.

The first national conference on supervised homemaker service was called in 1937 by the Children's Bureau. This conference led directly to the establishment of a national committee made up of a group of professionals, largely from the social welfare field, active in programs for children. For many years, on a voluntary basis, they helped local agencies establish services and, in general, became the "guardians" of this useful service.

There were those who recognized (in the early '50s) that the majority of referrals for homemaker service were being made because of family illness, regardless of agency sponsorship—whether health or social welfare based. Over the country it then developed rationally that the training of the homemaker and her supervision were more closely geared to the health needs of the patient. Even though the focus was on keeping the household running, personal needs of the patient could not be and were not ignored. With the addition of the medical dimension, the service took another leap forward. This trend started in New Jersey when that state, the first in the nation, passed a chronic illness control law which called for the establishment of homemaker services for all of its people.

In 1963, the National Council for Homemaker Services was established with the support and sponsorship of 29 national voluntary health and welfare organizations and eight governmental bureaus. It performs six major functions:

1. Encourages and guides communities in organizing and extending homemaker programs.
2. Provides a central source of information for its member agencies and other organizations.
3. Promotes understanding of the values of the service.
4. Promotes development of standards.
5. Publishes reports and distributes educational and promotional materials.
6. Sponsors conferences and seminars.

To achieve its goals, the National Council works with many groups. It is supported by

membership dues and grants made by private and public groups. Many grants are given for specific purposes; for example, the preparation, printing, and distribution of a guide for a training program for homemaker-home health aides funded by the Office of Education, HEW, which, parenthetically, contains a section on "Home Accident Prevention."

Less than five years ago, when the National Council was established, there were 300 homemaker programs in 44 states. Today, there are more than 900 such programs, an increase of more than 200 per cent. These services are now operating in all fifty states, the District of Columbia, and Puerto Rico. The total of homemaker-home health aides has increased 160 per cent in the same time. We have 12,000, and we need 200,000.

You will note that we have switched from using the simple term "homemaker" to "home-health aide." It was the passage and implementation of the Medicare law which brought about the change in terminology. Instead of using the familiar term "homemaker," Congress decreed that the worker who would be subsidized under Medicare would be called "home health aide." This tended to dichotomize the field and, in the beginning, seemed to spark off attempts to create differences in training, supervision, and salary. The National Council assumed a strong stance of "one worker—one activity" and reaffirmed the principle set forth in standards for homemaker-home health aide service that the term "homemaker-home health aide is generic, denoting a worker whose function it is to maintain and safeguard family life in a home disrupted by illness or other crisis."

Although the Medicare law is somewhat responsible for our growth, it is by no means totally responsible. Much of the forging ahead is due to the many new uses of homemaker service. Among the most timely, the most useful, is the prevention of family breakdown by upgrading family life. Although not entirely an urban problem, the disadvantaged city family is more in the spotlight than the disadvantaged rural family. With the exception of specific areas like Appalachia, families living in rural substandard dwellings, suffering from malnutrition in the midst of plenty, lacking the incentive for education, repeating the family poverty cycle, have not as yet evoked either the public attention or the empathy demonstrated for their city cousins.

This is the year all of us will long remember. We have seen the improbable, and sometimes the impossible, happen. We have seen unbelievable violence and tragedy—and we have seen a rebirth of hope. It has been a time of confusion.

The ultimate goal of every agency working in the social welfare and health fields is the prevention of physical and social ills. Yet, the charge is made that we are all so busy striving to cure the symptoms that we have neither the time nor the money to spend on correcting the basic illnesses.

We are seeing to it that the homemaker-home health aide services need not plead guilty to that charge. We have in our hands a direct and extremely effective means of reaching out to the most disadvantaged families in our communities. We have a service equipped to help them mobilize their resources and strengthen their resistance to the pressures that threaten to destroy them.

Our service is designed to assist all families, whatever their social or economic status. But perhaps our greatest possible challenge—or at least one of them—lies in finding the best possible ways of making the service available to those in greatest need. Today, a strong case is being made for provision of more protective services for children. This is an area in which there are limitless opportunities to do a significant job of prevention. If a homemaker can help to create the kind of environment that will give these children a sense of security, of self-worth, then she can help to prevent the development of feelings of hopelessness and despair and isolation that push them into delinquency.

A great majority of our agencies are seasoned experts in training. We have much to contribute to the training of mothers who really do not know the basic rudiments of housekeeping. Among this group are many mothers on the welfare rolls (AFDC). We must be aware of double objectives. Through training, we have helped the mothers become employable as homemaker-home health aides; and at the same time, we are helping them to acquire skills they need to do a far better job of household management and child care.

The basic course of instruction as developed in the National Council's training manual is the vehicle through which all homemaker service training may be accomplished. There is always more time for follow-up in specialty training. As we have observed in working with AFDC mothers, they much prefer, and react infinitely better if they are in classes with other community homemaker trainees. There is no need to segregate these welfare clients in training. This upgrading family life may be considered a cure, but it is also prevention against continuation of generation after generation of "welfare families."

Prevention is, necessarily, a long range objective—otherwise, we are simply treading water in a sea of social ills. But, at this point, we cannot afford the luxury of concentrating on prevention alone. We are committed to help families caught in emergency situations. This is the purpose for which this service was founded. It is not a question of either-or. It is a question of both. We will continue to assist families in riding out a crisis without losing their footing and, at the same time, we will seek to identify and correct basic causes of the elements which undermine family life.

Homemaker-home health aide service is indispensable to communities having well-planned, sensible, coordinated services. Its uses are legion. Our critical national problems have their roots in cities and towns and villages across the country where we are at work. Our social scientists tell us that underlying many of these problems is the instability of the family. In this area we pledge ourselves to our greatest effort.

NEW DIRECTIONS IN HOME ECONOMICS

By LYDIA JOHNSTON
Chairman, Dept. of Home Economics, Western Illinois University, Macomb, Ill.
and
MARY RUTH SWOPE
Chairman, Dept. of Home Economics, Eastern Illinois University, Charleston, Ill.

Today's Extension Service has decided to focus on modern homemaker problems as follows:

1. *Family Stability*—helping families understand that what happens to a child in early years of life can vitally affect his personality, self feelings, relationships with others, and his success or failure in life.

2. *Health*—with more emphasis on nutrition, and understanding home care in nursing and facing up to emergencies.

3. *Housing*—to meet safety needs, planned for this "turned on" power available for home use, with time and satisfactions to meet needs.

4. *Consumer Education*—all homemakers should know how to choose, know what is done for his protection by government, what needs to be provided by the public and what he can do to affect what's available to choose.

5. *Community Development* — Here is where the rural as well as the urban woman actively participates in influencing the world around her.

The Federal Extension Service has, in almost every county in the United States, a Home Economist who works in an Adult Education Program of the five areas listed above. There are over one million women (many rural, but not all) who are actively involved in these five program areas through Extension Homemaker Clubs. They are actively participating in highway safety programs, promoting acceptance of the 12 standards, and carrying out community projects of getting the slow moving vehicle signs used, getting pesticides, chemicals, and medicines handled correctly. In addition to these one million women, the Extension Service is making the program available to about eight million women and are not just working with the rural women.

income will be $25,000. (In the year 2000 AD).

Miss Johnston: And what all this means is that there will be no more need for traditional courses in foods and clothing.

Miss Swope: No, instead there will be: paper dishes; prepared foods; scientifically prepared for nutritional soundness and delegated for use by the home computer; paper dresses; yet, a much greater need for family relations and child development knowledge because of the problems of confined living in clustered cities. We'll need all the diplomacy and grace we can acquire to live sanely in a crowded society.

Miss Johnston: And it will be crowded, with 90 per cent of us in America living in the cities or suburban areas.

Miss Swope: In the home, the computer will be boss—planning our lunches, telling us when and what to eat.

Miss Johnston: Yes! It will estimate the amount of exercise we need to balance our food intake. And, if you order a cheeseburger and french fries and milkshake, and the computer says, "No, you must have broth . . ."

Miss Swope: Then's when the safety factor comes in, as you hurt your fist or your big toe by trying to bash in the computer.

Miss Johnston: There will be new ways of packaging foods, new convenience items, packages that themselves are edible when melted.

Miss Swope: An accelerated pace of living—and such acceleration often leads to safety hazards.

Miss Johnston: An uncertain future, an unknown future—yes, all these.

Miss Swope: Our physical, mental, social, emotional environment will be different.

Miss Johnston: Ours will be a world of mass production, automation, research and, thus, our industrial-technical environment will change. Atomic energy will be used much more so than today, in dramatic ways unthought of today.

Miss Swope: Electronic devices will speed money transactions to mere fractions of seconds. Our whole economic, educational, cultural way of life will change.

Miss Johnston: Then, there will be more affluence, more leisure time for recreation.

Miss Swope: Intercontinental travel will be commonplace and exceedingly rapid—almost beyond belief.

Miss Johnston: Yet, in the future, there will still be marriage and family—the marrying and the giving in marriage. But families in the future will be smaller, even more completely consuming units.

Miss Swope: They'll also be more democratic, affectional, companionable, adaptable, versatile.

Miss Johnston: Perhaps more concerned with the aesthetics of homemaking, more person-centered, more self-directing, internal directed, yet more concerned with events of the entire world.

Miss Swope: Yes, the surface of things will inevitably change. But the same sure values of today will live on into tomorrow. The thread of honesty, beauty, truth, justice, love of one's fellowman will run true then, as now.

Miss Johnston: Religious observances may change, but shall not cease. The important things that money cannot buy shall last, and endure.

Miss Swope: New directions in home economics? The new directions are limited only by our vision in seeing down the road of the future.

Miss Johnston: But one thing is sure. We have the faith and hope that Home Economics has the flexibility and adaptability to endure, for it is so much needed to be one of the positive building forces, buoying up and strengthening the homes and families yet to come.

HOST OR FRIEND—ALCOHOL IN THE HOME

By JAMES RAY ADAMS
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Drinking is a custom of long tradition and immense social significance. The advent of the modern traffic system in America, in which almost everyone drives his own automobile, has combined with our drinking customs to make a mixture with tragic potential. This paper will present the view that the drinking driving problem has come about through the evolutionary confluence of independent social practices—drinking and driving, and the resultant accident toll can be ameliorated through effort by a community to supplant certain drinking traditions with alternative and equally strong concerns.

The history of alcoholic beverages goes back to the beginnings of agriculture, and anthropologists who have studied the practice have noted that among primitive people, drinking increases in proportion to their anxiety. Students of the practice in modern society see similar motives—to reduce tension and anxiety, to buttress self-regard, to open the gates of pleasure, to relax the inhibitions of fear and guilt, to blend easily and effortlessly into social gatherings.

Social scientists see ours as a society rife with group conflicts and antagonisms. A competitive economy, job specialization that leads to ignorance of each man about his fellows, legacies of religious, racial and ethnic hostilities, all result in a segmented, stratified society. Here is fertile ground for mistrust, alienation and even enmities.

In a society so fractionated, the strongest bond holding contrary groups together is recreation. Fox and Lyon[1] have commented on this:

> Here is our chief common ground. And here, chiefly, is why the consumption of recreation has become so important in our frightening complex society. We consume recreation in great gobs: television, the movies, radio, professional and amateur sports, card games, gambling of all kinds. And, as like as not, we wash the gobs down with alcoholic beverages. Consider how important an adjunct to the country club is the nineteenth hole; consider how remunerative a business is the catering at professional baseball games or at race tracks; consider the cocktail party; consider how routine is the serving of alcoholic beverages to friends who drop in of an evening to watch television. The two are associated: alcohol and recreation. Alcohol is the solvent that enables the wheels of our recreational life to turn smoothly.

Alcohol Involvement in Traffic Accidents

Borkenstein[2] and his associates have recently completed one of the most thoroughgoing of the studies in this area. They measured the blood alcohol levels of accident involved drivers plus a control group exposed to comparable liklihood of being involved. This comparability of exposure to accident hazards was achieved by taking control samples at the same time and at the same location as the accident that occurred at a given place. Data from this study are abstracted in the table:

DISTRIBUTION OF ALCOHOL LEVEL CLASSES

	Blood Alcohol Level				
	0.00%	*0.01%*	*0.06%*	*0.08–0.09%*	*0.15%*
Control group per cent	89	1.09	0.53	0.72	0.18
Accident group per cent	88	1.10	0.77	1.80	3.19

It is clear from these data that blood alcohol levels over 0.04 per cent are definitely associated with increased accident involvement. Accident involvement shows marked increase at alcohol levels over 0.08 per cent, and Borkenstein estimates that "When the 0.15 per cent alcohol level is reached, the probability of causing an accident is increased to more than 25 times."

Source

[1]Ruth Fox and P. Lyon, *Alcoholism, its Scope, Cause and Treatment* (New York: Random House, 1955).

[2]R. F. Borkenstein, R. F. Crowther, R. P. Schumate, W. B. Ziel and R. Zylman, *The Role of the Drinking Driver in Traffic Accidents* (Bloomington: Department of Police Administration, Indiana University, 1964).

McFarland and Moore[4] have stated that "The official estimates in previous years were that alcohol was causally related to no more than 5 to 10 per cent of fatal accidents. This estimate now has to be revised on the basis of the recent studies. In general, the recent evidence suggests that alcohol is causally related to about 50 per cent of fatal accidents in the United States."

The study by Haddon and Bradess[5] of fatal accidents in Westchester County, New York, is evidence on this point. They took postmortem blood alcohol levels of a group of 83 drivers involved in one-car fatal accidents. They report: "Forty-nine per cent of the 83 were found to have blood alcohol levels at death of 0.15 per cent or more, while those of an additional 20 per cent fell between 0.05 and 0.15 per cent." By the standard of 0.05 per cent, based on Borkenstein's study above, it is evident that two out of every three drivers in those one-car accidents were intoxicated.

The Role of the Host

One crucial aspect of the social drinking tradition which may be subject to change is the role of the host. Perhaps the most fervent activity of a host is the encouraging of drinking by his guest (the role of 'host' includes the hostess, and the informal leadership function of the person who assumes the host role in an informal group). Cisin[6] has written of this:

> The guest who does not drink is somewhat out of place at many parties; he is just not a part of the social group. The proper guest cooperates in making it easy for the host to play his defined role: that of pressing drinks upon his guests. The party host who tries to minimize his guest's drinking is regarded as stingy and runs the risk of becoming the target of gossip. The correct host stages a kind of alcoholic potlatch, making sure that everyone has a glass and that no glass is permitted to remain empty.

It is reasonable to assume that this traditional role is a significant element in the sequence of drinking-driving-accident. Even the driver who sincerely wants to remain sober is put into a conflict between his need to restrict his drinking and his desire to be cooperative and responsive to the friendly, well-meant overtures of his host.

Accident Prevention through Redefinition of the Role of the Host

A person is most likely to change his behavior when he perceives both an unfavorable effect of his present behavior and a feasible alternative to which he can change. Many people are not happy about playing the host role as described. The steadily increasing toll of accidents by drinking drivers is weighing heavily on the consciences of people who are rational enough to accept unpleasant realities. Already many of stronger personality will not encourage drinking by their guests who are driving. They recognize and follow another tradition, a tradition as ancient and honored as the tradition of the host, and one which may be encouraged as the alternative of the tradition of the host as drink-provider.

It is the tradition of *brotherhood*—the concern of a friend for the well-being of his friend.

Might we not achieve something if we could make this tradition the predominant social custom, replacing the custom of the host as a drink provider? Might we not help in reducing the toll of driving while intoxicated by a deliberate effort to re-define the role of the host as primarily that of a concerned friend, and secondarily that of a drink-provider.

A theme for this effort could be:

First a Friend . . . then a Host.

This theme could be associated with the intention on the part of one who is a host that he will not encourage drinking on the part of his guests who are driving automobiles. The open affirmation of this theme by the influential citizens of a community could do much to establish the primacy of brotherhood as a standard for one's conduct as a host.

There should be no implication that a host attempt to "reform" his guests, or that he

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[4] A. McFarland and R. C. Moore, "Human Factors in Highway Safety: A Review and Evaluation," *New England Journal of Medicine* (April, 1957).

[5] W. Haddon, Jr. and Victoria A. Bradess, *Alcohol in the Single Vehicle Fatal Accident: The Experience of Westchester County, New York* (New York: Driver Research Center, New York State Department of Health, 1958). Mimeographed.

[6] I. H. Cisin, "Social Psychological factors in Drinking-Driving," in R. H. Fox and J. H. Fox (Eds.), *Alcohol and Traffic Safety* (Bethesda, Maryland: National Institutes of Health, 1963).

take initiative to discourage drinking on their part. It is implied only that the host provide non-alcoholic beverages and refrain from encouraging the drinking of alcoholic beverages by those who are driving. The theme could be associated with a simple symbol through communication channels of the community. The host could indicate his affirmation of the standard by prior display of the symbol (as on a bumper sticker, cocktail napkins, match book covers, etc.), and so communicate unobtrusively his concern for his guest's safe trip home.

Civilization has progressed to the point that man need not accept with passive awe every custom or tradition which happens to prevail in his culture. Culture should be made to serve man, not man to serve culture. Can we not set about to rationally define our social ways so that they will conform to our most vital concern for our friends—that they should stay alive?

JOINT SESSION WITH TRAFFIC CONFERENCE

EVALUATION OF EFFECTS OF EDUCATIONAL AND MASS COMMUNICATION TECHNIQUES

By JACK B. HASKINS, Ph.D.
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An intensive search of published literature was conducted to determine what is known about the effects of mass communication on drinking/driving in particular and safety in general.

The results of that search may be summarized as follows:

1. There has been relatively little research of any kind on the effects of the numerous campaigns that have been conducted.

2. The British have put more emphasis on such research than the United States.

3. Because of inadequate research design, one cannot be confident of the results obtained in most published studies. The principal flaw in campaign evaluation studies has been the reliance on before-and-after research designs with no control group, and an unfounded faith in the power of post hoc statistical analysis. In message pre-testing, the principal flaw has been unrealistic laboratory environments and the use of verbal measures of effect.

4. The principal conclusion is that no one knows whether previous communications campaigns on traffic safety and drinking/driving have had any effect or not (though many have strong beliefs about success or failure).

5. Some examples of good research studies whose methods or findings can serve as useful models for the future are:

(a) For pre-testing messages: "The Effects of a 'Fear-Arousing' Safety Film on Physiological, Attitudinal and Behavioral Measures." Beach (1966).[10]

(b) For pilot-testing campaigns: "An Experiment on the Effect of Specially Designed Safety Posters." Laner and Sell (1960).[26]

(c) For campaign evaluation: None available in field of traffic safety or drinking/driving. Otherwise, see Gosnell [20], Hartmann [21], Spector, et al [40], and Haskins [25].

6. Both campaign producers and researchers find a morbid fascination in fearsome, scary, threatening, gory, anxiety-producing themes for communication and education safety campaigns. This despite almost overwhelming evidence that such themes have, at best, no effect and, at worst, have a negative effect aggravating the very conditions they are designed to reduce. An article by Malfetti[28] and individual studies in this report, as well as in another review of evidence to be produced separately, bear this out.

Campaigns With No Research

A great deal of money and effort has gone into various safety campaigns. On only a handful of these has any research at all been done, either to pretest the messages before release or to evaluate the campaign in operation. It is of little use to look at and analyze subjectively the various non-researched campaigns, except possibly as a source of alternative ideas to be tested for subsequent campaigns.

The dimensions of the "campaign with no research" problem may perhaps be illustrated with an example.

Starting in 1965, the Advertising Council put together the "Buckle Up for Safety" and "Watch Out for the Other Guy" campaigns. As of October 1966, it was estimated that over $40,000,000 in advertising space, plus an unknown amount of creative and administrative effort, had been devoted to this campaign — in TV, radio, posters, magazines, and newspapers[42]. Yet, according to published reports, no systematic research on the effects of this campaign has been done and no one will ever know its effects, if any. Instead, one is reduced to speculation such as this: "It may even have done what it was supposed to do—help stop accidents . . . the death toll . . . turned slightly downward in 1965, the first year of this campaign. However, we all recognize that a dozen different factors are involved in the accident equation—and are chilled by the fact that the

statistics thus far for 1966 do not look bright."[42].

Or take the case of the British campaign of 1964, aimed at reducing drinking/driving accidents over the Christmas season. The five-week campaign cost over $1 million. Some research was done, as will be seen in later sections of this report, yet the success of the campaign remains in doubt because the research was inadequate. Many other such case studies could be reported.

The point is that a very small investment, relatively speaking, in properly-designed research will pay big dividends in determining the effectiveness of such campaigns and drawing conclusions for future communications activities.

Types of Research on Communication Campaigns

Communications research of various kinds may be employed at various stages during the development and life of a campaign. It can range all the way from research into the early stages of idea development, to evaluation of the effects achieved by a whole campaign. Some of these research phases that may be involved, arranged on a chronological basis, are message development, including pretesting of messages, and pilot-testing of messages in media; and campaign evaluation, including post-testing of messages in media, and campaign evaluation of overall effort.

The research efforts fall onto a chronological continuum which more and more closely approximates the achievement of the full effort in the real world, as time progresses. For convenience, segments of the continuum of research effort may be labelled as: pre-testing, pilot testing, post-testing, and campaign evaluation.

Pre-testing. A more precise, though more cumbersome, term for this phase of communications research is "pre-appearance testing." It is preliminary message development research employed before a campaign goes into operation to test and predict the effects of alternative messages and treatments. Such small-scale research helps to identify good approaches, to eliminate poor approaches, to diagnose and modify message weaknesses, to experiment with previously untried possibilities, all before a campaign actually goes into operation. In advertising, such measurement is called "copy research" and "creative research." It can be employed at many stages of message development — testing of themes (concepts, ideas, propositions, etc.), parts of messages (headlines, illustrations, layout, etc.), complete messages in rough form, or complete messages in finished form.

Pilot-testing. This is a form of pre-appearance testing conducted in a more realistic manner than pre-testing per se, but still conducted before a full-scale campaign gets underway. It is intended to more closely approximate the effects that would be achieved in the real world, but on a smaller scale. In advertising, such tests may be conducted in a single city before embarking on a national campaign, or in a single "predictor" magazine before insertion into a full schedule of magazines — with appropriate concurrent measurement, of course. There are varying levels of pilot testing, shading into pretesting on one end of the continuum and into campaign evaluation on the other.

Post-testing. This might be more appropriately labelled "post-appearance testing." It usually measures particular sorts of effects achieved from messages in a real-life campaign; for example, readership figures on newspaper articles and advertisements, the size of television and radio audiences, and so on. Post-testing reveals certain effects of particular individual messages in particular media, as contrasted with campaign evaluation which measures the overall effect without distinguishing the contribution of individual components.

Campaign Evaluation. This is research to measure the actual effects achieved in a full scale real-life ongoing communications campaign. While in a lengthy campaign it is sometimes possible to modify and make changes if early campaign evaluation shows the need, usually all the campaign decisions have been made and locked in by the time such effects are known.

Previous Communications Research on Drinking/Driving and Safety Campaigns

An attempt has been made to locate and evaluate as many published studies as possible. An initial observation is that the amount of published research on previous drinking/driving and safety communications campaigns is pitifully small. Hundreds—even thousands—of communications research

studies on other topics are reported in the published literature. This report deals only with drinking/driving and safety communications research.

Pre-testing and Pilot Testing Studies

Because of the small number of studies, and the difficulty in precise categorization, previous pre-tests and pilot tests are grouped together here.

Pre-test No. 1. "An Experimental Study of Traffic Safety Films, the Factors Involved in Determining Driver Behavior, and the Predictive Effects of a Behavioral Change Analysis." (McAshan).[29] This doctoral dissertation described a laboratory test of a film "Driving at Night." With college undergraduates as the subjects, divided into test and control groups, the effects of one showing of the film on verbally reported attitudes and knowledge were measured.

1. *Conclusion:* "The film had a favorable effect on knowledge about night-driving practices, but had no effect on attitudes.
2. *Study Design.*
   Research Environment: Laboratory, non-realistic.
   Design: Controlled experiment, measurement/after only, test and control groups.
3. *Comment:* Effects of this film in the real world are indeterminate from this study because of: forced nature of exposure in the laboratory situation; the atypical sample of subjects; only one exposure to the message; the use of unvalidated verbal measures of effect. As in many other studies, knowledge-gain is unrelated to attitude change, and relationship to actual behavioral change is unknown.

Pre-test No. 2. "Effects of Fear-Arousing Communications on Driving Safety Attitudes and Driving Behavior." (Moore).[30] This doctoral dissertation described a laboratory experiment on the relative effects of "good driving practice" films employing three levels of fear-arousal. College students were used as subjects, randomly divided into three test and one control group. The effects of one film showing on verbally reported attitudes and on simulated driving behavior were measured.

1. *Conclusion:* None of the three different fear-level films had any effect on either attitudes or behavior.
2. *Study Design.*
   Research Environment: Laboratory, non-realistic.
   Design: Controlled experiment measurement before-and-after, test and control groups.
3. *Comment.* This study is superior to the previous case because of the use of a behavioral measure of effects. But the effects of these films in the real world are indeterminate for the same reasons as in the previous case.

Pre-test No. 3. "Psychological Analysis of Anti-Accident Posters." (Undeutsch).[45] The original report of this foreign study was unavailable. The abstract indicates that tachistoscopic perception tests of anti-accident posters were conducted in a laboratory situation.

1. *Conclusion:* ". . . many posters are ineffective . . . the structural requirements that safety posters must meet are stressed."
2. *Study Design.*
   Research Environment: Laboratory, non-realistic.
   Design: Non-experimental, simple comparison of results from different posters.
3. *Comment:* The validity of tachistoscopic measures — i.e., relationship to behavioral effects — is unknown. However, the method may have some advantages over conventional question-and-answer measurement procedures, due to a lessened danger of reactivity of the measurement.

Pilot Test No. 1. "The Effect of a 'Fear-Arousing' Safety Film on Physiological, Attitudinal and Behavioral Measures: A Pilot Study." (Beach).[10] Measures of physiological responses, verbal responses, and behavior were made to determine the relative effectiveness of high-threat and low-threat safety films designed to promote seat belts. A group of 48 adult students and engineering workers were randomly assigned to two groups; one group saw the "Safety Through Seat Belts" film with a high-fear gory insert, the other group saw the same film with a non-fearful

insert. Verbal measures of attitudes were obtained before and after showing, physiological responses (heart rate and skin conductance) were measured during the show, and actual purchase of seat belts was determined some time after showing.

1. *Conclusion:* The low-threat film was more effective in creating intentions to install seat belts, and, strangely enough, in affecting heart rate. Their effects were equal on skin resistance measures. Regarding actual installation of seat belts some time later, there was no significant difference between the two films, though there was a tendency for the high-threat film to be more effective.
2. *Study Design.*

   Research Environment: Laboratory, non-realistic.

   Design: Experiment, with two treatment groups but no control group to measure absolute effects; use of verbal, physiological, and behavioral measures.
3. *Comment:* An excellent laboratory study, mainly by virtue of the experimental design and the use of non-reactive physiological and behavioral measures. Conclusions are limited by the small sample and by some initial (before treatment) differences between the two treatment groups. Replication with larger groups very desirable methodologically. Determining relationship between various kinds of measures desirable.

Pilot Test No. 2. "An Experiment on the Effect of Specially Designed Safety Posters." (Laner and Sell).[26] This British study closely approximates a campaign evaluation, except that it was conducted using a limited group of locations and therefore must be classified as a pilot test. Posters were designed to get workers in steel plants to hook up heavy steel slings when not in use. In some plants, three posters were on display, in others only one at a time (though changed at two-week intervals), in others no posters were displayed. Unobtrusive behavioral measures were used to measure effects (actual counting of "safe" and "unsafe" instances while plants were in operation).

1. *Conclusion:* The posters had a significant beneficial effect on safety practices within steel plants.
2. *Study Design.*

   Research Environment: Field, realistic.

   Design: Controlled experiment, measurement before-and-after, test and control groups, unobtrusive behavioral measurement.
3. *Comment:* This is an excellent piece of research in every respect. The posters were specifically designed to accomplish a specific objective among specific target audiences. An experimental design, with control group, enabled determination of cause and effect. Unobtrusive measurement was employed. Actual behavior rather than verbal response was used as the dependent variable. The study was conducted in a real life situation rather than in a laboratory situation.

Pilot Test No. 3. "The Ministry of Transport's Leaflet on Drinking and Driving." (Sheppard and Colborne).[36] An eight-page leaflet advocating the theme "Don't drink and drive" was distributed to those persons who requested it as one element of the British 1964 drinking/driving campaign. A mail questionnaire was later distributed to requesters to get their impressions of the brochure's effectiveness; comparison was made with a group of non-requesters.

1. *Conclusion:* ". . . this leaflet had no observable effect."
2. *Study Design.*

   Research Environment: Field.

   Design: Non-experimental; one-shot descriptive survey of non-random self-selected respondents.
3. *Comment:* No conclusions about effectiveness are justified because of inadequacy of the research methods used. Other studies have shown that audience impressions of effectiveness are unrelated to actual effectiveness. In addition, this study reveals nothing because of: self-selected nature of audience under study; use of verbal response; no control group to determine effects from other influences; etc. Not even a good descriptive study.

Pilot Test No. 4. "The Film 'Road Deaths —Xmas 1963'." (Sheppard and Colborne).[37] This was a pilot test of a "don't drink and drive" film, one element of the British 1964 drinking/driving campaign. A self-selected audience at a public event saw one showing of the film. Measurement consisted of a questionnaire after the showing to determine factual recall of content and impressions of the content.

1. *Conclusion:* "Even after seeing a lengthy and what one would expect to be a convincing film . . . quite a large proportion . . . still think it is safe to drink larger quantities of alcohol before driving than the BMA safe level."
2. *Study Design.*

   Research Environment: Semi-realistic.

   Design: Non-experimental; measurement/after only, no control group. Descriptive and correlational data only.
3. *Comment:* No conclusions about effectiveness of this film can be drawn because of inadequacy of the research design: biased sample of subjects; laboratory situation; use of verbal reports for measurement; lack of control group, etc.

Pilot Test No. 5. "A Study of a Film on Drinking and Driving." (Sheppard and Colborne).[38] A 27-minute film on drinking/driving, "Slaughter on the Avenue," was shown to an invited audience of British drivers. Verbal reports of attitudes toward drinking and driving, and impressions of film segment effectiveness, were obtained before and after viewing.

1. *Conclusion:* Most audience members were less tolerant of drinking drivers after the film than before. Impressionistic reports showed men were more impressed by scientific data, women by humanitarian appeals.
2. *Study Design.*

   Research Environment: Laboratory, non-realistic.

   Design: Non-experimental; measurement before-and-after, no control group.
3. *Comment:* Real effects of the film are indeterminate because of audience sampling bias, laboratory situation, verbal measures of effect, no control group, etc. However, test may have some diagnostic value for improvement of film content, although impressionistic reports on film segments are of dubious validity.

Pilot Test No. 6. "Results of Street Interviews on Drinking and Driving Pay-off Lines." (Anonymous).[5] A modest "portfolio" study to test possible negative reactions to the slogan expressed in anti-drinking/driving ads was conducted prior to the British 1967 campaign. The same advertisement was made up in four different versions varying only in the slogan expressed as the "pay-off" line. Each of the four versions was exposed to an equal number of drivers for a few seconds, in individual interviews, then two short questions on meaning were asked.

1. *Conclusion:* The expected negative reactions were not as apparent in one version as in others.
2. *Study Design.*

   Research Environment: Field, semi-realistic.

   Design: Quasi-experiment; measurement/after only with test and control groups.
3. *Comment:* This "portfolio" technique has been used extensively to test alternative versions of ads. For determining specific negative reactions, its semi-experimental design can be quite useful, though it reveals little about overall effectiveness.

Pilot Test No. 7. "Breath Test Campaign: Research Findings on the Illustrations of the Testing Device." (Anonymous).[6] In the British 1967 drinking/driving campaign, there was some concern over a specific print ad showing the breath measurement device. The illustration, to some, resembled a test tube and, therefore, might inspire fear. An alternative advertisement, identical except that the breath measurement device was shown with collection bag attached, was devised. Again, a "portfolio" test design was used. Each ad was exposed to an equal number of male drivers for a few seconds, in individual interviews, then a few simple questions were asked to get reactions — word association, understanding of the illustration, fear reactions, etc.

1. *Conclusion:* There was no significant difference in response to the two different illustrations, therefore the decision was made to continue with the "test tube" illustration.
2. *Study Design.*
   Research Environment: Field, semi-realistic.
   Design: Quasi-experiment; measurement/after only with test and control groups.
3. *Comment:* This "portfolio" technique has been used extensively to test alternative versions of ads. For determining specific negative reactions, its semi-experimental design can be quite useful, though it reveals little about overall effectiveness.

Post-Testing

As has been mentioned, post-testing refers to the performance of individual messages. Readership figures of individual advertisements provide the only illustration available at the time of this report.

During 1967, the Mobil Oil Company emphasized the anti-drinking/driving theme in much of its national advertising. The Daniel Starch research organization, in the course of its regular readership surveys, obtained readership figures on some of these ads along with others in national magazines.[41]

Attention paid to such ads can be determined from the following figures:

Percent Who Noted (saw)
One-Page Black-and-White Ads

	Mobil Safety Ads		*Regular Mobil Ads*		
	Men	*Women*	*Men*	*Women*	
Average, 6 Life ads	37	21	33	20	Average, 5 Life ads
Average, 3 Post ads	46	29	35	24	Average, 3 Post ads

Analysis of such figures can reveal some possibly useful conclusions regarding campaign conduct. For example, men consistently pay more attention to safety ads than women (in these publications); safety ads can be more interesting than normal commercial ads; some media vehicles may be better suited for such ads than others on the basis of attention paid by the audience. Much more detailed breakdowns of such results are possible.

Campaign Evaluation Studies

Campaign Evaluation No. 1. "A Survey of Successful Road Safety Campaigns." (Duurloo).[18] The title of this article overstates the case, being merely a summary of several European safety campaigns with little or no measurement of success or failure; therefore, the adjective "successful" — as in most other subjective evaluations — must be interpreted as wishful thinking. Allusion is made to some pretesting of a Dutch campaign, but details are lacking. A reduction in accidents in Belgium is mentioned, but this may or may not have been due to the communication campaigns.

1. *Conclusion:* No conclusion on the effectiveness of these campaigns can be drawn. Research was either lacking entirely, inadequate, or not reported.

Campaign Evaluation No. 2. "Effect of an Accident Reduction Campaign." (Swanson and Lauer).[43] A four-month Iowa traffic safety campaign was conducted in 1958 with the theme "Save 100 lives in traffic this year." A publicity campaign (presumably in a variety of media) was accompanied by spot checks of traffic. Measurement consisted of analysis of traffic accidents and fatalities before and after the campaign.

1. *Conclusion:* No conclusion about campaign effectiveness could be drawn. "The evaluation of before and after effect in traffic needs more attention, and suitable models for such procedures should be developed to account for the various influences which prevail," were the words of the report.
2. *Study Design.*
   Research Environment: Realistic.
   Design: Non-experimental post hoc analysis; before-and-after analysis with no control or comparison group.
3. *Comment:* No conclusion possible, because no control group was used to

assess what would have happened without the campaign.

Campaign Evaluation No. 3. "Dipped-Headlights Campaigns in 1963-64." (Anonymous).[2] The British conducted a "dip your headlights" campaign in 1963-64. To measure the effects, a test town and some "matched" control towns were selected; accidents, fatalities, injuries and various other statistics were analyzed for the before-campaign and after-campaign period.

1. *Conclusion:* No conclusion possible. In the words of the official report: "A detailed assessment of the . . . campaign . . . was arranged . . . but was abandoned . . . because several major road and traffic changes had occurred between the comparison periods . . . These made the separate evaluation of the effect of dipped headlights impossible."
2. *Study Design.*
   Research Environment: Field, realistic.
   Design: Quasi-experimental; measurement before-and-after; test and quasi-control towns ("matched" rather than randomly assigned to treatments).
3. *Comment:* The research design of this study is quite an improvement on the conventional before-and-after study. An attempt was made via matching to get a control group. Changes in behavior were assessed instead of using question-and-answer surveys only. But it is still only a quasi-experimental design, and therefore no valid conclusions could be drawn.

Campaign Evaluation No. 4. "Cars at Public Houses." (Sheppard).[34] "A Survey Among Drivers." (Sheppard).[35] During the 1964 Christmas season, Great Britain conducted a five-week anti-drinking/driving campaign. To measure the effects, a sampling of bars and taverns produced figures on the number of cars parked outside before, during, and after the campaign. In addition, personal interview surveys were conducted among the public before and after the campaign.

1. *Conclusion:* No conclusion on campaign effectiveness was possible.
2. *Study Design.*
   Research Environment: Field, realistic.
   Design: Non experimental; measurement before-and-after with no control group; unobtrusive measurement of cars at public houses, a positive feature.
3. *Comment:* Since no control group was built into the research design, no measurement of the effects of communication influence as separated from other influences was possible.

Campaign Evaluation No. 5. "Amended Formal Tender for Research on Drinking and Driving." (Anonymous).[7] For the 1967 British drinking/driving campaign, surveys of the general population are to be conducted before September 1967 and after January 1968 as the campaign evaluation method. The surveys are to measure public attitudes toward drinking and driving, awareness of changes in the law, and verbal reactions to the publicity campaign. Results are to be cross-tabulated by drinking practices, driving habits, demographic characteristics, and various other factors, to determine changes among specific sub-population.

1. *Conclusion:* See comment (3).
2. *Study Design.*
   Research Environment: Field, semi-realistic.
   Design: Non-experimental; measurement before-and-after with no control group.
3. *Comment:* No conclusions about the effectiveness of the communications campaign can be drawn from this study. Any changes that occur may be due to the change in law, to the publicity, to the breath measurement procedure itself, or any of many other factors that occur between the two measurement periods. The essential flaw is that no control group (no publicity) is available to determine what would have happened without the publicity campaign. It can be predicted that complex statistical procedures will be used after the surveys are completed to try and separate out the various influences.

Campaign Evaluation No. 6. "The Lackland Accident Countermeasure Experiment." (Barmack and Payne).[9] In 1958-59, Lackland Air Force Base mounted an information/

education campaign to reduce drinking/driving accidents. (Unfortunately, at the same time there was increased activity by Base police and changes in accident-reporting methods.) For one year, a theme roughly translatable as "drinking drivers are disturbed, not heroes" was put forth through meetings, bulletin boards, and the Base newspaper. Accident records were analyzed before and after the campaign.

1. *Conclusions:* ". . . there was a significant reduction in accident experience . . . counter to rising national, state, and city trends, (and) . . . counter to the experience at Randolph AFB, a nearby base. An uncontrolled design contaminant was stepped-up on-base air police activity . . . Further research is suggested to determine which elements of the program were effective."

2. *Study Design.*

   Research Environment: Field, realistic.

   Design: Quasi-experimental; measurement before-and-after campaign with test and quasi-control group; treatment consists of combined effects of campaign and police-activity change. Method of measurement (accident records) changed during course of campaign.

3. *Comment:* Effects of the communication campaign itself are inseparable from various other uncontrolled activities, therefore impossible to determine communications effects. A little extra care in and control of research design would have made this a landmark study.

Campaign Evaluation No. 7. "The Great Holiday Massacre: A Study of Impact." Naisbitt).[32] An attempt was made to measure the effects of a one-hour television documentary "The Great Holiday Massacre," in 1960. The theme may be stated as "holiday driving is especially dangerous, particularly if drinking occurs." Interviews were conducted before and after the program, among both viewers and non-viewers in four large cities, to detect changes in awareness and attitudes engendered by the program.

1. *Conclusions:* No specific effects were concluded in this article. However, an examination of the data presented reveals the following interesting findings:

Before-and-after Change (before-to-after)

Idea	*Viewers* %	*Non-viewers* %	*Net effect on viewers* %
Holiday driving is very or fairly dangerous	—11	—3	— 8
A "cocky" attitude	— 3	—1	— 2
Alcoholism is a driving hazard	+17	+4	+13
Driving message doesn't apply to me	+20	+2	+18

If the results above were true measures of effect (which they are not, as will be discussed below), they would indicate:

a. The program caused fewer people to believe holiday driving is dangerous—i.e., a "boomerang" effect.

b. It had no effect on "cocky" attitudes about driving.

c. It caused more people to believe alcoholism is a driving hazard—i.e., a positive effect.

d. It caused more people to believe safe driving practice messages don't apply to themselves i.e., a boomerang effect.

2. *Study Design.*

   Research Environment field, semi-realistic.

   Design: Non-experimental, measurement before-and-after program with cross-tabulation by self-selected viewers and non-viewers; i.e., "static group comparison" design.[18]

3. *Comment:* It is impossible to draw any valid conclusions about the effects of the program from this study. The use of non-viewers as a "control" group gives a deceptive appearance of having here an experiment. However, because of the self-selective nature of those who chose to become viewers, and non-viewers, this indicates that the groups were different (in their interests, motivations, characteristics, behavior, etc.) to begin with. Therefore, it is impossible to determine how much of the change is due to the program and how much to the differences among the two groups initially. In many other respects this was an excellent study, but the fatal flaw in research design makes the results almost useless.

Prototypes for Campaign Evaluation Studies

Since no truly adequate research studies for measuring traffic safety or drinking/driving campaign effects have been conducted, one must turn to other topics for models—prototypes which may be used to guide future research design. Presented below are various examples of controlled field experiments on communication which satisfy all the criteria for realistic measurement of cause-and-effect in the real world.

For additional examples of such studies, advertising and non-advertising, and a complete discussion of methodology, see a recent monograph by the author.[23]

Effects of Direct Mail on Voting

The earliest reported non-commercial case of a controlled field experiment in mass communications is the classic study reported by Gosnell[20]. Gosnell tested the effect of a non-partisan "get out and vote" direct mail campaign on registration and voting turnout among Chicago adults. This study is a worthy prototype of experimental design, naturalistic communication, and unobtrusive measurement. In addition, the message itself was scientifically designed, based on a previous survey of non-voters to discover their reasons for abstinence. An additional feature was the testing of several different kinds of messages—factual; cartoons; personal reminders.

The test campaign consisted primarily of a post card, a pamphlet, and other registration and voting instructions mailed out at intervals prior to registration and election time. After-campaign measurement, conducted on 6,000 adults randomly assigned to either a test or control group, consisted of auditing voting and registration records after elections.

The study showed that the direct mail campaign significantly increased registrations and voting turnout for local elections, but had no effect on the turnout for the national election.

Effects of Emotional vs Rational Themes

The effects of two political leaflet themes on voting was reported by Hartmann[21] in a study conducted among voters in a local and state election in Allentown, Pennsylvania. The city's 19 wards were non-randomly assigned to three treatment groups—an emotional appeal (three wards), a rational appeal (four wards), and control (no leaflet, 12 wards). A single four-page "Vote Socialist" handbill with either an "emotional" or a "rational" appeal was delivered to homes during the week preceding the 1935 election. Measurement consisted of analysis of ward-by-ward voting results in 1934 and 1935.

The study showed that the emotional appeal tended to be more effective than the rational appeal, though in no case was the net change in socialist share-of-vote as much as one per cent.

This study illustrates three important aspects of real-world communications effects: a very small change in behavior can usually be expected from single-message communications on established significant issues; extremely large samples are needed to reliably measure such small changes; the necessity for randomly assigning experimental units to treatments cannot be overcome by "matching" (the Hartmann study reveals large pre-test differences among the treatment groups).

Effects of a United Nations Information Campaign

The effect of a heavy United Nations information program on community leaders' opinions and on newspaper UN contents was reported by Haskins and Jones[22] and the Carnegie Foundation[17]. (This study is unusual in one of the dependent variables employed, the amount and kind of foreign affairs content of newspapers). The experiment was conducted in six middle-sized U.S. cities, sponsored by the Carnegie Foundation for International Peace. In the pretest-post test design, six cities were randomly assigned to two groups—test (three cities) and control (three cities). The information program consisted of pamphlets, films, lectures and workshops for community leaders over a two-month period in 1956. Measurement over a five-month period before and after the campaign consisted of sample surveys of community leaders and content analysis of a sample of daily newspaper issues.

The study showed that the information program had absolutely no effect either on community leaders' knowledge, attitudes, interest, or activities, or on the kind and amount of UN/foreign affairs news printed in local newspapers.

Note that the treatment group (top line) is presented with the *opportunity* for exposure (X_o) as in the real world, and not exposed forcibly (X_f) as in the case of the laboratory experiment. Among the group receiving the opportunity for exposure, there will be some who will selectively expose themselves and some who will not (X_s and NX_s respectively). This group is compared with the control group (bottom line) from whom the opportunity for exposure is withheld, or as it has been called, forcible non-exposure (NX_f).

A direct comparison of three post test-only designs—non-experimental design 1, laboratory experimental design 2, and controlled field experiment design 3—will make the distinctions between the three more clear.

Design 1
non-experimental

P_1	—	X_s	M
P_2	—	NX_s	M

Design 2
Laboratory experiment

P_1	—	X_f	M
P_1	—	NX_f	M

Design 3
Controlled field experiment

P_1	—	X_o	M
P_1	—	NX_f	M

Note the only notable difference between the laboratory experiment and the controlled field experiment is among the treatment group in the stimulus-exposure condition (top line, second cell)—this distinguishes all of the unnatural conditions of the laboratory, as previously discussed, from the natural conditions encountered in real life.

In the ideal controlled experiment — where non-reactive measures such as sales or other natural forms of behavior are used — we might attach the subscript *nr* to the measurement symbol. This would distinguish those controlled field experiments using the superior technique of non-reactive or unobtrusive measurement from the others — M_{nr} vs. M_r.

The reported use of controlled field experiments to measure the effects of mass communications goes back to 1923. The head of what was at that time the world's largest advertising agency has decribed in general terms the testing of alternative mail-order advertising approaches, the results measured in terms of behavior[25] — coupon returns, sales, and cost efficiency. Hopkins' approach to scientific measurement of communications' effects in realistic situations has yet to be significantly improved upon.

The advantages of controlled field experiments have been discussed in various proposals for use of that design. English[19] proposed that controlled field experiments would be useful in testing the effectiveness of various typographical approaches in advertising. Campbell[15] suggested that the "bandwagon" effect might be verified or refuted by testing effects on various direct mail treatments on voting behavior; he discounts the feasibility of newspapers for the purpose, a medium subsequently employed for experimentation. Towers, Goodman, and Zeisel[44] give a particularly thorough discussion of the flaws in some commonly used designs, while advocating the controlled field experiment, particularly in studying the effects of television. They note: "An essential aspect of a controlled experiment is randomization in determining whether a family (or an individual subject) is to be in the control or experimental group. When rigorous proof is desired, randomization can not be replaced by any other device, be it by so-called matched samples . . . by before-and-after studies, or by matched city studies, even if statistical adjustments of the date are introduced . . . In some field studies where attempts have been made to approximate controlled experiments, the usual practice has been to substitute for randomization the use of so-called matched samples (of, say, viewer and non-viewer) or to rely upon statistical adjustments of the data . . . Nevertheless, because of audience pre-selection, similarity in respect to (the matched) characteristics will not guarantee similarity in respect to others . . . (p. 91).

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*X = exposure to campaign or message; NX = non-exposure;

X_f = forced exposure; X_s = normal self-selected exposure;

X_o = opportunity for exposure; t_1, t_2, t_3, etc. = points in time;

M = measurement; P = population; P_1, P_2, = two different populations.

"There is one flaw in the specific method proposed, however, in suggesting that the cooperation of participating families in such an experiment should be solicited by offering incentives; this would, of course, alert participants to the fact that something special is going on and increase the possibility of a 'Hawthorne' effect, and should be avoided in the ideal situation. Particularly appropriate is a comment to the effect that "the arguments for the controlled field experiment are completely independent of the nature of the effects to be studied or of the difficulties in measuring those effects." (p. 95)

A proposal for controlled field experimentation on communications comes from an unusual quarter in an article by Schwartz[38]. He suggested that it be used in legal research in preference to the case study, the survey, or the laboratory experiment. Schwartz concludes that the controlled field experiment is "a model of the type of research that promises most for the empirical study of the consequences of law" and offers an example of how it might be used; patriotic vs. threatening vs. control direct mail appeals to taxpayers, with unobtrusive measurement in the form of tax payment records by individuals.

Experimental Units in Controlled Field Experiments

The experimental unit used in controlled field experiments on mass communication is partially a function of the extent to which message distribution, or vehicle units, can be controlled. Case studies are reported, further on, in which three different categories of experimental units are used — individuals, plots or blocks, and geographical areas.

Two or more treatments can be randomly assigned to *individuals* in the case of direct mail and some printed media. An example is the "split run" magazine experiment, in which a complete list of subscribers is available and every other name is assigned to either an *A* or *B* treatment, designated in ABABAB fashion throughout the list; every other house in an area gets an *A* copy of the magazine, every other house gets a *B* copy. Such a design is possible anytime a complete listing of individuals or addresses is available, provided that distribution of the alternative treatments can be pinpointed by individuals or addresses.

A somewhat larger experimental unit is the *plot;* a geographical area is split up into plots, blocks, wards, precincts, tracts, or other subdivisions in a checkerboard pattern. All individuals within each plot get the same treatment. An example of this is the Milwaukee Advertising Laboratory[4] in which a single market area is divisible into many small sub-areas with alternate versions of a newspaper going into each on an ABAB basis.

The third category of experimental unit employed in previous controlled field experiments is the *city/market area.* When a number of cities or market areas are randomly assigned to two or more treatments, the alternative treatments and accompanying measurement can sometimes be controlled more precisely than when smaller units are employed. Many large-scale marketing experiments take this form; for example, 60 metropolitan areas might be randomly divided into three groups of 20 each to test different levels of advertising effort, or to test different message themes, etc.

In the case of the individual split-run procedure, there exists the risk that individuals in one treatment-group may contaminate individuals in another treatment or control group. Such contamination would always operate in the direction of minimizing real treatment differences and thus the measured effects would always be a conservative estimate of true differences — a bias toward the Type II error, the acceptance of a null hypothesis when it is, in fact, false.

In the case of the checkerboard (split-plot) procedure, the conservative bias would be reduced but not eliminated.

In the "market experiment" procedure, where isolated and non-contiguous markets are the experimental units, the conservative bias would be minimized. However, to account for within-market correlation, special statistical procedures may be required, and the requirement of at least two markets — preferably three — per treatment raises treatment and measurement costs considerably.

References

1. Anonymous. "What Motorists Really Think About Traffic Safety." Washington, D. C., ATA Foundation, Inc., 1958.
2. Anonymous. "Dipped Headlights Campaigns in 1962-64." London: Her Majesty's Stationery Office, Road Research Laboratory, Technical Paper No. 73, 1964.
3. Anonymous. Commentary No. 1 on the Milwaukee Advertising Laboratory. New York: Advertising Research Foundation, 1965.
4. Anonymous. Milwaukee Advertising Laboratory: Operations and Performance Report/1965-66. Milwaukee: The Journal Company, 1967.
5. Anonymous. "Results of Street Interviews on Drinking and Driving Pay-off Lines." London: Ministry of Transport, July 1967 (Mimeographed, semi-confidential).
6. Anonymous. "Breath Test Campaign: Research Findings on the Illustrations of the Testing Device." London: Ministry of Transport, August, 1967 (Mimeographed, semi-confidential).
7. Anonymous. "Amended Formal Tender for Research on Drink and Driving." London: Ministry of Transport, October, 1967 (semi-confidential).
8. Anonymous. "Centering Traffic Safety Communications Around Drivers' Motivations." An exploratory study conducted for the ATA Foundation, Inc., and the Pure Oil Company. Princeton, New Jersey: Opinion Research Corporation.
9. Barmack, J. E., and Payne, D. T.: "The Lackland Accident Countermeasure Experiment." *Highway Research Board Proceedings*, 1961, 40, 513-522.
10. Beach, R. I.; "The Effect of a Fear-Arousing Safety Film on Physiological, Attitudinal and Behavioral Measures." A pilot study. *Traffic Safety Research Review*, 1966, 10 (2), 53-57.
11. Belcher, J. C.; "Acceptance of the Salk Polio Vaccine." *Rural Sociology*, 1958, 23, 158-170.
12. Blomgren, G. W., Scheuneman, T. W., and Wilkins, J. L.: *Effect of Exposure to a Safety Poster on the Frequency of Turn Signalling*. Evanston, Illinois: The Traffic Institute, Northwestern University, Research Project RR-214, 1962.
13. Blomgren, G. W., Maddock, J. W., and Wilkins, J. L.: *An Evaluation of Seat Belt Advertisements*. Evanston, Illinois: The Traffic Institute, Northwestern University, Research Project RR-220, 1962.
14. Campbell, D. T.; "On the Possibility of Experimenting with the Bandwagon Effect." *International Journal of Opinion and Attitude Research*, 1951, 5, 281-289.
15. Campbell, D. T., and Stanley, J. C.; *Experimental and Quasi-Experimental Designs for Research*. Rand McNally & Co., Chicago, 1966.
16. Cannell, C. F., and MacDonald, J. C.; "The Impact of Health News on Attitudes and Behavior." *Journalism Quarterly*, 1956, 33, 315-323.
17. Carnegie Foundation. "The United States Public and the United Nations." Report on a study of American attitudes on the U. N. and the communication of information to the U. S. public. New York: Carnegie Endowment for International Peace, 1958.
18. Dunrioo, U.; "A Survey of Successful Road Safety Campaigns." *International Road Safety and Traffic Review*, Spring, 1957, 20-28.
19. English, E.; "Use of Split-Run Techniques in Studying Ad Typography." *Journalism Quarterly*, 1946, 23, 66-68.
20. Gosnell, H. F.; *Getting Out the Vote: An Experiment in the Stimulation of Voting*. Chicago: University of Chicago Press, 1927.
21. Hartmann, G. W.; "A Field Experiment on the Comparative Effectiveness of 'Emotional' and 'Rational' Political Leaflets." *Journal of Abnormal and Social Psychology*, 1936, 31, 99-114.
22. Haskins, Jack B., and Jones, R. L.; A report on the Carnegie Endowment for International Peace newspaper study. Minneapolis: Research Division, School of Journalism, University of Minnesota, 1956.
23. Haskins, Jack B.; *The Controlled Field Experiment: A Research Design for Measuring the Effects of Communications*. Syracuse: Dr. J. B. Haskins, School of Journalism, Syracuse University, 1967, (multilithed, 112 pp.).
24. Henderson, H. L., and Kole, T.; *Progress Report: Mass Communication and Group Discussion Techniques*. A study of the effectiveness of small group discussions of safety films and driver problems in changing the attitudes and behaviors of accident-involved drivers. New York: Drivers Safety Service, Inc., 1963 (supported by PHS contract no. PH-43-103).
25. Hopkins, C. C.; *Scientific Advertising*. New York: Lord and Taylor, 1923.
26. Laner, S., and Sell, R. G.; "An Experiment on the Effect of Specially Designed Safety Posters." *Occupational Psychology*, 1960, 34, 153-169.
27. Levy, S. J., and Greene, H.; *The Effectiveness of Safety Education Materials*. Chicago: Social Research Inc., 1962 (Mimeographed for Employers Mutuals of Wausau, Wisconsin).
28. Malfetti, J. E., "Scare Technique and Traffic Safety." *Traffic Quarterly*, 1962, 318-330.
29. McAshan, H. H. "An Experimental Study of Traffic Safety Films, the Factors Involved in Determining Driver Behavior, and the Predictive Effects of a Behavioral Change Analysis." *Dissertation Abstracts*, 1963, 23(1), 125-126.
30. Moore, H. M., Jr.; "Effects of Fear-Arousing Communications on Driving Safety Attitudes and Driving Behavior." *Dissertation Abstracts*, 1966, 26(10), 6210-6211.
31. Murphy, D. R.; *What Farmers Read and Like*. A record of experiments with readership on Wallaces' Farmer and Wisconsin Agriculturist, 1938-1961. Ames: Iowa State University Press, 1962.
32. Naisbitt, J.; "The Great Holiday Massacre." A study of impact: Public reaction to television documentary throws new light on safety propaganda. *Traffic Safety*, March, 1961, 42-49.
33. Sheppard, D., and Colborne, H. V.; "A Study of a Film on Drinking and Driving." Crowthorne, Great Britain: Road Research Laboratory, LN/368/DS.HVC, June, 1965.

34. Sheppard, D.; "Cars at Public Houses." Crowthorne, Great Britain: Road Research Laboratory, TN-184/2, March, 1967.

35. Sheppard, D.; "A Survey among Drivers." Crowthorne, Great Britain: Road Research Laboratory, TN-184/3, March, 1967.

36. Sheppard, D., and Colborne, H. V.; The Ministry of Transport's leaflet on drinking and driving. Crowthorne, Great Britain: Road Research Laboratory, TN-184/5, March, 1967.

37. Sheppard, D., and Colborne, H. V.; "The Film, 'Road Deaths-Xmas, 1963'." Crowthorne, Great Britain: Road Research Laboratory, TN-184/4, March, 1967.

38. Schwartz, R. D.; "Field Experimentation in Sociological Research." *Journal of Legal Education*, 1961, 13, 401-410.

39. Scott, G.; "Anatomy of a Campaign." *Advertising Quarterly*, Spring, 1965, 14-22.

40. Spector, P., Torres, A., Lichtenstein, S., and Preston, H. O.; "Communications and Motivation in Community Development: An Experiment." AIR-D18-11/63-PR Washington: Department of State, Agency for International Development, December, 1964.

41. Starch, Daniel.; "Mobil Oil Safety Campaign." Personal communication to Jack B. Haskins, October, 1967.

42. Sulcer, F. D.; "The Advertising Council's Traffic Safety Campaign." New York: American Association of Advertising Agencies. AAAA Central Region Annual Meeting, October 4, 1963.

43. Swanson, C. O., and Lauer, A. R.; "Effect of an accident reduction campaign." Washington, D. C.: Highway Research Board Annual Meeting, January, 1959 (Mimeographed, Iowa Department of Public Safety).

44. Towers, I. M., Goodman, L. A., and Zeisel, H.; "A Method of Measuring the Effects of Television Through Controlled Field Experiments." *Studies in Public Communication*, University of Chicago Press, 1962, (4), 87-110.

45. Undeutsch, U.; "Analisi Psycologica dei Cartelli Antinfortunistici." (Psychological analysis of anti-accident posters). *Securitas*, 1963, 51(5), 77-103.

46. Waisanen, F. B.; Summary: "The Impact of Communication Rural Development: Costa Rica." East Lansing: Department of Sociology, Michigan State University, 1963 (Mimeographed).

ALCOHOL AND ACCIDENTS: PUBLIC HEALTH EDUCATION

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It appears to many that the familiar admonishment "If you drink, don't drive; if you drive, don't drink," hasn't done the job it was intended to do in reducing the large number of motor vehicle accidents in which alcohol plays a part. Although it is the antisocial drinker who constitutes the greatest alcoholic menace on our streets and highways, also involved is the strictly social drinker who has "one for the road," after several to be sociable, and ends up driving himself home with one eye shut to eliminate double vision. Sometimes he never makes it home. And sometimes he is the reason another who has the ill fortune of sharing a roadway with him never makes it home.

The fact that drinking has become a part of our culture is evident from the 65 to 70 million adult Americans who drink in contrast to the 35 to 40 million who don't. Eight of ten men over 21 and two of three women over 21 drink alcoholic beverages at least occasionally.

Research has revealed that as many as half of all highway accidental deaths and injuries have alcohol involved as a prime contributing factor. Based on less definitive studies, it has been estimated that at least one-fifth of home injuries are associated with excessive use of alcohol. Too frequently, people combine drinking with activities requiring sound judgment, fast reactions, and a high degree of skill and coordination — precisely the body functions that alcohol impairs.

The first impairment is judgment, resulting in a false sense of confidence in ability. A state supreme court has held that a person is under the influence of alcohol when, due to the imbibing of alcohol, he has lost to any extent some of that clearness of intellect and self-control that he would otherwise possess.

People often grossly overestimate the number of drinks they can consume before engaging safely in demanding activities such as driving a car, operating power machinery, or even participating in some sports.

Some people have the impression that they can sober up any time they wish. This is a fallacy. Although alcohol is absorbed swiftly and directly into the bloodstream and takes effect almost immediately, it is eliminated only very slowly at a constant rate of about ¾-ounce per hour. It takes an extended period of time for the effects of only two or three drinks to wear off. No amount of coffee, fresh air, cold showers, or any other type of treatment does anything to speed the process. While some persons may seem less groggy after such widely-used sobering-up processes, their degree of intoxication is not reduced. There is no scientific basis for any conclusion except that one may, after treatment, simply have a wide-awake drunk on his hands.

A report was completed just last month by the Public Health Service Injury Control Research Laboratory at Providence, Rhode Island, entitled, "The Effects of Alcohol on Decision-Making with Traffic Signals." The investigators* conclude from their studies, done under conditions similar to or in the real-life situation, that most persons can take a certain small amount of alcohol with no measurable behavior change (at least with respect to traffic signal response). Beyond that amount, the effect increases rapidly.

For most drivers, levels of blood alcohol below .05 per cent apparently increase accident risks only moderately. Two bottles of beer or two ounces of whiskey consumed over a short period of time by a person weighing 150 pounds will raise the blood alcohol level to this percentage. A smaller person would have a higher blood alcohol level after having consumed an equivalent amount. The Uniform Vehicle Code (1967 Rev.) states that an alcohol concentration in the body of .05 per cent or less is presumptive evidence of *not* being under the influence of alcohol; while .10 per cent or more is prima facie evidence of being under the influence of alcohol. For the ambiguous area of concentration between .05 per cent and .10 per cent, there is no presumption either way in the United States. However, in Sweden and Norway, the law considers .08 per cent and .05 per cent respectively, to constitute concentrations of alcohol sufficient to render a person incapable of safe operation of a motor vehicle. Under a new British road safety law it is an offense to drive, or attempt to drive, with 80 mg. (.08 per cent) or more of alcohol in the body for every 100 ml. of blood.

The Providence study was designed to test whether or not impairment of a simplified driving task would occur at blood alcohol levels (B.A.L.) above .05 per cent but below .10 per cent. The results of the study lead us to conclude that a moderate blood alcohol level of .05-.10 per cent will significantly impair performance on a simple driving task. However, performance differed, depending on whether blood alcohol levels were ascending or descending. It appeared that a rising blood alcohol level would produce a greater impairment of driving performance. The descending alcohol level sessions showed a marked reduction in total errors. Nevertheless both alcohol sessions showed more errors of judgment than normal sessions.

Many people drink and drive for years without experiencing an accident. This reinforces their belief that "accidents only happen to the other guy." It has led to the common misbelief that only the pathologically motivated heavy drinker, or the alcoholic, presents a significant traffic hazard. Most recent studies now show that the alcoholic is a major contributor to the problem, but there is still a substantial proportion of drivers killed, particularly under the age of 25, who have been found to possess comparatively low blood alcohol levels at the time of their deaths. Perhaps older social drinkers have learned the limitations of their driving ability and of their drinking prowess.

The fact remains that alcohol affects judgment adversely to such a degree that it impairs the safe performance of acts which require skill or carry a large degree of individual responsibility. According to the Secretary of Transportation's report to Congress in August of this year, the use of alcohol by drivers and pedestrians leads to some 25,000 deaths and a total of at least 800,000 crashes in the United States each year.

The sensible approach to control of the problem would be to keep drinking and ac-

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tivities which demand skill far apart. This has been attempted by educational methods and by legal restraints. With respect to the alcoholic population, legal sanctions applied to drivers convicted of "driving under the influence" have been only partially effective. Apprehension takes place after the fact of an accident which they have caused or, more rarely, after police observation of erratic driving behavior. Penalties are far from being uniform. Driving after license suspension or revocation is widespread. In short, most chronic alcoholics are not susceptible to persuasion or to the prospect of administrative restrictions. Recognizing that the traffic hazard is but one aspect of the manifold health and social issues of alcoholism, the Advisory Committee on Traffic Safety has recommended that there should be a national goal, backed up by a national program, to eradicate the disease of alcoholism.

It is not our purpose to discuss the many ramifications of such a program. Suffice to say it would include educational measures quite different from those which might influence casual, occasional, or social drinkers.

Alcohol-related injuries and deaths, on and off the highways, are of such magnitude as to warrant utilization of all possible avenues of corrective action. It would seem in order for the organizations and agencies now grappling with the alcohol-accident problem to supplement existing educational efforts by an experimental approach directed toward that large segment of the population comprised of the social drinkers — not chronic alcoholics in the viewpoint of society or the medical profession. An additional approach which might be highly effective would be an educational program designed to inform people who drink before driving or walking on the highway, or undertaking other potentially hazardous activities, that the higher the alcohol concentration in their blood, the greater their risk of being involved in an injury producing accident. An essential element of such a program would be information on how individuals might determine their own accident risk factor in relation to the number and kinds of drinks they consume. They should be able to know generally where their danger level starts, and where it may be expected to rise rapidly.

If a national educational effort of this nature were mounted, working at state and local levels, primarily through health and education agencies, I believe that a substantial reduction in alcohol-related accidents could be brought about. Most people are poorly informed and many are misinformed about the role alcohol may play in accidental injuries. This results in hazardous drinking patterns that greatly increase the likelihood of accidents and injuries.

In summary, we reiterate that abstinence from drinking before driving, or mowing the lawn, or working around the home, or engaging in outdoor recreational activities, would be the simple and obvious solution to one of the major, direct causes of accidents. Drinking of alcoholic beverages is so widespread, so socially acceptable in many circles, and so compulsive among alcoholics that many individuals are unlikely to follow this course. Among several feasible alternative solutions, we suggest that the reasonable person might well be persuaded to drink in such a manner that he will not be under the influence when he drives or carries out other activities for which he must exercise skill and unimpaired judgment. Data is available upon which to base the necessary educational material. We urge that such material be developed, tested and refined in selected areas; then utilized on a national scale.

Practicing physicians, public health agencies, and voluntary health organizations would be particularly effective if they would combine their efforts, and treat this subject as a special aspect of health education.

WHY NOT TEACH PEOPLE TO DRINK AND DRIVE?

By LAURANCE QUANE
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Driver education at the present time is beginning to undergo major changes. In the past, "driver training" was just that—training kids in braking, steering, and gassin.' In the future, starting very soon, I hope, driver education will be a more practical, more useful, and certainly more meaningful course than just the acquiring of the physical skills of driving by sixteen year olds.

One aspect of driver education which will receive much more attention in the future than it has in the past is the whole area of alcohol. The question which is raised often by many people is, why should the study of alcohol be included in school, and especially why in driver education? Why not in health or physical education or science? It would be extremely beneficial if alcohol were studied in all these subjects, but driver education by its nature requires an adequate study of alcohol.

Several research studies have shown that many of the individuals who are involved in fatal traffic accidents have alcohol blood levels which are surprisingly high. *Accident Facts 1967* states that drinking is indicated to be a factor in at least half of the fatal motor vehicle accidents in the United States. For example, California reports three out of five of those drivers injured had been drinking; Wisconsin, two out of three; Minnesota, two out of three; and in Massachusetts three out of four of the drivers in single-car fatalities had been drinking.

Another reason why the study of alcohol should be included in driver education is really a matter of default. Even though most states have laws which prescribe a certain amount of alcohol education, this does not seem to be enough; or it is not taught adequately, as the number and scope of misconceptions about alcohol is staggering. For example, how often is it repeated that giving an inebriated person a cup of black coffee will sober him up? When, instead, all you have is a wide-awake drunk when you are done. Or the misconception about the amount of alcohol in different drinks. "I can't get drunk on beer, no one can!" Not so! One serving of beer contains the same amount of alcohol as any other average serving of alcoholic beverage. And if enough alcohol is ingested, a person becomes inebriated. Or the misconception about the sobering effects of a cold shower. The elimination process or oxidation of alcohol is constant for each individual, and it can not be made faster by various methods. Or the misconception about alcohol and disease. While it is true that heavy drinkers do have more alcohol-related diseases (cirrhosis, malnutrition, etc.), the problem belongs to *heavy* drinkers and not social or occasional drinkers. And the misconception about the stimulating effects of alcohol—alcohol is a depressant to the central nervous system, even though it doesn't appear that way. These misconceptions may seem to be far-fetched or contrived, but they are held by many uninformed or misinformed young and old people alike today.

Who does driver education hope to influence or educate? In our fondest dreams, we can not imagine reaching all people in our country, even though each driver must have this vital information concerning alcohol. The largest single group of people that driver education must reach is the young driver or potential driver. The literally millions of young adults at approximately age sixteen comprise the overwhelming number of students in driver education.

However, another group, although not extremely large in number, is one which must not be overlooked—the adult learner. These drivers can have a more significant influence in their circle of acquaintances than can the sixteen-year-olds, and this must be recognized, as this can be an important help in our cause. Even though we can not hope to educate all the drivers in the country, we can hope to have some impact on the general adult population.

The question is then raised concerning the content of the study of alcohol—what particulars should be studied out of this broad and rapidly expanding field. Professional opinions vary widely as to the exact con-

tent, but there is much agreement as to some particular points. First, I should like to present some of my own feelings about the study of alcohol in driver education classrooms, and then dwell upon the consensus of most professional educators.

From very limited personal research that has been conducted concerning the source of information about alcohol, it has been found that teens are getting very little of it from the schools. What little information they are receiving is obtained in subjects ranging from Physical Education and Science to English and Civics. In research conducted at Michigan State University, it was found that students received their alcohol information mostly from non-school sources, and that which was school-based was inadequate. There does not seem to be any one place that students can say, "Yes, I learned about that." Since alcohol is so closely related to the fatalities on our highways, why shouldn't driver education attempt to do this necessary job?

But what content is to make up the individual lessons in school? The effects of alcohol can be divided into three groups—physiological, psychological, and pharmacological. All three of these divisions are important, as drivers will be affected in these three ways and therefore must understand each.

A very dramatic demonstration of the psychological affects of alcohol is easy to present. A similar phenomenon occurs everyday in many doctor's offices. A patient complains of indescribable and unidentifiable ills. The doctor, knowing his patient, prescribes a certain medication which he knows is nothing but a sugar pill or the like—a "placebo." The patient makes a hasty recovery even though there was no real medication. A similar event can occur with alcohol. At many institutions, subjects involved in experiments dealing with alcohol have been thoroughly drunk or "bombed" on grape juice or other non-alcoholic beverages. All the outward symptoms of drunkenness appear even though no alcohol was present in the body. Another psychological effect which is easily seen is the "life of the party" effect. Many of us have seen someone whom we have thought to be very quiet, and yet after a few drinks, no one else can get a word in. A similar effect is the tone of a party where alcohol is served. Often, at the outset, most people are jovial but relatively quiet. As the alcohol intake increases and the effects begin to be felt, the party gets louder, and the people who were unbearable before become easier to talk to, as well as more friendly. This increases until the effects begin to wear off.

It then appears that intoxication is not only related to the amount of alcohol present in the blood stream, but also to the mental and emotional state of the individual. This idea is extremely important to driver education and young drivers. It is not typical that the teen drinker-driver has ingested enough alcohol to physiologically intoxicate himself, and yet he is truly intoxicated and drives in a corresponding manner. This psychological intoxication is the biggest danger for teenage or inexperienced drinking-drivers. With only small amounts of alcohol, this driver responds as if he had consumed much, much more. Inexperienced drinkers and drivers should be made aware that they may be subject to such a phenomenon and how to compensate for it.

The physiological effects of alcohol are many and varied, depending on the type and amount of alcoholic beverage consumed, the time span in which drinking takes place, the amount of food in the stomach, as well as the size of the person.

Different alcoholic beverages have different physiological effects on people. While each serving of beer, wine, or distilled spirits has the same amount of alcohol in the solution, some are absorbed faster than others. If a beverage contains CO_2 bubbled through it, the drink will be absorbed much faster than if CO_2 is not present. This is to say that the "bubbly" will be absorbed in less than the ½ hour or so needed for absorption of other alcoholic beverages.

It has been shown on many occasions that alcohol will be absorbed at a tremendously slower rate if food is present in the stomach at the time of the consumption of alcohol. One such occasion took place in Finland, when a subject was given two ounces of alcohol on an empty stomach. His blood alcohol level reached over .10 per cent. However, after eating two and one-half pounds of potatoes on another occasion, with the same dose of alcohol his blood alcohol took twice as long to peak at less than .05 per

cent. This, of course, was not a typical meal; but it does amply demonstrate the effects that pulpy, oily, or just plain food will have on the absorption rate of alcohol.

A final idea concerning the physiological effects of alcohol is the relationship of body size to the amount of alcohol consumed. For example, in your mind's eye picture a six foot one inch tall football player, weighing 250 pounds. Naturally, he marries a girl who is four feet ten inches tall and weighs 94 pounds. If they went to a party and each had a couple of average drinks, the results would be extremely different blood alcohol levels. While his 250 pound mass can distribute and dilute the alcohol in much more fluid, her body has less than half the amount of fluid to dilute the alcohol. Her blood alcohol level may be as high as .05 per cent, while his may be as low as .02 per cent. Body size and the corresponding amount of fluid present have a definite relationship to the physiological effects of alcohol.

The third division of alcohol effects are the pharmacological effects. The most misunderstood of these is that alcohol acts as a depressant, and not as a stimulant. The chemical effects of alcohol are much the same as those of ether, but not nearly as fast. Even though people seem to be stimulated, as their activity usually increases in intensity and amount, their central nervous system is being depressed, as well as other body functions. Their inhibitions are broken down and they do more than they normally would do; they give vent to their emotions more fully and vividly; but this pseudostimulation is nothing more than a false mask which will soon be lost.

Another aspect of the pharmacological effects of alcohol is the way in which the body rids itself of the substance. Alcohol is oxidized or burned up almost exclusively in the liver. Approximately 90 per cent of the oxidation occurs there. Exercise, black coffee, or other such remedies have no effect on the oxidation process in the liver, and only little effect on the total elimination of alcohol. Thus, each of us has a specific rate at which alcohol will be eliminated, and this can not be changed.

Before proceeding to some of the other professional opinions concerning what should be included in the study of alcohol in driver education, I should like to present a controversial viewpoint on one more aspect of the subject.

If we look at the national statistics of the numbers of drinkers, we find that about two-thirds of the people in the United States consume alcoholic beverages. If schooling, and especially driver education, is to be effective it must have some observable effect on the students. Many driver education students (typically 15½-16 year old sophomores) still have not completely formed their ideas, concepts, and attitudes concerning alcohol. This process has, of course, been started at home with the parents' feelings and their use or non-use of alcoholic beverages. But, I feel that if students are confronted with the whole story, they can better make their decision when the time comes.

We should not force our opinions and ideals on students, but influence them we must! It is not my intent to make all the students drinkers. On the contrary, I hope that they all will make their own personal decision *after* I have presented them with the facts about alcohol. I do not intend to disrupt or contradict teachings from the home, but I feel that in drver education we have the moral obligation to help students obtain the concepts about alcohol that they must have. While teaching about alcohol, we are also attempting to teach students to make decisions, of which their future choice of indulgence or abstinence is but one.

The real meaning of the old slogan "If you drink, *don't* drive" should be explained to students in Driver Education. I perceive this meaning to be "If you drink too much, don't drive." The logical question to follow is, "How much is too much?" It is generally felt that the effects of one drink in the body does not cause a great deterioration in the ability to perform the driving task. Therefore, I am of the opinion that students should be taught how to know when they could drive safely after drinking. This includes the spacing of drinks, about one hour intervals, to allow the body to oxidize the alcohol as fast as it enters; this means the counting of drinks, so as to be able to compute the amount of alcohol in the body, and computing the amount of alcohol that has been oxidized (approximately one drink per hour). If the general adult population (at least the 25,000 plus that

were killed in traffic collisions last year with alcohol in their bodies) knew how to apply these ideas, they would be better and safer drivers.

The last comments I would like to make concern a somewhat controversial subject which I feel very strongly about—implied consent. Perhaps you do not know what implied consent is. You are not in the minority, as research conducted by students at Illinois State University shows. Of a random sample of townspeople, it was found that only 20 per cent knew what implied consent was. Of a selected random sample of students at Illinois State, only nine per cent knew what implied consent was.

What is implied consent? The law allows a police officer, when he has reason to suspect that a driver has been drinking, to administer a chemical test to determine the alcoholic content of the blood. This law has been passed in about half of the states (28). I feel that it is absolutely necessary for us, if we hope to reduce the drinking and driving problem.

Does implied consent work—does the alcohol related death rate drop? I shall cite two examples. *Accident Facts 1968* reports that the states which have implied consent laws in operation do have lower death rates. *Time* magazine reported on the recent enactment of England's implied consent law and its results. The drop in accidents and fatalities was astounding. Of course, a basic premise is that an implied consent law will be enforced as it was in England.

I hope that I have shown the directions in which driver education must go in alcohol education. If students learn the pharmacological, psychological, and physiological effects of alcohol; if misconceptions about alcohol are wiped out and basic concepts are put in their place; if the drinking and driving problem is made real as well as meaningful to students; and, finally, if public support, not only student support, can be gotten for legislation like implied consent, the death rate will have only one way to go!

ADULT EDUCATION ABOUT ALCOHOL AND SAFETY

By JULIAN A. WALLER, M.D., M.P.H.
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The National Safety Council motto accurately describes the goal of education about alcohol and injury. "In safety it's performance that counts." Our main interest is not in popular ideas, in catchy slogans, or in programs that will avoid upsetting people. Rather, we are interested in reducing the toll of injury and death that results from use and misuse of alcohol. It is appropriate to note that alcohol is a major factor not only in unintentional injury, commonly called accidents, but also in intentional injury such as assault, homicide, and suicide.

Traditionally, education about alcohol and safety has been limited to admonishing people about the hazards of combining drinking and driving. And traditionally we have been missing the boat. Most people who drink and who drive do so in combination at least occasionally, despite educational programs, and as long as accurate figures have been available—about 40 years—alcohol has been known to be a consistent factor in about half of severe or fatal crashes. The current educational approach has been a grand experiment in pouring good money and good effort after bad.

Why have we failed thus far? Education about alcohol and safety has ignored four realities that are necessary for success, that is, for reducing the toll of injury and death.

1. The designers of educational programs have assumed homogeneity of the audience to be reached, and further have assumed that those who get into trouble are merely ordinary social drinkers who have ignored the admonitions. Increasingly, evidence is showing that the population to be reached is not homogeneous, and that those who get

into trouble by and large—but not entirely —are not ordinary social drinkers.

2. We have attempted to educate people about proper actions with respect to their personal drinking only, instead of dealing with other areas for action, such as their ability directly or indirectly to affect the behavior of others, or their ability to reduce injury or death in ways that might not even involve changing drinking behavior.

3. Programs have been concerned only with alcohol and driving. We now know that alcohol ingestion by pedestrians is a major factor in pedestrian injuries, and that alcohol is involved in fatal nonhighway injuries such as burns, drowning, poisoning, and private plane crashes about as often as it is in highway fatalities.

4. Finally, there has been almost no attempt to evaluate the success of educational programs. This is why for years we have been able to delude ourselves and the public into believing that educational programs as currently practiced are of value. The truth is, we don't really know and, as noted before, there is good reason to believe that much of our effort is being wasted.

What, then, can be done? Educational programs must be defined in terms of specific goals. These include:

1. Education of the general public as to the nature and extent of the problem of alcohol and injury. People must know how often alcohol is involved, in what types of injuries, what types of persons are most commonly involved, and what options exist for attacking the problem. We have been singularly uninventive in informing the public of the options. These include not only changing behavior but also changing the complexity of tasks people are required to perform whether or not they have been drinking.

We have the option of modifying the transfer of energy so that mishaps need not necessarily result in injury. Even though a person falls asleep with a lighted cigarette after drinking too much, he needn't burn to death if he is wearing fire retardant clothing or if the bed or chair is made of such material. Another option is to improve emergency health services. Many persons with alcohol who are injured, and many of the innocent victims they involve, die only because even the simplest of first aid procedures are not being applied or are being applied ineptly.

2. Direct modification of personal drinking behavior. Insofar as injury results from overzealous social drinking, such behavior can be modified by helping to define moderation and by suggesting how it can be achieved. Obviously, with respect to injury control, it would be better to avoid alcohol altogether. But this suggestion ignores a reality that was apparent even in biblical times. People do not take kindly to prohibition. We can inform people that one drink per hour is, for most individuals, a moderate intake, and that the dilution of alcohol with food and nonalcoholic mixers further reduces the risk of injury. We can also point out that even this amount is immoderate for certain high risk groups such as new drivers, the elderly, and the ill.

3. We can reach those segments of the population that can directly affect drinking behavior or can affect the actions of those who have been drinking. I refer to police officers, fire prevention personnel, judges, physicians, and other health personnel, driving license authorities, and others who maintain surveillance, who intercede during proscribed behavior such as drunken driving, or who are in a position to identify previously undiagnosed alcoholism and to institute therapy. Such persons need to know the frequency with which the presence of alcohol and the existence of problem drinking are missed, and to learn how to increase their acumen in both areas.

4. We can educate the special segments of the public who are in a position to reduce injury and death through indirect means, such as improvements in urban planning, in emergency care, or in design and construction of automobiles and other consumer products, highways, or other aspects of the environment in the home and elsewhere. Education of these groups is especially likely to yield results, because the numbers of people to be reached are relatively few, they are in professional and educational groups that are most responsive to usual educational techniques, they often can be reached through already existing organizations and group media, and because the re-education of even one person in such groups can affect hundreds or even thousands of the general public, including those at highest risk of injury.

5. Again working with special groups including some of those described above, education must be provided as to the need and methods for collecting accurate and comprehensive data about alcohol and injury in order to properly define the nature and extent of the problem and to evaluate any changes resulting from educational or other programs.

Within this context, what specific things can be taught? The most specific information is available on the subject of alcohol and highway safety. Three recent sources of information are the pamphlet, *The Way to Go*, by the late Kenneth Rouse of Kemper Insurance Group; the Report to Congress on Alcohol and Highway Safety from the U.S. Dept. of Transportation; and my recent article, "Suggestions for Educational Programs About Alcohol and Highway Safety," in the 1968 issue of *Traffic Safety Research Review*. Relatively little is available as yet about alcohol and nonhighway injury. The development of such material is a challenge that befits the skills of The National Safety Council Committee on Alcohol and Drugs, the Public Health Service Injury Control Program, and others.

In summary, educational programs about alcohol and safety will succeed only if they are based upon a recognition that there are several goals and several audiences, each of which must be approached differently, and only if such programs are carefully evaluated and redesigned as necessary, using appropriate scientific techniques which are available but all too often are ignored.

YOUTH SESSIONS

WHAT IS BEING DONE BY THE JUDICIAL JUDGE IN TRAFFIC SAFETY?

By HOWARD R. HILL
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JUVENILE COURT VS. MUNICIPAL COURT IN HANDLING OF TEENAGE TICKET VIOLATORS.

I. Municipal Court

A. Parents—When juvenile traffic offenders appeared in Municipal Court, parents did not have to appear. Some parents were unaware their son or daughter received a traffic citation.

B. Fines—The juvenile could forfeit his bail and not even appear in court.

C. Recidivism—money was no problem to some repeated offenders. The juvenile had enough money himself or, in some cases, the parents would provide the financial backing.

D. Records—Municipal Courts had no records of previous offenses in other jurisdictions. Example: A juvenile offender conceivably could have received four speeding citations, and in each case he might be on record as a first offender in four municipal courts. (Las Vegas, North Las Vegas, Henderson, Boulder City)

II. Juvenile Court — Clark County (Example)

A. Parents—In Juvenile Traffic Court, at least one parent is required to accompany the teenager. Naturally, parents are now aware of every citation their son or daughter receives.

B. Fines—There are no fines or bail in connection with Juvenile Traffic Court, so the offender must appear.

C. Recidivism—Juvenile Traffic Court uses a demerit system, the policy being that a license is suspended for the first moving offense.

D. Records—Up to date files are kept on all offenders. That is to say, if a juvenile receives three citations from three different county law enforcement agencies, the juvenile appears in the Clark County Juvenile Traffic Court to account for all three citations. This also holds true when a Clark County juvenile is cited by another county or state.

III. Operation of Juvenile Traffic Court — Educate Parents

A. Point System

B. Fines

C. License Suspension

D. Statistical information concerning:

1. Types of tickets
2. Days of tickets
3. How many in car

IV. Court Traffic School

A. Teenage classes

B. Uniform instructors

C. Eight-hour course of laws, etc.

D. Fee for school

E. Compare with Driver Education classes.

V. Teenage Juries

A. Judged by peers

B. Truth is more probable

VI. Judges Also Aid in:

A. Traffic Safety Programs

1. "Teen Ticket Tally" contest
2. Governor's Youth Traffic Safety Conference

B. Riding with local law enforcement

VII. Parents Can Be Judges

A. Profiles passed on from generation to generation

B. Reaction time

C. Social status — speeding violations

D. Youngsters driving habits — under five years of age. Parents are teachers and, in effect, judges.

E. Emotional problem

F. Parents not strict enough.

HOME FIRE SAFETY

A Demonstration

By FLOYD OGLESBAY
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How many of you have watched the dancing, flickering fingers of a fire and asked yourself these questions: What is fire? What makes fire burn? What things are needed to make a fire?

Let's answer them by the fire triangle board. Three things must be present before a fire will burn. First, we must have something that will burn, a piece of wood or paper. We'll call it fuel. In order for a fuel to burn, it must be in the form of vapor. We'll learn later that some fuels have to be hotter than others before they will give off vapors that will burn.

The second thing we need is heat. It doesn't have to be a flame.

Still, fire will not occur unless we have the third ingredient, that special something in the air called oxygen.

Fire can be your best friend or your worst enemy. Fire can be your servant or your destroyer. There is no in-between for fire. Fire as a friend will heat your home, cook your food, and run your jets. However, if fire is not properly controlled it can burn you, burn your home, even cause injury or death. I think that you want to be friends with fire.

Last year, thousands of persons died in the United States as a result of fire and explosions. The most tragic part was that many of these deaths occurred to small children.

Fire, Its Prevention and Control

Why should I tell you what it takes to make a fire, when I am interested in fire prevention? Only by learning what elements are required to make a fire are we able to learn how to control or prevent a fire.

Fire will go out if any one of these three elements is removed: (1) we may remove the air or oxygen; (2) we may remove the fuel; (3) we may remove the heat.

We have learned that if you take away the air, the fire will go out. Let's try that. We'll place a jar over the flame of a candle. In about three seconds, when the air is used up, the fire will go out. *(Demonstrates)* If your clothing were on fire, fall to the floor or ground and roll over slowly. If possible, roll up in a blanket or rug. This will shut off the supply of air.

We've learned that if you take away the fuel, the fire will go out. By removing the fuel from the path of the fire, the fire goes out. If you remove a full trash container from near the cook stove, the tea towel from above the burners, then your chances of having a fire are lessened. A clean home very seldom burns because excess fuel has been removed.

We've learned that if you take away the heat, the fire will go out. We can take away the heat by pouring water on the burning material. When water is poured on a burning material it lowers the temperature, and the material then ceases to give off vapors that will burn. Paper gives off vapor at about 360°F; wood at 500°F.

Everything Will Burn, and Nothing is Fireproof

Let me say something about the term "fireproof." No material or building, regardless of its nature or construction is fireproof. Although the floors, ceilings, and walls of modern buildings are made of steel and concrete, the combustible interiors of these buildings can be burnt out and lives can be lost. Let's forget the term "fireproof;" almost anything will burn if you have the right conditions.

Here are some examples: Notice that I can hold the smooth side of a piece of wood over the flame and nothing much happens. A little carbon is deposited. *(Demonstrates)* When I place the splintered part over the flame, the splinters burn quickly, because more air reaches the smaller pieces of wood. We have also increased the surface area, thus giving it the ability to absorb more heat. Everything will burn if we have the right conditions.

Do you think steel will burn? This is a piece of steel wool; it is minute particles of

steel. Let's divide the steel wool so that we have more surface area, and get more air between the particles. *(Demonstrates)* The steel is burning; steel is a fuel.

Remember, nothing is fire-proof. Everything will burn if you have the right conditions.

Remember, I stated that you do not necessarily need a flame in order to have a fire. Let's see what would happen if someone were to accidentally drop or toss a piece of steel wool (fuel) onto a battery (heat—electrical energy) where plenty of air is present. Fires don't just happen, they are caused! Most fires are caused by three things: men, women, children — things they do or don't do. Only you can prevent a fire.

Don't Fan a Skillet of Burning Grease.

Fats and grease in a hot skillet often catch on fire. A serious fire may result if the proper methods are not used to bring the fire under control. If a fire should occur, the first thing to do is to turn off the burner under the skillet. But turning off the burner will not put out the fire.

We have learned that the quickest way to put out a fire is by removing the air. Let's try it. By placing a lid on the skillet, the fire quickly goes out. *(Demonstrates)* We bring the lid in from the side to protect ourselves. If you have no lid, throw baking soda into the skillet. When baking soda comes in contact with heat, it produces carbon dioxide (CO_2) which shuts off the air as did the lid. Without air, fire will not burn. A word of caution — never use flour or dry cereals, as they are very explosive when mixed with air.

Never attempt to run with a skillet. This will give the flames more air and cause the flames to leap into your face. While the skillet is motionless the flames don't burn too high, because the fire is not receiving much air.

When I start to move the skillet, the flames grow higher. *(Demonstrates)* If I move the skillet faster, the flames mount up because they are receiving more air. Why trade a small, controllable fire in a skillet for a more serious house fire and possible burn injury? Leave the skillet on the stove, turn off the burner, and shut off the air or oxygen.

A Petroleum Product Misused — Gasoline

Sometimes it is the things that we can't see that harm us the most. There are invisible vapors which are heavier than air. Some of these vapors are doubly dangerous because they are highly flammable. For example, gasoline gives off vapors — dangerous, invisible vapors, even at room temperature. This is also true of other items such as naptha, benzene, paints, turpentine, and some cleaning fluids.

Gasoline gives off vapors which will burn at a temperature of 45 degrees below zero. Kerosene, another petroleum product, can also be hazardous. Kerosene will give off flammable vapors at 130°F.

In this can is a rag that has been soaked in gasoline. This will demonstrate how dangerous, flammable vapors can cause a serious fire. The lighted candle in the trough represents any of the pilot lights in your home, or an electric spark from a motor, such as a refrigerator or washing machine. Watch what happens when I place the rag in the top of the trough. *(Demonstrates)*

We put out the fire by closing the door and shutting off the air. Did you notice that the invisible vapors "walked" down the trough and ignited some distance from the cloth? Flammable, petroleum vapors are dangerous! Rags, pieces of cloth, and even clothing that have been used around gasoline and other volatile liquids can catch on fire some distance from a flame. Place all such rags and other materials in a closed, metal container and remove them from the building before the end of the day.

Gasoline — Power and Proper Storage

Here is an example of the power of petroleum vapors. Remember the three elements necessary to make fire? Oxygen, fuel, and heat. We'll scoop some air into a tube. Now we'll place one drop of gasoline into the tube, and a penny to mix up the vapors. There is the fuel. The heat will come through the spark plugs.

Where do you think the vapors will locate after shaking the tube? Will they be at the top? No.

The bottom?

Only one drop of gasoline produces quite a loud explosion. A gallon of gasoline contains approximately 155,000 drops; and under

ideal conditions it could produce an explosive force of about 155,000 times the force of one drop. This could be equal to the power of at least 30 sticks of dynamite.

Never store flammable liquids in the house or utility room, especially in a utility room containing a water heater, and definitely not in a glass container. Always store flammable liquids in a metal safety can or a clearly marked metal container with a tight fitting lid. Remember, gasoline is made to burn and explode. If you use gasoline as a cleaning agent, you can expect it to explode.

Perhaps you do not use gasoline or kerosene as a cleaning agent or to boost a fire. Do you know that several other household and personal items are as dangerous when misused?

For instance, hair spray net. People seldom read the directions on the labels on these containers. This one states that the product should be kept away from excessive heat or flames.

Watch as I spray the mist into the flame. Do you see what could happen when a spray comes in contact with a source of heat or a flame? Be careful when you apply an aerosol hair spray.

Another item which would prove dangerous is an ordinary bug bomb. This particular label states that nearly ¾ (varies with different brands) of this container is a petroleum distillate, about the same thing as kerosene. Let's see what would happen if you spray this near a flame.

Another frequently used item is fingernail polish remover. This product is equally as dangerous as gasoline if misused.

Let's place two drops of fingernail polish remover in this clear lucite tube. Add a penny to shake up the vapors.

Will these vapors dissipate in the air or will they act like gasoline and settle?

Nothing happens at the top.

How about the bottom? You can see that there is an explosion. We have learned that fingernail polish remover acts the same as gasoline.

Remember, many vapors, which are often invisible, plus oxygen or air and some source of heat or flame can produce a fire or serious explosion.

Electricity Commands Respect

Electricity was thought to be quite a miracle when first harnessed by man. Electricity probably does more jobs easier in the home, shop, and school than any other source of power. But the lack of adequate knowledge about electricity has been a factor in causing fires which have claimed the lives of many victims each year. Overloaded circuits and improper fusing are high on the list as causes of fires.

If we try to force too much electricity through any size wire, such as when too many appliances are pulling current from one circuit, the wire becomes hot, even red hot. This will ignite the insulation covering the wire or anything near that will burn. To protect the electrical wiring in your home from getting too hot, a fuse or circuit breaker has been placed in the electrical system to break or disrupt the flow of electricity before a danger point has been reached.

Different size wires carry different amount of electricity safely. We must protect each size wire with the proper size fuse. The physical sizes of fuses are the same, but each has a number such as ten, fifteen, twenty, or thirty on the base and on the inside, which tells you how much electricity will have to flow through the fuse before the fuse will blow and break the circuit.

Normal household circuits are provided with 15 ampere fuses to protect normal circuit wires from getting hot and causing a serious fire. In this demonstration, I will pretend that I know nothing about the proper fusing of circuits or the danger of overloading.

I enter the house at the end of the day, very tired and hungry. I turn on the light in the kitchen. You notice I have only one outlet in this room. Maybe that's all you have in your kitchen.

I enter the living room and turn on the light. We are always needing additional outlets, so the other day I called in an electrician to give me the cost of installing a wall outlet. He said it would cost at least $30. I told him I would do it myself. (Extending my electrical system is when I made my first big mistake.) I placed a two-way outlet in the ceiling outlet, added an extension cord, and hooked it over a nail. (This is very dangerous) Now we plug in a light bulb

which uses about the same amount of electricity a radio uses (60 watts).

After listening to the radio for a few minutes, I call to my wife, who is in the kitchen, "When will dinner be ready?" She states that since the company is expected tonight it will be two hours before dinner. I can't wait two hours, so I'll go to the kitchen and make some coffee. I have no outlet in the kitchen, because I am using the light bulb. I'll take out the light bulb, screw in this two-way outlet, replace the light bulb, and I'll soon have some coffee.

Now, I'll plug in the heating element which uses about the same amount of current that a percolator uses (660 watts). Now I have made my second mistake, by placing two appliances where only one should be.

Toast would go well with the coffee, and I do have two more hours to wait. I don't have any more outlets, but I do have this three-way extension cord. I'll take the percolator out and install this item — plug in the percolator plug in the toaster. Now I have three appliances where only one should be, and two of them are heavy current drawing appliances.

While waiting for the coffee, my wife asks me to iron her blouse since she is busy in the kitchen and company is coming. Before I plug this element in to represent the amount of current an iron uses (1000 watts) let's count and see how many items I will have where only *two* should be.

One-two-three-four-five-six, and three of them (iron, toaster, percolator) require a lot of electricity. I'll turn on the iron and see what happens.

The fuse blew.

Somebody told me that I could stop blowing fuses by putting a penny behind the fuse or by using a larger ampere fuse. I don't have a penny, so I'll try a 30 ampere fuse. A 30 ampere fuse does not cost any more and fits the same hole. We might as well go first class.

The lights are back on, and everything is working. Even the iron that caused the fuse to blow the first time is heating up. I sure fixed that circuit.

What's this — smoke? Where there is smoke, there's fire. Let's see what takes place in the walls when the proper size safety valve is removed and circuits are overloaded.

The evening is when most electrical systems experience the heaviest load. This can be illustrated by turning on one or more additional appliances in an already overloaded circuit. If someone should turn off an appliance or the refrigerator quits running, perhaps you won't have a fire — only a little smoke. Plug all in at the same time, and some day a situation like this could occur. This can cause a serious fire to burn for hours undetected, which will break out in all its furor after the family is asleep. What caused these fires and what could have been done to prevent them?

Normal wiring is not large enough to safely carry 30 amperes of electricity, which the 30 ampere fuse allowed to flow. The wires became red-hot and caused a fire to burn behind the baseboards and in the walls. This type of fire will burn out of control long before it is detected.

By replacing the burned-out 15 ampere fuse with a 30 ampere fuse, I removed the only "safety-valve" in our electrical system. If a 15 ampere fuses continues to blow, it means that you should either add another circuit or remove some appliances from the electrical system of your home while others are in use.

Never replace a 15 ampere fuse with a larger ampere fuse. Never place a penny behind the fuse. Remember, a 15 ampere fuse will protect almost any size wire in your home from over-heating and causing a serious fire.

Many fires of this type are blamed on faulty wiring. I wonder how many should be blamed on faulty thinking?

In this demonstration, we have tried to show the basic facts about fire, its use and control. If everyone, including you, would refrain from misusing flammable liquids, and would use the correct size fuses in your home, many of the fires and resulting deaths and injuries would never occur. It's either fire prevention or fire investigation — Which do you choose?

DRUGS EFFECT ON SAFETY

By JOHN MEYERS
Danville, Ill.

In America today, there is an epidemic of drug abuse. It is on our college campuses, it infects our high school students, adults in our cities, suburbs and small towns. No one seems to be immune. Our whole society seems to be getting dependent on drugs. Many can't sleep, wake up, or feel comfortable without drugs. Young people smoke marijuana and use LSD. Barbiturates, which are depressants, and amphetamines, which are stimulants, are taken by both youths and adults with utter disregard for the individual's future health condition.

Drugs are no longer only a slum or ghetto problem. Their improper and illegal use are affecting all stratas of our society. Over 12 billion amphetamines and barbiturate tablets and over 50 million tranquilizers are manufactured in the U.S. every year. About half of these are diverted into the illegal market. In many communities, police report arrests for the sale of illicit drugs are up 400 per cent this year.

A 1967 survey of 2,800 students in an upper middle class neighborhood that included two high schools showed that eight per cent were smoking marijuana, six per cent took barbiturates without a doctor's prescription, and two per cent used LSD. LSD and marijuana use, the major problem on the college level, reaches from the Naval Academy to the so called acid heads at the University of California campus at Berkeley to the Harvard freshman class.

What is this LSD you have heard so much about? To the chemist, the letters stand for lysergic acid diethylamide. That is the formal name for one of the most powerful mind-altering drugs that has been known for many years. To the hippie, LSD is known as "Acid" or "The Chief" or "The Hawk."

A droplet of LSD can take one on a mental trip to the Lord knows where. Medical scientists now studying the effects of LSD on the human body say that it is a threat of deadly damage to the human body. It can cause appalling defects for generations yet unborn in that LSD creates problems with the chromosomes of the person using it, and when that person takes part in the conception of a child, the child may very well have leukemia or may be abnormally shaped.

Drug abuse is nothing new. It can be traced from Sheng Nung, who lived in China about 2737 B.C., from Central Asia centuries ago, from the Incas and the Aztecs right down to modern times. What are the drugs most misused in America, where do they come from, and what is their effect?

Marijuana, whose proper name is canabis satiua, comes from a very old plant known as Indian hemp. Every race and creed, from ancient China to America's Harlem to our present day universities and junior colleges, have used marijuana in some form. There are records of its use some 3,000 years before Christ. Marijuana has no established medical use. Its reaction on man seems dependent on the individual's personality and physical structure. It may excite or depress the person using it within the same reaction period.

In the U.S., marijuana is most commonly smoked. The tops of the female hemp plant are cut and dried, then chopped or crumbled. The cigarettes are hand made, usually with a double thickness of paper to prevent coarse pieces from puncturing the paper. They are easy to recognize; they are shorter and thinner than regular cigarettes. The ends are tucked in, and the paper is usually brown. The cigarettes have a variety of names such as reefers, hay, muggles, tea, weed, sticks, brownies. They must be smoked continually to remain lit.

When marijuana is smoked, the pulse rate and blood pressure increase. If the intake is too high for the smoker's tolerance, nausea, vomiting, and diarrhea may occur. Marijuana works on the central nervous system. The user becomes dissociated with reality, he may be exuberant one moment and moody, fearing death, the next. Imagination runs riot. Perceptions are confused. Minutes seem hours. Fast seems slow. Far seems near. The smoker's head, hands, and feet seem swollen and heavy. Behavior is impulsive, and he may feel a dual personality. In some individuals, it can produce a true psychotic state. Inhibitions are released, and this often leads to experimentation with drugs of a higher order, usually opiates.

Most opiate addicts in the U.S. start from the use of marijuana. I need not point out the obvious safety hazards caused by the use of this drug.

When we use the term opiates, we mean drugs that are derivatives of opium. It is difficult to exaggerate the tragedy that opium has brought to humanity. No other drug has caused such corruption and heartbreak. Opium comes from a species of the poppy; its cultivation is forbidden in most countries, but today it is grown illicitly on millions of acres.

By a strange quirk of nature, the opium poppy has perfectly harmless roots and flowers; its seeds are so safe they are commonly sprinkled on rolls or buns, and an oil pressed from them is widely used as an adulterant of olive oil. Only in the unripe pods is there real danger, and the care and harvesting of them occupy an army of men, women, and children in Turkey, Iran, Lebanon, Yugoslavia, Bulgaria, China, and India. A few days after the poppy petals fall, the unripe greenish pod is carefully slit by a very sharp knife, but not deeply enough to cut into the interior of the capsule. From the cut rind there exudes, especially in hot weather, a milky juice which coagulates in about 24 hours. This is then carefully scraped off and, after cleaning, becomes commercial opium, which is gummy and dark colored.

Legitimate imports of opium for the U.S. do not ordinarily exceed 350,000 pounds a year and are wholly used for the extraction of its aklaloids, chiefly for medicinal purposes. In addition to this legitimate importation, there is an enormous traffic in illicit opium from Red China. Seizures of this illicit opium in every port in the world are generally traced back to Red China; there are, however, other illicit sources.

The two most powerful derivatives of opium are morphine and heroin; the latter is so dangerous that its importation even for medical use in this country is forbidden, yet heroin is the drug most frequently used by addicts in the U.S. Many famous people have succumbed and become slaves to opiates: Thomas de Quincy, Coleridge, Poe, Swinburne, and many others. Coleridge warned his followers what that slavery meant. He said, "After my death I earnestly entreat that a full and unqualified narrative of my wretchedness and of its guilty cause may be made public, that at least some little good may be effected by my direful example."

The U.S. is the main target of illegal opium traffic. Addiction to opium costs the victims over $500 million a year. The average heroin addict spends between $20 to $50 a day for the drug. A Turkish farmer may sell his raw opium at $23 a pound, but in New York, Chicago, and L.A., when reduced to heroin, that pound yields the illicit trafficer $16,000. Profits are so huge that criminal prosecutions are only a partial deterrent. In an attempt to stop this traffic, millions of dollars and many devoted men and women are involved, for the criminal purveyors of narcotics are preying on weak and all but helpless addicts. No crime could be worse and no penalty too severe for these sellers of heartbreak and death.

Heroin extraction plants exist in China, Japan, Turkey, Italy, France, and the U.S.—all illicit except in Red China, where the government appears to harbor the thought that spreading heroin addiction will hasten communist domination.

The opiates such as morphine and heroin produce drowsiness, inability to concentrate, apathy, lessened physical activity, reduced visual acuity, and mental and physical performance is impaired. The body feels extremely heavy and warm, the face, especially the nose, may itch, the mouth is dry, pain is relieved, and hunger abolished.

Tolerance to opiates develops through repeated use. If the drug is withdrawn for a few days, tolerance disappears and small doses will again produce narcotic reaction. As the drug is readministered, tolerance builds more rapidly than the first time. The development of tolerance means addicts require larger and larger doses to achieve the narcotic effect. Death may result if tolerance is misjudged and too large a dose injected.

Aside from personality defects, addicts do not differ from the rest of society. They appear normal while receiving sustaining doses of drugs. Initially, they dress and act as they did before addiction. They generally experience a decrease of sexual urge. Their ultimate derelict appearance results from the exorbitant cost of maintaining their habit. When their supply of drugs is threatened, addicts exist only to secure more. Maintenance of their supply of drugs is their only purpose for living.

brittle. Likewise, rubber becomes as brittle as glass and shatters under the slightest stress.

There is now a good assortment of cryogenic handling equipment on the market for laboratory use. Cryogenic containers are made from certain ferrous alloys or, in some cases, non-ferrous metals which can withstand the rapid changes and extreme temperature differentials encountered in working with these liquids. However, even these special containers should be filled slowly to minimize thermal shocks which occur when any material is cooled.

Always follow all of the procedures prescribed by the manufacturer for operating and maintaining his equipment. This is especially important in laboratory work where (because of changing projects) there is a tendency to improvise or adapt a piece of equipment purchased for a particular experiment for use in a different project under widely different conditions.

Fill containers only with the liquids they are designed to hold. Because of the wide difference in physical properties of cryogenic fluids, it may be unsafe to switch a vessel to a different service.

Even if a vessel is safe to use with more than one fluid, it is a good practice to have every vessel identified for use with a specific fluid. The reason for this is to prevent the accidental mixing of fluids or the inadvertent use of the wrong fluid, such as oxygen instead of nitrogen, which could be extremely hazardous. Thus, if liquid oxygen were added to a liquid nitrogen refrigerator, the O_2 could cause any organic matter in the refrigerator to burst into flames.

Pressure relief devices must be installed in every part of a setup where liquid may be trapped; for example, in piping between valves, within valve bodies, vaporizers, pumps and other accessory equipment. Again, it is important to get competent advice on the type of relief device needed and its proper maintenance.

Ventilation

The inert gases do not support life; oxygen increases the fire hazard; hydrogen is highly flammable. Adequate ventilation must, therefore, be provided to remove the gases vaporizing from cryogenic fluids. Except for hydrogen, which is flammable, this is not a serious problem in laboratory operations because the quantities of fluid involved are generally small and the ventilation is good. However, this factor should not be overlooked. If ventilation is lacking, vapors from liquefied inerts could reduce the atmospheric oxygen to an unsafe level. A person entering such an area could lose consciousness without sensing any warning signals.

Additional Precautions for Specific Fluids

Hydrogen. The low temperature of liquid hydrogen can solidify any gas except helium. Its vapors are flammable. The liquid should, therefore, be handled in closed systems and its vapors vented to a hood or other safe area.

Particular care must be exercised to prevent air or other gases from entering vessels or systems containing liquid hydrogen. The solidified gases can plug vent paths, valves, or small openings and cause failure of vessels or associated equipment because of pressure. Also, solid oxygen-enriched air in liquefied hydrogen may present an explosion hazard. Small-scale laboratory or test operations involving one to two liters of liquid hydrogen may be safely performed in open Dewar vessels properly stoppered and vented, as explained above.

All equipment used to transfer liquid hydrogen should be grounded to prevent electrostatic sparks, which might ignite an explosion mixture of hydrogen and air.

Experiments involving the use of liquid hydrogen must be confined to laboratories specially prepared for such work. Typical considerations for such areas are general ventilation, local exhaust systems, elimination of ignition sources, hydrogen detectors, and provision for safe delivery and storage of liquid hydrogen.

Oxygen. Liquid oxygen has a much greater capacity to support combustion than air. Organic materials exposed to liquid oxygen will burn violently if ignited, even several minutes after exposure. Under proper temperature and pressure conditions, materials such as oil, grease, alcohols, hydrocarbons, ethers, and other organics may react violently with oxygen. All equipment used in liquid oxygen work must be specially cleaned for this service. Care must be taken to make certain that any material used is suitable for liquid oxygen work.

There followed the accompanying dialogue between Miss Johnston and Miss Swope:

Miss Johnston: New directions in home economics.

Miss Swope: This means that we have come from one direction and we'll change direction, now. Do you agree?

Miss Johnston: Yes—and here's the direction we have come from: chemistry, food, and nutrition; clothing and textiles; home management; family relations; child development; family economics. These were the curricula emphases from the past.

Miss Swope: Yes, the emphases in the college curricula. But, wait a minute, Lydia. That was theoretically the path down which we have come. But that isn't the way that public school home economics has been run. Actually, studies show that high school home economics teachers are spending nearly 80 per cent of their time on two subjects—50 per cent on food preparation and 30 per cent on clothing construction.

Miss Johnston: No wonder then that John Q. Public thinks of Home Economics as cooking and sewing.

Miss Swope: And, no wonder too, that avant garde leaders in Home Economics are predicting the doom of the old type of Home Economics.

Miss Johnston: Thus, we are suggesting specific ways to give home economics a vital new sense of direction—a direction future-oriented as best we can know the future. Let's look for a moment at what is in the offing for America in the future. What do you see in your crystal ball, Mary Ruth?

Miss Swope: I see Home Economics subject matter being used in many different ways to meet the needs of many different kinds of people and families. These changes are resulting naturally from the vast changes in our society.

Miss Johnston: Such as: 1. New ways of processing and preserving foods—freeze drying, irradiation, and spaceman-type foods.

2. The changing food patterns of families.

3. The cashless, checkless society in which things are ordered by card dialer telephones, your bank balance is immediately adjusted with each purchase—the era when carrying cash around will be obsolete.

Miss Swope: 4. The he-she fashions, with no need to be individualistic. Macy's has a place for girls to try on boy's fashions in the boy's fashion department, places for boys to try on clothes in the girl's clothing departments—the same with Sak's 34th and Gimbel's. This means that only a few key designers will be needed to mass produce our clothes. Then, sewing will become only a craft, a hobby, not a necessity. Clothes will be made of paper.

Miss Johnston: Then, there is the vast move of people to the cities and the revitalization of cities.

Miss Swope: Bringing new impetus to the need for sound family relations and child development knowledge, consumer education, family service.

Miss Johnston: Think of communications—all the vast improvements in only a brief span of years. There's TV, the difference telephone, the phones with TV receivers attached, single concept films, filmstrips, movies.

Miss Swope: Marvelous new ways to reach the people.

Miss Johnston: Then, too, there are the fantastic advancements in travel in the world. Home Economics has much to contribute to the international scene.

Miss Swope: But, only 1.7 per cent of all Peace Corps Volunteers are Home Economists, despite the 500 additional places made for them internationally just last year alone. What do you see in your crystal ball, Lydia?

Miss Johnston: The rise of megalopolises; drive-in stores just like drive-in banks; fully automated cars; homes with automatic cleaner robots that come out at night, clean the house of dust and dirt, and then return themselves to their cleaning closets automatically; computer rooms in the home; wallsize TV receiver screens; moving aisles in stores and moving sidewalks; large skyscraper complexes with banking, entertainment, and school facilities.

Miss Swope: That will be the era of the four day work week, with three months off per year, when the median family

An Experimental Method for Pilot Testing

The effects of many different magazine typographical and editorial treatments on reader attention have been measured in a regular "split run" testing program reported by Murphy[31]. Some of the variations tested over a period of several years include the use of color, pictorial matter, cover subjects, headlines, and other typographical variations. In regular issues of Wallace's Farmer, alternative *A* and *B* versions of a treatment were distributed to every other name on the subscriber list (the standard "split run" procedure). Several days after receipt of the test issues, a sample of about 400 subscribers (200 per treatment) were questioned in personal interviews on readership by the recognition method, in a post test-only design. These studies show that, with content held constant, variations in form or typographical treatment do create substantial differences in reader attention and readership.

This design has, strictly speaking, no control group, being concerned only with the relative performance of two alternatives rather than absolute effects. Similar procedures for pilot testing entire campaigns, in newspapers and on television, are available[3,4].

Radio vs Audio-Visual vs Combined Campaigns

Possibly the most remarkable single non-advertising study, in terms of sophistication of design, complexity of execution, ingenious analysis, and implications of the results is the controlled field experiment reported by Spector et al.[40]

Under sponsorship of the Agency for International Development, the comparative effects of three different media usages on adoption of innovations were tested in isolated towns in the Andean Mountains of Ecuador. The purpose of the campaign was to stimulate the adoption of such innovations as building latrines and stoves, making marmalade, and being vaccinated. In addition to the adoption rate on these practices, dependent variables included amount of time and amount of money invested in them by village residents.

Six cities were randomly assigned as a test or control town for one of three treatments (radio, audio-visual, and combined radio/audio-visual).

The media treatments consisted of a radio series (248 hours of programming) and an audio-visual campaign (movies, demonstrations, posters, slides, and exhibits for a total of 244 hours) and a combined radio/audio-visual treatment, spread over a nine-week period in 1963. Measurement consisted of personal interviews and observation just before, just after, and several months after the campaign. The study showed that radio and audio-visual media were both effective in creating participation, but they served different functions in terms of the type of action and effort induced; the double-media treatment was not appreciably more effective than one used alone.

Radio vs Booklets-and-Discussion

A comparison of the effects of two communications media on knowledge of health, education, and agriculture innovations was reported by Waisanen[46]. Rural residents in a developing nation, Costa Rica, were the subjects. The media treatment was either radio (52 weekly half-hour programs) or "literacy campaign" (52 booklets with discussion) over a period of one year. Measurement consisted of personal interview sample surveys before and after the campaign. 14 villages (of 50 to 150 households each) were assigned randomly to three groups—radio (four), literacy campaign (four) and control (six). The results were not available at the time of Waisanen's progress report.

Methodology of the Controlled Field Experiment

The controlled field experiment, properly executed, combines the advantages of the field survey and laboratory experiment and minimizes most of their disadvantages. It is an experimental design executed under naturalistic environmental conditions. Executional problems, including costs, can be much greater than in either field surveys or laboratory experiments.

*Design Notation For Controlled Field Experiments**

After Only Measurement, Controlled Field Experiment

	t_1	t_2	t_3
P_1	—	X_e	M
P_1	—	NX_c	M

Before-and-After Measurement, Controlled Field Experiment

	t_1	t_2	t_3
P_1	M	X_e	M
P_1	M	NX_c	M

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FIRE PROTECTION AND FIRE FIGHTING IN COAL MINES

By W. B. JAMISON
Manager, Technical Services, Hi-Ex Foam, Walter Kidde & Co., Inc., Belleville, N. J.

Obviously, the best solution for the fire problem is to prevent fires in the first place. Fire prevention has been discussed so many times that it is difficult to add anything new or significant that has not been covered adequately many times. We all recognize that good housekeeping, preventive maintenance, and safe practices in choosing and operating mining equipment will go a long way to eliminate fires. Careful compliance with mining laws and codes is a good way to start.

Certainly, the development and use of non-flammable hydraulic fluids is an important step to reduce the chance of fire. It is important, however, to understand the usefulness and the limitations of non-flammable hydraulic fluids—limitations which are probably so severe that they can only reduce some chance of fire. Therefore, good fire protection and good fire fighting capability are still necessary.

Two types of non-flammable hydraulic fluids are available: glycol based and emulsions of oil in water. The glycol based non-flammable hydraulic fluids are used in aircraft hydraulic systems and in other specialized hydraulic systems where a high level of design and maintenance can minimize loss of the very expensive fluid. Oil-water emulsions are much less expensive and have been used with varying success in place of oils in the hydraulic systems of mining equipment.

The non-burning characteristic of oil-water emulsions depends upon the maintenance of the proper oil to water ratio. Because the vapor pressure and boiling temperature of water are well below those of oil, the heat generated in operating hydraulic systems tends to drive off the water, raising the oil content of the emulsion and, if permitted to go too far, destroying the non-burning characteristic.

Assuming that the oil-water ratio can be controlled, there is still one major problem. Usually the main contribution of hydraulic oil to the fire problem on operating equipment results from the ease with which an arc or friction can ignite coal coated with oil. Usually oil soaked coal can be ignited more readily than either oil or coal alone. When an oil-water emulsion leaks into coal, the oil will separate from the emulsion and will coat the coal. As long as the water remains, it will be helpful in suppressing combustion; but the water drains out rapidly or will evaporate, whereas the oil is absorbed by the coal and evaporation is negligible. Thus, an oil-water emulsion does not eliminate many of the fire ignition problems created by hydraulic oil.

An oil-water emulsion of proper ratio will eliminate the very severe fire situation which can result when oil at high pressure leaks through a small opening and is ignited. With combustible oil, this condition provides combustion similar to that of an oil burner. It is believed that this type of fire occurrence is most infrequent.

Classification of Mine Fires

Fires in coal mines can be classified usefully as to types of fuel, origin, and location. While there are fuel classifications beyond the three common categories, Class *A*, Class *B*, and Class *C*, these three fire types are the only ones encountered in coal mines. A class *A* fire is one in which the fuel is coal, rubber, wood, or other solid material which will burn. A class *B* fire is is one in which the fuel is a liquid such as gasoline, or oil. Fortunately, about the only low flash point *flammable* liquid found underground in coal mines is the very limited amount of naphtha contained in flame safety lamps. The vast quantity of high flash point *combustible* liquids used in coal mines are the lubricating oils and greases and the hydraulic oils used in various types of mining equipment. Class *C* fires occur in live electrical equipment when arcing occurs. Since arcing is seldom of long duration, class *C* fires usually are important only as the source of ignition of class *A* or class *B* fires.

The vast majority of fires in coal mines start from electrical failures which cause arcs or class *C* fires. Also, many fires result from heat developed when bearings fail or objects rub or slip. A few fires occur from spontaneous heating of coal or, more generally, the sulphuritic impurities of the coal seam.

It is important to classify fires as to location, primarily because fires which start in unattended areas may have time to become well established before anyone knows the fire exists and can organize to fight it.

From these comments, it is possible to establish the following classification table for fires in coal mines:

Fire Classification Table

Type	*Origin*	*Location*
Class *A*	Electrical	Attended
Class *B*	Friction	Unattended
Class *C*	Spontaneous	

Records of fires in coal mines in the United States permit closer definition of mine fires by regrouping and elimination. Previously, we commented that class *C* fires really don't exist for very long, but that electrical arcing is important in starting the fire. Next, it is useful to realize that most fires take place on operating mobile equipment in the face area. Generally, these fires start from an electrical arc igniting hydraulic oil, lubricants, and fine coal. Since mining equipment often has rubber and always has some coal on it, the fire quickly becomes class *A* as well as class *B*. The fire almost always starts when the equipment is in operation and the operator has evidence of the fire almost immediately. If the operator can be effective on the fire quickly, the fire may not spread to the coal seam; but if he does not have effective means to act quickly, the fire will spread and enter a different dimension of damage, fire loss, down time, and difficulty of eventual extinguishment. The important point to note and to classify is whether the fire started with personnel present; if so, these people could be effective only if enough extinguishing agent for use on class *A* and *B* fires was quickly available.

Fires in unattended areas usually have plenty of time to become well established before they are detected. By then they are essentially class *A* fires of coal since combustible liquid may not have been present or was consumed early in duration of the fire. These fires can start from electricity or friction if moving machinery such as a belt conveyor is involved. Fires can start anywhere along a haulage road when a fall or wreck may damage the power wiring, igniting coal or timber. Belt heads where belt drives or car spotters operate unattended are areas where fires often get a real start. The important point to note is that fire protection for unattended areas must involve a system capable of automatic detection of the fire and automatic release of the extinguishing media. Because of the vast length of haulage roads and belt lines, automatic fire protection cannot be justified throughout but must be limited to certain key areas, such as belt heads, where the risk of fire and the probability of damage from fire are great. Effective fire fighting equipment and trained personnel are the only answer to fires on the long haulage roads and belt lines.

Perhaps a more realistic basis for classification of fires in coal mines would be:

Revised Fire Classification Table

Location	*Attended*	*Unattended*
Fire Type	Class A & B	Class A & B
Origin	Electrical or Friction	Electrical or Friction
Detection	Not needed	Needed
Extinguishing Systems	Manual	Automatic
Back-up Fire Fighting Equipment	Necessary	Necessary

Fire Extinguishing Agents

Today, the fire protection engineer and fire fighter have a wide range of extinguishing agents available to control and extinguish fires. All have their special advantages and their peculiar disadvantages; however, if there is one agent which most nearly meets all of the requirements for a universal extinguishing agent for controlling and fighting mine fires, that agent is water.

Water has obvious advantages. It is cheap, it is abundant, it can be piped for easy distribution in quantity, it has good range when forced through a nozzle at reasonable pressure, it can be dispersed into a fog for great heat absorption, it can be expanded to a low expansion foam for direct application to

class *A* and *B* fires, and it can be expanded greatly to a high expansion foam which has many characteristics of special value in fighting mine fires. Pound for pound, water can absorb more heat than any other extinguishing agent. Water is relatively safe to use and is harmless to people. Truly, it is the universal agent.

Of next greatest importance is the relatively new ABC powder. This powder is an ammonium phosphate treated to inhibit water absorbency and caking. It is expelled from a suitably designed pressure cylinder and applied to the fire through a nozzle. It has effectiveness equal to sodium bicarbonate on flammable liquid fires, and in addition to snuffing out the flame of a class *A* fire it coats the hot material, forming a glaze to exclude air and prevent re-ignition. Like all dry, chemicals, it has little heat absorbing capability but does inhibit flame in a way which is not thoroughly understood.

Another relatively new agent is Purple K, which is potassium bicarbonate treated to inhibit water absorbency and caking. This material is very effective on fires of flammable liquids but has only limited value on class *A* fires, where it can control flame during discharge but rekindling is likely unless the fire is very small.

Standard dry chemical is sodium bicarbonate treated to inhibit water absorbency and caking. It is about two-thirds as effective as Purple K on fires of flammable liquids, but has limited effect on class *A* fires where it can control flame during discharge only. Sodium bicarbonate is less hygroscopic than Purple K or ABC powder, so caking is less severe. Extinguishers designed for standard dry chemical, for Purple K or ABC powder should be filled only with the powder for which that extinguisher was designed. If the powders are interchanged or mixed a dangerous chemical reaction can occur.

Carbon dioxide is useful on flammable liquid fires and in areas such as electrical rooms, where its unique cleanliness and negligible damage makes it especially useful. It can be moderately effective as a coolant when discharged close to the fire, but when used in general flooding its effect is to displace the oxygen content of the air and control of the fire is by inerting only. If sufficient cooling did not take place during the period of low oxygen level, a class *A* fire will rekindle. In confined areas such as those which exist under the protective covers of mining machines, rapid discharge of a substantial volume of CO_2 will extinguish a class *B* fire and can literally blast out the burning coal of a class *A* fire.

Volatilizing liquids such as carbon tetrachloride should not be used in coal mines since their vapors, especially the vapors resulting from the dissociation occurring at high temperature, are harmful to humans.

Certain other volatizing liquids such as Freon 1301 (CF_3Br), CBF, and others also have remarkable abilities to inhibit burning and are not harmful to humans in low but effective concentrations. Their use in mine fire fighting and fire protection does not appear to be favorable now since it is not easy to control concentration under the widely variable conditions of coal mines and since, like carbon tetrachloride, they break down at high temperatures to give toxic gases. They are being considered for special problems where detection can permit quick application before high temperatures develop and where careful matching of quantity of agent to volume of protected area can exist. Since mining applications cannot assure these requirements, I believe that it is not wise to consider these agents at this time.

Comparison of Agents. By using the listings developed by Underwriters' Laboratories for rating the extinguishing capabilities of fire extinguishers, it is possible to show a reasonable comparison of the relative effectiveness of different extinguishing agents. In most cases where this sort of comparison has been made, agents have been compared on the basis of weight of agent. I do not feel that weight is the proper measure for comparing agents in mining applications, since the weight of the agent is not the limitation in applying it. The limitation is one of space —space on machinery or at locations in a mine for the container which holds the agent. In the table which follows, containers have been chosen which are approximately the same size.

U. L. ratings for extinguishers are based upon performance tests carried out under rigidly controlled conditions on carefully set fires of wood and of gasoline. The wood class *A* fires give an *A* rating and the relative size of the fire is given by the number

preceding the letter. Thus a *4A* rating signified effectiveness on a fire twice as large as a *2A* rating. The *B* ratings signify effectiveness on gasoline fires and the number ahead of the letter *B* gives the area of the burning gasoline in square feet. The *C* rating signifies that the extinguisher can be discharged upon an electrical arc without risk of shock to the user.

Table of Agent Effectiveness

Agent	*Size*	*U. L. Rating*
Water	2½ gal.	2A
Standard DC	20 lb.	40 B :C
Purple K	20 lb.	60 B :C
ABC Powder	20 lb.	10A, 40B :C
CO_2	15 lb.	12 B :C

There are no comparable sizes of extinguishers listed by U. L. which use volatilizing liquids. The only one rated by U. L. are very small and carry small *B* and *C* ratings.

It is apparent from the above table that ABC powder is outstanding in its usefulness for both class *A* and class *B* fires, such as those which occur on mining machines. This comparison clearly shows that, when the agent is limited in quantity, ABC powder is the best to consider. Thus for shuttle cars, mobile drills, loading machines, and other mining units which are not connected to a substantial source of water during operation, a pressurized ABC extinguisher or an extinguishing system containing ABC powder is the first choice. Until recently, there was some doubt about possible caking of ABC powder when the container was subject to the shocks and vibration of being mounted on mining machinery. Not long ago, a new Kidde ABC extinguisher, mounted on an operating shuttle car for about six months, was discharged normally and inspection showed that the normal quantity of powder was expelled.

On the basis of the U. L. ratings, water does not appear to be the ideal agent, and when the quantity is severely limited, as it would be if a pressurized supply had to be carried on a mining machine, water is not as good as ABC powder. But when the equipment can receive water at a reasonable rate from a water line, the continuous supply of water applied for an extended period is much more effective than the quickly expelled supply of dry powder. Water lines, such as are used to reduce dust on continuous miners, cutting machines, etc., will cool and stop a fire on mining equipment. By holding down the heat, spread of the fire to the coal seam can be prevented. While water extinguishers do not carry a *B* rating, water is effective on class *B* fires in mines where the fuels are high flash point oil or grease, though not on the gasoline fires which U. L. uses for rating tests.

Practical Suggestions

This is a good point to become practical and to make specific recommendations on how to use the preferred agents for the different situations which were defined. The Revised Fire Classification Table noted that the fires were class *A* and class *B* and the fires started from electrical arcs or friction. The remainder of the table can be summarized into two situations: where machinery is operating attended or operating unattended. Where protection systems can be applied either internally in mobile equipment or externally to cover stationary equipment, it appears to be easier to discuss the practical problems of fire protection by distinguishing between the agents to be used—in one case, water supplied through hose or pipe, and in the other, ABC powder or CO_2 available from a stored container.

Protection of Attended Equipment—Water Supplied. When water is used to allay dust on operating continuous miners, cutting machines, and loading machines, this continuous supply of water can be an effective source of fire fighting agent to control and extinguish fires on this operating equipment. Usually, the water is fed from a piped supply and is available for a relatively unlimited period. Since the last run of piping is usually reduced to ¾-inch or one-inch size and is finally carried to the equipment through ⅝-inch or ¾-inch hose, the free flow rate available at the equipment seldom exceeds 15 to 20 gpm, and often is less than 10 gpm. Thus, the water supply usually can provide a limited flow rate for an unlimited period.

It would be helpful if the water were available at a substantially higher rate, even if it were available only for a shorter period. Then a large number of nozzles could be located so as to cover all fire areas on the machine. Simultaneous mass flooding of all areas under covers, of all exposed areas

where wiring and hydraulic components are closely placed, and of the roof over and ribs beside the equipment would be ideal, but the quantity of water necessary to attain this ideal is not available. Instead, it is necessary to ration the available water to adequately supply as many nozzles as possible.

Installation of a reasonably effective water spray system starts with the choice of the spray nozzle. I believe that spray quantities of less than two gpm are not useful. Also, spray patterns are not good if the nozzle pressure is less than 15 psi. If any reasonable range is needed, 20 psi is usually necessary. Nozzles with small openings or close passages are undesirable, since small dirt particles can plug the nozzles.

It is important to know the characteristics of the water supply. These can be determined most easily by equipping a one-inch water meter with a pressure gauge at its inlet and a gate valve at its discharge. The water meter is attached to the end of the normal length of water hose at the remote side of the section and the water pressure is read with the valve closed. Then the water valve is opened until the pressure gauge falls to 25 psi, and the water flow is obtained by timed readings of the water meter. The total flow rate at 25 psi can be expected through the desired nozzles at about 20 psi, since there will be some pressure loss through the piping, valve, and strainer which are necessary parts of the fire spray system. Knowing the flow and the nozzle characteristics at the flow pressure, the allowable number of nozzles can be determined.

The reason for reading shut-off pressure as well as flow rate at a given pressure is to permit plotting the flow characteristics as shown in Figure 1. The two points determined by test are joined by a straight line, then the available flow at any other pressure can be picked off the plotted line.

Normally, the water supply will not adequately feed the number of nozzles which we would like to install on mining machinery. Therefore, we must attempt to cover those areas which are most critical. These should include areas beneath covers where hydraulic oil lines and power wiring are present. The region of the hydraulic pumps and hydraulic oil reservoir are important. Electrical cable reels such as those on cutting machines

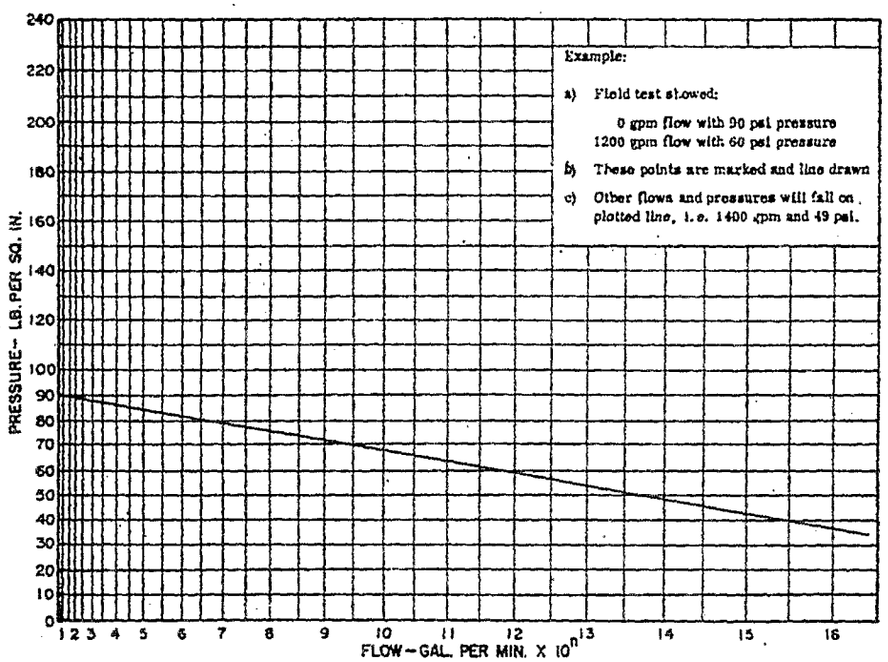


Fig. 1

should be covered. Perhaps most useful of all would be at least two nozzles fore and aft on the machine aimed directly upward to cool the roof and air over a machine, to prevent the spread of a fire to the coal, and to prevent a possible roof fall caused by the heat of the fire. While this overhead protection will not prevent direct fire damage to the machine, it will make subsequent fire fighting much easier and help to prevent ultimate destruction of the machine.

All of the nozzles should be piped from a smooth acting three-way valve which would divert the water from its normal dust control function to the fire nozzles. A strainer of adequate size and with a screen only fine enough to trap particles which would not go through the nozzles should be located on the fire discharge side of the three-way valve. The valve should be located conveniently on the back end of the machine, so that it can be thrown by the operator when leaving the machine under emergency conditions.

Often, the best solution for an inadequate water supply may be to supplement the water spray system with portable extinguishers or even a built-in-dry-chemical or CO_2 fire protection system. In this way, the quick knock-down of the agents is combined with the cooling and continued control of water sprays.

Protection of Attended Equipment—Water Unavailable. The shuttle car is typical of the severe fire protection problem on mining equipment which is attended by an operator when it is in use but which does not have a supply of water available through a hose. As previously explained, the best agent for control of fires on this type of equipment is ABC powder, with CO_2 as a possible second choice.

Intelligent application of fire protection systems to any piece of mining equipment requires evaluation of the logical points of fire origin and then application of extinguishing agent to cover these points. Obviously, not all possible points of origin can be covered since we are faced with practical limitations of space and weight to carry the extinguishing agent. With ABC powder, it is not necessary to cover all possible points of origin if the main areas can be coated with the powder. This coating of ABC powder will prevent or greatly retard development of a fire so that fire fighting techniques can be used to extinguish the relatively small fire remaining.

The likely points of origin of a fire on a shuttle car may be listed in decreasing order of importance, as:

1. Cable reel.
2. Tires, which may be ignited by running over a cable.
3. Gear transmission compartments.
4. Hydraulic pump compartment.
5. Hydraulic oil reservoir.
6. Wiring entrances to controllers, motors, etc.

Motors, controllers, and other electrical components are usually of a low order of importance, since the heavy enclosures effectively contain arcing. The wide distribution of fixed wiring on machines probably makes it impossible to cover all wiring runs. Instead of attempting to cover all the wiring, I think that it is more practical to cover the critical areas where oil, oily dust, or other combustible material may be present.

It is possible to locate one or preferably two 30-pound ABC dry chemical cylinders on most shuttle cars. A 30-pound cylinder can be discharged through six or eight nozzles to get good distribution of the dry chemical. In addition to providing a larger quantity of agent, two cylinders permit doubling the number of discharge nozzles for even better distribution. On shuttle cars, operating trips should be available at the operator's position and at the opposite end of the car. Continuous miners and cutting machines should be treated in similar fashion. The large size and value of a continuous miner certainly indicates that at least two or more 30-pound cylinders are needed.

If the extinguishing media is a dry powder, certain precautions on piping are important. The pipe sizes are critical and the piping runs to the different nozzles must be balanced in length. Flow of finely divided powder propelled by a gas does not act as a true gas or as a homogeneous liquid. The first installations on any machine should be made by an experienced person and should be tested to assure proper performance. While piping requirements are not so critical with CO_2, the nozzle locations and piping runs should be made initially by an experienced person. Also, a CO_2 system should be dis-

charged to check performance and especially to be sure that the discharge covers the critical areas fully.

Protection of Unattended Equipment—Water Supplied. Typical of unattended equipment which can be protected very well with water sprays are belt drives, belt heads, automatic car-spotters, belt feeders, etc. If a reasonably sized water line is not too far away, it is not difficult to provide a fire protection supply for adequate fire protection. The simplest fire protection system which combines automatic detection and automatic response can consist of a run of pipe supported at the roof directly over the machinery to be protected with sprinkler heads installed every 10 feet.

Sprinklers are equipped with a temperature sensitive release which will cause the sprinklers to open, exposing a ½-inch orifice when rated temperature is reached. The most common operating temperature ratings of sprinkler heads are 165°, 212°, 286°, and 360°F. Flow rates related to pressure are:

Pressure at Sprinkler	*Discharge Rate*
10 psi	18 gpm
15 psi	22 gpm
20 psi	25 gpm
25 psi	28 gpm
35 psi	34 gpm
50 psi	41 gpm

When the standard sprinkler is discharging 15 gpm, the spray will cover an area having a diameter of about 16 feet at a distance of about four feet below the sprinkler deflector.

Upright standard sprinklers or pendant standard sprinklers are recommended. I prefer pendant standard sprinklers since then the pipe can be supported against the roof or cross bars, and the sprinkler head is beneath the pipe in an unobstructed position. Accepted practice of sprinkler application allows the installation of many more heads than the water supply could be expected to handle, since not all of the heads would be activated. The number of heads which might be activated in a mining situation is a matter of judgment, since there is little if any actual experience or test data to go on. Also, there are many special problems presented by the mine environment which do not exist in areas normally protected with sprinklers. Perhaps the most important of these special conditions is the possibility that air currents of high velocity can move the heat of a fire horizontally so that the sprinkler directly over the fire might be very slow to operate.

Normally, a fire should not open more than four heads, so a water supply capable of flowing 60 gpm at 15 to 20 psi is an acceptable minimum. An additional 40 gpm or more is desirable. But if operation of the sprinklers very close to the fire were delayed too long and the heat of the fire carried to other sprinklers, substantially more sprinklers could open. Then the water supply would be inadequate, and the flow through each sprinkler will be too low. The discharge pattern will be affected badly and the fire will not be controlled.

Since a high velocity ventilation current can cause the system to fail, obviously ventilation should be controlled in the area to be protected. Some benefit might result from the use of higher temperature sprinkler heads in the spots where the greatest probability of origin of the fire exists. This is a controversial thought however, since higher temperature heads are slower to react to a fire. The objective must be to open only those heads closest to the fire and to open the fewest number possible.

This simple sprinkler system has one major weakness. It has been suggested for use in protecting areas where no person is normally present. Therefore, it can function without warning mine personnel of the fact. Large volumes of water can be released into the mine, especially during idle periods, without anyone's knowledge. Water flow switches can be added to the system, but unless there is some reliable communication means to carry the alarm, no one would be warned. Various expedients such as thermostatically controlled sprinkler systems which will shut off when the fire is controlled or extinguished can reduce the chance of releasing a lot of water, but without automatic remote alarms, no fire suppression system can be completely reliable.

Protection of Unattended Equipment — Water Unavailable. When water is not available, large pressurized dry chemical or CO_2 systems can be used to control and extinguish fires in equipment areas. These systems are available with automatic detection to catch the fire quickly, before it has time to become large and get beyond control.

On conveyor drives, belt heads, etc., the superiority of ABC dry powder has been covered. Since the protection problem does not involve mobile equipment which must carry the fire extinguishing agent, no real space problem exists, so the dry powder system can be very large. Automatic systems are available which contain 150 pounds of dry powder. This amount of agent in a well designed system certainly should be able to control just about any fire that might occur.

In more permanent installations involving electrical equipment, such as motors, controls, transformers, rectifiers, etc., CO_2 is ideal. CO_2 systems can be made up in almost any size by manifolding high pressure bottles of gas. Good detection systems can trip the system to give rapid and controlled application of large volumes of CO_2. Pressure releases are available and should be used to close fire and ventilation doors so a high concentration of CO_2 can be built up and maintained.

Obviously, the tripping of any CO_2 or dry powder system should be interlocked with the controls of the equipment being protected, to shut the equipment down. Again, it is important to have some alarm system which would advise of the operation of the fire suppressing system.

Fire Fighting Equipment

A mine which is well equipped for fire fighting will have a whole arsenal of equipment designed to respond to a wide variety of conditions. No discussion of the mine fire problem would be reasonably complete unless fire fighting equipment for mines is covered.

Hand Extinguishers. It is safe to say that almost all of the hand extinguishers in coal mines today are obsolete. The great superiority of ABC powder requires that all mining officials should consider a program to replace all extinguishers on mobile equipment, in section areas, in shops, and at other critical points with the latest models of ABC extinguishers. The replacement extinguishers should be as large as possible. Extinguishers on shuttle cars and other mobile equipment should not be small 2½ pound units, but should be at least the 10-pound size. Extinguishers to be kept in relatively fixed locations can be 20-pound size or larger. Mine fire fighting problems are never small, and extinguishers which have been designed for fighting fires in the home kitchen will not do the job. Of course, the bigger extinguisher costs more, but it is false economy to buy and use an extinguisher that is too small. The only rule to follow is to buy and install the very largest possible, since even it may not be large enough.

Section Fire Fighting Equipment. In addition to the extinguishers, which should be mounted on equipment and kept as back-up in the section, there should be a second and possibly third level of fire fighting tools available. Obviously, to back up the hand extinguisher they should have a greater fire killing capability and range than the hand extinguisher, since they would be needed if the hand extinguisher had already failed.

Several types of equipment are available and are logical for back up fire fighting tools. One of the best would be wheel mounted dry powder extinguishers holding 150 pounds of ABC powder and carrying 50 feet of discharge hose. Another agent available in similar wheel mounted pressurized units with a length of discharge hose is the loaded stream water units. While the range of these units is good, it is likely that they could not be used except by men equipped with all service gas masks. Therefore, at least two masks should be kept with each extinguisher.

An alternate to the wheeled fire extinguisher would be to provide foam nozzles adapted to use the water system provided for allaying dust. The limited capacity of this water system means that special foam nozzles rated in the order of 12 to 15 gpm must be used. These nozzles should have pick-up tubes which will pull the proper quantity of wetting-agent based high-expansion foam concentrate from a five-gallon container. The resultant foam will have an expansion ratio of about eight or ten to one and is effective on class *A* and class *B* fires. The nozzle will discharge around 100 gpm of this foam and has reasonably good range. Again, men using this nozzle should have service gas masks available.

Another practical way to back up hand extinguishers, if the water supply is adequate, is to store an adequate quantity of 1½ inch fire hose and proper nozzles on the section. The water supply should be able to provide on the section at least 60 gpm of water at 70 to 80 psi minimum if it is to be effective.

Water Supply for Fighting Mine Fires. Experience has shown that a mine fire which was not controlled during its early stages just cannot be fought successfully unless an adequate supply of water is available.

Just what is an adequate water supply? I am sure that you can get a different answer each time the question is asked. A supply that could make available 150 gpm of water at 100 psi for an indefinite period would be very adequate. In high coal, where fires can develop and spread very rapidly, 100 gpm at 100 psi is just adequate. In low coal, perhaps 60 gpm at 100 psi is barely enough. These standards are expensive and probably can be satisfied only by a pipeline.

In addition to the obvious need for good hydraulic design of any piped water supply for fire fighting, the pipeline should be equipped with taps having valves each 300 or 400 feet, where a hose can be connected. Also, at every 1,000 feet, or every third or fourth tap, there should be a shut-off valve which would permit closing the flow of water to points beyond. These valves are necessary, since a fire can damage the pipeline in the fire area and the open flow would draw the water away from the taps where it is needed. Fire lines should be joined with Victaulic couplings, as these provide an easy means of breaking the line and introducing additional taps or branch lines. Pipelines should be installed in intake air entries, preferably on haulage or belt entries.

Large water cars are useful and can be especially effective in supplying a large amount of water at high pressure. However, water cars cannot provide a continuous supply.

Fire Hoses. Fire hoses require special consideration at mines. Cotton or linen jacketed hoses should not be used, as they are subject to mildew attack. Even mildew treated hose does not seem to stand up. Rubber lined and rubber jacketed hose appears to resist mildew attack but this hose is heavy, stiff, and expensive. Probably the best hose for mine use is rubber or, preferably, neoprene lined polyester hose with rocker lug couplings. The pins of pin type couplings are too likely to be knocked off, and should be avoided.

Two sizes of hose should be considered. In low coal and where the water supply can deliver only about 60 gpm at good pressure, 1½ inch hose should be used. When the water supply is able to provide 100 to 120 gpm at good pressure, two-inch hose should be used. I do not believe 2½-inch hose has any real advantage over two-inch; the extra capacity usually is not useful since the volume of water available through a two-inch hose is enough to control and extinguish all of the fire which can be reached by the projected stream of a fire hose. The extra weight, size, and cost of 2½-inch hose is considerable.

Hose threads of 1½ or 2-inch hose couplings should be SIPT, Straight Iron Pipe Thread. While it is always preferable to use fire hose adapters, SIPT couplings can be attached to standard male pipe threads. This is especially important if the number of taps which I have suggested have been provided.

Two additional points should be mentioned. When the gasket of a fire hose coupling is in good shape, the coupling should be tightened with bare hand pressure only. It will not leak. Hose wrenches are needed to uncouple hose only. Tightening couplings with hose wrenches will harm the gaskets. Finally, hose should always be coiled up into bundles or doughnuts, with the male coupling at the center. In this way, the hose is in proper condition for quick use. Also, the exposed threads of the male coupling are protected against damage.

Fire Hose Nozzles. The best nozzle for mine use is a combination type, able to give a good long range straight stream and also a good spray. 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, the characteristic of the straight stream should decide the choice of nozzle.

High-Expansion Foam. Good high-expansion foam equipment is the all-important back-up fire fighter which can still do the job when the extinguishers and hose lines fail, as they will when the fire spreads beyond their very limited range. High-expansion foam is effective against a fire in three ways. First, the tremendous volume of high-expansion foam can prevent air from reaching a fire. Second, when driven into the heat of a fire, a foam containing sufficient water will produce enough steam to reduce the

oxygen content of the atmosphere so that active burning ceases. Finally, a high-expansion foam containing a reasonable amount of water will wet all objects which it contacts; it will cool and extinguish a class *A* or class *B* fire if the foam is supplied in sufficient volume and is maintained long enough.

In simplest concept, the bubble is a means to carry water from the foam generator to the fire. The water content of the foam when generated is of minor importance compared to the water content when it reaches the fire. A stable foam will deliver a high percentage of its water to the fire, whereas an unstable foam may not contain enough water to be effective.

When mine fires have reached a size and intensity that they cannot be controlled with a good fire hose stream, a small foam generator won't do the job. The cooling capability of high-expansion foam is no greater than the quantity of water which it contains. A few thousand cubic feet per minute of high-expansion foam usually contains less than 20 gpm of water. This amount of water usually is not enough to absorb the heat of the fire in a coal mine entry, so this low rate of foam generation can't advance into the fire to drive it back and extinguish it. This low rate of water delivery just won't control a mine fire.

High-expansion foam equipment must have the highest rating possible, consistent with the size limitations imposed by the mine and consistent with the water supply capability. Previously, I indicated that a water supply able to handle a 1½ inch hose should have 60 gpm at good pressure while a two-inch hose should have 100 gpm. These water capacities permit corresponding high-expansion foam generators to provide in the order of 7,000 cfm and 12,000 cfm. When equipped with high pressure fans, suitable air rate indicators, and controls, high-expansion foam is effective on large fires at long range.

Training

The vital ingredient in fighting any mine 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. Unless 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 stream reasonably well, but they do not know or understand the best techniques of using spray or water fog. A little bit of practice will speed up laying, coupling, and putting a hose line in operation.

Practice sessions develop team work and speed. When every man has a job, there is a minimum of confusion and wasted effort. Training sessions test equipment also. Hoses which have been neglected may not be in shape when needed. Training includes putting 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. Of course, a man cannot use or be effective wearing a gas mask or breathing apparatus unless he has trained with it.

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 became a supervisor. Above all, no training takes place until it becomes company policy and someone's responsibility.

The Future

I have expressed the opinion that I do not believe it is practical to attempt to provide automatic fire protection for the vast lengths of haulage roads or belt lines. But it is within the range of present technical feasibility to provide reasonably quick fire detection.

At this time, there may be two practical ways to do this job. The first could be to use thermostats at suitable intervals on the roof over the belt line or over the track. These thermostats would be heated by any fire and operate a contact on suitable wiring to an alarm. This is possible now, but might be too expensive if existing standards are followed. On the other hand, existing thermostats which have been tested for use in buildings might be very effective in the even tempera-

ture of a mine where the ventilation current would carry the heat a considerable distance. Perhaps the normal 50-foot maximum spacing used in buildings could be considerably longer in a coal mine. This should be tested. Another possibility might be to use ionization detectors, which can be very sensitive to the products of combustion. No one knows if they could be modified to make them reliable in mine environments. Perhaps their sensitivity might permit a relatively few detectors to do the job. The need is for intelligent testing to develop good standards for detectors to be used in coal mines.

Good detection must be coupled to a good alarm system to be effective. The combination of good detection and a reliable alarm system would permit prompt evacuation of areas inby the fire and a prompt fire fighting effort. Both of these are important goals to attain. They are the keys to preventing loss of life and to reducing the enormous damage caused by mine fires.

In any phase of human existence, fire is a useful and necessary tool; but it can be a terrible and cruel enemy. Nowhere is a fire more terrible and cruel than in mining. We cannot now prevent all fires, but we can improve the ways that we have to detect, to warn, and to fight mine fires.

TRANSPORTATION, STORAGE, AND USE OF OXYGEN AND ACETYLENE UNDERGROUND

By PAUL C. LINGO
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According to U. S. Bureau of Mines reports a number of serious accidents have occurred recently which involved oxygen-acetylene equipment. One such accident in 1967 resulted in the death of three men and the severe burning of another. U. S. Bureau of Mines investigators concluded that an accumulation of methane in a large roof cavity was ignited by an acetylene torch.

A more recent accident occurred in 1968 in which two men died as a result of third degree burns. Bureau of Mines investigators concluded that an explosion occurred inside an oxygen regulator. These investigators were of the opinion that the presence of oil inside the regulator caused the initial explosion.

In another incident an acetylene ignition occurred in a pillar area when the gas was ignited by sparks created when the carbide tipped bits of a continuous miner ruptured an acetylene cylinder. Three of a seven man crew sustained first degree burns.

Again a ripper type continuous mining machine, while cutting through a pillar block, ruptured a charged oxygen cylinder that had been covered by a fall. The continuous miner operator and two roof bolter operators were burned and required hospitalization.

Finally, during repair of a loading machine, where oxygen acetylene welding was being performed, an energized electric cable lying on the oxygen cylinder arced, puncturing the cylinder. The escaping oxygen accelerated the arc, causing grease and oil on the loading machine to become ignited. The resulting heat ruptured the safety plug on the acetylene cylinder, which added fuel to the already raging fire. One man was fatally injured, six sustained second and third degree burns, and two others required medical treatment.

There have been other incidents involving oxygen acetylene equipment, but the above examples were chosen to point out some of the more serious accidents that have occurred because of improper and careless use and handling of oxygen acetylene welding equipment.

The very nature of oxygen and acetylene causes them to be very hazardous even before the torch is ignited. Oxygen is stored in the cylinder at an extremely high pressure, from 2,200-2,640 psi, making the oxygen cylinder a potential jet-propelled projectile. The combustion supporting properties of oxygen are well known; it is in fact this property that enables the flame generated by the burning of acetylene to cut metal.

The Acetylene Cylinder. The acetylene cylinder is a very special type of container differing in several respects from the more common types of compressed gas cylinders. It contains a porous mass that must always completely fill the cylinder; it also contains a quantity of acetone, enough to half-fill (approximately) the porous mass. It is absolutely essential that the acetylene be stored at pressures above 15 psig. Above this pressure, acetylene becomes unstable and the hydrogen and carbon, will under certain circumstances, give off considerable quantities of heat and become explosive. The filler material separates the acetylene into small units. The decomposition heat is absorbed and isolated by the walls of the porous material to the point where decomposition can no longer continue. Therefore, it is possible to compress the contents of the cylinder to 250 psig at 70°F.

The acetone will dissolve 25 times its own volume of acetylene for each atmosphere of pressure. A fully charged acetylene cylinder is under approximately 17 atmospheres of pressure, which yields an acetylene capacity of 425 times the volume of acetone in the cylinder. It is extremely important that the filler material maintain a uniform density throughout its life and that voids do not develop which would permit decomposition of the acetylene. Very severe tests are required initially by the Interstate Commerce Commission and tne Bureau of Explosives to assure long life reliability, a high safety factor of the containers, and proper composition, packing, and integrity of the filler material.

Acetylene cylinders are equipped with fuse plugs in both the bottom and the top which soften at 212°F. These plugs generally consist of threaded steel plugs taper-drilled through the center and filled with a low-melt point metal. Whenever it is observed that the soft metal protrudes from the steel plug, the cylinder should be taken out of service and returned to the supplier for replacement of the fuse plug. Under no circumstances should a person without the proper training attempt to repair or replace any of these plugs. A leaking acetylene cylinder should be removed to a safe location and allowed to exhaust its pressure slowly. This presents a special problem if the leak occurs underground, where it would be hazardous to attempt to transport the leaking cylinder to the outside. In such a case the cylinder should be removed to the return air course and the cylinder slowly exhausted. Remember that mixtures of acetylene and air between the limits of 2.6 per cent and 80 per cent acetylene have been shown to be explosive if ignited. This work should be done under the supervision of a certified man and extreme care taken to assure that no source of ignition be allowed near the leaking cylinder. Frequent tests for explosive mixtures of gas should be made in the return air course where the cylinder is being exhausted.

Underground Transportation and Storage. The manufacturers and suppliers of oxygen and acetylene recommend that cylinders be transported in an upright position and secured so as to prevent them from falling over. This is, of course, not feasible in a number of underground coal mines because of height limitations.

At the four mines in the Ohio Division of The North American Coal Corporation, in order to afford maximum protection for cylinders in transit from the outside to the various storage areas and points of use underground, a simple cover made of a piece of 12-inch diameter plastic pipe with a piece of two-inch oak board in one end is slipped over each cylinder. In addition to insulating the cylinders from possible contact with electric circuits, it affords protection from falling objects and keeps the cylinders from hitting the side of the car or jeep or striking each other. As an added precaution, where practicable, the powder car, which is lined with wood, is utilized to transport cylinders from the outside to the underground shop.

In the two large mines in the Ohio Division, cylinders are stored in the underground shop. From that point they are dispatched to other areas of the mine as needed and returned to the shop when not in use. Several basic rules are observed to effect safe storage of these cylinders underground:

1. Cylinders are stored in definitely assigned places where they will not be knocked over by passing or falling objects.

2. Cylinders are kept away from all sources of heat, and they are stored well away from highly combustible material such as oil and grease.

3. Oxygen and acetylene cylinders are stored well apart from one another.

4. Cylinders are not stored near the face regions, but are removed to a regular underground storage area or brought outside when not in use.

Use of Oxygen and Acetylene Underground. Probably the most acute problem involving the use of oxygen and acetylene underground is the actual use of the torch in the face regions. The reasons for this are fairly obvious. In addition to the usual hazards involved in the use of such equipment, there are at least two notable hazards, not likely to be encountered at any other place, usually present where welding is performed in the face region:

1. The welder is almost completely surrounded by combustible material (coal).

2. The face and ribs are a potential source of methane gas.

In order to minimize the possibility of starting an underground fire or an ignition, a number of precautions must be taken that would not be necessary in most cases if the same welding job were to be performed above ground. The framers of the Federal Coal Mine Safety Act took cognizance of these hazards in Section 209 (g)(6) in Title II of the Act:

"Welding, cutting, or soldering with arc or flame in underground face regions in other than a fireproof enclosure shall be done under the direct supervision of a certified person who shall test for methane before and during such operations in gassy mines and shall make a diligent search for fire after such operations in all mines. Rock dust or suitable fire extinguishers shall be immediately available during such welding, cutting, or soldering."

During the past year or so this section of the act has been the subject of a series of rather interesting albeit confusing interpretations by the Bureau of Mines, in which an imaginary line which separated the "face regions" from the rest of the mine has vacillated from the last open cross cut to a point 300 feet outby the last open cross cut and finally, on July 10, 1968, came to rest at a point 20 feet outby the last open cross cut in first mining and 150 feet outby the pillar line in second mining.

The latest interpretation of the section has clarified the meaning of "direct supervision of a certified person" to mean that the certified person is required tc be at the site of the welding, cutting, or soldering operation immediately before any such work is done, at least once each hour while work is being done, and immediately after the work is completed.

In addition to the requirements of this section of the act, in all the mines in the Ohio Division we insist that the entire area be well rock dusted and at least three bags of rock dust be on hand and a portable fire extinguisher readily available.

There are many general safety precautions that must be observed in using oxygen no matter where the work is being performed. I will not attempt to enumerate all of these precautions at this time; however, it would be well to review a number of the more important safety measures that should be observed. (There are several excellent publications on this subject. Two of these I would particularly recommend: *Safety in Welding and Cutting*, published by the American Welding Society, and *Precautions and Safe Practices in Welding and Cutting With Oxy-Acetylene Equipment*, by the Linde Division of Union Carbide Corporation.)

Oxygen Cylinders. 1. Use no oil. Never let oil or grease come in contact with oxygen or any of the equipment through which oxygen passes. Oil or grease is easily ignited and burns violently in the presence of oxygen under pressure. Therefore, every piece of equipment through which oxygen may pass must be kept entirely free of oil and grease. This includes cylinder outlets, regulators, manifolds, oxygen pipe lines, hose lines, blowpipes, and all connections. Such oxy-acetylene apparatus is designed so as not to require lubrication. When handling such apparatus, keep hands and gloves free from oil and grease.

2. Stand to one side when cracking the valve. To properly and safely crack an oxygen cylinder, stand to one side or the rear of the oxygen cylinder outlet, open the oxygen cylinder valve slightly for an instant, and then close it.

3. Use the correct wrench to connect the oxygen regulator.

4. Loosen the pressure adjusting screw of the regulator valve before opening the cylinder valve.

5. Open the cylinder valve slightly at first, then all the way. Again, stand to one side

and away from the gauge faces when performing this function.

Acetylene Cylinders. 1. Remember that acetylene is a fuel gas and will burn, and under certain conditions is explosive.

It is recommended that acetylene cylinders be in an upright position when in storage and while being used. However, many times where the cylinder is being used underground for short periods of time, it is impractical to have the cylinders in an upright position. After trying a number of methods of keeping the cylinders in an upright position while in use in the face regions, such as chaining them to a post or attempting to secure them to a piece of equipment, none of which proved to be entirely satisfactory, safety and maintenance personnel in the Ohio Division became convinced that the most effective means of making certain that the cylinders were not being used while lying on the bottom was to stack at least three sacks of rock dust on the bottom and lean the cylinders against this stack. This positions the cylinders at about a 30° angle from the horizontal, more than enough to prevent the acetone-acetylene from accumulating in the valve. This will also serve to assure that an adequate supply of rock dust is on hand. It should be noted here that anytime an acetylene cylinder is placed in a horizontal position for any length of time, it should stand upright for several hours before use to permit the acetone-acetylene solution to settle away from the valve.

The users of oxygen and acetylene should be completely familiar with the proper use and function of all the apparatus involved, including the cylinders, gauges, regulators, connections, bases, and blowpipes.

Last but by no means least, no person should ever be permitted to use a torch without proper protective clothing. In addition to the protective clothing worn by all persons in an underground coal mine, the welder should wear goggles while performing such work. The goggles may have either clear or colored glass, depending on the amount of exposure involved in the welding operation. Helpers or attendants should also wear goggles.

Except when engaged in light work, all welders should wear flame-proof gauntlet gloves. Sparks may lodge in rolled-up sleeves or pockets of clothing or cuffs of overalls or trousers. Therefore, it is recommended that sleeves and collars be kept buttoned and pockets eliminated from the front of overalls.

No attempt has been made here to include all the particular hazards which may be inherent in the transportation, storage, and use of oxygen and acetylene equipment. Rather, an attempt has been made to point out a number of hazards that are peculiar to underground coal mining.

THE USE OF METHANE MONITORS IN THE DUTCH CREEK AND L. S. WOOD MINES

By JOHN A. REEVES
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The properties of the Mid-Continent Coal & Coke Company, situated in the Coal Basin area of Pitkin County, Colorado, are well known as one of the major sources of mid-volatile coking coals in the western United States. Since carbon in the form of coke is the most economical reducing agent for the production of iron, the mining of coking coal is significant to our modern civilization. The coal beds of the Rocky Mountain province have only a few select areas which contain coking coal reserves of metallurgical grade. One of these areas is the Coal Basin district. Compared to the majority of Late Cretaceous coal deposits of the west they are a geologic oddity. It is the geologist's opinion that the metamorphosis of coals in the Coal Basin area to mid-volatile rank was probably associated with the Tertiary intrusives which are present in the vicinity. Stresses applied to this coal bed as the sediments were compressed, folded, and faulted during the emplacement of the igneous masses, and the heat from these intrusives undoubtedly con-

tributed to the metamorphism of this coal bed. The higher than average methane content of the Coal Basin beds is also attributed to the metamorphism of the coal.

Mid-Continent operations are presently being conducted in the Coal Basin *B* bed. This bed is about seven feet thick. It is immediately underlaid by the upper and lower members of the *A* bed which have a combined thickness of about twelve feet. This lower bed is not considered mineable because of its high ash content and the separation from the *B* bed by a layer of carbonaceous shale which is anywhere from nine inches to 15 feet thick. Undoubtedly, the presence of this bed under the bed which we are mining contributes to the methane liberation which occurs as mining takes place.

The bed dips rather uniformly at a rate of 12 to 13 degrees and is considered to be the upper limit for efficient mining by mobile mining machinery. Roof conditions can be described as bad to good. Consequently, all areas are roof bolted.

The mine portals are situated just above 10,000 feet elevation. Adverse weather occurs approximately eight months out of the year.

The Coal Basin bed is considered one of the gassiest beds in the United States with approximately 2,000 to 2,500 cubic feet of methane generated per ton of coal mined. Necessity being the mother of invention, the mines of the Mid-Continent Coal & Coke Company are among the best ventilated mines in the world. Approximately 800,000 cubic feet of air per minute is circulated to dilute the methane and render it harmless. All faces are single-shifted, which gives a sixteen-hour bleed or cooling-off period for each entry between production shifts. Every section is on a single split of air and it is necessary to have from 80,000 to 110,000 cubic feet of air per minute ventilating each split. Brattice curtains at all times are kept within fourteen feet of the working face and 30,000 to 50,000 cubic feet of fresh air per minute is circulated directly over the top of the mining machine. All machinery is operated in fresh air, and the air returns behind the brattice curtain after sweeping the working face.

In spite of the outstanding ventilating system at the Mid-Continent Mines, an explosion of methane gas occurred in 1965. Nine men were killed. It was apparent to those of us who investigated this disaster that an accumulation of explosive gas of sizeable proportion existed in the working face. It is the writer's opinion that an explosive mixture of gas was existent up to twenty to thirty feet back from the working face. From this it was concluded the men in the working section were unaware of the accumulation or failed to take heed of it. The advantages of proper and timely detection of methane gas are obvious. It is also obvious that men, being mortal creatures, are capable of making errors in judgment. It is a well known fact that numerous ignitions and explosions have resulted from human failure to detect unsafe conditions and take the necessary corrective steps.

The Bureau of Mines approached Mid-Continent with the idea of installing methane monitors on the continuous miners in their mines. The Bureau for many years had been doing research work on the development of a monitor and was anxious to have the monitor installed in a mine where it would be adequately tested and proven. Mid-Continent agreed to the installation of these monitors, and the Bureau promptly sent three methane monitors to the Dutch Creek Mine for installation.

The monitor is a device capable of giving a warning when any predetermined concentration of methane in the air is reached and is capable of de-energizing the equipment and rendering it inoperative when a dangerous concentration of methane is present in the air. The monitors installed on the continuous mining machines at Mid-Continent's mines show an orange light when a one per cent methane mixture in air is present in the atmosphere and a red light at a two per cent methane mixture in air is in the atmosphere. All electrical circuits are automatically de-energized if the two per cent condition is reached and can be manually reset only after the condition has abated.

The main components of the monitoring system are a sensing head, an amplifier with a warning system, a power shut-off relay, and a power supply. When the monitor unit is energized a green light turns on indicating that the monitor is in operation. A warning light turns on when the methane concentration in the atmosphere surrounding the sensing unit increases to one per cent. This light continues to burn until the gas concentration drops below one per cent

or increases to two per cent. At two per cent concentration the red light alarm is turned on and the power tripping relay is deactivated, de-energizing the power circuit of the machine. Warning and alarm signals can be set for pre-determined methane and air concentrations. A meter, located where it can easily be watched by the machine operator and the crew, also shows the concentration of methane present.

The location of the sensing head was a problem which deserved much study at the Mid-Continent mines. As stated before, the purpose of the monitor is to warn the crew when a build-up of methane is occurring in the area where the machine is operating, and to shut the machine off in the event said warning is not heeded. After investigating many places on the machine, it was decided to install the monitor just forward of the traction motors on the caterpillar platform of the 6CM Miner. This area has a low vibration level and therefore would give good filament life on the sensing head.

The monitor is mounted inside a steel cage which is welded to a pipe which in turn is welded to the deck of the caterpillar frame. The desirability of selection of this point has been proven. We have had good filament life on the sensing head, no heads have been damaged as [redacted] of a rock fall or roof fall, and the head is mounted in such a manner that most of the air, after sweeping the working faces, sweeps past the monitor.

The monitor is a completely automatic device and little skill is required to operate the monitor. The monitor has a test circuit which permits the operator to determine if the machine is operating correctly. An increasing percentage of methane is simulated when the test button is held in and the operator can determine if the lights come on properly at the correct times and the power turns off the machine. Operating rules have been given to all men associated with the monitor; when the orange light comes on the operator will turn the power off of the machine and improve the ventilation in the area until the orange light goes off. Any man found to be operating a machine with an orange light on will be subject to dismissal from the company. When writing the rules, we did make one exception: a machine could be operated with an orange light on if it was in a cave area and it was necessary to remove the machine from the cave in order to prevent loss of the machine. It can be done only directly under the mine foreman's supervision. It is interesting to note that we have never had to operate the machine with an orange light on because, generally speaking, our pillar districts do not make much gas.

Maintenance on the monitor to date has not been expensive. However, we have found it necessary to keep one spare monitor on the property at all times. It is also necessary to carry extra filament heads, as usually this is the item which goes out on the monitor. The filament head can easily be changed out in about 20 minutes, and another 30 minutes is required to re-calibrate the machine after replacing a filament head. This can be done by any trained person with a voltmeter.

Experience with the monitor to date has been very satisfactory. The mining crews have accepted the monitor and are strong boosters of it. We have found that if we keep our ventilation in good shape we can operate several shifts without the orange light coming on. Another benefit of the monitor is that it enables the crew to determine the quality of the ventilation in the working area. Also, a good miner-operator can tell just about how much gas the face is making by watching the recording needle on the monitor box. By observing his needle, he has a good idea of the amount of methane the face and bottom may be liberating. It has been emphasized to our crews that the monitor is not a substitute for the flame safety lamp, but merely an extra tool for the unit foreman and the miner-operator to utilize in the detection of methane. Frequent checks must be made by the miner-operator and the unit foreman throughout the shift because it must be understood by all that the monitor is a mechanical and electrical device and therefore capable of a malfunction. The monitor has a fail-safe feature; if the detector head has become defective it will shut the machine down rather than cheat on gas. It must be understood that the installation of the monitor will not prevent face ignitions but, if used properly, it should go a long way towards preventing a devastating type explosion. Since the installation of the monitors at our properties, we have had one face ignition. This occurred when the sparks

from the cutter bits hitting rock ignited gas feeders coming from the face.

Present operating practice at Mid-Continent is to install a monitor on each continuous miner that produces coal. In addition, one spare unit is kept at the mine shops as a replacement for any unit that cannot be field repaired. Initially, the monitors were returned to the manufacturer for repair if the operating adjustments failed to make a machine perform correctly; however, we have recently begun to stock a few parts and feel we will be capable of making virtually all future repairs at the mine. The original U. S. Bureau of Mines machines have been converted to the more modern Johnson & Williams circuit so that all monitors at the property are now standardized.

The management and union members are highly pleased with the operation of the monitor. It is a rugged machine, easily operated, which does not have excessive maintenance. In conclusion, it can be said that it is Mid-Continent's opinion that the methane monitor is the major break-through for the safe operation of a gassy mine.

WHY, WHEN, AND HOW TO SEAL ABANDONED WORKINGS RATHER THAN VENTILATE

By DENNIS FRAILEY
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This subject has been much discussed, usually with a degree of opinion; however written material on the subject is very limited. This presents a problem, because different parts of the country have different reasons and methods for sealing. The most likely reason that very little has been written, except on the sealing of mine fires, is due to a mining law clause which usually states that "abandoned areas shall be ventilated or sealed." This mining law requirement is accepted as a good practice and, over the years, sealing has become a means of eliminating many problems in mining. Certainly it is a must that abandoned areas either be sealed or ventilated; however it is my opinion that worked out areas many times are sealed when, by ventilating, subsequent mining in these areas can be possible on retreat. Although this discussion is on why, when, and how to seal, I reserve the prerogative to also mention the importance, often times, of *not* sealing.

Why seal abandoned underground mine areas? Many good reasons come quickly to mind, but initially we should review situations in mining operations that may make sealing of abandoned areas a necessity. A few mining situations which may require decisions to seal are:

In gassy mines.

1. Where ventilating air is allowed to pass by abandoned areas before moving to active mine workings, or before traveling active haulage entries.

2. Where ventilating air passes through abandoned areas left by an enclosed panel and room mining system where pillar extraction is not practiced.

Mining operation which has severe water problems. The inherent hazards in unsealed abandoned mining areas are many as we consider the problem of handling methane, squeezing mined out areas, and requirements of mine examination.

1. Problems with mine gases.
   (a) Control of large bodies of methane.
   (b) Danger of ignition of methane.
   (c) The exposed face area in such areas can effect total gas liberation so as to make ventilating air sub-standard.
2. Problems with squeezing abandoned areas.
   (a) Prohibit entrance to areas for examination.
   (b) Disrupt air coursing by destroying stoppings.
   (c) Possibility of occurrence during an idle time where extraordinary precautions would be required to prevent difficulties.
   (d) Increased liberation of mine gases.

(c) Contamination of ventilating air currents by unusually high concentration of mine gases.

3. Mine examination.
   (a) The examination of old works constitutes a safety hazard to those who examine them because of mine gases and bad top.
   (b) The more uncaved areas that are left open, the more personnel required for proper examination.

Economic consideration includes the cost of personnel for examination and the cost of providing air currents for abandoned works.

Finally, the possibility of spontaneous combustion within abandoned areas may be controlled by sealing. The type and design of the seal used on abandoned areas depends upon the purpose for which the seal is being constructed: whether for gases, water, or both. Any water seal will be of more substantial construction than the seal built to control methane and other gases.

However, the "how" of sealing varies in different parts of the country. In some mines where the overburden is in excess of 800 feet and squeezing is prevalent, it is a practice to build timber seals filled with clay or rock dust laid longitudinally to the entry. This type of seal will take an extraordinary amount of weight and will become a better seal with time. There are mines which do not have nearly as much over burden but are bothered by weight. In these mines concrete seals are built without footings to the hard pan. These seals are built by removing the coal bottoms and constructing from the fire clay up. This soft underlay provides a cushion for the seal and prevents cracking or crushing.

Speaking generally, a well constructed gas and limited water seal would be one that has had a trench dug wide enough to facilitate the thickness of the seal and deep enough to remove the soft fire clay. Hitchings should be cut into the coal ribs to insure good sealing against the coal. It is good practice to remove any top coal in this line so that a good seal can be made against the undisturbed top rock. This type of seal can be constructed of two filled-concrete block walls spaced from four to eight inches apart, filled with concrete grout, and keyed into the hitching.

Water seals that are likely to sustain large head pressures are prepared much the same as above, except footings and hitchings are much wider and may be built of reinforced concrete. These seals vary in thickness from three to eight or more feet, and are reinforced with concrete wings from the coal rib to about one-third the width of the seal on both ends.

Occasionally it becomes necessary to seal the middle of an enclosed panel if the inby end begins to squeeze, work, or move as the result of extraction of coal. In this case, it is necessary to leave a fire barrier or cut off pillar to protect the seals from crushing. This type seal does not have to be as well constructed as a permanent seal, but should withstand any pressures that the protective pillars do not afford. An ideal seal in a squeezing panel is the timber seal previously mentioned.

The time for sealing also has many variables, but in normal practice if sealing is to be done it is best to seal as soon as possible. In order to speed the final sealing of an abandoned area, footings can be dug and poured and hitching cut soon after development of such area is started.

In mines where pillaring is done along an extended gob line, employing exhaust type ventilation with bleeder system, and having only slight pressure differential across the gobs from the front to the back, it becomes impractical to seal. It should be remembered that control of gobs should be done with low ventilation pressures rather than with large quantities of air. Studies by the United States Bureau of Mines and individual companies have shown that barometric changes have very little effect on open gobs. This type of mining and ventilation permits the recovery of barrier and chain pillars with high rate of production on retreat operations.

Many tons of coal have been abandoned in barrier and chain pillars in the past because of inadequate roof support, poor ventilation and seals. Today, with the facilities we have for roof support, high capacity fans, and properly designed mines, there will be less sealing done and therefore better recovery of our depleting coal reserves. Every mine, even though in the same area, has characteristics of its own, and the problems govern in what manner abandoned workings are controlled. It is our responsibility as mining men to control these areas in the safest way.

BLEEDERS INCLUDING LONGWALL WORKINGS

By JOHN W. STEVENSON
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Abandoned or worked-out areas in gassy coal mines are natural reservoirs that may contain potentially hazardous air-methane mixtures. The quantity of such mixtures is continuously increasing or decreasing as atmospheric pressure falls or rises. This is in accordance with Boyle's Law, which states that the volume of a perfect gas varies inversely with the absolute pressure.

Because massive gob areas lie adjacent to active workings in both longwall mining and pillar extraction, the ventilation problem in abandoned areas is similar. The Bureau of Mines interest in ventilation of gob areas is prompted by the knowledge that hazardous conditions can develop when major roof falls occur in the gob or from the influence of substantial atmospheric pressure drops of long duration. Either of these conditions can cause dangerous quantities of methane to migrate towards the active working face unless an effective bleeder-entry system is established and maintained. By definition, bleeder entries are special return airways developed and maintained as part of the ventilation system. They serve a two-fold purpose by:

1. Continuously drawing air methane mixtures from the gob area away from active pillars and into the return.

2. Relieving the hazard from expansion of gob contaminants due to atmospheric pressure drops, by directing the expanding methane air mixture away from active pillars and into the return.

Longwall System

Recently, in the United States, longwall mining areas have been developed with either continuous or conventional mining equipment. Because the development pillars are not recovered when the longwall face is extracted, the basic design necessary for a bleeder-entry system is present. When ventilation controls are properly installed in adequately supported and dewatered entries, the bleeder system is complete.

The Bureau has conducted ventilating pressure and air-quantity surveys in most longwall mining areas in the United States. The purpose of the studies was:

1. To determine existing ventilation practices and problems.

2. To obtain ventilation data that would aid operators in selecting a desirable ventilation system.

The enthusiasm of all people connected with longwall mining is extraordinary. Even when the system proved uneconomical, the potential reduced cost, conservation of coal, and increased system production continued to arouse interest and enthusiasm. The most significant factor found to influence the abandonment of a longwall-mining system is roof control. Although much has been learned about factors that influence roof action, more information is needed about the interrelationships of these factors. Another problem that requires additional investigation is the increase in rate of methane liberation in a longwall area immediately before, during, and after the first major roof fall. After this initial roof fall, successive roof falls do not generally liberate excessive methane quantities.

Although many ventilation systems are possible, Figure 1 illustrates a plan frequently used. The primary intake airways are in the left set of entries adjacent to the solid block of coal. The right set of entries, adjacent to the gob, serve as a secondary intake airway and the longwall return airway. Bleeder entries are established and maintained around the perimeter of the mined area.

The number of intake airways, center spacing, width of the entries, and depth of the panel vary. Intake airflow in different mines varies from 15,000 to 80,000 cfm. At the longwall face, regulation is used to force most of the ventilating current across the face. Airflow through the regulator is split so that a portion flows into the bleeder entries while the remainder flows to the main mine return airways.

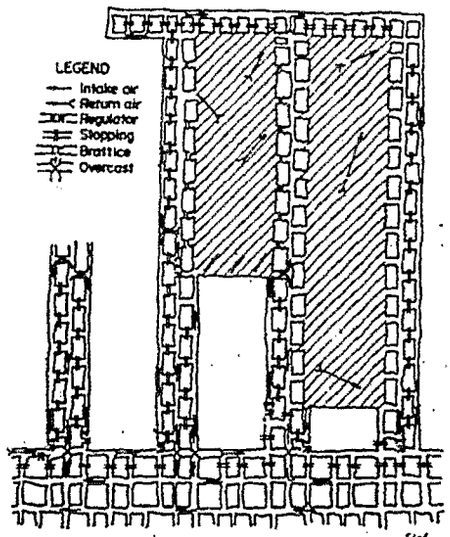


FIGURE 1. - Ventilating System Using Bleeders—Longwall Mining.

Usually less than 15,000 cfm of air is supplied by the secondary intake airway at the right side of the longwall block. At the face conveyor tailpiece, it joins the primary ventilating current. The total air then flows to the bleeder entry connections or the development return airways and finally joins the main mine return. The purpose of the secondary intake is to provide an escapeway in intake air for personnel working near the longwall tailpiece.

Face air velocities may be as high as 600 fpm. At this high velocity, trickle rock dusters are required near the face conveyor tailpiece.

The tightness of check curtains that replace permanent stoppings in the crosscuts is an important factor in controlling ventilation at the longwall face. Regulation is applied to the primary ventilating current near the longwall head drive to direct most of the airflow across the longwall face. If check curtains are not substantially installed, air may short circuit into the gob and into the bleeder connection. If check curtains are not substantial near the tailpiece, air may bypass the longwall tailpiece and enter the gob prematurely. The ideal situation, of course, is to have some air enter the gob from the longwall face while enough volume passes the tailpiece to dilute and transport methane liberated along the face. This situation is very similar to that in pillar mining where substantially installed check curtains are needed to insure an adequate ventilating current at the active workings and the edge of the gob.

Longwall ventilation differs from pillar ventilation in at least three important respects:

1. In longwall mining, all the intake ventilating current must pass either the head or tail drive of the face conveyor. In pillar mining, secondary intake air currents can join the primary air current at different locations to ventilate the pillar line and dilute methane drainage.

2. Air contaminated by methane liberation at the longwall face must pass over some of the electrical equipment. In pillar mining, methane laden air can be directed away from the pillar line into secondary return airways.

3. In longwall mining, stoppings installed during primary development usually are removed to facilitate airflow along the face. Later, check curtains must be installed in crosscuts where stoppings were removed in order to restrict airflow into the gob fringe. In pillar mining, most of the primary ventilation controls remain intact.

Hydraulic ventilation-control devices operated remotely have been suggested in longwall areas to regulate airflow so that a movement of air will always be away from the direction of mining. In ultra-gassy mines, this arrangement appears to have merit, but only if the ventilation-control devices can be interlocked so they fail safe.

Room and Pillar System

Figure 2 illustrates an effective bleeder system in a pillar area. The proximity of the gob to active workings is apparent.

The primary ventilating current travels towards the pillar line in the right set of entries. The right entry in this set is isolated and serves as a regulated bleeder return. Most of the ventilating air is controlled by check curtains, causing it to travel along the pillar line. Some air enters the gob and flows to the bleeder connections and into the returns. This air dilutes and transports methane liberated in the gob. The volume of air flowing through the gob is controlled by regulation applied to the bleeder entries at the junction with the main return.

Secondary intake air travels towards the pillar line in the middle set of entries to

join the primary ventilating current. The right entry in this set serves as a regulated return airway, where part of the ventilating air leaves the pillar line. Doors and check curtains direct and control the ventilating current along the pillar line.

The entry at the far left serves as the main return airway from this mining area. Other entries at the left are not used as airways. The regulator at the end of the pillar line is the chief control of the volume of air flowing along the pillar line. It also controls pressure drop across the gob.

Recommendations for Maintenance of Bleeder Entries

Recommendations pertinent to the safe application of bleeder ventilating systems here presented were previously published in Bureau of Mines Report of Investigations 5360.[1]

1. Special attention should be given to roof control, both when bleeder entries are driven and during subsequent mining, to assure that the bleeder entries remain open. Regularly spaced cribs or center posts may be desirable as additional support in roof-bolted entries.

2. Bleeder entries should not be permitted to become blocked by roof falls or impounded water. Enough maintenance should be provided to keep them open to airflow at all times.

3. Weekly inspections of bleeder entries should be made by a mine official to determine the physical condition of each bleeder and its effectiveness in removing methane from the gob. Information should be recorded.

4. When bleeder entries are expected to serve adjacent working panels and also to remain as bleeder returns for an area after the area has been mined out, extra support (such as barrier pillars) should be provided to keep them open.

5. Ventilating pressure should always be applied to gob areas to direct the airflow away from trolley wires, electrical installations, or active workings.

6. If a bleeder ventilating system is to

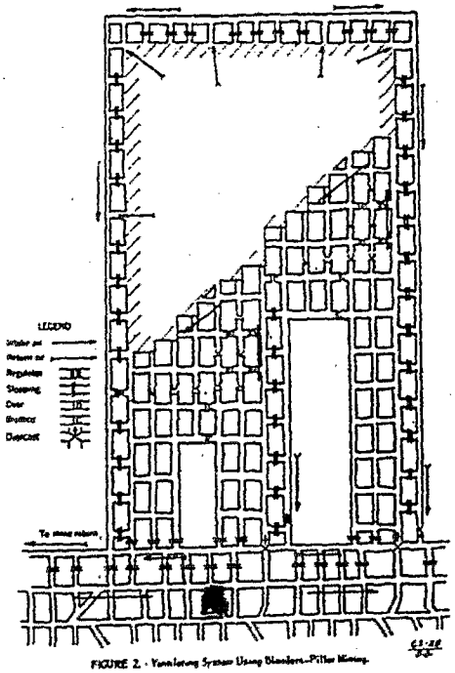


FIGURE 2. - Yonnlating System Using Bleeders--Pillar Mining.

be used, plans for future mining should include development of bleeder entries and control procedures to be followed when mining reaches the retreat stage and bleeders begin to function.

7. Complete dependence should not be placed on bleeder entries as section returns. Supplementary return air courses should be provided to function should the bleeder entries fail. The return entries used during development are commonly used for this purpose.

8. Regulation of the bleeder should assure positive pressure all along the pillar line without creating short circuits where excessive airflow through the pillared area robs the remainder of the pillar line of needed ventilation.

9. Flexible control measures and regulated airflow should be provided in the bleeder ventilating plan to prevent short-circuiting the air across the corners of the gob to the bleeder, preventing a sweep of the interior of the gob. This usually can be accomplished by stoppings that force the air currents to pass into or through the gob before going directly to connections to the

[1]Kingery, D. S., and D. D. Dornenburg. "Effectiveness of Bleeder Entries in Ventilating Pillared Areas of Bituminous-Coal Mines." *BuMines Rept. of Inv.* 5360, 1957, 24 pp.

bleeder entry. The number of bleeder connections required varies with the extent and tightness of the gob.

10. Ventilating pressure should be applied so that the intake air will flow from the working areas across the gob to the openings in the bleeders on the return side of the gob area. Where the gobs are connected to the bleeders is important, for if the connections are misplaced, airflow will not be induced to the far corners of the gob and the air could be short circuited across the gob, leaving large areas unventilated.

AN EDUCATOR'S VIEWS ON THE INDOCTRINATION AND TRAINING OF WORKMEN FOR THE COAL MINING INDUSTRY

By ORVILLE JOHNSON
President, Poteau Community College, Poteau, Okla.

The more I studied this subject, the more I understood the words of a song which was popular a few years ago. It went something like this:

SIXTEEN TONS

Some people say a man is made out of mud
A poor man's made out of muscle and blood
Muscle and blood and skin and bones—
A mind that's weak and a back that's strong.

You load sixteen tons, and what do you get?
Another day older and deeper in debt.
Saint Peter, don't you call me
'Cause I can't go
I owe my soul to the company store.

I was born one mornin' when the sun didn't shine
I picked up my shovel and I walked to the mine.
I loaded sixteen tons of number nine coal
An the straw boss said "Well, bless my soul!"

I was born one mornin', it was drizzling rain
Fightin' and trouble are my middle name.
I was raised in a cane-brake by an ole mama lion
Cain't no high toned woman make me walk the line.

If you see me comin' better step aside
A lotta men didn't, and a lotta men died—
One fist of iron, the other of steel,
If the right one don't get you, then the left one will.

This might have been a reasonably accurate commentary on the socio-economic life of the coal miner fifty years ago, but this is no longer true for the industry as a whole. Today's miner doesn't dig sixteen tons of coal, but 10 times that much with modern machinery. He doesn't owe his soul to the company store. He might well own a part of the store.

Improved economic conditions and improved working conditions do not in themselves make a more productive or satisfactory worker. Modern machinery and efficient management are only parts of a larger whole which constitutes the work climate.

The worker himself—his training, his attitude, his total being—must be considered in evaluating and planning a situation that is both profitable to the employer as well as satisfying to the employee.

In this country, 70 per cent of the people live on one per cent of the land, often times crowded in by concrete and steel and smothered by smog and smoke. Here, neighbors are faceless and the worker is far removed from government and management of the plants and mines where he might earn his living. This situation many times develops attitudes which are alarming to our com-

munity, destructive to the workers moral and family life, and damaging to his efficiency as a worker. It is beyond the scope of this presentation to attempt to solve all the ills of our land; but it is possible to examine a few of the aspects of the problems as we have viewed them.

First, today's society requires trained people. The pioneer miner in Oklahoma needed mainly a strong back and plenty of guts. He went down into the black hole because it provided a living; and he was determined to take care of his own.

Today, these same mines are equipped with modern machinery, and it takes more than intestinal fortitude to operate it; yet, mind you, intestinal fortitude is still necessary. Miners must be skilled in handling electricity and operating complicated machinery, and must have a complete knowledge of safety factors and an understanding of a multitude of mining laws and regulations. They must, above all, know that they are part of a team, and understand where they fit into the scheme of things. The many skills required of today's miners make it mandatory that great care be exercised in the selection and training of trainees.

Our brief excursion in training mine machines operators at Poteau taught us that we know very little about it. But this MDTA project opened up several avenues of opportunities for the future. We learned that government agencies can work together for the common good on a project if there is singleness of purpose.

The Poteau project was funded by Manpower Training; the students were selected by the U.S. Employment Service; expert instruction was furnished by the U.S. Bureau of Mines and the Oklahoma State Mine Inspectors office; the local mine operators cooperated and the entire project was coordinated by the Poteau Public Schools and the Junior College. We consider the project moderately successful and recommend that further study be done to determine if this is an effective way to relieve a very real shortage of trained manpower.

A curriculum should be developed which teaches not only the necessary technical skills but contains motivational content to create a workman with attitudes compatible to modern operation methods. This means the development of a feeling of personal worth in each individual worker. He must know that he not only depends on the team but the team depends on him.

In one of the demonstrations I observed at the school, the U.S. Bureau of Mines Inspector examined a student's safety lamp with this remark: "I'll check his lamp now because he is a student, but when he finishes this course I'll risk my life on his lamp being perfect. I must, because he must." This student beamed with appreciation. He had self-respect. He knew the feeling of human dignity and responsibility. This is an important part of the training for any worker.

Skill without pride in performance is not effective.

Training in regulations without engendering responsibility for conformance is wasted effort.

Elaborate safety devices do not bring safety to those who ignore them.

Good wages do not bring more production from the shiftless.

We must, and I believe our schools and the industry will, provide the very best vocational and technical education available to our young men who want to become miners. These jobs must have prestige values with adequate pay and satisfactory working conditions so this young worker can say, "I am proud to be a miner." This is, perhaps, an idealistic approach to the training of a workman, but it is important that the industry take a look at the whole individual if it is to secure the most benefit from this human resource.

A mine should be clean and free from dangerous debris, not because the operator demands it but because the workman sees the value of order. The machinery should be kept in good working order, not because you have a good machinery repair man, but because the workman has pride in the performance of his equipment and does not abuse it.

Mining laws and regulations should be kept not because of strict enforcement but because the workman is a law abiding worker. Safe operating procedures should be observed because the workman values the lives of others as well as his own.

The personal life of a man with self-respect both on the job and off the job reflects an attitude of team work. He knows

the crew can't do its best work if he is not in top physical and mental condition to carry his own load.

I'm sure these observations are not new to you, but I urge you to take a renewed interest in that phase of training which goes beyond the technical skill to do the job. Talk with people who write training programs, and urge them to take a close look at that part of the curriculum which will create good work habits and creative personal attitudes.

SAFETY AT FMC CORPORATION, MINE AND PROCESSING PLANT, GREEN RIVER, WYOMING

By JOHN KOVACH, SR.
Safety Director, FMC Corporation, Green River, Wyoming

A brief description of our Green River, Wyoming operation might be interesting.

The State of Wyoming is sparsely populated with less than 400,000 people and is among the larger states in the Union. We are blessed with an abundance of natural resources. Coal, trona, natural gas, oil are among the leaders in our State industry.

The trona seam is about 1500 ft. in depth; the seam is horizontal, averaging 12 ft. in thickness and extends over an area of several hundred square miles.

Trona is processed into soda ash, which is a versatile chemical principally used in the manufacture of glass, pulp, paper, soap, detergents and has many other uses. This nearly pure bed of non-metallic mineral (sodium sesquicarbonate) was discovered by chance by a United States geologist. In 1938 the trona was identified in the core sampling of what proved to be a "dry oil" exploration drill hole.

The first shaft was started in 1947 by FMC Corporation. A second shaft was completed in 1952. Large scale operations started in April of 1953. Since that time, the soda ash development in this area has made tremendous progress. We now have three shafts: one for men and material, one for ore haulage and the other, the original shaft, is maintained for possible emergency. Our mine is equipped with beefed-up coal mine equipment because the ore is much harder than our semi-bituminous coal.

Six or seven entry systems are used in major development and four or five entry systems are used in secondary development. Pillar extraction is done by splitting blocks.

We have continuous and conventional mining: Marietta continuous miners, Goodman loaders and for the most part, Joy top cutters, face drill machines, roof bolters, etc.

We are equipped with a force-feed ventilation system. This includes a Jeffrey two-stage high pressure fan presently operating at 400,000 cubic feet per minute capacity at 7-inch water gauge. Shaft resistance is responsible for the unusual water gauge. The fan is powered by a 1500 horse power motor and has a top capacity of 500,000 cubic feet per minute. The standby ventilation installation has a capacity of 300,000 cubic feet.

Haulage is done by shuttle cars to belts, to underground crusher, and to the ore shaft, which is equipped with double skip balanced hoisting.

The trona is stockpiled on the surface for plant processing, which includes more ore crushing. It is then mixed with high temperature water and impurities are removed through a huge filtration system. Crystallizing, de-watering and calcining follow in order. This crude description results in a high grade soda ash product.

About three-fifths of our total work force are needed to operate the plant, powerhouse, technical department, and perform the maintenance. We employ about 560 people.

Our accident frequency from 1955 to 1967, inclusive average is 3.2, 662 consecutive days without any lost time has been our best experience, and 7.68 during 1958 was our most discouraging year. The last six years of this period has shown some progress. Our combined frequency rate for these six

years has been 2.47; total man hours worked during the thirteen years is about 13,000,000.

The 1500 ft. of cover causes bottom heave and problems with roof control. There is methane occluded in the laminated oil shale strata immediately above the trona seam. Methane detectors are used at each working face at the start of each shift by supervision. All machine operators and blasters are certified by the state mine inspection department in the care and use of safety lamps. The operators are issued safety lamps and are required to test each face before performing any work. This is a continuous 24-hour, three shift operation. Fire bosses are required to "fire-boss" the mine before each eight-hour shift.

Our surface processing operation includes the use of elemental phosphorus, liquid H_2S, sulphuric and nitric acid. We do have our share of hazards.

The nearest local doctors (all general practitioners) are located 22 miles from the plant. The county (and only) hospital in the area is located about 40 miles from the operation. When special medical care is required of any kind the nearest available service is in Salt Lake City, Utah, 200 miles away.

The corporate management firmly believes that safety and the welfare of all employees is the primary concern of each manager and supervisor; in short, it is considered one of the most important functions of successful management.

The safety supervisor is responsible for coordinating the over-all safety effort at our location and in assisting management and supervision in developing acceptable safety attitudes and procedures.

The safety program must have the full cooperation of all supervisory employees, but is not intended in any respect to reduce the individual hourly employee's responsibility for injury or loss prevention. Each supervisor is held responsible for the safety of the employees under his supervision.

We can easily agree that there are many areas in any safety program that require mature and sound judgment that cannot be included in rules or written procedures. However, a review of the methods presently in effect could in part help someone. The items do not necessarily appear in order of importance, as it is quite difficult to determine which is effective in preventing injuries, damage or needless waste.

1. *Manager's Monthly Safety Meeting* The resident manager conducts a meeting each month to review the over-all monthly safety performance. Attendance at this meeting includes: resident manager, general mine and plant superintendents, industrial relations department and the safety supervisor.

2. *Hourly Employees Monthly Safety Meeting* Hourly employees from each department are scheduled to meet on the second Friday of each month at the first aid meeting room. This is a suggestion type meeting which encourages healthy hourly employee participation. All suggestions and discussions are noted in the form of minutes by the safety director and distributed to all in attendance — management and line supervision — and are posted on plant and mine bulletin boards. These meetings are helpful. They do encourage the hourly employee to contribute to the over-all prevention effort.

3. *Departmental or Crew Safety Meetings* These are conducted by crew supervisors at the work places. Previous month's safety suggestions and action are covered; current safety problems and general areas of possible improvement are discussed. Minutes of these meetings are made available by the supervisors and routed to the department heads and the safety director for review and follow-up if necessary. The nature of the soda ash processing plant presents difficulties in scheduling effective group safety meetings. A supervisor to individual employee "safety chat" is used as a substitute. These chats are logged and checked by the shift supervisor each morning.

4. *General Group Meetings* The surface maintenance group schedule these meetings every three months. Preparation for shutdowns, starting new equipment and safety items of general interest are presented. The mine department only holds general meetings when problems arise that require group attention.

5. *Safety Inspections — Mine and Surface* This is a union contract provision. This committee is composed of two members appointed by the union and two members by the company, a supervisor and the safety director. Hazardous conditions, unsafe prac-

tices and housekeeping are discussed with the responsible supervisor, and recommendations are made for prompt correction. Reports of the inspections are written by the safety director and routed to management and union, and posted on the bulletin boards. (Items that have not received attention during the month are listed under "Repeat" in the following month's report. These "repeats" are covered at the general management meeting.

6. *Indoctrination and Training* Each new hourly employee is informed of our safety program and general safety rules pertaining to his department. The desirability of the proper safety attitudes is stressed during the indoctrination. Follow-up training of new employees is the responsibility of the foreman in charge and the safety supervisor. National Safety Council's *Industrial Supervisor* magazine is distributed to all supervision monthly and their booklet, *Safe Worker*, is made available to all hourly employees. Safety posters are posted on mine and plant safety bulletin boards.

7. *First Aid and Mine Rescue* About 90 per cent of all employees have received Bureau of Mines' first aid training. This training is done on the job by our certified first aid instructors. Refresher and new hire training is done during the first quarter of each year. Approximately 75 employees are trained yearly. Because of the gaseous mining operations, employees who are interested and are physically qualified are trained in performing mine rescue initial training. This is done by the U. S. Bureau of Mines instructors. Refresher courses are conducted at least twice each year. Three rescue teams are maintained for possible emergency.

8. *Fire Brigade* A group of maintenance and operating personnel are trained in the skills of fire fighting and fire prevention. The fire brigade is under the direction of the powerhouse supervisor. Training for this group is conducted by the fire chief with the assistance of the safety supervisor.

9. *Safety Rules* A booklet of general safety and conduct rules are issued to each employee. Additionally, a mine safety rule book covering specific rules for mine employees and a surface safety rule book have been issued to each respective employee. Since changing conditions warrant the necessity to revise some rules, they are reviewed and changed as needed to insure that they are valid and enforceable.

10. *Head, Eye and Toe Protection* All employees are required to wear hard hats, approved eye protection and hard toed shoes. This is a condition of employment.

11. *Safety Incentives — Dinners and Yearly Slogan Contests.* In an attempt to encourage safety awareness among crews, a program has been developed to provide steak dinners for any crew that completes a year without a lost-time injury. For this purpose, departments are broken down into crews which work on the same shift (about 30 people in each crew). Supervisors of successful crews are responsible for the development of a program at the dinner with the assistance of the industrial relations department. A safety slogan contest is conducted each year. Suggestions for these slogans are encouraged from employees and their immediate families. A U.S. savings bond is awarded to the winner. The slogan is posted in reflectorized form throughout the mine and plant area.

12. *First Aid Dispensaries and Ambulance* Two complete first aid and treatment rooms are maintained at this operation. One is located in the plant changehouse and the other is in the mine changehouse. The first aid rooms are staffed by an industrial nurse during the day shift and employees are encouraged to have all injuries treated at the dispensaries. During the swing and graveyard shifts, injuries are treated by the guards, who are Bureau of Mines certified first aid instructors. A fully equipped ambulance at the plant is maintained in top condition for possible emergency service.

13. *Injury, Near Misses, Error and Property Damage Investigations* An investigation form, which includes error and damage investigation, is a recent development at our operation. This report form must be completed by the foreman, injury or otherwise. The completed report is routed to the foreman's supervisor, the resident manager and the safety supervisor to be analyzed. The report is intended to have the foreman and involved employee seek out the reason for the injury, mistake or injury potential incident and together suggest action for prompt control or correction.

14. *Major Injuries — Frequency Rate* Injuries which require a doctor's attention

are classed as major injuries. Minor injuries are those which are only treated at the dispensaries. Lost-time injuries are computed in accordance with rule Z-16, the USASI standard of recording and measuring work injuries. A record of all injuries are prepared by the first aid departments and routed to the respective department superintendents; this is done daily. Monthly total injury and six month's exerience reports are also routed in the same manner to possibly detect unfavorable trends by departments throughout the year.

15. *Job Procedures with Integrated Safety Analysis* A program to up-date plant and mine operating manuals with safety analysis has been in effect for some time. Job hazard analysis for hazardous or unusual jobs have been completed in the mine and to a large extent in the surface maintenance department. The job hazard analysis has been beneficial in indoctrinating new hires and transfers.

16. *Special Safety Procedures* Procedures that are too detailed or complicated to appear in either the safety rule book or in a summary of our program are written and reviewed by the responsible departments. These procedures become a part of the safety policy and procedure manual and are reviewed as required. They include, but are not limited to, lock out, tank and vessel entry, mine fan failure, working in high places, scaffolds, etc.

17. *Diaster and Emergency Planning* In an attempt to hold injuries and loss at a minimum if an emergency should arise, preplanning is being completed to anticipate what action should be taken. These plans will be documented and discussed with the individuals involved to insure minimum confusion and danger to life or property.

18. *Off the Job Safety* With all the fringe and other benefits, we find that off the job injuries are just as painful and costly as the work injuries and according to our records, employees are much safer on the job than off the job. Home safety is frequently discussed at the many meetings at work. We provide the quarterly, *Family Safety* magazine, published by the National Safety Council to all employees with or without families. Employees who have incurred off the job injuries are called into the dispensaries when they return to work and the circumstances involved are reviewed with the employees, with the emphasis on repeat prevention. All off the job injuries are reported quarterly to our corporate safety department and the National Safety Council.

These are the highlights of our present safety program. We have experienced a certain measure of success over the years by applying, selling, encouraging, enforcing and some praying. We are extremely fortunate in that our hourly people for the most part, are stable and safety minded. However, we realize that the many recent and new developments in mining equipment, surface process equipment, new chemicals, new products, etc. present new problems that will require more future safety attention.

In conclusion, a brief look into our thinking for the future might be timely: We have enlarged the scope of the supervisors injury investigation form to include mistakes, damage and unscheduled outages.

The injury investigations over the past 50 years have commendably contributed to our safety progress — after the injury. Why can't we realize future progress by investigating cause factors, i.e., the common work error, property damage situations or unscheduled outages and mutually decide on methods of control — *before the injury!*

This investigation form has been in effect for eighteen months and was initiated as a preliminary step in adding the zero defect technique, property damage, control and work scheduled outage or breakdown prevention to our program.

The above safety techniques have been used in U. S. industry in part and have been tremendously successful. We feel that all of these comparatively new approaches can be "fed" into our existing program by careful conditioning of all employees as to the need for the change, the need for more depth in our safety thinking, the need for doing what is *right* for the employee and the employer. We are presently in the process of this change and have made some encouraging progress. But we still have a long way to go.

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CONSTRUCTION SECTION

OPENING REMARKS AND REPORT OF YEAR'S ACTIVITIES

By THEODORE S. McKOSKY
Supvr. of Toolhouses, Bethlehem Steel Corp., Bethlehem, Pa.
General Chairman, Construction Section

Recently, the construction industry has been under fire for its safety record. Those who criticize the construction industry fail to realize that today we must erect bigger and more complicated structures, use bigger and higher speed equipment, face ever changing job conditions, and experience large turnover of manpower. With all of these complications, we are holding our own in safety.

Yes, we are having problems in the construction industry. Action is being taken to overcome these problems. Many construction contractors have excellent safety programs. The unions have excellent apprentice training programs. The AGC has an excellent training program. They have graduated over 14,000 from their training school and have now enrolled over 1,000 in their correspondence course. Why should the entire construction industry be criticized for a few mavericks?

When frequency and severity rates are compared with other occupations, the hazards to which the employees are exposed and the ever changing conditions must be taken into consideration. When this is done, people will get a different understanding of the construction industry.

Some feel that safety in construction can be obtained through legislation. I, for one, do not. Since a man must do the work or operate the equipment, we can make our greatest gains in safety in the construction industry through training and education of the men.

The Construction Section of the National Safety Council has been active in producing material to aid the construction industry. Many of our members have also given talks to different organizations to aid safety in construction. There are five divisions in the Construction Section: Building, Heavy, Highway, Specialty, and Home Building Divisions.

In 1968, we completed three data sheets and fifteen safety releases. Fourteen data sheets and seventeen safety releases are being prepared by the five divisions. Many of these projects will be completed shortly. This material is available through the National Safety Council.

We are alarmed over advertising showing unsafe conditions in construction magazines, and we have formed a committee to make the editors of these magazines aware of these unsafe conditions in advertising.

We have appointed a chairman for USASI A10 committee to get the *Safety Standards In Building Construction* moving. He is doing a good job and we expect revised USASI construction standards to be available in the near future.

Our Research Committee is developing material on the following items: wind hazards in high-rise construction; employee motivation and behavior; material and man hoists; heaters; ventilation; and housekeeping.

We have developed an off the job program. With the disabling injuries off the job being approximately four times that of on the job injuries, we plan to really attack off the job accidents in 1969.

We have been proud of our *Newsletter* in 1968. We intend to continue to publish articles of interest to the construction industry.

Since "Falls" continue to be one of the major causes of serious injuries in construction, the "Falls" campaign was pushed by each division. We also intend to carry on the "Falls" campaign through 1969.

SAFETY REVUE SCRIPT — 1968

A SKIT

Tennessee Valley Authority Office of Power, Chattanooga, Tenn.

NARRATOR: Welcome to the safety revue. It is our intention during the next few minutes to entertain you—slightly—and to present to you through entertainment, a few safety messages—seriously—that we don't want you to miss. So, away we go with our safety show! Here's a group that gets star billing in every hospital; they're called the Medics.

(Enter QUARTET *dressed as interns and carrying doctors' implements.)*

Song Parody to Tune of "Hello, Dolly"

Hello people, well hello people,
It's so nice to see you in good health
today.
You're looking swell, people—
We can tell, people,
You've put safety into practice in
your work and play.
We've come to just remind you
Danger lurks behind you,
Be alert, and stay alive, and
don't forget—
That Safety pays, people,
In many ways, people,
Now settle back and just relax,
Watch our safety program acts,
Being here we know you won't regret.

NARRATOR: We *are* glad to see you in good health today. Glad some silly inanimate object like an automobile or an electric wire or a nail didn't keep you away from your family, your work, your play—your life. You know, all those inanimate objects are perfectly safe—until some animate object, usually a human being, enters the act. Then look out! Consider this heart-rending story of poor, darling Clementine.

Song Parody to Tune of "Clementine"

She was driving, in the city,
Cars in front and cars behind,
She was fumbling for a hairbrush,
Failed to notice the "Stop" sign.

Oh my darling, oh my darling,
Oh my darling, Clementine,
I do hope that you'll recover,
You can help me pay the fine.

Fog was hanging, o'er the city,
Had to get to work at eight,
Truck ahead, without a tail light,
Ended up a full month late.

In the country, near the highway,
Cows were grazing, here and there,
One stepped out to cross the roadway,
Never cared for beef so rare.

Traffic moving, oh, so slowly,
Followed close for many a mile,
Car before me stopped too sudden,
Found myself beneath the pile.

On the freeway, going homeward,
I was driving much too fast,
Failed to slow down for my exit,
Come and autograph my cast.

At a party, wine was flowing,
Though I'd have a drink or two,
Going home, I hit a power pole,
Lights went out—I went out, too.

Now the moral of this story,
For each one who plans to drive,
Keep your mind on what you're doing,
If you want to stay alive.

NARRATOR: Spring has sprung upon us and we've arranged a special preview for you. You know, this is the time of year when the world's top fashion designers spring their new creations on eagerly-waiting women and not-so-eagerly-waiting men. You men are lucky to have pocket change after a fashion change. But anyway, we will not be denied our share of the fashion world today.

Music: Fashion Theme ("A Pretty Girl Is Like a Melody.") Establish, Fade, Hold Under.

NARRATOR: Yes, you are privileged to witness our first annual Safeless fashion show, which is being brought to you through the courtesy of TVA and the carelessness of some of its workers. The items modeled are very much in demand; many people are just *dying* to get into them. These items were designed by members of the American Medical Association and can be obtained with

ery little effort, and paid for with pain, uffering, grief, or perhaps your life. *(Man nters with bandage on head.)*

Check the exquisite detail of this custom-made, beautifully styled head bandage. This darling bandage is sterilized and made of the finest gauze and tape which have been imported from Johnson & Johnson Company. This bandage has been designed by Dr. Derryberry for each worker who thinks his head gives more protection than a hard hat. *(Man enters on crutches.)*

The next ensemble is a two-piece, handmade, beautifully finished hardwood set of crutches. These little cuties can be purchased for $3.50 from any of your better medical supply houses. These were furnished to our model by TVA after he proved he could use a broken ladder without getting caught. *(Man enters with bandaged big false finger.)*

Coming up is one of our most popular items. *(Pause for model to enter.)* Hurt fingers can be worn in high style this year with almost any outfit. An oversize, throbbing finger can be obtained by anyone who is willing to get careless. This particular one came from catching a glimpse of a beautiful girl while the hammer was in mid-swing. *(Sneak music out.)*

Song Parody to Tune of "Billy Boy"

GIRL: Oh, where have you been Billy boy,
Billy boy,
Oh, where have you been,
charming Billy?

BOY: I have been to get first aid
From a hammer I mislaid;
It's a foul thing; I really pulled a
boner.

GIRL: Does it pain you awful much,
Billy boy,
Does it pain you awful much,
charming Billy?

BOY: Yes, it pains me to my head
And I feel like I'm most dead;
It's a foul thing, I really pulled a
boner.

GIRL: Have you learned from this event,
Billy boy, Billy boy
Have you learned from this event,
charming Billy?

BOY: Yes, I've learned to stay alert,
Heed safety rules and not get hurt,
And I'll never again pull such a
boner.

BOTH: Please be careful, so you don't pull a boner.

Music: Fashion theme. Man enters with back brace on.

NARRATOR: On with the show as we endorse the high fashion of this newly acquired back brace. This charming little number is extremely popular with our older customers who still think they are as strong as they used to be! This brace is easily acquired after you show the boys how much weight you can pick up by yourself. *(Lady enters with eye patch on.)* Doesn't the little lady look stunning in her attention-getting eye patch! She was rather stunned, too, when she discovered how close she came to losing her eye when attempting to repair her stapler with a desk knife. Each secretary has a chance to be first on her floor to wear one, by failing to use a little judgment. *(End Music.)*

Judgment—a synonym for sense. Isn't it strange how often that word can mean the difference between the living and the dead? Ever ask yourself these questions: should I pass that slowpoke car ahead on this curve; should I fasten my seat belt; should I speed up to get there on time? No doubt, if you take time to ask, your answers will be based on judgment. What happens, though, when judgment isn't present? Listen.

Song Parody to Tune of
"My Bonnie Lies Over the Ocean"

My Bonnie refuses a seat belt,
Her culottes they soil, so says she,
I slammed on my brakes on the freeway,
Oh, bring back my Bonnie to me.

Bring back, etc.

I rushed down a steep grade at eighty,
A curve and a skid, plus a tree,
Caused Bonnie to wing through the
windshield,
Oh, bring back my Bonnie to me.

Bring back, etc.

My Bonnie was struck by a dashboard,
The impact was shocking to see,
The dashboard survived the collision,
But bring back my Bonnie to me.

Bring back, etc.

NARRATOR: And that's what can happen when you mix one idiot driver with an automobile.

Music: Sneak in fashion theme, hold—under.

NARRATOR: Speaking of transportation, let's check again with our fashion parade. *(Man enters in wheelchair.)* And in rolls this hot-rod, a new 1968 flat-back, two-off-the-floor, spoke-wheeled wheelchair. This sporty little model is powered by two hands or the effort of a wife or good friend. It has one bucket seat and is equipped with hand-powered brakes. This little honey is truly the ultimate in travel for those who think safety is just a lot of baloney. Our driver got this beauty from playing Tarzan while working in a boiler. *(Man enters with dark glasses and cane.)*

You can tap along with Guy Lombardo if you have this matching set: a beautifully hand-crafted cane and chic dark glasses. This outfit may last a lifetime. The ensemble can be obtained by neglecting to wear safety glasses. *(Music: fade out.)* Protection is available for eyes and heads, if only we'd accept it.

Song Parody to Tune of
"Ain't Gwine Study War No More"

Better cover those great big eyes with
safety glasses (repeat 2)
Better cover those great big eyes with
safety glasses,
Best glasses you ever "seed."
They'll help you buy them for your need,
Help you buy them for your need,
Help you buy them for your need.
You ought to try them, yes indeed,
Ought to try them, yes indeed,
Ought to try them, yes indeed.

Better cover that lil' ole head with a
hard hat (repeat 2)
Better cover that lil' ole head with a
hard hat,
Best hard hat you can obtain.
It'll help you stay away from pain,
Help you stay away from pain,
Help you stay away from pain.
You ought to stop and use your brain,
Ought to stop and use your brain,
Ought to stop and use your brain.

NARRATOR: The name of the safety game is "brain"—brain-power. Would it be embarrassing if I asked each of you who had an accident within the last year to raise your hand? I'm not requesting that you do that—although we know of many minor and not-so-minor accidents that have occurred. But another point about accidents is that we are embarrassed after we have one. As embarrassed as we are at having had an accident, we always come up with a stock remark: "It wouldn't have happened, except. . . ." or, "If only I had. . . ." The point is: we must become accustomed to thinking safety beforehand. We must take time to care.

We have a few more extremely popular fashions to show you before the show is over. *(Music: Sneak fashion theme, hold under. Lady enters with small cast on ankle.)*

In waltzes this little lady sporting a mod-colored, mini-ankle cast. This cast is the grooviest and will be right in style with all of the new, swinging colors. It's so easy for every secretary to get her own ankle cast as a reward for tripping over an open file drawer. *(Man enters with neck brace on.)*

This neck brace is made of the strongest of materials so it will support a "fat head." This little gem is commonly referred to as an "insurance collar"; but it can be obtained legitimately, as in this saga of Jack and Jill. *(Music out.)*

Song Parody to Tune of
"On Top of Ol' Smoky"

It was out on the highway, while topping
a hill
And passing a Greyhound, that Jack met Jill.

A head-on collision resulted when he,
Took chances and passed, when he could
not see.

He was a good driver (or so he did think),
But the accident happened as quick as a
wink!

He woke the next morning in a hospital bed,
All bandaged and bleeding; he wished he
were dead!

A lawyer came to him with a message from
Jill:
"There's a whole lot of damage—and
you'll pay the bill!

And you will pay dearly for causing this
wreck,
'Cause when I am able, I'll sue you,
by heck."

Now listen, you driver, of a TVA car,
Perhaps you drive near, perhaps you
drive far.

Just remember this story of Jack and of Jill,
Never pass on a curve or climbing a hill!

NARRATOR: *(Music in. Man enters with face and arms wrapped for burns.)* Red and black are the style colors this year. You can certainly testify to that if you think signs that read "No Smoking," "Caution—Hydrogen," "Flammable Liquids," and others were just placed around for decoration. Burns may give you a stylish color, but it's so much easier to read and believe signs. *(Man enters tuning hearing aid.)*

How about trying to "tune in" on safety with this new 50-transistor, high-fidelity hearing aid? You may have a chance to, if you can't be convinced to wear ear protection around those noisy areas. If you'd like to talk to one of these hearing-aid owners, please be sure to speak slow and loud. *(Music out.)*

Song Parody to Tune of
"Whoopi-Ti-Yi-Yo"

As I was fishin' one mornin' for pleasure,
Below Nickajack where the water is rough,
They opened a gate, my boat did a side slip,
I found that those danger signs weren't just
a bluff!

Whoopie-ti-yi-yo, get along little fishie;
It's my misfortune and none of your own.
Whoopie-ti-yi-yo, get along little fishie;
I'd rather not drown in your watery home.

One day I was backing my truck at the
warehouse,
Failed to step out and check what was
around,
Heard someone yell, but too late—I had
done it,
Scott Cummings' new car was mashed flat
on the ground!

Whoopie-ti-yi-yo, get along little push broom,
This job as a sweeper is really a bore,
Whoopie-ti-yi-yo, get along little push
broom—
They won't even let me drive nails anymore.

I once had a good job with power
construction,
I had a good foreman—we were a good
crew,
I just wouldn't follow those safety
procedures,
So Shotgun said, "Sorry, my boy, but
you're through!"

Whoopie-ti-yi-yo, get along little shovel,
My muscles are aching, my shirt soaked
with sweat,
Whoopie-ti-yi-yo, wish that I'd been more
careful,
'Cause a job digging ditches is all I could
get.

I laughed at my friends who on safety
insisted,
Said, "Get off my back," when they warned
me one day,
The joke was on me—but I heard no one
laughing—
I was on my *own* back from September to
May!

Whoopie-ti-yi-yo, get along little crutches,
You'll always be with me as I walk along,
Whoopie-ti-yi-yo, now listen dear people,
Remember our story—remember this song.

NARRATOR: I understand that, during the show, we almost had an accident backstage. Here's how the dialogue went:

Song Parody to Tune of
"Clementine" or "Peanut"

BOY: "Found a wire, found a wire,
found a wire just now;
Just now I found a wire,
found a wire just now.

GIRL: Where'd you find it, where'd you find
it, where'd you find it just now?
Just now where'd you find it, where'd
you find it just now?

BOY: On the floor, on the floor, on the
floor just now;
Just now on the floor, on the floor,
just now.

GIRL: Did it bite you, did it bite you,
did it bite you just now;
Just now did it bite you, did it bite
you just now?

BOY: Yes it bit me, yes it bit me, yes it
bit me just now;
Just now yes it bit me, yes it bit me
just now.

GIRL: Where'd it bite you, where'd it bite
you, where'd it bite you just now?
Just now where'd it bite you,
where'd it bite you just now?

BOY: On the behind, on the . . ."

NARRATOR: *(Interrupting promptly):* Hold it! This is a family-type show! Let's not let it get out of hand. Right now, I'd like to introduce you to a man who is wearing the ultimate in safety protection. He is well-prepared to do his job safely. *(Man enters wearing every safety item—goggles, hard hat, ear muffs, welding hood, respirator, chemox, welding sleeves, gloves, lead burner pants, knee guards, safety caps on shoes, safety belt, and ropes. The man trips, falls, and lies still.)*

Well, it just goes to show you. All of these protective items are no good unless you use the greatest safety protection of all —the human brain! *(Man rises, exits, scratching his head wonderingly.)*

Our entire fashion show cast returns now to give you another glance at the styles that may be "in" and "with it" during the coming seasons. We hope you will never have to purchase any of our expensive fashions. *(Fashion cast enters, single file, lining up behind pieces of lettered cardboard which have been previously placed on stage, face down. A large letter is on each cardboard to spell out "Safety Pays.")*

And now, as if by magic, before your very eyes, cast members will reveal something that is very dear to you, something that you're extremely interested in. *(Cast members pick up cards, showing blank side to audience; except now, three cast members turn cards to audience to reveal the word "Pay." Narrator continues after pause for audience reaction.)*

Well, yes. But there is more to it than that. *(Remaining members of cast turn cards to reveal entire message to audience—"Safety Pays.")*

Yes, that's more like it. Safety pays. And we hope, through our songs, skits, and fashions, that we've put that message across.

Song Parody By Cast to Tune of "Vive l'Amour"

"Let every good fellow now join in a song,
Safety for TVA.
Success to each other and pass it along,
Safety for TVA.

Safety for, safety for, safety for sure;
Safety for, safety for, safety for sure;
Safety for sure, safety for sure,
Safety for TVA.

A friend on your left and a friend on your right,
Safety for TVA.
I'm sure that you'd like them to be here tonight,
Safety for TVA.

Safety for, safety for, safety for sure;
Safety for, safety for, safety for sure;
Safety for sure, safety for sure,
Safety for TVA.

Now wider and wider our idea extends,
Safety for TVA.
And this is the way that we'll keep all our friends,
Safety for TVA.

Safety for, safety for, safety for sure;
Safety for, safety for, safety for sure;
Safety for sure, safety for sure,
Safety for TVA."

(All members of cast bow, exit.)

WORK VESTS—SAFETY OR FALSE SECURITY?

By I. E. HANSON
Guardian Safety Equipment Co.

A small candy mint is sometimes a "Life Saver" for those of us trying to give up smoking. A martini is sometimes a "Life Saver" for those of us finishing up a long hard tense work day. And an approved work vest type life jacket is sometimes a "Life Saver" for those of us making an unplanned entry into the water. We all expect and are prepared for the candy mint and the martini to be a sometime part-time "Life Saver." But I think we all expect and depend on an approved work vest, life jacket, or life

preserver to be a close to 100 per cent effective "Life Saver"; rather than a sometime part-time performer.

About two years ago, A. J. Scardino, Safety Director for Jahncke Service, Inc. in New Orleans, Louisiana, while purchasing life vests for his young children, remembered an article he had read in an earlier *Reader's Digest*. The title of the article was "Drowned While Wearing Life Preservers." In essence, it described an accident at sea. The sea was calm and warm, and the victims should have been able to float safely until rescued; an inquest held on 58 bodies showed that the majority had been injured or stunned when they struck the water, and their life preservers failed to hold their nostrils out of the water. Mr. Scardino decided to have his children test their jackets in the stunned or unconscious attitude. Much to his dismay, he found they were effective in saving the body—but rarely the child; in most of the tests the wearer ended up in a face-down position. Shortly thereafter, his company decided to choose a new work vest for employees. Seizing this opportunity, Scardino, along with Ray McDonald of Boh Brothers Construction Company, in New Orleans, conducted a series of tests on five approved work vests to determine which would be the best choice for their companies.

In thinking about how work vests are actually used, several pointed requirements were injected into the tests; one in particular was the comfort and workability of the unit on dry land, since in industrial applications the work vest 99.99 per cent of the time is just being worn by the workman while performing his duties. For those rare situations in which work vests are called upon to perform their water function of saving a life, the test-vests were required to orient a stunned or unconscious victim to a face-up position within five seconds and float him in a safe supine inclination thereafter. The results of these tests were reported in an article in the *ASSE Journal* in April 1967, which in part stated: "Unfortunately and surprisingly, not one of the devices tested met all six of our standards; in the past we have not tested for orientation but for buoyancy. Perhaps we were saving the body and not the man, so let's not be lulled into an area of false security. We suggest that you check the following comparisons, then test for yourself."

In the ensuing months, keen interest in the article from all over the country, coupled with very little available information regarding practical research on water life saving jacket devices, led finally to the University of Southwestern Louisiana, which graciously offered to supply somatotyped student victims and the facilities for testing the land workability and the fresh water floatability of the work vests. Seventeen persons gathered there, representing industry, manufacturers, Corps of Engineers, insurance companies, and of course, the university. For liability and insurance reasons, we incorporated the test group and, for want of a better name, called ourselves the National Association for Better Work Vests, Inc.

Seven hundred eighty individual wearability or workability tests were conducted with 13 jackets, while the students performed such skills as mall swing, ladder climb, bending and stooping, package lift, and overhead work. At the pool, 304 individual floatability tests were conducted, using the 13 jackets and 12 student-victims. Water entry was from both level and three-foot elevations; both feet-first and panic free-fall entries were tested. All tests were in an "unconscious" condition.

About two months later, the same student-victims and 39 persons representing industry, Coast Guard, manufacturers, Red Cross, the university, Civil Defense, and Corps of Engineers assembled on Lake Pontchartrain on the deck of a spud-barge to conduct the open-water flotation tests. One hundred forty-one tests were performed from the spud-barge, all in the "unconscious" condition. Most all of these tests were from an approximate eight to ten foot elevation. The reason for the relatively low number of tests here was due to the weather we encountered on the lake that day. We had at least three-foot running seas, and at one point had to shut-down tests because of thunder storms, high winds, and high waves.

What makes a work vest wearable or workable?

1. It has to be easy to put on, with no complicated rigging, and easy to adjust to size.

2. It has to be easy to feel relatively comfortable over a considerable length of time.

3. It has to allow reasonably full freedom of movement, because the men who wear them are performing work duties.

4. It has to be easy to take off.

5. You have to require that it be worn, and worn properly!

In the workability tests in Lafayette, none of the vests fell into the poor-to-fair classification; about half were in the fair-to-good, and half in the good-to-excellent. The percentage acceptance ranged from a low of 48 per cent for vest No. 1, up to a high of 93 per cent for vest No. 11. Both workability and floatability need to be considered when choosing a work vest.

In a booklet entitled *Problems of The Life Jacket,* Captain John Schumacher, Inspector of the German Lifeboat Institute, says, "the special significance of the exhausted or fainted condition of a human being floated in water has lately often been discussed. As to the question as to which powers of buoyancy of a life saving appliance would make the most favorable position in water possible, not only is the contemplation of the fainting situation important, but also the floating-physical way of acting of the human body in water at all."

We are all familiar with the fact that treading water, or placing buoyant materials around the chest, will overcome the weight of the head and produce a 90° position, with the person vertical in the water, his head and breathing openings well out of the water. There is a natural tendency of the head to tilt forward from a 90° position to a face-down position, and on to a typical drowned person position. The problem of the work vest, then, is to counteract this natural positioning without any help from the victim. A buoyant material placed on the front upper chest area tends to raise the chest and lower the hips and legs, then rotate the victim to a face-up position. However, the breathing openings are just above the water, where they could easily be overwashed by wave action, or closed off should the head turn to one side.

A second buoyant force is added behind the victim's neck to raise his head up and out of the water. The amount, as well as the positioning, of the buoyant material is very important—a little too much will bring us back to a rather unstable angle of inclination. We changed the ratio of buoyant forces to position the victim within a Safe-Zone of 30-60° inclination; and added material along the sides of the neck to prevent a sideways turning of the head. Captain Schumacher did not intend necessarily to suggest the physical outline of an ideal work vest or life jacket, but he did show the floating-physical characteristics of an unconscious or stunned victim, and those buoyant forces that seem necessary to orient and maintain such a person in a safe position in the water.

In 26 per cent of the 304 tests in the Lafayette Pool, the victim was within a 30°-60° angle of inclination and face-up, at 30 seconds following water entry. Personal observation seemed to indicate a 10°-70° safety zone will be acceptable, depending upon the amount and positioning of the buoyant materials. Forty-one per cent of the tests fell into this category; but to show the wide variation between individual jacket performance, one vest made this category in only 17 per cent of its tests, whereas another made it 83 per cent of the time. In 30 per cent of the pool tests, the victims were face-down in the water 30 seconds following entry. A number of tests were conducted for a period longer than 30 seconds; but the vests rarely, if ever, changed the angle of inclination of the victim after 30 seconds.

Lake Pontchartrain results were: 33 per cent—30°-60° at 30 seconds; 52 per cent —10°-70° at 30 seconds; 30 per cent—face-down at 30 seconds. Again, to show the wide variation in vast response in the 10°-70° safety zone, one vest was never within this zone; the highest vest was within it 75 per cent of the time.

Victim orientation at five seconds after entry into the water:

29%—30°-60° at 5 seconds	[0% to 58%]
43%—10°70° at 5 seconds	[0% to 75%]
27%—face-down at 5 seconds	[100% to 0%]

Even if we take the best average results —52 per cent—P.10-70—30—we have 48 per cent of the tests in which the victims were in either a face-down or unstable inclination; not very good safety odds!

Correlation between floatability performance, total buoyancy, and front-to-total buoyancy, was good. The test vests were more successful in the water with victims that tended to be either round and soft, or thin and slender, and had the most trouble with

the more muscular victims. This correlates pretty well with a note in a Canadian Government life jacket report, which states . . . "of the male victims, it can be seen that the mesomorphic (muscular) conformation is more difficult for the jacket to handle."

An approved work vest should:

1. Have at least the minimum buoyancy to conform with the latest Coast Guard requirement.

2. Have positive closure hardware; be easy and fast to put on, adjust to size, and take off.

3. Be comfortable, and allow freedom of movement while being worn for extended periods of time in the performance of industrial and marine activities.

4. Surface and maintain, or rotate, an unconscious victim to a face-up position within five seconds after entering the water from a fall of 10 feet.

5. Orient and maintain an unconscious victim within a 10°-70° supine inclination, with head-out and face-up.

6. Not support combustion.

As a result of these efforts, changes, modifications, and re-designs are already being made by many manufacturers. If your company uses work vests, take a good serious look at them!

BASIC PRINCIPLES OF MANAGEMENT AS RELATED TO SAFETY PROGRAMMING

By ALLEN K. HEYDRICK
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Management is a profession. (Definition of a profession: a calling in which one professes to have acquired some specific knowledge used by way either of instructing, guiding, advising, or serving others.)

Management is a science. It is subject to scientific approach and certain principles to guide its basic activities.

Management is an art, because it requires certain specific aptitudes and skills.

Management is getting things done through people. Management is for the purpose of getting people to do what we would like to have them do, and to get them to do it because they *want* to do it. Managers must distinguish, however, between that which they have to get other people to do, and that which they do themselves.

Managers are people who get things done. Managers don't wait for the future—they make it. Managers don't react—they act.

Managers measure their own effectiveness:

What is different in my organization in the last 12 months because I've made it so? What's different in the area for which I'm responsible? Is the quality any different because *I* did something about it? Are the costs any lower because *I* did something about them? Are the people any better qualified, any better motivated? Is their job satisfaction any greater? Are profits higher because of something specific I did on my job? What impact am I having on things and people? Do I recognize the principle that management is the development of people and not the direction of things? Do I know what's happening, do I watch things happen, or do I make them happen?

Let's examine more closely the following, more comprehensive, definition of management:

> Management is guiding human and physical resources into dynamic organization units which attain their objectives to the satisfaction of those served and with a high degree of morale and sense of attainment on the part of those rendering the service.

To do these things successfully, we must have a working knowledge of:

1. The principles of organization.
2. The functions of management.
3. The elements of leadership.
4. The elements of motivation.

Principles of Organization

1. The *Unity of Command* principle is invoked to avoid the inefficiency that results when an individual is held accountable to more than one superior for a single key result area. This does not preclude his being accountable to different superiors for different key result areas, provided that authority and responsibility for resolving conflicts has been clearly fixed.

2. The *Span of Control* principle is invoked to avoid the inefficiency that results when an individual is responsible for too many, or too few, key result areas. If too many, he cannot give timely and accurate account, if too few, he does not have a full time management job. This principle is less concerned with the number of people a manager has reporting to him than with the number of key result areas they represent. If the latter number is manageable, the former can readily be made so.

3. The *Delegation* principle is invoked to avoid the inefficiency that results when decisions are made too far from the point at which the need for them initially arises. This is possibly the most crucial principle of the four, for while "wars are won on strategy" (centralized decisions), "battles are won on tactics" (decentralized decisions). Provision must be made for both.

4. The *Specialization* principle is invoked to guard against the inefficiency that results when the key result areas for which an individual is accountable are not logically or functionally related. The "Vice President in Charge of Miscellany" cannot be held accountable for any "key" results.

The above principles were stated negatively rather than positively because we can more readily recognize why a given organization is not working well than why it is working well. Nevertheless, the positive version of these principles is easier to remember:

1. *Unity of Command:* to provide for clarity of purpose.
2. *Span of Control:* to provide for integration of effort.
3. *Delegation:* to provide for timely and responsible decisions.
4. *Specialization:* to provide for competent performance.

Note the repetition of the phrase "to provide for." The principles are guides to the manager who wants seriously to provide for organizational effectiveness. These principles alone will not, however, achieve "clarity of purpose," "balanced integration of effort," "timely and responsible decisions," or "competent performance." It is only the men who are in the chart-boxes who can, in varying degrees, achieve these things by transforming the chain of command into a chain of understanding.

Functions of Management

We have defined these functions in terms of the questions that are of make-or-break importance to each key result area for which the individual manager is responsible:

1. *Planning*—what are we aiming for, and why?
2. *Organizing*—who's involved, and how?
3. *Directing*—who is doing what, and when?
4. *Coordinating*—who informs whom, and about what?
5. *Controlling*—who judges results, and by what standards?

After you have reread this list a few times, read over the principles of organization—both the negatively stated and the positively stated versions. Then ask yourself this question: Can one achieve the effective management of key result areas if the principles of organization are not being invoked on a day-to-day basis? Possibly, but the wear and tear on mind and emotion will have snatched away most of the satisfactions. At worst, the results will fall short of the potentialities. Good organization, evidenced in the day-to-day behavior of its incumbents, is the prerequisite of good management. Management must function through organization. The better the latter is, the more efficient the former can become.

Leadership

We shall define leadership as the ability to get others to do what you want them to do because they want to do it—and the guts to take the blame (as well as the *generosity* to pass on the credit) for the consequences. The four elements of leadership in business are:

1. *Character:* This cultivates and evokes respect.
2. *Personality:* This is developed and evokes cooperation.

3. *Responsibility:* This is assumed and evokes compliance.

4. *Competence:* This is acquired and evokes confidence.

If you will review once more the principles of organization and the functions of management, it will become clear that the elements of leadership constitute the personal equipment necessary to develop an efficient organization and successfully to manage its progress in all key result areas. The kind of management at any organizational level reflects the kind of manager at that level. This is why, in the list of elements given above, we have been at pains to note how an individual manager comes by them during his lifetime, and the role they play in his career.

Note that they are listed from bottom to top in the order in which business is willing to pay for them. Early in his career, the employee is selling his *competence.* Later, his company will pay him more to assume managerial *responsibility.* Still later, he will get more pay for his way with people in, getting the key results that higher management is looking for. Thus, his *personality* will have now become an important factor. Finally, what with the heavy political, social, and community responsibilities that go with the top positions in business, *character* emerges as a critical element.

But note also that they are listed from top to bottom in the order in which we must be concerned with them. Character cultivation begins first. "If you want to create a gentleman, you must begin with his grandmother," is an old Scandinavian saying. On the other hand, acquisition of competence in a specialized field begins last, usually in college. But as we noted before, competence is the first consideration of an employer when hiring a new man even though he acquired it last, and character is the final (and most important) consideration in picking a man for the job of industrial statesman (which the corporate officer is) even though he began coming by it first. The ones in between, namely the development of personality and the assumption of delegated responsibility, are elements of prime importance in the middle management phase of a man's career and constitute the bulk of the emphasis found in management training programs.

Our discussion of the order of these elements will clarify to some extent the corporate problems and responsibilities in management succession planning. As the emphasis, in personnel selection, moves upward in the list, so must the emphasis in executive development. Juniors should get job training; supervisors—training in the responsibilities of management; middle managers—training in human relations; and the key members of the firm should extend their training into those economic, social, and political areas that will help them to broaden their *vision* and sharpen their *insight.*

Motivation

Our structure of knowledge is now complete except for its keystone, *motivation.* People will work for what they want as long as they are convinced that by working for what they want they can get what they want. They cease being productive either when (1) they no longer believe that they can get what they want, or (2) they already have what they want. In brief, satisfied needs do not motivate; neither do unsatisfiable needs. Only satisfiable needs will motivate a man. Each of us is a bundle of unsatisfiable and satisfiable needs. No two bundles contain the same assortment. The man who would motivate us would have to know what our satisfiable needs are, and what we are willing and able to do to satisfy them.

What are these basic human needs? We have listed them thus:

1. Self-realization
2. Self-esteem
3. Self-identification
4. Self-preservation

Note that only one of these, the need for security (self-preservation), is directly related to wages. It is the primary need of those whose income is at a bare subsistence level, and it is the prime motivator of their actions. However, once this need is satisfied to the point where an individual can plan ahead with confidence in his personal financial affairs, the need to belong (self-identification), heretofore relegated to the background, comes to the fore. This is the need to get involved, to identify oneself with a name, a symbol, a cause, an enterprise, etc. He might even go to as great length to satisfy this need as he would to satisfy his need for self-preservation.

When this need is satisfied to the point where he can plan ahead with confidence in his relationship with others, another need now makes itself felt—the need for recognition (self-esteem). This is the stand-out-from-the-crowd aspect of our make-up, and is the opposite of the belong-to-the-crowd aspect. They are not contradictory, but complementary. We all want to be recognized as individuals in the crowd to which we want to belong as a group.

Once he has satisfied this need to the point where he can hold his head high in the conviction that he is as good as the next man, his mind is sufficiently free to work on the satisfaction of the highest of all human needs—the need for opportunity (self-realization). This human need for self-realization has been the prime motivator behind the greatest human achievements. The frustration of the attempt to satisfy this need is also the cause of most of the common aberrations in human behavior. This is as true of nations as it is of individuals.

In looking at these four elements of motivation with the purpose of utilizing them for getting results from people we must recognize these fundamental truths:

1. People are *alike* in that they are all working toward the fuller satisfaction of these same four needs.

2. People *differ* from each other in: (a) the relative order of importance they personally place upon these needs and their satisfaction; (b) the way they see these needs in terms of their own business, professional, and social objectives; (c) the role they believe their jobs play in the satisfaction of these needs; (d) the extent to which these needs are realistically satisfiable.

Without doubt, the greatest personal asset the manager can develop is the ability to find out how his subordinates differ from each other and from himself in these four differences. Once he has found this out, he has in hand the keys that will unlock the productive potentialities of each man. Perhaps the biggest obstacle to doing this is our tendency to judge, rather than use, what we find out. For example, the manager who is, himself, mostly opportunity-motivated may be contemptuous of those who are mostly security-motivated. This contempt will not be lost on his security-minded employees, and the frustration they will experience will result in unproductive and problem behavior. The effective leader accepts the motivations of each of his subordinates exactly as he finds them and puts this knowledge to work in getting them to do what he wants them to do because they want to do it.

Summary

It takes a certain kind of man to get the kind of results he wants from the attitudes, habits, skills, and knowledge of the kind of people who happen to be working for him. This kind of man is the professional manager. This kind of man knows what is meant by the profession of management.

WHAT THE CONSTRUCTION INDUSTRY MANUFACTURERS ASSOCIATION IS DOING IN EQUIPMENT SAFETY

By G. E. BURKS
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I want to discuss the Construction Industry Manufacturers Association, more commonly known as CIMA; our activity in safety; some of the aspects of accident prevention; and the role our association can play in helping to make the construction industry a safer place to work.

Very briefly, CIMA is an organization of manufacturers that either build construction equipment, supply components to the builders

of construction equipment, or have an interest in our industry. Over 160 corporations are members of this organization.

We serve the public in many ways. Let me mention four of the more prominent ones. First, our organization is a focal point for joint action. By this I mean the giants of the industry join forces with the small business firms on a single vote per member basis to promote improvements that few could achieve alone.

Second, we provide services to the makers of construction equipment, to help establish product standards and supply needed market data. This is done through our sponsored councils and industrywide committees.

Third, we provide services to the people who use construction equipment. We keep contractors up to date on design advances through our Bureaus and also through a national equipment exposition which we call *Conexpo*, held every six years.

Fourth, we provide services to the general public. We are a collector and a disseminator of information and provide this information about the equipment industry to lawmakers, news media, and schools. Thus, CIMA is a communication medium for a very large and diverse industry.

It is only natural that we, as part of our operation, should be vitally interested in the overall subject of safety. We have always had this interest.

In January 1968, CIMA decided as a policy to become more active in safety performance standards for construction equipment. We have accepted the responsibility of bringing together and coordinating those bodies (government, business, labor, etc.) involved in construction and industry safety and disseminating any information to these bodies which we may have about safety.

Let me emphasize that these are *safety* performance standards which state *what* a product should be capable of, in contrast to specifications standards which define *how* a product is to be manufactured. For example: The requirement that a vehicle should be capable of stopping in 30 feet from 20 mph is a brake safety performance standard. Specifying the band width and drum diameter, such as 4x18, is part of a specification standard of how a vehicle is to be made. CIMA is concerned only with those standards which are directly or indirectly related to the *welfare* of *people* and/or the *protection* of *property*. We are not concerned with that performance of equipment which relates to doing so much work in a given time period.

We will generally request those technical and/or professional bodies most closely associated with and having knowledge of the problem to write such standards. It is the engineers in the industry who are active in these organizations that are most qualified to collectively formulate the required safety standards.

Our basic policy on performance standards is stated in the first paragraph of the policy, and I quote: "Create and maintain by its member companies the highest possible level of dedication to provide in their products the design, manufacturing quality and operating performance to insure optimum public protection and welfare."

With the establishment of this policy, we are aggressively participating in and cooperating with legislative bodies that are requesting performance standards on our type equipment. For example, I have the pleasure of representing CIMA on a committee of the California Safety Division. This group was assigned the task of studying safety regulations in the construction industry toward the development of good realistic safety standard.

A standard by definition is a rule for the measure of quantity, weight, extent, value or quality. Since we are talking about safety performance standards we are concerning ourselves with requirements of performance primarily in the area of value or quality which is related to the welfare of people and/or the protection of property. But these requirements imply that certain conditions must be satisfied to meet the standard. Herein lies the task: to define the criteria for which this equipment must satisfy a particular safety standard. For example: under what conditions should a rollover protective canopy be required to withstand the forces applied to it and still not deflect inside the area needed by the operator? I think you will agree that it is somewhat unreasonable to expect that such a canopy will withstand the forces imposed when a tractor drops off a 20 ft. ledge and lands on its top. But somewhere between this extreme and the normal operating position is a situation for which rollover protec-

tion should be provided in the event of a rollover. The question we must concern ourselves with is, "What is reasonable and what is unreasonable?"

Once the conditions have been defined, then the criteria must be written so that the designer has the freedom to develop good functional and reliable components using the material and processing methods he feels are necessary to meet the condition.

We should not establish safety standards in such a manner that they put stringent limitations upon the innovative processes that have permitted all industries to develop the many products that are on the market today.

A safety performance standard has been written on rollover protective devices. This standard, though not completely satisfactory, has served a good purpose in that it has pointed up the task before use to define relatively unknown conditions. It has also pointed out the problems of designing structures which fit arbitrary conditions when the knowledge of the design of such structures has not yet been fully developed.

A group of SAE members recently assembled at the Caterpillar Tractor Co. Proving Grounds to witness a static test on a wheel tractor scraper rollover protective device.

The test illustrated the massive structures involved, the amount of expensive equipment needed and the labor to get the job done. Incidentally, this test failed to prove the SAE j320 standard. So we are now working with SAE in the process of reevaluating the test procedure *and* their standard.

The static type test has little meaning unless the rollover protective canopy will withstand a dynamic roll situation.

The early canopies put on crawler tractors were primarily for the purpose of overhead protection rather than rollover protection in a rollover. To determine if these canopies would also withstand a rollover, the crawler tractor was rolled down a 28° slope. A mannequin was instrumented to try to get some measure of the forces imposed on an operator during such a roll condition.

It is through the type of testing, both static and dynamic, that the answers will be obtained for the ultimate safety performance standards on rollover protective systems.

A rather interesting question has been raised a number of times about the application of more safety equipment to machinery. The question is something like this, "If we supply this machinery with all these added safety features, isn't the operator more likely to rely upon these so-called safety devices for protection and operate his machine in more dangerous positions such that the ultimate result will be more accidents and thus, more people injured?" It is an interesting question and one that I am sure we do not have the answer to at this time. However, as we learn more about the contributing causes and how they relate to an accident we will be closer to a solution to better accident prevention. Let's consider some of the factors that may contribute to causing an accident.

There are generally three elements involved in an accident. They are: terrain, equipment, and people. Terrain by itself cannot cause an accident. Terrain in combination with faulty equipment can result in an accident. Terrain, equipment, and people can result in an accident.

The development of a safety performance standard as we discussed a little earlier will tend to aid in reducing accidents that are equipment oriented. But, how do we reduce the accidents that are caused by the improper evaluation of the situation or those caused by the man who violates safety regulations?

If we take an operator, any operator, and put him in a pioneering situation, we have supplied all of the elements that contribute to an accident: terrain, equipment, and people. Let us assume now that the equipment is and will continue to perform satisfactorily under the direction of the operator; then, we have isolated the chances of an accident entirely to the judgment of the operator. In a situation like this, the man's judgment and his skill in maneuvering a 50 ton machine properly over the terrain will determine whether an accident will happen. He must continually evaluate his present and future situation as he works. He must be sufficiently knowledgeable about the terrain and the characteristics of his machine so that he can predict his continuing future position with respect to terrain with reasonable accuracy. The men who will put themselves into this type of situation must have adequate training as an operator, sufficient mental ability, and instinctive ability to reason and to think quickly and not panic when the going gets rough.

Yet all of these things I have just said are very closely affected by and associated to the operator's physical and mental condition at the time that the critical situation arrives.

There is growing evidence to indicate that periodical medical examinations may be desirable for all people operating this equipment. At least one state—Michigan—already has a law which requires all operators to have annual physical exams. At the Associated General Contractors first national conference in Washington, D.C. this past spring, Mr. Beltport, Chief Engineer, Bureau of Reclamation of the U.S. Department of the Interior, cited some statistics that were made on one large project. Of the subjects tested, only 25 per cent were fully fit for duty; 47 per cent were suffering minor correctable defects but otherwise fit for work; 26 per cent were suffering defects limiting fitness for work and requiring medical control; and. two per cent possessed defects which seriously limited fitness for work. Relating figures like these to accident rate in our industry is something which has not yet been done to the best of my knowledge.

It is also quite conceivable that a number of these accidents that we hear about in the construction industry have been caused by an influencing mental condition that is not associated with the job. Suppose the operator starts to think about his sick wife when he loosens a large rock. Or suppose his boss chewed him out before he went on the job this morning and he has been brooding over this as the day progresses. Or suppose he lost a lot of money in a poker game last evening that should have been applied to his home mortgage or perhaps he is grieved at the loss of a loved one. I am sure many of you can think of some incident in driving your automobile when your mind strayed for an instant just prior to a critical moment. Perhaps you were lucky and escaped with nothing more than edgy nerves. Perhaps you were less fortunate. Sickness in the family or grief from the loss of a loved one are not part of the job operation. Yet these and the other factors mentioned can be a distracting influence at the time when the operator needs his full mental capabilities. I have touched briefly on the operator's training, skill and mental ability, the physical and mental condition at the moment and have indicated that these are factors that can possibly contribute to accidents. We don't know how they contribute or that any particular condition within a man will cause an accident. We need to learn more about these distracting influences and how they prevent the sharpness of thinking or the appropriate use of logic when a critical situation arises.

There is another factor in safety that helps to get a whole job done safely and effectively. I am speaking about good communications. Communications are essential between all levels of management, between companies, between the man and his boss and vice versa. There is no substitute for good communication.

It is in this area of communications that we will find much of the answer of reducing accident rates. I say that because communication is such a vital portion of our lives. The formal or informal education and training that the worker received as part of his instruction prior to and after becoming an operator, a service man, or whatever, is communications at work.

Knowledge of this man's physical condition through medical examination; the giving of good instructions on the job and the knowledge that they have been received and understood; the man to man discussions between man and boss are forms of communications. Notice I said between the man and his boss! This is a two way street that must have both lanes kept open all the time.

As I see it the primary job that all of us have in our effort to reduce the frequency rate of accidents in our industry is getting recognition and understanding of the accident contributing elements in time to prevent that accident from occurring. In so doing, each man in the organization from the operator up has assumed his full responsibility for accident prevention to himself and to his fellow workers.

There is some evidence that good communication can play an important role in accident prevention. For example, consider these very low accident frequency rates: E. I. du Pont de Nemours & Co., two per million man hours. They have a record of over 8 million man hours worked without a lost time injury. H. K. Ferguson Corp. of Cleveland has a frequency rate of 4.9 per million man hours. Morrison-Knudsen Overseas, Inc., has worked over 4 million man hours without a lost time accident. I am

sure that these companies have done a lot of effective communicating about safe work habits to have such outstanding records. If we could reduce the frequency rate of our whole industry to 3, 4 or 5 per million man hours we would be making substantial gains. We can if we work hard at communications.

In this regard CIMA has a pilot program under way to publish an operator's manual for various classes of equipment. Hopefully, such manuals will aid in communicating safe operating practice to our many operators, particularly the younger, and less experienced ones. But, it will never replace good man-to-man communications on the job. Such a manual can only be an aid to the man who will read, study, and understand it.

To sum up my remarks, CIMA is very active in this whole complex area called safety. We are actively working with technical and professional societies such as the Society of Automotive Engineers and the American Society of Mechanical Engineers in the development of safety performance standards. We have active and effective liaison with the Associated General Contractors, American Roadbuilders Association, and other similar organizations, both inside and outside the United States, and we are actively working on an operator manual which we hope will also be useful and effective in communicating to the operator.

Additional effort needs to be devoted to employee training, physical exams, safety slogans, tool box sessions, and the publication of accident statistics as these are all forms of good communication. In this area of safety slogans, I am sure you all recognize what Smokey the Bear stands for. Perhaps a similar characterization could tell a story in our industry. It's worth considering. All of these things I have mentioned work toward keeping the man appraised of his situation. These, along with good communication between the employee and his boss, *their* full understanding, and *their* full participation in a strong safety program will help prevent the accident from happening.

This whole area of accident prevention is a difficult task. Our goal should be *no* accidents on the job. More realistically, if we could reduce our frequency rate 25 per cent each year, our industry would soon be one of the safest places to work.

IMPACT OF THE MODEL CITIES PROGRAM ON CONSTRUCTION SAFETY

Opening Remarks By George Moore, Moderator of Building Division Program

The Model Cities Program was established by Congress in 1966 and was conceived to demonstrate how to improve the quality of urban life and the general welfare of people living in the cities. Citizens who live within the chosen area will plan together with public and private agencies for the kind of neighborhood that they, the citizens, desire.

My exposure in the limited time that I have had to prepare as moderator of this panel has been with the people involved in the Portland, Oregon program and I should like to thank them for their cooperation and time and effort spent to afford me the primitive background which I shall attempt to pass onto you.

In Portland, the planning year is nearly completed. At the outset, the community requested a $312,000 planning appropriation from the Department of Housing and Urban Development. After an analysis of the objective, they received a grant of $143,000 and with this they have attempted to resolve their program and have achieved the following:

1. They discovered new solutions to existing problems.
2. They have planned the necessary improvements in the model area.
3. They have planned new and better school problems.
4. They have planned housing for low-income residents as good as the housing for the rest of the community.
5. They have planned for steady employment for area residents.

6. They have developed local initiative and citizen participation.

7. They have used good design and open spaces to make the neighborhood more pleasant.

When this program is completed and operating, this will mean more jobs for the residents of the area.

As you can see, the Model Cities Program differs from Urban Renewal in that the citizens plan all phases of the community's future and no building or removal of buildings will take place unless the citizens approve the change first. All residents of the community are urged to participate in the planning and the building of the Model Cities area, and no plan will be accepted or given financial assistance that has not been approved by the citizens themselves.

As for the timing, the year of planning was 1968 and it produced two programs: a one year program for 1969 and a five year program for 1969-1973. Briefly, that is a primitive explanation to Portland's response to the Model Cities Program; and with untrained citizens involved in implementing the program that the citizens evolved, it is not difficult to envision the safety problems that will arise in the construction portion of the Model Cities Program.

IMPACT OF THE MODEL CITIES PROGRAM ON CONSTRUCTION SAFETY

GOVERNMENT

By JOHN E. EVANS

Special Ass't. to the Sec'y. for Labor Relations, Department of Housing and Urban Development, Washington, D. C.

The Model Cities program was developed by a Presidential task force seeking new approaches to the problems of the American city. It was enacted as part of the *Demonstration Cities and Metropolitan Development Act* of 1966. Model Cities is a different kind of Federal program. In a fundamental sense, Model Cities represents a new urban strategy—a dramatic departure from traditional ways of dealing with urban problems.

Prior to Model Cities, it was not uncommon to approach city or urban problems in terms of what some urban observers have termed "single purpose" solutions. For example, planning a freeway through a community to the exclusion of considerations other than engineering design is a single purpose planning solution in response to a transportation problem. A freeway planned in this manner is easily recognized as both shortsighted in concept and totally unsuited to the complexities of life in an urban community. The Model Cities approach, on the other hand, involves looking at particular problems in terms of their relationships to the whole condition of community life, and attempts to offer solutions to such problems in comprehensive and complementary terms.

Specifically, the Model Cities program asks an applicant community to analyze itself in terms of its "urban hangups," concentrating on a defined target slum neighborhood and, in complete conjunction with citizens residing in the model neighborhood target area, to plan a massive and coordinated attack on the particular ills of the neighborhood. This attack or action plan must relate as much as possible to the revitalization, both social and physical, of the model neighborhood and also, at the same time, have positive impact on the environment of the entire community. In concrete terms this means new housing construction and rehabilitation, improved city services, job training and development, health facilities, recreation, welfare and education, economic development, transportation, and any additional program areas necessary to meet problems peculiar to the particular community involved.

Two types of Federal assistance are available to Model Cities. First, the complete range of all existing so-called categorical Federal grants-in-aid programs in the field

of housing, renewal, transportation, education, welfare, economic opportunity, and related programs; and second, new supplemental grants of 80 per cent of the local share of Federal grants-in-aid programs. The categorical programs will be utilized just as they are under older law, except that when focused on the target neighborhood, they will be coordinated through the Model Cities process. Supplemental funds, on the other hand, may be used to help finance any project or activity within the approved, locally developed Model Cities plan. So a city may innovate, experiment, test, and learn.

The first round of communities selected for Model Cities planning grants numbered seventy-five. Recently, thirty-three additional communities have been selected for second round planning grants. Under present first and second round plans a total of approximately one hundred and fifty communities will have received planning grants. The planning phase of the Model Cities program involves those activities which a community must carry out in order to establish a comprehensive framework for the implementation of an efficient and effective action program. Some $23 million will be expended for the two rounds of cities in this phase of the program. HUD funds 80 per cent of the costs of a community's planning effort. Planning is required to be a continuing activity. The action phase involves the implementation of programs through the use of categorical and supplementary grants. It has been estimated that Model Cities expenditures (Federal sources) will run some $7.1 billion over the five-year program period and will generate an additional $6.9 billion from other sources.

In summary, HUD is asking local communities to deal imaginatively and creatively with their problems. At the same time HUD is making a concerted effort at the Federal level to make interagency cooperation, coordination, and hopefully, funding, a productive reality. We realize that Model Cities is a very demanding program. But we are used to dealing with very demanding problems; problems that we as a nation cannot afford to remain unsolved any longer.

Today we are concerned with Model Cities as it relates to construction safety. The National Safety Congress is to be congratulated for focusing on this special area in the midst of a natural preoccupation with the general problem of occupational health and safety. Through this panel discussion we deal then with safety as an immediate and important issue in terms of the Model Cities program. I can assure you that the Department of Housing and Urban Development is likewise vitally interested in this issue. I make this presentation as evidence of that interest and to solicit your interest and assistance in designing a program of safety for the Model Cities program.

In February of this year I testified before the Select Subcommittee of the Housing Committee on Education and Labor on H.R. 2567—the *Construction Safety Act.* HUD recognized at that time that there was a definite need for more aggressive action in this area. This recognition has since taken on greater significance when it is considered that the vastly expanded construction programs of the next decade—as a result of the new HUD Act of 1968—may well contribute to furthering the number of construction injuries, unless strong and thorough measures are affected. In addition, many of you are undoubtedly familiar with the wording in the *Demonstration Cities Act* which calls for "maximum opportunities for employing residents of the area in all phases of the program, and enlarged opportunities for work and training." Somewhat less known, at least at the present time, are similar provisions in the *Housing and Urban Development Act* of 1968 (P. L. 90-448) which require that "to the greatest extent feasible, opportunities for employment arising in connection with the construction or rehabilitation of projects assisted under such programs (221(d)(3) BMIR, low-rent public housing, rent supplement, 235, 236) be given to lower income persons residing in the area of such projects." With specific reference to the Water and Sewer Facilities Program, there is a statement in the 1968 Act that "In the administration of this section the Secretary shall require that, to the greatest extent practicable, new job opportunities be provided for unemployed or underemployed persons. . . ."

These provisions mean training for construction jobs for both skilled and unskilled workers residing in project areas. Among the many difficult problems involved in molding the potential but unskilled work force into a productive work force, particularly

in the construction industry, is the problem of job safety. Statistics indicate that new workers, especially inexperienced workers, suffer more accidents and injuries than other categories of workers.

Inasmuch as HUD is directed by legislation to increase substantially the employment of low income or unemployed persons residing in model cities areas and in areas where other HUD-assisted construction is being carried out, HUD is morally obligated to assure that such people are protected from the potential dangers of construction. This is especially true in relation to large scale rehabilitation. The rehabilitation process is by nature unique in the type of skills and experience required. Demolition, an activity which is often a necessary part of the rehabilitation process, is a particularly high accident and injury producing industry. All rehabilitation and demolition jobs cannot be performed in the same way, and safety problems result even for experienced laborers and mechanics. Furthermore, to my knowledge, there are no safety standards specifically applicable to rehabilitation, but we must deal with the rehabilitation situation as well as with new construction in terms of safety. My purpose here is, I reiterate, to seek your assistance in developing means to reduce safety risks in general and with special reference to the employment provisions under discussion.

At the same time, I want to make it clearly understood that HUD intends to implement vigorously the employment and training objectives provided in this legislation. The difficulties raised by this discussion are not intended as any evidence of doubt about the ultimate value, indeed, the vital necessity, of the implementation of such programs as Model Cities. The problems I have raised are typical of the complexities that confront all attempts to deal with the urban crisis. Because they are so difficult and so important, I seek your assistance that they may be dealt with.

Surely we must approach these inherent safety problems from a strong awareness of the public interest—the responsibility for protecting the health and safety of all construction workers engaged in publicly-assisted construction. At the same time, as your programs have emphasized, every worker has both an obligation to himself to act safely and respect dangers, and an equal obligation to his coworkers to concern himself with their safety. This organization has as its mission translating these public and private responsibilities into programs.

As matters now stand, HUD has no really formal approach to the problem of construction safety for the most part, because it has been without any real specific and detailed statutory authority in the field of construction safety. This indicates no lack of interest on HUD's part in the need for constant attention to safety factors. In some of the older components of the Department there has been a long-standing, continuing interest. But as a recently formed Department we are now concerned about an overall approach. Under a number of HUD programs, administrative procedures utilize guide form contracts containing safety clauses which HUD suggests for use by local bodies in letting construction contracts.

These clauses emphasize compliance with local codes, laws, rules, and regulations and also incorporate by reference the Associated General Contractors' *Manual of Accident Prevention in Construction* as the standard for certain safety precautions. Such clauses are in fact widely used by local public bodies operating under programs of the Renewal Assistance Administration and Housing Assistance Administration. Occupational safety clauses are also contained among the general conditions for assistance in a number of Federal Housing Administration and Metropolitan Development programs. These clauses obligate the recipient of assistance to assure that safety requirements are applied to construction contracted under the program. However, it should be stated again that these clauses are not rooted in any specific statutory authority. Neither as you know, do the protections of the Walsh-Healy Act on occupational safety apply to construction contracts.

Pre-construction conferences are also used on HUD programs to stress safety requirements and to engender compliance with local laws and regulations and acceptance of the standards of the Associated General Contractors' *Manual of Accident Prevention*. To the extent practicable, field inspections are made to monitor compliance with safety standards. Effective enforcement, however, is limited by the very restricted number of people who can be assigned to such work and who have the necessary expertise and

training. There are also variations in approach from program to program which must be overcome. It seems clear, though, that the problem cannot be resolved through more widespread use of enforcement of contract requirements alone. It is to be doubted that significant progress will be made in changing the generally dismal picture in construction safety without the adoption of a comprehensive program specifically providing the necessary machinery for regulation, research, training, and judicial and administrative enforcement.

When we superimpose on the current rate both the massive construction programs called for by the Model Cities program and the HUD Act of 1968 and the influx into the industry of many new construction workers and trainees, the grave safety implications become quite apparent. Here again, I repeat, these grave problems must not be regarded as stumbling blocks, but as building blocks; not as insurmountable obstacles, but as opportunities for creative contribution.

It is incumbent upon us, therefore, to protect the worker, the construction industry, and the public through the joint development of safety programs and the energetic support of effective safety legislation while carrying out the mandates of the larger national goals. I hope this panel will produce concrete proposals to the Federal Government. I have voiced my concern that the Federal Government is ill-equipped to confront this program without assistance. Will you now, as one of this nation's most logical sources, offer that assistance and suggest by what means it can be made most effective?

LABOR

By W. VERNE REED
First Vice President, Laborers' International Union, Washington, D. C.

Our never ending quest for health, safety, and accident prevention in our construction industry must receive priority attention with the rising tide of technology, long-range construction goals, and legal requirements, to open widely the doors of previously little tapped manpower sources. These few of the many impacts upon our industry of the Comprehensive Urban Redevelopment Act offer to us exciting challenge but equally great opportunity to contribute to the well-being and sound future of our nation, but more so to the health, safety and economic welfare of all our citizens.

No single construction program in the history of man is as far reaching, not only in material investment of rebuilding of our urban structures, but at the same time in stressing the more significant investment in the resident citizen, causing his exposure to new and fertile opportunities to develop and exercise his full potential, and eliminating obstacles that caused him such denials during the long and painful past. The Model Cities Program must and will be accomplished, but not without additional cooperation and imaginative planning by the construction industry.

We have read surveys and data regarding ghetto living, where denial and lack of opportunity has had overwhelming effect on individual frustrations, lack of motivation or counter motives, discouragement of work initiative, etc. Combine this with our own frustrations and motivations, and it blocks trust and constructive communication at the job level, which is so necessary and vital to assure timely and economic productions in a healthy, safe, and orderly manner.

This sketchy background on such a complex subject emphasizes the responsibility of all participants in this program if we are to enjoy the fruits of this project as a society. Before we measure the effect of Model Cities on construction safety, let us briefly state our construction program and its effectiveness.

In some divisions of our industry, for example, under the auspices of agencies of the Federal government, we can account for a remarkable reduction of the accident frequency rate. We find safety manuals and constant supervision with excellent salesmanship. We can also point to many individual construction firms where the top boss motivates a real concern in all categories

of supervision, and many safety programs invite meaningful participation by employees, creating an awareness that leads to virtually accident-free work sites.

Some of our unions and employers' associations have created constructive safety programs with good results, but participation has been extremely limited, for the greater part.

On the national scene, we have a tremendous job ahead in accident prevention; only the mining industry frequency rate is leading that of construction, and it is a sad commentary indeed for an industry that can boast of coping and solving unusual and vexing industrial problems. To our credit, the industry leaders on both sides are in mutual agreement in their concern, with limited variance only on the approaches to the problem of accident prevention, and equally determined to work together with safety personnel from government, insurance companies, owners, architects, engineers and the public.

Now with a desire that's good, but with a safety record that needs and demands improvement, how do we propose to handle the additional impacts in the Model Cities Program?

On the physical side, codes will vary, as well as inspection, from area to area. On demolition of structures that are rat harborages, health and safety codes are very limited. The construction of mass transportation systems are considered in only a few of the codes, and none have taken the full advantage of medical research.

On the human factor, the law will practically dispatch personnel with native ability but little or no experience at a construction work site. When we add to this problem today's political and civic events, there is no doubt we also have a detrimental human equation impact.

These are a few reminders of the complex and vexing problems confronting all of us, and I hastily add that the responsible leaders of the construction industry, of management, and labor will meet these problems with unwavering determination. Their total experiences and skill will be the best possible tools in setting aside this massive problem of major proportions that faces this nation. The first step in eliminating the communication gap between residents of the impact area and the construction industry will be in the medium of skill and safety training.

No *Model Safety Manual,* backed up by management support, will be worth a damn if cooperation and communication is not apparent at each job site. To attain this, we must diminish present misunderstanding and engender trust by creating an atmosphere of real welcome at the work area and related training centers. Much can be done in this direction by experienced safety personnel creating a dialog on health, safety, and accident prevention programs, soliciting employee participation as the meaningful step for success of any accident awareness program.

Instead of spending unlimited time on trainee recruitment, let us turn to the important endeavor of selection of training personnel and safety missionaries, supervisors, and stewards.

Once selected, can we broaden the number of future assignments, hold seminars on the human problems we must face, and broaden our understanding, our patience, and our dedication to accomplish the full and meaningful potential of this urban development program?

To move closer to the problem, to effect a complete and total attack on the causes, I believe we will see new frontiers on collective bargaining fronts established. There may well be a negotiated "Health, Safety, and Accident Prevention Fund" with a concept of total involvement in the safety of employees both on and off the job site.

When we analyze our industrial accidents and relate them to the perils of the home and highway I ask, "Why not get involved in the question of health and safety on an environmental basis?" This is the public posture in the whole theme of the Housing and Urban Development Act. How can we, the responsible leaders in the construction industry, live up to our monumental responsibilities in this Act by turning the trend of individual failure and putting the tendencies to quit in sharp reversal?

There are other social services which Federal policy has declared necessary to meet the total environmental needs of the trainee, but the field of safety and accident prevention is a key common denominator among all of us as participants.

Doing business as usual can lead only to increased frequency rate in Model City construction when we consider a higher percentage of new employees; employees with limited work background; employees with limited experience in construction; employees with limited exposure to work regulations and disciplinary requisites for job productions performance on an equality and safe basis. These added exposures will increase the main contributing source of our present high frequency area, which is unsafe acts. Reduction in this area must be by education and will benefit the mainstream of industry if we become mutually involved to provide facilities and our own selected or agreed upon instructor power.

We must re-tool our manpower in supervisory capacities: job stewards, skill instructors, safety personnel, union representatives, and top management if we are to cope with these new exposures. This is long overdue if we intend to change from the talking to the doing stage and effectively eliminate human suffering in construction generally.

Safety funds could provide the industry with a staging area for an all-out offensive with our own trained personnel. This will mean closer support by labor to the managerial responsibilities of providing a safe work environment. Trained personnel with effective educational programs will be necessary to effectively measure by medical means our physical capabilities. This, in turn, may lead to a practical solution of cost factors concerning work career, health measuring tests, and safe employment placement procedures.

A safety fund established and administered on a sound basis can be the means of developing skilled safety manpower that can be utilized in this safety sagging industry now facing the added burden of Model Cities programs.

Such an inventory of talent in the field of safety, but the usual tandem abilities in the human relations field, is a natural in the Model Cities area and long overdue on an industry-wide basis. With this pool of experienced and trained safety leaders that both labor and management can respect, appreciate, and fully support, we would expect a complete separation of safety from labor relations. Although this gives rise only on rare occasions, once is too often and generally leaves a bad lingering effect in the field of safety.

An effective, continuing safety education program and effective accident prevention movement could dissipate interest in additional Safety Legislation just to be legislating, continuing agitation for excessive liabilities because no improvement is in sight.

The concern of responsible men in our industry, when it comes to safety, is indeed welcome and inspirational, but their effective reasoning is limited to the conference room or their own particular operation. This will not satisfy the near future demands for progress, nor will legislative or punitive formulas end with meaningful solution. Nonetheless, some activities now in the hopper and on the law books, will find their way to Model City construction—and the next stop, who knows?

There is no question that the Model Cities program offers possibilities for accident increase unless coordinated solutions are attained by a vigilant program. There is no simple answer, and I have simply proposed a means of expanding our safety work force and their work area to include the environmental question. This latter expansion again takes advantage of the human relationship, by increasing individual contacts and leading to greater confidence by the employers. This could be a tremendous contribution to supervision, who have the added burden of disciplining employees to insure responsible productive work attitudes on a coordinated basis with fellow employees.

In substance, the experience, skill, and safe work habits must be taken from our present work areas and released with all possible good will at Model City locations to overcome added problems if we are to even maintain our present frequency ratings. If we can involve ourselves in training and upgrading the economic well-being of the recruits from the impact areas, in a safe and orderly manner, then why not correlate any such progress to the entire construction industry with one area complimenting the other?

MANAGEMENT

By CARL M. HALVORSON
Senior Vice President, Associated General Contractors of America, Inc., Portland, Ore.

The 8,800 members of the Associated General Contractors in the United States, perform about two-thirds of the contract construction which is done, and consequently we have a very compelling interest in this program of Model Cities.

When we talk about Model Cities, we must recognize that when we relate to safety there is no difference in any of the work basically that will be done under this program than any other work that we have ever done, other than the stipulation in the law that residents of the area are to be employed to a substantial amount in the work. This is where this program can be somewhat different and I would say that any program that is of worth in our normal construction efforts will also be used in our Model Cities work, except that there will have to be done a more compelling job on it.

In evaluating the Model Cities there are some other things we ought to think about, because I am convinced that building up these areas with new brick, new plaster, building new buildings, new sewers, or things like this are not necessarily going to increase the value of our way of life in the urban areas in these cities. I think it is a much more compelling situation; that we must get down to changing the way of life of the people living in these cities. In other words the construction is not going to change the way of life in New York, Bedfordshire, in Harlem, in the Hough District in Cleveland, in the areas in Chicago, of the people that are living in these areas, by one man or another. One of the helpful things of this program is that there is a vehicle created here for more meaningfully introducing those people into the way of life we have now; and I think this is the great start. Industry, labor, and management can do a great job to effectively set a pattern in renewing these people into our way of life.

There are some other things about Model Cities that bear some study. I recently spent three weeks in Europe looking at the new cities that have been built, particularly in England, Sweden, Finland, West Berlin, and The Netherlands, and when I came back to this country, I had a feeling that we today have a really great opportunity to take a look at where we are, and then take a look at those countries and relate ourselves that we may be looking like them forty years from now.

A great public relations man whose name was Hill sold an awful lot of cigarettes for the American Tobacco Company (before they became a health hazard), and one of the slogans was "Coming Events Cast Their Shadows Before." Now, when we think of the type of a program we are getting into with Model Cities, that over a period of ten or fifteen years we may spend 100 to 150 billions of dollars primarily for enlargement purposes in creating living spaces, we know that much of the stuff is going to be subsidized. Are we apt to get into the same type of a situation that they have in Northern Europe where the City of Glasglow owns 40 per cent of the living spaces in that city? In the town of Brighton, so small most of you have never even heard of it, the city corporation owns 10,000 of the units in that city and the people living there are renting from the city. This is subsidized housing, housing that costs $15 to $20 a square foot and rents for $50 a month. In other words, they have changed; they have come under a very controlled economy where they have sublimated virtually the total population into such a thin package that by the time they relate what they earned to their income taxes, everybody is in about the same spectrum.

Now, I for one hope that we do not get into a situation like that in these urban areas, because I think that the people living in these areas now should not become or should not be created into that segment of the society, and this is one fear that I have. The motivation, what these people can look forward to, I think they're going to have a great relationship to the over-all safety of the Model Cities Program. It isn't only the safety of a man on the job; when you start working in those areas, you have a safety

problem 24 hours a day—if you've got a contract on there, you have people working on there.

The Federal government, particularly the Department of Housing and Urban Development, must forthwith define some distinct perimeters on what some of these clauses in the law mean. What does it mean that these people are to have these opportunities? What is to be the involvement of these people? Are we looking in general at 20 per cent of the people on this job? Are they going to be the residents in these areas, or is it to be 50 per cent, or is it going to be 90 per cent, or what kind of a program are we looking at concerning involvement of the residents of the area? This is something labor cannot say; this is something that we as management cannot say. This is something that must be announciated by the Department. What will be the scope of the training programs? Who will implement them? Where will the funding for these programs come from? Will they be a responsibility of the contractors? Will they be a responsibility of the community agencies within the city? Or, will they be done by some other agency? S[illegible]y must definitely set up what these training programs are and how they are going to be handled; until this is done, it is going to be most difficult to negotiate labor agreements.

I think there are a great number of things that relate between management and labor in doing this work. I am convinced that labor wants to do a very good and effective job in creating this involvement under this legislation, and I can assure you that management feels that way. I think that management, labor, and the government can effectively get together to create the proper type of climate among the people in these areas who are to have these opportunities. In other words, if we make this something that makes sense to those people, our safety problems on this work are going to be minimum; on the other hand, if we try to structure something that is not sensible as it relates to these residents, there is going to be all kinds of trouble in safety, in job control, in all the things that can be bad in an area like this. It is up to all of us to see to it that we take a really objective look and that we really get everything wrapped as far as possible into a package that makes sense on an over-all basis.

SAFETY AND THE MODEL CITIES — AN INSURANCE VIEW

By ANDREW KALMYKOW
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Urban problems are among the major challenges which face our country today. The welfare of the nation is at stake. It is a problem in which we are all concerned. This is not the other fellow's problem. We are all involved in it in one way or another.

Some years ago I heard the Surgeon General of the United States say that the area from Boston to Washington will soon become one vast urban area—megalopolis was the term he used. I frequently have occasion to fly over this area. It is only too evident that his prediction is rapidly becoming a fact. This is also happening in other sections of the country. When areas of this magnitude are involved we must realize that most of us either live in urban areas, work in them, or in one way or another obtain our livelihood from them.

The model cities program is a bold attempt to try to resolve the worst of these problems in areas where they are most acute. Previously, attempts concentrated on one or the other aspects of the problem: urban renewal, housing, manpower training, education, transportation, health, crime, unemployment, etc. The model cities program is an effort to coordinate these separate programs into an overall plan intended to provide solutions on a broad scale in areas relatively limited in size where the problems are most pressing.

Naturally this involves many activities, some of which are unrelated to construction

or physical rehabilitation of structures. For example, some plans have been described as including birth to kindergarten head-start training programs, reorganization of a city government, subsidized boarding schools, and expanded maternity programs. However, most if not all plans will involve construction in one form or another.

The *Program Guide* for the model cities program issued by the U. S. Department of Housing and Urban Development (HUD Pg. 47, Dec. 1967) specifies that the model neighborhood should be predominantly residential. Commercial and industrial areas of the city should not be included unless they are directly and primarily related to the needs of the people in the neighborhood for services or jobs. Areas selected for upgrading into model neighborhoods are to be substantially "hardcore slums in which low income families are concentrated and which are characterized by overcrowding, poverty, unemployment, dependence on welfare payments, low educational and skill levels, poor health and disease and crime and delinquency." As a general rule, the guide goes on to say, the model neighborhood should contain substantial numbers of residential buildings that can be rehabilitated. However, projects and activities need not be confined to model neighborhoods provided they are closely related to the physical, economic, and social problems of the neighborhood; for example, housing for persons displaced from the neighborhood, residents, etc. may be included. Thus, it may be seen that construction is to play a very important part in the program. It is the effect on construction safety that this program may have which is the subject of our discussion.

Insurance companies are vitally interested in safety. In addition to humanitarian reasons which, of course, are of importance, safety service is a major area of competition between them. Safety service sometimes determines whether business is lost or retained.

Construction is one of the most important but hazardous industries in the country. Its safety problems have received special attention from insurance carriers. For example, our association, with a membership of 169 stock casualty and property insurance companies, has a special Committee on Construction Hazards. It is composed of outstanding experts from our member companies' engineering staffs and the Underwriters' Laboratories. They guide the work of our engineering and safety department in this field. This includes the issuance of periodic *Construction Management Bulletins* and pamphlets related to various aspects of construction safety. These have very wide distribution.

Our staff also cooperates closely with labor and industry in resolving safety problems in this field. For example, in New York some five years ago the Building and Construction Trades Council, representing labor, and the Building Trade Employers' Association of New York, representing employers, joined forces to establish the New York City Building and Construction Industry Joint Safety Committee. The program is administered jointly with the Greater New York Safety Council. This is a most worthwhile activity which is aimed at furthering construction safety through a variety of programs. One of its prime objectives is the development of standard safety policies which it is expected will be adopted voluntarily on an industry-wide basis. These policies offer specific safety recommendations to labor and management. They cover such subjects as hard hats, job housekeeping, and storage and handling of compressed and flammable gas cylinders, etc. Reports indicate that they are being supported and adopted by both management and labor. Our engineering and safety department provides consultative assistance to this program.

It is worth noting that according to the latest available figures published by the New York Labor Department, between 1964 and 1965 injury frequency in New York was reduced by 9 per cent. The severity rate dropped from 2,273 to 1,759. Almost three quarters of the contractors reported no injuries in 1965. The value of safety activities is evident.

It is generally recognized that in construction, as well as in other fields, accident prevention is largely a matter of education, vigilance, and cooperation. Mechanical safeguards prevent a relatively small percentage of accidents. It is necessary to stress these three factors in discussing safety in connection with the model cities program. Title I of the Demonstration Cities and Metropolitan Development Act of 1966 (Public Law 89-754, 89th Congress), authorizes the model cities program. Section 103 of that act specifies that a comprehensive city demon-

stration program is eligible for assistance only if it is of sufficient magnitude to provide "maximum opportunities for employing residents of the area in all phases of the program and enlarged opportunities for work and training."

From the HUD *Guidebook* description of areas to be selected for upgrading into model neighborhoods to which I have made reference, many of these residents will have low education and skill levels. Many of them will be part of what has been described as the hardcore unemployed. Thus, particular emphasis will have to be placed upon education and training. This will require a great deal of sympathy and understanding. Long standing social and educational handicaps cannot be overcome quickly, but they must be overcome.

A successful model cities program requires careful planning. Programs that have been approved are still largely in the planning stage. Thus, we cannot speak from experience on the impact the program will have on construction safety. One can only judge by conjecture and analogy. It is obvious that special effort will be required to avoid adverse effects. I am sure that such effort will be made. It should form an important part of the planning to which I have referred. This will require the full cooperation of labor and industry.

Labor will play a particularly important part. Traditionally, the construction trades have been charged with providing the skilled personnel which the building industry requires. I believe that press reports of labor agreements that have been reached in connection with model cities program have indicated appreciation of labor's responsibility in this area.

Industry also has major responsibilities. Management must actually organize its safety programs. These will not succeed without full support from management. Its continuing personal interest must be evident. An important part of any such safety program is employee training and placement. These, as we have seen, are of particular importance in the program under discussion with respect to model cities projects.

Insurance can be of important assistance in providing materials and consultation for such training and in establishing and continuing safety programs. We have many pamphlets dealing with various aspects of construction. For example, the *Your Guide to Safety* series includes pamphlets on construction projects, road construction work, heavy motorized building equipment, crane operation etc. Our *Handbook of Industrial Safety Standards* includes many chapters dealing with hazards also found in construction. However, probably the most widely used and comprehensive manual in this field is *The Manual of Accident Prevention in Construction,* published by the Associated General Contractors of America. It is an essential authoritative guide in any construction safety program. It is presently being revised by the Safety Engineers-AGC Joint Cooperative Committee, of which we are members, as are representatives of mutual insurance companies. It is chaired by an engineer of one of our member companies. Its secretary is a member of our Engineering and Safety Staff. Many members of our Construction Hazards Committee also serve on it. AGC representation consists of its Safety Committee. Thus, there is close collaboration. Other representatives are members of the American Society of Safety Engineers. This manual is one of the most effective means of achieving safety in this field.

The supervisor is in a key position in organizing an effective safety program. This manual has served as the basis for the Supervisor's Training Course sponsored by the AGC. The Joint Cooperative Committee serves in a consulting capacity to this program. In seminar form this course has been given to 14,000 supervisors. There are 750 currently enrolled in the correspondence course which has been given and passed by over 300 supervisors. These will be of particular importance in the training of employees who will be employed in the model cities program.

There does not appear to be very much information as yet concerning the accident experience with personnel such as that likely to form a considerable part of the model cities program. Insurance companies have instituted special programs for the disadvantaged, but naturally these have been largely centered on training employees for employment within the insurance industry. These are largely of the clerical and office variety. We have a special committee on manpower training in this connection. In-

surance companies have also cooperated or taken the lead in community programs, as for example in San Francisco and Hartford.

In Hartford, Connecticut, there is a training center for hard core unemployed by a large aircraft company, with which the insurance industry has been cooperating. Its director reports they have had an excellent accident experience during the training period. Very few of these students dropped the course for lack of motivation. Those graduated and placed in industry have had as good if not better records than other employees.

A special workmen's compensation insurance program was established for youth corps members receiving training under the Economic Opportunity Act. Experience under this program has not yet become available, but inquiries to several large centers do not indicate any special difficulties.

It is true that during World War II, when a number of inexperienced and untrained personnel entered the labor market, accident rates rose. But those were emergency conditions with great pressures on time schedules and production. Limited effort could be expended on training and safety programs. There was a great shortage of skilled personnel to do the training. With carefully planned programs and emphasis on proper training placement and safety, experience should be satisfactory.

At the same time it should be recognized that if this is not done experience could be adverse. It would be most unfortunate if neighborhood residents should add physical disability to their other handicaps. This should not be permitted to occur. While many jobs in the construction industry require skill and experience, others are not so demanding. They may well provide the stepping stones in a well planned training program.

It is interesting to note what one city has done. In Rochester, New York, great voluntary effort was exercised to encourage employment of the underprivileged. The labor market in that city is particularly demanding in technical skills. Special training programs were organized. A specific organization was created, Rochester Jobs Inc., known as R.J.I., for obtaining jobs for the hard core unemployed. Another was created to help organize business ventures which would provide such jobs; a third to alleviate housing problems. Reports of these efforts are very encouraging, all on a voluntary basis.

R.J.I. realized it would be necessary to acquaint company foremen with some of the special problems, from a human relations viewpoint, they would have to deal with when working with people having limited skills and employment experience. Special seminars were set up for them on subjects like "The Non-Competitive Applicant and the Foreman," "Labor Relations and Communication," "Understanding," etc. Most of the foremen in most of Rochester's industries have been through at least one seminar. Effort has evidently produced results.

I am certain that, through cooperation of all segments—model city residents, labor, industry, government, and insurance, as well as the public—the necessary effort will be made. This, however, will mean work and good-will. I can assure you that insurance will do its full part.

ROTOCRAFT EXTERNAL LOAD OPERATIONS IN THE CONSTRUCTION INDUSTRY

By WILLIAM R. GAINES
Safety Dir., U.S. Army Aviation Center School, Fort Rucker, Ala.

Over the years, the past 12 or 14, we have gathered considerable knowledge in the area of external loads. Considering that the US Army Aviation Center is currently flying almost one million flight hours per year, we should be learning something. Some of our knowledge or experience has come about the hard way.

Some of you might be wondering, "Why carry dangling loads on a cable when you can place them inside the machine and be off?" There are a couple of good reasons for external loads. The first is that all internal loads require a landing pad at delivery point. The second is that a palletized load is not always compatible with the in-flight control of the helicopter. Let's assume we want to carry a load of 6,000 pounds—be it a load of bridge timbers for the engineers or chickens for the mess hall. The weight and balance of the helicopter would have to be computed for the load to keep the timbers or chickens within the center of gravity limits for in-flight control. When we place this 6,000 pounds as an external load on a pallet or in a net suspended on a single cable, our one factor is how much can the bird lift? The 6,000 pound load is exactly on the center of gravity of the helicopter, which may not be possible with an internal load, and maximum control is available during flight. This center of gravity problem for internal loads is much more critical in the single rotor craft than the tandem rotor. Some of you can remember when the airline hostess would ask you or assign you to sit in a seat near the rear of the DC-3. This was especially true if the load in the rear baggage compartment was light. The pilot needed your help to get the tail down and keep it there on landing.

For many years we have been shifting the battery in small helicopters from the chin bubble to the tail boom, depending on whether or not we have a passenger riding with us. At times, in the early days, we used sand bags as was done in the pre-World War II open cockpit trainers. I recall a pilot in a Bell H-13 helicopter who came in to pick up a mechanic. The mechanic placed his tool box at his feet. The pilot picked up the aircraft and immediately found out his CG had shifted forward to the point where he had insufficient control to stop forward flight. The weight of the tool box was sufficient to tip the scales. Fortunately, with more sophistication of our helicopters, these problems have been greatly reduced.

In 1955, we experienced an engine failure and an accident with a "Bird Dog" L-19 Cessna aircraft. The aircraft landed in a cornfield and flipped onto its back. We had no injuries, except the instructor's pride. The field was about 45 acres in size, and the aircraft was in the middle of it. The corn crop was exceptionally good that year in Alabama. To bring a 10-ton wrecker and a low-boy into that field was going to be quite expensive. We had just received the H-21 Vertol helicopter, commonly called the "Flying Banana," at the aviation test board—with a hook for an external load. In 2½ hours we built a harness with a single point attachment and delivered the bent "Bird Dog" to the shops, 15 miles away. The claims officer paid $3.25 for the corn damage; he should have bought the whole darn field, as this is now Deerfield housing area, in the city limits of Enterprise, Alabama. This airlift was a first for us, and we continued this method for a considerable time. As long as fully qualified crews performed the mission, it was highly successful. Then came other pilots wanting to make recoveries. To make a long story short, one pilot airlifting a "Bird Dog" aircraft failed to keep his airspeed down. The Bird Dog began to fly and bumped the bottom of the helicopter. The pilot immediately jettisoned his load. Well, he turned $200 damage into a total loss of a $15,000 aircraft. We learned to put spoilers on air foils to make them stall instead of fly. Another problem which can be encountered is oscillation, which the pilot must prevent. A shorter cable helps prevent this; slower airspeeds are also re-

quired, and slower accelerations and decelerations.

The hooks used on some aircraft for sling load operations have a three-position switch in the cockpit: Safe—automatic—on. The automatic opens the hook when the pilot places the load on the ground and the pressure gets less than 125 pounds. Our second bad experience came when one of our pilots failed to place the switch in "safe" position when lifting another Bird Dog—on his way home, the aircraft got light on the hook and away it flew, with no pilot. The pilot had the switch on automatic and the hook functioned exactly like the manufacturer planned for it to operate.

External loads are serious business, and nothing should be assumed. Prior to any lift, the hook mechanism must be thoroughly inspected and activated to ascertain if it is functioning as it should in all positions. In aviation, for many years we have had "Murphy's law." "Murphy's law" is quite simple—it says "If something can be put together incorrectly, sooner or later someone will put it together incorrectly." As I stated, there are three cockpit positions: safe—automatic—on. On final approach to the release area (150-200 ft. altitude), the pilot may switch to "automatic," and when the cable load is reduced to 125 pounds at touchdown, the load automatically releases. To connect the hook controls, four wires have to be connected to the pilot's control box. We did experience a case where the "automatic" position was connected to the "on" position, and a beautiful case of "Murphy's law" was presented. As the pilot approached his release point, he switched to "automatic," and away went a brand new jeep—into a street intersection. Fortunately, there were no injuries. That is why we say, "It's serious business—assume nothing." The loss of that jeep was the pilot's fault, because he assumed the mechanic had made the proper electrical connections. Now, one step further—the engineer who designed those connections so they could be improperly put together needs to have a good course on how to design accident prevention into a product.

The cases which I have discussed are all well over 10 years old. We still have an occasional loss of a training load, but when it happens that aircraft belongs to my people until we have determined what caused the inadvertent drop. We did have a rigging problem about two years ago, but have since corrected it.

In the late 'fifties and early 'sixties, a considerable number of "good will" missions in Europe were performed, such as the placing of church steeples and crosses. We are capable of performing missions such as these today, providing a plan of action or pre-plan is well developed. We did lose two men and one helicopter in Germany, placing a cross on a church steeple in the summer of 1963. As I stated, we have the equipment and trained pilots to do these jobs—the 1963 accident was purely a lack of proper preplanning and adequate communications, not to mention the language barrier.

Positive communication is of utmost importance. The state of the art today in transistorized radio provides us with excellent positive communications. Remember, an air lift is not like a fork lift—the pilot will usually only see the load as he approaches it for pick-up. We have recently done extensive evaluations on airborne crash fire fighting. We placed rescue personnel in fires, wearing protective suits. Each suit helmet was equipped with a voice-actuated transistor FM radio. This freed both hands for work and at the same time allowed him to talk with the pilot of the aircraft and other personnel in the area. This radio can also be used very effectively for external loads control. Incidentally, we have put out in less than two minutes as much as a 500 gallon JP-4 fire with 25 gallons of "light water." The helicopter has a great potential in the area of hard-to-get-at fires.

The day is here where we can efficiently lift, move, and place objects, regardless of dimensions, up to 20,000 pounds. We have manufacturers talking in terms of 20 to 25 ton external load capability—maybe someday we will need a stronger cable.

HELICOPTERS IN CONSTRUCTION

By DAN KRASS
Senior Accident Prevention Officer, The Hydro-Electric Power Commission of Ontario, Toronto, Ontario, Canada

Ontario Hydro owns, operates, and maintains a fleet of 12 helicopters consisting of the following types: one Sikorsky type S58, three Bell type G2, four Bell type G2A, one Bell type G2A1, two Bell type J, one Bell type Jet Ranger.

The work-horse of the fleet for construction purposes is the S58, capable of carrying a pay-load of approximately 4,000 pounds. The other smaller craft are used for various support purposes, such as supervisory patrols and air-lifting loads of tools and materials. The smaller craft are capable of carrying a load of approximately 500 to 600 pounds.

Following is an outline of our performance in construction since 1961, using the helicopter as the main construction machine: built approximately 300 miles of transmission line for operating voltages of 115 kv, 44 kv and 12 kv; carried and set approximately 3,500 poles; strung approximately 900 conductor miles of wire.

As well as the above, we used helicopters extensively on the construction of over 400 miles of 500 kv EHV transmission line.

To give you an idea of our use of helicopters in the power utility field, we have logged well in excess of 60,000 rotary wing hours with our own fleet, as well as many additional hours logged using rented rotary wing craft.

Accident experience since 1959 to date:

1963—S58 crashed while setting a 65-ft. pole.
Cause of accident—knuckle pin failure on crank shaft.
Injuries—minor injuries to pilot and air observer.

1968—Air observer received serious leg injury in S58 while flying pulling line.
Cause of accident—suspected cargo hook failure.

Some steps to ensure safe practices:

1. Air and ground crews must be thoroughly briefed prior to every operation in order to function as a well-trained unit; teamwork is essential.

2. Know your loads and weight of load. How will the load fly?

3. Establish good communications, both audio and visual.

4. Guard against prop wash. Ground crews must be equipped with proper safety devices. Beware of flying debris such as small twigs, sand, small stones, etc.

5. Establish a rigid inspection system of rigging equipment used—slings hooks, nets, etc.

6. Don't trail empty slings under the craft.

7. Outline precautions to be taken when entering or leaving a helicopter while main rotor is turning.

ROTOCRAFT EXTERNAL LOAD OPERATIONS IN THE CONSTRUCTION INDUSTRY

By JOHN A. PROCTOR
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The Bureau of Labor Standards became interested in helicopter cranes in 1965, when a state labor official requested information on safety standards for the protection of ground personnel. Following an accident on the transmission tower erection job, the state official was encountering some difficulties with the contractor, who was planning to utilize the helicopter for wire-stringing and other jobs. A search of our extensive library of state safety codes produced no standards for helicopter crane operations. The Federal Aviation Agency, Flight Standards, Washington office was contacted for information, and they furnished a copy of their Title 14, Chapter 1, Part 133, Helicopter External-Load Operations regulations. The offices in the Bureau's specific regions were asked to look into this type of work and reports were received from the Portland, Seattle, and San Francisco offices. Our staff reported several projects for utilizing helicopter cranes, including a pipeline project in the Grand Canyon and even some experiments with logging in the Northwest. Since then, we have assembled a considerable file which discloses extensive use and wide variety of activities for which the helicopter's ability to raise and transport external loads has been attempted or carried out successfully. The Maritime safety office in New York observed an attempt to use a flying crane to set an eight-ton dummy smokestack on a vessel at a pier where the job could not be done by a conventional crane. This operation was photographed by the staff for viewing by our Washington personnel. Screening of military periodicals and other publications as well as the press disclosed many accounts of successful external-load operations, and only a few accidents came to light.

Briefly, here are some of the types of accidents that we found described in different periodicals and in the press.

In the case of military applications, we found the accidental dropping of external loads was not too uncommon, and in one instance a 10,000 pound load of tractor wheels was dropped onto the Viet Cong.

In another case, the pilot had released a sling load of construction materials moments before his engine quit and the helicopter crashed. This was the first major accident reported on that particular project.

Another accident described the accidental dropping of a test concrete weight, measuring about 20 x 20 feet which was spinning at the end of a 240 foot line. This load was dropped on the Potomac River in the vicinity of fishermen and caused some concern there, I'm sure.

In another incident, a drag line operator for a road contractor alighted from the helicopter just as a gust of wind tipped the machine. The blade struck and killed him.

Another employee alighted from a helicopter and, due to the high wind, dense smoke, and dust, he lost his sense of direction and ran into the stablizing rotor of the helicopter.

A decision was made to prepare a questionnaire for distribution to helicopter manufacturers, users, and any associations interested in rotorcraft. The data accumulated on helicopters was reviewed to determine what hazards to ground personnel were disclosed, and the questions were directed at obtaining confirmation of these hazards and any control methods in use or recommended.

The questions submitted were:

What is the safe load rating of a rotorcraft and its hoisting machinery?

Describe the construction of hoisting winches, ropes, and other cargo gear such as bridle swings and hooks, including the quick release features of the hook.

Is there a problem with static electrical charge dissipation?

What means are used to prevent rotation of external loads?

What communications or signal systems such as hand, voice, flag, or radio are rec-

ommended for use between the helicopter operator and ground crew?

What are the effects of rotor downdraft on the load and on the ground crew?

What pre-operational instructions are given ground crews to insure safe conduct of operations such as positioning of the load or slinging of the load to achieve proper balance?

What emergency measures are taken in event rotorcraft power failure or casualty requires it to land?

What are the effects of wind, rain, darkness on the conduct of external load operations?

What problems do you have with downdraft and its effect on structures that are being erected by means of helicopter?

Do you have any statistics to support the safety record of helicopter external-load operations?

The questionnaire was mailed to manufacturers and users whose names had been developed in the course of our study of flying crane operations. Most answers were submitted in the form of safety recommendations which were categorized and used as the basis for our recommendation. Helicopter safety rules for rescue operations and certain rules of the military departments and Coast Guard were procured and added to those reported by means of our questionnaire.

All accidents on file were analyzed and used in preparing our recommendation. Of course, our maritime staff, who observed the attempted ship alteration using a flying crane, reported their recommendations to us. The National Safety Council's helicopter survey of December 1964 which was directed at the public utility industry was also reviewed for safety recommendations. Our Nov.-Dec. 1967 issue of *Safety Standards* magazine carried an article entitled "Safety with Flying Cranes" and listed 13 safety rules for the protection of ground personnel assisting in helicopter external-load operations. This article was subsequently reprinted in Best's *Safety Maintenance* magazine and in the U.S. Coast Guard's *Engineer's Digest*. The responses received to our recommended standards for the protection of ground personnel have been very few, but hopefully some attention has been directed to a potentially hazardous operation before a history of casualties is allowed to accumulate to justify the need for safety standards. The present glamorous nature and novelty of helicopter operations will certainly result in front page publicity for all casualties. Witness the recent occurrence in California which saw two men die while attempting to paint a church steeple by raising the painter in a harness suspended from a helicopter.

The State of Alaska has proposed safety regulations for helicopter operations in the construction industry. The State of Washington has also advised us of its intention to develop safety regulations for helicopters used for material handling. As of this time, only one private company has reported to us that they are planning to use our recommendations for instructing their employees who participate in helicopter operations.

ROTORCRAFT EXTERNAL-LOAD OPERATIONS

By MERVIN H. LAW
Supervising Inspector, Dept. of Trans., Fed. Aviation Adm., Des Plaines, Ill.

One of the principal objectives of the FAA Flight Standards Service is to promote aviation safety and protect the public interest. The *FAR's* are minimum standards governing appliances as may be required in the interest of safety. *FAR* Part 133, entitled "Rotorcraft External-Load Operations," was adopted in January 1964 to establish certification and operating rules governing nonpassenger rotorcraft in external-load operations conducted for compensation or hire, and to govern persons engaged in such operations.

An operator must obtain an external-load operator's certificate prior to engaging in this type of operation. These may be obtained from any General Aviation or Air Carrier District Office. To qualify, an ap-

plicant must have the exclusive use of at least one rotorcraft that meets certain certification requirements and must hold or have available at least one person who holds a current commercial or airline pilot certificate with appropriate ratings. He must also have satisfactory knowledge regarding rotorcraft external-load operations. There are certain airworthiness requirements that must be met. The applicant must demonstrate by performing operational flight checks that the load combination has satisfactory flight characteristics.

There are three classes of rotorcraft load combinations. In Class *A* the external load cannot move freely, cannot be jettisoned, and does not extend below the landing gear. Class *B* is jettisonable and lifted free of land or water. Class *C* is jettisonable and remains in contact with the ground or water. The particular classes for which the operator is qualified are listed in the operating certificate.

The applicant must also prepare a *Rotorcraft Load Combination Flight Manual.* This manual sets forth the safety requirements, operating limitations, normal and emergency procedures, and performance data. It must also contain information on any peculiarities of particular type loads, precautions for static electricity discharges for Class *B* combinations, information on hand signals to be used, operating in and out of ground effect, oscillating tendencies, density altitude, strong and gusty winds, acceleration and deceleration limits, and any other information considered essential for safety in a particular type of operation.

Since the helicopter is an extremely versatile aircraft, it can be utilized to lift almost anything, anywhere, anytime. Due to this versatility, it is not practical to formulate a detailed operational procedure that would apply for all operations. Therefore, it becomes increasingly important that the operator plan each operation separately and ensure that all associated personnel are fully briefed prior to each operation, and that all equipment is inspected for serviceability. It may be noted that Part 133 has no specific requirement for ground personnel. However, operational requirements normally make it necessary that one or more ground personnel be utilized, and the rule requires that flight crew and ground workers be given proper instructions.

Many operators utilize radios instead of hand signals to provide instructions to the pilot. Others use hand signals to give instructions to the pilot. When using hand signals, the pilot must keep the person giving the signals in sight. The use of a radio allows the ground man to station himself to his advantage, and the pilot is relieved of the necessity of continuously shifting his gaze from instruments to signal man.

Some of the factors which have caused or were major factors in accidents which have occurred in external-load operations are: engine or equipment failure; loss of rotor rpm; misjudgment of altitude; improperly briefed or trained ground personnel; pilot losing sight of ground signal-man; misinterpretation of hand signals; improper load attachment, resulting in shift of weight and balance; cable breaking and entangling in the rotor system; and exceeding load limitations. These are only a few.

Safety rules pertaining to external-load operations include, but are not limited to, such items as: a detailed inspection of the aircraft, sling assembly, and cable immediately prior to the operation; a detailed briefing on the duties of each individual participating in the operation (this should include an on-the-scene briefing to familiarize personnel on the actual items to be lifted, the attaching means, and an actual inspection of the area in which the operation will be conducted); hand signals or radio phraseology to be used; route of flight and emergency landing areas; and emergency procedures in the event of engine or equipment failure. These items are a must on each and every operation.

As rotorcraft external-load operations continue to expand with the use of new, larger, and more complex equipment we must continually strive to develop and utilize operating procedures and practices which lend themselves toward a safe and profitable operation.

(subsquently referred to as safe levels). Additionally, many individuals[6,7,8] and corporations have proposed safe levels. Since the threshold doses presented in most biologic research literature[9] are generally presented in terms of retinal intensities, early standards proposed safe levels at the retina. Such levels created serious problems for many users who were not familiar enough with physiological optics to extrapolate retinal doses to the exterior (cornea) of the eye. Safety factors ranging from two to 100 have been utilized by different groups in arriving at safe levels from the same biologic data. Opinion varies as to whether safety levels should be based upon cell damage detected by biomicroscopic methods, by clearly evident damage to the retina determined ophthalmoscopically, or by detectable functional loss of vision. It may well be that there exists a significant difference between acute and chronic effects of laser exposure. In general, it has been the practice on the part of those who have proposed safe levels to be conservative. Except where lasers are utilized in an outdoor environment over long ranges, conservative levels have not resulted in significant operational restrictions. Safe levels which have been utilized by the US Army Environmental Hygiene Agency are: 10^{-7} j/cm² for q-switched and 10^{-6} j/cm² for non-q-switched pulsed lasers based upon a wavelength of 694.3 nm; and 10^{-6} W/cm² for continuous-wave lasers, based upon white light. Additional safety factors of from two to ten are utilized with these levels, dependent upon the situation.

Reflections

The foregoing exposure criteria assume that the incident laser radiation consists of a parallel beam, and that the eye is focused at infinity. This would be true for intra-beam viewing within the direct beam or for a specularly reflected beam; however, most reflections which individuals view are diffuse in nature. A safe retinal irradiance can readily be related to a safe surface brightness measured at the diffuse reflector. Our agency has been using the following surface "brightness" values as the upper limits in judging safe operations: 0.07 j/cm² for q-switched lasers, 0.9 j/cm² for non-q-switched lasers and 2.5 W/cm² for c.w. lasers, measured at the surface. It is essential to understand the significance of these values. If a surface brightness occurring from pulsed laser illumination is viewed, it is equally as hazardous for all viewing angles or distances, provided the reflection appears as an extended source. On the other hand, the likelihood of an observer's eye being within the direct or a specularly reflected beam in any practical situation is remote. In this regard, I believe there are two principal reasons for the low incidence of laser injury in the past; namely, the low probability of a person receiving a well-collimated specular reflection in most operations, and the fact that the rule regarding the wearing of protective eyewear is seldom disregarded when using lasers capable of producing hazardous diffuse reflections. An accident resulting from viewing a hazardous diffuse reflection has recently been reported in the literature[10].

Considerations of Hazard Criteria and Hazardous Range for Small He-Ne Lasers.

The output power of present He-Ne lasers is not sufficient to cause injury to the skin. A potential hazard exists to the eye, however, since the beam may be focused to a small spot on the retina. This hazard applies only if the eye is located within the primary beam or a beam created by reflection from a flat specular surface. Reflections of the beam from any diffuse surfaces are safe to view as long as the beam power density is below 2.5 W/cm². Present experimental and theoretical research indicates that retinal burns may result from exposure to beam intensities of the order of one mW/cm² and above. Because of effects other than retinal burns which may be of significance from viewing the beam for long periods of time, it is presently considered wise to limit ocular exposure to intensities of one μW/cm² or less. Average beam intensities above one mW/cm² exist only to a range of approximately 50 to 100 meters or not at all for most construction lasers. Thus, at these close ranges the potential eye hazard may be significant even for short exposures. Although an occasional accidental exposure to the c. w. laser beams at levels below one mW/cm² would not be expected to produce a burn, repeated exposure at levels between 10^{-6} and 10^{-3} W/cm² is undesirable. Personnel would not be expected to stare into the beam in any case, since 10^{-6} W/cm² has been experienced by the author as quite dazzling

THE AMAZING LASER

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That amazing new light source, the laser, has found many applications in its eight years of existence. In addition to the growing applications in electronics, scientific research, medicine, the military, geology, geodesy, mapping, and many industries, the laser has been shown to be a promising new tool in the construction industry.

Concurrent with the development of laser technology, the understanding of potential hazards associated with the use of lasers has been expanding. A far more elaborate and specific program of hazards control is now possible with the experience gained in the past few years. Initially, only common-sense guidelines were available. Theoretical calculations and actual measurements of laser output parameters, the primary and reflected beam intensities, have made possible the development of guidelines based on knowledge and more substantial practical experience. Field and laboratory evaluation of hundreds of laser operations and biological research have led to the development of tentative safe exposure levels. The purpose of this paper is to present the highlights of recent developments relating to hazards and controls which may be applicable to laser operations in the construction industry.

What characteristics of a laser make it a hazard? It seems strange to many that a one-tenth watt laser is considered a potential ocular hazard, while a 100 watt light bulb is not. The principal reason for this is that the laser can be effectively a *point* source of great brightness close to the source, and the light is emitted in a narrow beam; whereas conventional sources of illumination are extended, they are considerably less bright, and emit light in all directions. The laser has characteristics of coherence and monochromaticity which in themselves do not contribute to the hazardous aspect. The parallel rays of a laser may be focused to a point image while rays from an extended source as from a conventional lamp (or rays from a diffuse reflection of a laser beam) produce a sizeable image at the retina. Light from a laser entering the eye is concentrated 100,000 times at the retina. Because of this focusing effect, the eye is by far the organ of the body most subject to damage. Hence, injury to the skin is seldom of concern except in dealing with very high-powered lasers.

The Uses of the Laser in the Construction Industry

The type of laser which has found the greatest use in the construction industry has been the helium-neon (He-Ne) gas laser. Its highly collimated beam has been used to project a reference line for construction equipment in such operations as dredging, tunneling, pipe laying, bridge building, and marine construction. One of the greatest requirements for such a reference line exists in operations over large bodies of water where position references are most difficult to establish. Several manufacturers provide small He-Ne lasers complete with transit mount and collimating optics for this purpose. These lasers generally have a power output of one to ten milliwatts. Most small He-Ne lasers have a beam diameter of one to three millimeters which is expanded by collimating optics to 20-30 millimeters (approximately one inch), thereby increasing the collimation of the beam. Some collimation systems have been designed to provide a fanned-shaped beam, so that a reference plane is produced rather than a line. In some applications, the beam is directed at another reference point, such as a target card.

The small He-Ne gas laser has also been used for highly precise distance measuring in surveying. The US Coast and Geodetic Survey presently uses laser geodimeters.

Exposure Criteria

A number of groups, such as the British Ministry of Aviation[1]; the British Electronic Engineering Association[2]; the American Conference of Governmental Industrial Hygienists[3]; an ad hoc committee on laser safety for the US Atomic Energy Commission, Nevada Operations Office[4]; the Armed Forces-NRC Committee on Vision[5]; and others have developed recommended safe ocular exposure levels for laser radiation

during daylight, as is 10^{-8} W/cm² at night. Thus, the protective mechanisms of the eye may be expected to prevent individuals from staring into high intensity beams. This protective feature of the eye is not helpful, however, for lasers emitting in the infrared, since the beam is not visible, nor is it helpful for pulsed lasers.

Optically Aided Viewing.

An important concept to understand is the effect of viewing laser light by optical instruments, such as binoculars or telescopes. The laser light arriving at the eye after passing through a telescope or binocular may be concentrated by as much as the square of the magnification of the instrument. Thus, viewing the direct beam of a laser through 7 x 50 binocular could increase the intensity level at the eye by as much as $(7)^2$ or 49 times. This applies only if the beam is viewed directly or by specular (mirror-like) reflection, but not if viewed by diffuse reflection. There is no additional hazard in viewing diffuse reflection by binoculars or telescopes. If personnel with binoculars can be in the direct beam at ranges normally considered safe for viewing by the unaided eye, a single "safe range" cannot be defined.

Operational Aspects

The application of the hazard criteria already discussed depends heavily upon the nature of the laser operation. For example, in one tunnel boring operation the laser beam passed above occupied areas and was directed at a photodetector at the boring machine, which then gave the machine operator information as to whether he was on course. In this type of situation, no problems would be expected to arise. On the other hand, some applications call for equipment operators to align their equipment visually by looking directly into the beam. This is not considered wise unless the average beam intensity is down to approximately 10^{-6} W/cm² (one μW/cm²) for occupational exposure at night, or five times this value in bright sunlight. At ranges where beam intensities are much greater than one μW/cm², protective eyewear may be used to reduce the intensity to a satisfactory level while still rendering the beam visible. Laser protective goggles or spectacles are commercialy available which attenuate the He-Ne laser light (wavelength 6,328A or 632.8 nm) by factors of 10 (O.D. = 1), 100 (O.D. = 2), 1,000 (O.D. = 3), or more. An optical density (O.D.) of three or four still renders the beam visible in bright sunlight. The goggle-type of protective eyewear utilized in the laboratory is often unsuitable in the field, because of fogging. Laser protective spectacles may be considered more advantageous for many environments encountered in operations in the construction industry. Alternatively, the beam may be safely viewed by diffuse reflection. A He-Ne laser beam is generally visible by diffuse reflection from a white card in daylight at approximately one mW/cm², or 0.1 mW/cm² if the card is shaded. Retroreflective sheets will render lower levels visible if the viewer is near the beam axis. Goggles which cut out ambient light but transmit the laser beam are also available for rendering lower intensities of light visible; however, such goggles must not be mistaken for protective eyewear.

Reflections Encountered in the Field.

Some applications, such as the laser geodimeter, utilize a reflected beam from a corner-cube retroreflector which is directed back along the beam path to the geodimeter. The reflected beam may be observed through the finder telescope. The retroreflector is typically only used at distances greater than a kilometer in order to enhance the reflected beam. For close ranges, retroreflective Scotchlite is utilized. Reflections from the Scotchlite are not hazardous from present geodimeters. Reflections from natural surfaces, which are reasonably diffuse, are not potentially hazardous. However, reflections from specular surfaces, such as flat grass or flat surfaces of still ponds, may be potentially hazardous if these surfaces are quite near the laser. For instance, directing the beam through a glass window from within a building would create a reflected beam with an intensity of approximately eight per cent of the primary beam (or more, depending upon incident angle and polarization of the beam). If the polished surface is curved, safe levels are achieved at shorter ranges.

Estimating Beam Intensities at Selected Ranges.

It is often desirable to estimate beam intensities at various distances to evaluate the range of hazards. The formula for the beam intensity I in W/cm², at a range r in centi-

meters, for power out E in watts, for a laser with a circular beam pattern

$$I = \frac{Ee^{-\sigma r}}{\pi/4\ (a + r\phi)^2}$$

where $e^{-\sigma r}$ is the term for atmospheric attenuation and can be disregarded except for ranges beyond 10 or 20 kilometers, a is the emergent beam diameter at the laser, and ϕ is the beam divergence in radians. Note that the numerator is the total power in the beam and the denominator is the beam area (i.e., $\pi/4$ times the square of the beam diameter).

Example: Consider a typical laser with an initial beam diameter of one inch (2.5 cm), a power output of 5 mW, and a beam divergence of 0.1 milliradians (10^{-4} radians). Ranges of interest are at zero and one kilometer (0.6 miles). The formula may be simplified to:

$$I \text{ (when } r = 0) = \frac{1.27\,E}{(a + r\phi)^2} =$$

$$\frac{1.27\ (5 \times 10^{-3}\ W)}{(2.5\ cm + 0)^2} = 1.0 \times 10^{-3}\ W/cm^2$$

and

$$I \text{ (when } r = 1\ km) =$$

$$\frac{1.27\ (5 \times 10^{-3}\ W)}{[2.5\ cm + (10^{5}\ cm)\ (10^{-4}\ rad)]^2} =$$

$$\frac{6.3 \times 10^{-3}}{(2.5 + 10)^2} = 4.0 \times 10^{-5}\ W/cm^2$$

The foregoing example is typical — the emergent beam power density is close to one milliwatt per square centimeter, and 10^{-6} W/cm² is not reached for a distance of several kilometers. One should be cautioned against relying heavily upon theoretical calculation. "Hotspots" exist in the beam due to the laser and to atmospheric turbulence.

Laser Hazards Controls

Hazard controls should be designed to minimize the opportunity for ocular exposure to the direct laser beam and specular (mirror-like) reflections. The controls should be reasonable, while not hampering the operation or creating new hazards.

In our experience of evaluating many laser operations, we have commonly encountered a lack of understanding, on the part of users, of the different orders of magnitudes of intensity levels found in the operational environment and the understanding of the probability of potential accidental exposures. A program of educating personnel concerned with laser hazards is an essential part of the total hazard control effort. This must be supplemented by continuing on the job supervision. The laser safety problem must be presented in perspective with other hazards encountered on an everyday basis.

Environmental controls may differ widely, depending on whether the laser is used in a laboratory or out of doors. Backstops and shields to exclude the beam from occupied areas are commonly used both in and out of doors. Well illuminated laboratories and limited-access rooms are important environmental controls. The prevention of unsafe acts by personnel may be achieved by the use of physical barriers, by the application of administrative procedures (education and training) and through careful supervision. The use of protective eyewear is a major control which would be mandatory when a serious risk of injury to the eye exists.

In general, it appears that present laser equipment may be operated safely by trained operating personnel without undue restrictions. However, several procedures are required to minimize long term low-level exposures. The following guidelines are based upon this conclusion. Additional guidelines and others similar to those listed below are provided in the NSC Construction Safety Release.[11]

Lasers should not be left unattended during operation. Beam shutters or caps should be utilized, or the laser turned off when laser transmission is not actually required.

Personnel who work with laser units should be instructed in the potential eye hazards and the importance of limiting unnecessary exposure. Personnel occupationally exposed to laser light should receive preplacement, periodic, and final eye examinations.

A warning sign should be attached to laser equipment in a conspicuous location indicating the potential eye hazard associated with the laser and warning against looking into the primary beam and at specular reflections. Such a warning sign might read: "Danger—Laser Light. Do not look into primary laser beam. Do not aim laser at flat glass or mirror surfaces. Aim only at reflectors supplied with unit."

The use of corner-cube retroreflectors should be avoided at close ranges if the re-

flected beam is to be observed. Diffuse or retroreflective card targets are recommended for short ranges.

The use of binoculars or aiming telescopes should not be used to view the direct beam, or a reflected beam from mirrors or corner-cube retroreflectors unless the beam intensities are greatly below safe levels. If necessary, a filter having sufficient optical density is placed in the optical path of the telescope for such situations, or adequate laser protective eyewear is worn by the operator.

For ranges where beam intensities are significantly above one $\mu W/cm^2$, personnel receiving the beam should be provided with protective eyewear with a typical optical density of three. Protective eyewear should be considered necessary for personnel at the laser itself only if strong specular reflections are expected, if the laser is so situated that personnel can walk into the emerging beam at eye level, or when viewing strong retroreflections through the telescopes. If protective eyewear is required, it should be labeled as to the optical density at the appropriate laser wavelength or as to the laser equipment for which it was designed. Personnel who must wear protective eyewear should remain in good communication with the laser operator to insure that eyewear is worn during laser operation.

During the alignment and setup procedures, care should be taken to avoid aiming the laser into potentially occupied areas. Prior to use in heavily occupied areas, the alignment of the beam with the pointing telescope or aiming equipment should be checked if the instrument is so equipped.

If the beam is directed through a glass window, the beam should pass perpendicularly to the plane of the glass, or protective eyewear should be required for personnel in the vicinity of the window.

Stable mounts for the laser are important so that beam traverse can be readily controlled.

Reflections from rain, snow, dust, and other particulate matter are not of concern unless the beam intensity is above 2.5 W/cm^2 (seldom if ever with construction lasers).

The above guidelines should only be applied to the small He-Ne lasers discussed in this paper. Other guidelines would apply to other types. Finally, it should be reemphasized that present safe exposure levels are only estimates and should not be considered as fine lines between safe and hazardous intensities.

References

1. Weston, B. A.; *Laser Systems — Code of Practice.* London, The Ministry of Aviation, November 1965.
2. *A General Guide to the Safe Use of Lasers.* The Electronic Engineering Association, London, September 1966.
3. *A Guide for Uniform Industrial Hygiene Codes or Regulations for Laser Installations.* The American Conference of Governmental Industrial Hygienists, Cincinnati, March 1968.
4. *Recommendations of the Ad Hoc Laser Committee, Standards for Laser Safety.* US Atomic Energy Commission, Nevada Operations Office, Las Vegas, October 1967.
5. Sperling, H. G.; Ed. *Laser Eye Effects.* A Report of the Armed Forces NRC Committee on Vision, Washington, D. C., April 1968.
6. Sliney, David H., and Palmisano, William A.; *The Evaluation of Laser Hazards.* Presented before the May 1967 meeting of the American Industrial Hygiene Association, Chicago.
7. Vos, J. J.: *Some Considerations on Eye Hazards with Lasers.* Institute for Perception RVO-TNO, Soesterberg, National Council for Applied Research in the Netherlands, Report #IZF 1966-4: 23 pp., 1966, (AD800156).
8. Goldman, Leon, and Hornby, Peter: "Personnel Protection from High Energy Lasers." *American Industrial Hygiene Journal,* 28, No. 6:553 - 557, November - December 1965.
9. Ham, William T., Jr., Williams R. C., Meuller, Harold A. et. al.; "Ocular Effects of Laser Radiation." *Acta Ophthalmologica,* 43: 390 - 409, 1965.
10. Curtin, Thomas L., and Boyden, Douglas G.; "Reflected Laser Beam Causing Accidental Burn of Retina." *American Journal of Ophthalmology,* 65:188-9, February 1968.
11. Nelson, Charles R.; "The Use of Lasers in the Construction Industry." *Construction Safety Release* No. 69, Construction Section, National Safety Council, Chicago, Ill.

PRACTICAL EXAMPLES OF USING LASERS IN THE FIELD

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We at TECOM have the responsibility of testing and evaluating lasers, newly incorporated into military hardware. Our field experience has been with the testing of pulsed, ruby lasers. Most of the problem areas we have encountered should be similar to CW laser problems; likewise, our methods and formulae for calculating range hazards are the same as those used for He-Ne lasers.

Lasing in the field creates many safety problems not encountered in the laboratory such as:

1. Hazardous primary beam ranges and specular reflections change from just laboratory length to kilometer length.

2. We must be concerned with the safety of many non-alerted, unprotected personnel who could be positioned in these kilometer ranges.

3. Compared to laboratory use, field laser devices are subject to being placed on unsteady mountings.

4. The hazardous beam diameter changes from fractions of a centimeter to many meters.

5. Communication between the laser operator and target area personnel is usually required.

6. Most lasers designed for field use are of the low energy type; because of this and other factors, we must use caution, common sense and facts in translating safety to field safety. We must not unnecessarily over-restrict field user personnel yet we must insist that the laser be safely tested.

We resolve these safety problems as follows:

1. We must consider lasers as line-of-sight hazards and handle accordingly.

2. We must work very closely with local safety officers.

3. We must eliminate all lasing that is at, toward or near populated areas.

4. We attempt to use mountains or other backstops to terminate laser beams.

5. Most operations will have communications.

6. We must apply knowledge and common sense in the tactical field testing of lasers. We must make on the spot visits to non-routine type of field tests. We must be capable of making calculations as to the safe ranges and beam intensities at target areas from primary and reflected beams.

Let's consider a typical problem, which involves most of the above concepts. A .2j ruby Q switch laser range finder, possessing a one milliradian beam divergence is to be used in the following field problem.

In this problem, we are lasing at various survey points, known as targets 1, 2, and 3. First, we will evaluate lasing at Target No. 2; i.e., we will calculate the J/CM² at 5 and 8 Km.

At 5 Km. $\ldots E = \dfrac{1.27\ (0.2)}{[10^{-3}\ (5 \times 10^{5}\ \text{Cm})]^{2}} = 1. \times 10^{-6}\ \text{J/cm}^2$

At 8 Km. $\ldots E = \dfrac{1.27\ (0.2)}{[10^{-3}\ (8 \times 10^{5}\ \text{Cm})]^{2}} = 4 \times 10^{-7}\ \text{J/Cm}^2$

Because these levels exceed 10^{-7} J/cm² we will not direct our laser on Target 2. An abandoned truck at Target No. 3 poses the problem of specular reflections from rear view mirrors, rear window, and diffuse reflection from paint surfaces.

Specular reflection of truck mirror:

Distance to reduce to 10^{-7} J/cm²

$$10^{-7}\ \text{J/cm}^2 = \frac{1.27\ (0.2J)}{[(r)\ (0.001)]^2} = 16\ \text{Km}$$

Distance that this specularly reflected beam will extend (from mirror) until reduced to 10^{-7} J/Cm²: = 16 Km — .5 = 15.5 Km.

Specular reflection hazard from rear window of truck:

Decrease of energy due to passing through window:

$$.2\text{J} \times .08 = 1.6 \times 10^{-2}\ \text{J}$$

Distance required to reduce this energy to 10^{-7} J/Cm²

$$10^{-7}\ \text{J/Cm}^2 = \frac{1.27\ (1.6 \times 10^{-2}\ \text{J})}{[(r)\ (0.001)]^2} = 4.5\ \text{Km}$$

Distance that this specular reflected beam will extend from window =

$$4.5 - .5 = 4.0\ \text{Km}$$

Diffuse reflection hazard at truck:

J/Cm² at 500 meters = 1×10^{-4} J/Cm²

Note: This is less than 0.7 J/Cm² criterion for hazard; i.e., no diffuse reflection hazard exists. (Diffuse hazard for cw is 2.5 W/cm²).

Summary

1. Lasing in the field poses many problems, particularly when utilizing a laser of the type just described.

2. The formulas for calculating intensity levels for industrial cw lasers are the same as for the ruby lasers we have just described.

3. Safety officers must master the many formula manipulations involving ranges and reflections in order to properly evaluate and advise personnel on laser safety hazards.

PUBLIC EMPLOYEE SECTION

HOW TO DRIVE AND SURVIVE

By DONALD S. BUCK
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How should you drive to survive? Almost anyone can drive a car, but few drive safely —and few consistently avoid accidents. If we were certain that we drive safely, then why carry automobile insurance?

Vehicle registrations in this country in 1967 totaled one million vehicles. Of these, 24 million vehicles were wrecked seriously enough to require reporting to state authorities, usually because damages exceeded $100. At least 26 million additional vehicles were banged up to a lesser degree, hence were not deemed reportable except to insurance companies, body repair shops, and out-of-court settlements.

This means that a total of 50,000,000 vehicles were wrecked last year—half of those registered. If you haven't experienced an accident this year, take heart: you're statistically overdue. This year is not yet over!

In general, we know how those 50,000,000 vehicles were wrecked—the reasons for the upsets, the rear-end collisions, the side-swipes, the broad-sides, the run-off-the-roaders, and the roll overs. We do know that these 50 million vehicles were driven by men (and women) who felt worried, hurried, lucky, drowzy, tipsy, or some other emotion which made them unable to pilot the old buggy for 365 successive and accident-free days.

Maybe 50 million Frenchmen can't be wrong, but how about 50 million drivers who wrecked their cars last year?

How did 50,000,000 vehicles avoid accidents? Doubtless, they had their share of near-misses. Somehow, "luck" rode with them all year. Or was it luck?

According to the 1968 edition of *Accident Facts*, 53,100 persons died in traffic accidents, and 1,900,000 sustained disabling injuries. These figures are so large that they escape understanding. If we were to bury in a single grave those 53,100 persons who died in last year's traffic accidents, we would need a trench 80 miles long! This would equal the distance from Chicago to Rockford, Illinois, or to South Bend, Indiana.

And how shall we view the toll of 1,900,000 persons who were disabled? If we line them up in their hospital beds, head-to-toe, the unbroken line would stretch 3,068 miles from coast to coast!

While we're at it, let's get a better look at the 50 million vehicles wrecked last year. Allowing 20 feet per vehicle (many were telescoped into substantially shorter dimensions), last year's score of wrecked cars, trucks, and buses would make an unbroken line nearly 19,000 miles long! Imagine those wrecked cars, lined up bumper-to-bumper, spanning this continent six times — with enough wrecks left over to make a line 1,000 miles long.

Now, do you wonder why we have selected the title, "How to Drive and Survive"? To survive means to weather the worst. It means coming through unscathed, if possible. Fifty million failed to do it last year—but another 50 million succeeded.

There are practical ways to reduce the probability of accidents and to lessen their severity. An old-timer, who had survived for more than 80 years in rattlesnake infested area, was asked for the secret of his success. He explained that the secret of survival was quite simple: "Snakes live in the woods, so, if possible, I don't go into the woods. If I've gotta go into the woods, I try to go in winter time, when snakes hibernate. If that's not possible, I'll go on a cool day, when snakes are most likely out sunning themselves where they can be seen. But, if I must go into the woods on a warm day, I stay away from the areas which snakes like and, above all, I try to see the snake before he spots me. If this fails, I make sure the snake sees me long before I'm near enough to be bitten, and I listen for his [redacted]ing. I wear heavy clothing and boots, so it won't hurt me if the snake does bite me. If I do get bit, I'll make sure that it's only once

and lightly. I'll kill the snake so he won't bite again, then I'll get the very best medical treatment possible. And I'll likely stay out of the woods next time."

We find a parallel lesson in how to drive and survive in traffic. Accidents occur on streets and roads. If possible, don't drive where and when accidents most frequently occur. If you must chance it, try to spot the reckless driver before he is in a position to hit you. Make sure that you see him and that he sees you in time to avoid collision, and listen for his warning. Wear your safety belt just in case, but try not to get hit. If you are hit, avoid the head-on crash, to minimize the impact. And get the best possible treatment for yourself and your car. Next time, don't drive.

To decrease the probability of accident and to lessen the severity of damage or injury, there are six practical measures which any driver can apply. Some measures are taken before departure, some while driving, and some when the accident occurs.

1. *See.* First on the list is to make dead sure that you can and do see all hazards in time to avoid accident. You cannot see if your windows are frosted or fogged over. You cannot see if your headlights are dirty or mis-aimed. You cannot see well if your spectacles are not being worn. You cannot see well against glare from sunshine or headlights. You cannot see to drive and survive if you gaze into the eyes of another person when your hands are upon the wheel. Accident reports often contain the honest admission, "I just didn't see him until it was too late." What can we do to see better?

a. Fill that windshield washer tank with an anti-freeze solution which will help remove dust, dirt, grime, and frost from windshields.

b. Apply anti-fogging solution to inside surfaces of windows. One application will prevent fogging for approximately one week.

c. Defrosting solution in pressurized spray cans will dissolve Jack Frost's whitewash. A cloth or paper towel will wipe away the melt before it can refreeze, when solvents have evaporated.

d. The air conditioner, if one is available, will wring out moisture inside the vehicle and quickly clear fog from all windows.

e. Check defroster hoses to make sure they are in place. Many drivers who did not survive last year unsuccessfully attempted to "come in on instruments" when windows were frosted or fogged. Windshields which cannot be seen through do provide exciting and adventuresome travel by increasing the probability of meeting people—head-on!

f. A good windshield scraper is essential. When the frost is on the pumpkin, you'll find the scraper more effective than fingernails, curses, or prayer.

g. Equip the vehicle with better rear view mirrors, both inside and out. Extra mirrors will broaden the field of vision to the rear and eliminate blind spots (including those spots where traffic police like to lurk). I use those wide-angle, multi-sectioned rear view mirrors which provide a 180 degree rear field of vision. These let one see without having to constantly swivel his neck. Additionally, I value that rear view mirror installed outside the vehicle and adjustable from inside. We need to see what is coming —from every direction.

h. Use the sunshade as a sunshade—not as a bookcase or catch-all! Some of us dare not snap down our sunshade lest we will be buried by an avalanche of papers, maps, bills, receipts, cigars, and other items which we store behind the sunshade.

i. Wear prescription glasses. Many who will not survive will try to fly blind by failure to wear spectacles needed for vision correction. Drivers determined to survive use dark glasses to tone down glare from sunshine. Prescription-ground dark glasses help greatly. A side benefit is the possibility that dark glasses will make you look like a movie star in hiding.

j. Clean the windows. Exteriors smeared with assorted bugs, grime, and dirt are difficult to see through until service station attendants push back the dirt. But inside surfaces of windows suffer from neglect. They go long without being touched by human hands—except those which will smear from ice cream, candy, or smudge. Heavy smokers quickly impart a lovely patina to inside glass surfaces. This deposit obscures vision and probably constitutes a greater actual threat to life than does the use of tobacco. The recipe for clean windows is a paper towel or a cloth mixed with some water filched from the windshield washer, and rub until the job is done. Clean windows do forfeit some privacy—but they insure that one can see to drive and survive!

k. Remove (or cover) papers, maps, and other light colored materials which collect on the ledge beneath the windshield. White or light colored materials are mirrored in the windshield, and this seriously interferes with vision. Clear away this stuff or cover it with something dark, like a piece of black cloth.

2. *Be Seen.* The best way to survive the risk of driving is to do everything possible to make sure that the other guy can and will see you in time to prevent an accident situation. Drivers hit what they don't see. This is true day or night, snow or rain, backing up or going ahead. The more nearly your vehicle resembles a Christmas tree, the better are your chances of being seen. Survival depends on your being able to successfully attract the attention of other drivers, despite mini-skirts, bright lights, and traffic. There are several practical ways to assure that you are more readily seen.

a. A light colored vehicle is safest. Forest green vehicles are unseen sitting ducks in wooded areas. Black vehicles are regal bulls-eyes after dark. The light colored vehicle is hard to see in a blizzard, but in most other circumstances it will be easiest to see. The ideal color combination would be alternate stripes of reflective white and fluorescent blaze orange. This vibrant fluorescent color is foreign to nature—it jars the senses of the viewer. It is especially effective at dusk. There may be some reluctance to ride in a blazing orange rig, but it's better to be seen than dead. In general, the lighter the color, the more readily it will be seen.

b. Make maximum use of reflective materials, particularly on the rear of the vehicle. Reflective license plates are used in several states. These help to prevent rear end collisions. Auto supply stores sell inexpensive stick-on reflective tape and decals in red or white. These make your bumpers light up vividly from headlights of other vehicles. Reflective paints are also available in both spray and brush-on types. The rear end of my vehicle has been literally treated with reflective paint. It's comforting at night to know that to any vehicle approaching from any direction, my vehicle will be seen. It may not look esthetic, but it causes others to look and see. It is good to know that even if my tail lights were to fail, my vehicle will present a conspicuously red behind to other cars.

c. Clean the lights. Lights often are covered with dirt and grime. The more light the better, and that well-scrubbed look on lights will help you to live longer.

d. Use headlights during daytime. Studies show that motorists will more readily spot another vehicle if headlights are used in daylight. Accordingly, Greyhound buses burn headlights in daytime, and it is reported that as a result, the number of accidents have been reduced 12 per cent. Eyes instinctively seek light, so headlights provide an early alert to the other driver. If you want to be seen, turn on those lights. This puts no strain on the battery. Modern vehicles are equipped with electrical generator equipment which provides output adequate to the load.

e. Use emergency warning lights and flags. The most hazardous situation, particularly at dusk or night, is the vehicle stalled in traffic. Modern vehicles are equipped with a switch which will cause all four parking lights to intermittently flash a warning. These lights, although infrequently used, will provide an excellent intelligible warning to other traffic. If you stall on an expressway, some kind of white signal flag will usually bring help. I carry an emergency kit to assure maximum protection in case of a stall. In addition to conventional flags and fuses, there is a folding, reflectorized warning sign and a flag to fly from the radio aerial. "Send help" is printed on one side of this flag. If anyone runs into me, it won't be because I couldn't be seen.

f. Dim it, dammit! It is dangerous and provoking when the other guy fails to dim. Some drivers take satisfaction in giving 'em back the full treatment with high beams—all four of them! One who hopes to survive considers it inadvisable to deliberately blind the other driver. Sometimes the other guy can't do anything about his lights. An overloaded trunk or the weight on the trailer hitch will depress the rear springs and elevate the light beams. To use headlights to jam the vision of such a driver may prevent his seeing needed reference points (edge of road, lane markings). In his blind confusion, he may deport himself and his vehicle straight toward your lights, like the moth attracted to the flame. Quickly flick the dimmer switch to remind the oncoming driver to dim. Don't make the other guy guess to get past you.

3. *Keep Awake.* Numerous one-car crashes result when sleepy drivers smash into trees and bridges. They continue on straight courses when the roads suddenly turn. They fail to see stop signs and traffic lights. They slam into stalled vehicles in broadlight.

It does no good to admonish drivers not to get sleepy. Drowziness is not a condition of will or intent. Several things contribute to it. High on the list is heavy meals. Fatigue and lack of sleep invite the sandman. One of the commonest ways to induce drowziness is to indulge in that family of popular tranquilizers known as alcoholic beverages. Eyes exposed for an extended period to glaring lights or sunlight will tire rapidly and demand some shut eye. The comfort provided by soft cushions and the monotonous silence of modern motor vehicles are conducive to sleep. Bad air from exhaled breath, leaky exhausts, and tobacco smoke also contribute to drowziness.

There are several practical safeguards against sleepiness.

a. Catnaps. Instead of fighting sleep, give in to it. Pull off at a safe spot such as a service station, curl up, and rest those eyes. Sleep is surely the best treatment for sleepiness.

b. Stimulants. The coffee break is the driver's best friend. Mild stimulants such as coffee, tea, or coke help to offset drowziness, and the activity in stopping to procure them will quicken his pulse and perk him up. To survive, carry a thermos of hot coffee. Some rest stops on expressways may be 40 miles apart, and that thermos of coffee is handy when needed. "Pep" pills (i.e., amphetamines) to offset sleep are suspect. The tired, although wakeful, driver may experience unhappy side effects from the drug, such as seeing the "little men who are not really there." Doped horses are ruled off the track. Doped drivers should be ruled off the road.

c. Moderate cold. Cold water or air will quicken the breath, stimulate the pulse, and clear the mind. A cold shower has long been recognized as being a most effective means for jarring awake any drowzy person. While built-in showers are not yet an accessory commonly found on vehicles, there is a practical substitute. Dip the cloth into cold water (or wrap it around an ice cube) and apply it to the eyelids, the back of the neck, and the face. This effectively eliminates the dregs of drowziness. Open the windows and side vents to bring in cool air to help make you bright-eyed and wide-awake.

d. Exercise. Sleepiness can be offset by exercise vigorous enough to quicken both pulse and breath. The driver who dismounts to do a few deep knee bends may look dizzy but he won't be drowzy. Tone can be restored to mind and muscle by jogging briskly. Deep breathing helps offset sleep.

e. Let someone else drive. To dispel any desire towards sleep, surrender the wheel to someone else. If you have confidence that your relief driver is wide-eyed and competent you'll be able to rest your eyes and catnap. If you lack that confidence, you'll lose every vestige of drowziness. Sleep may come easily to a person with a clear conscience—but it comes readily and permanently to a drowzy driver.

4. *Avoid Hurry.* Speed, of itself, does not cause the accident, but speed determines how severe it will be. Relative speeds play an important role in determining our chances of surviving a crash. The faster we go, the harder we hit.

What speed is most conducive to accident involvement? 90? 60? 40? No. It is zero! —a vehicle standing dead still on a fast road at night is most likely to become involved in an accident. A negative speed may be even more dangerous. For the distance traveled, backing probably is our most dangerous maneuver. This is especially true of attempts to back up on an expressway because a turn off is missed. Our chance for surviving is good if we go on to the next exit instead of trying to back up. It takes only a few extra minutes of driving to prolong life. Any speed which is substantially faster or slower than other traffic threatens our survival. The safest speed lets you keep up with the crowd. It minimizes the requirement to pass and be passed. Sudden changes in speed or direction, such as the quick slowdown, the belated turn, or stomping it, are hazardous.

It's not so important how fast you drive. It is quite important how you drive fast.

Higher speeds (60 and faster) introduce several considerations which are important to survival.

a. Fast moving vehicles can't turn or swerve sharply. Many drivers do not realize

that the turning ability of the vehicle falls off as speeds go up (varies with the square of the difference in speed). You may safely chop the steering wheel at 20, but the same maneuver at 40 could flip you over. Squalling tires on turns tell their own story of speed by announcing when tires have just about lost their grip. When tires squeal on you, ease up—or else.

b. Speed prevents quick stops. The least understood law of nature is: When speed is doubled, the skidding distance increases four times (varies as the square of the difference in speed). Tailgaters have little choice other than to hit the vehicle ahead when it stops suddenly. Drivers correctly insist that "brakes failed to hold." A stop in only 20 feet at 20 miles per hour is exceptional. It calls for good tires and dry road surfaces. Double the speed (40 mph) and the skid marks will be at least 80 feet long. At 80 mph (if you remain right side up) your vehicle will use at least 320 feet to skid to a minimum stop. Try an emergency stop at 20 mph, then measure the skid marks. Then, try it at 40 mph, being ready to get off that brake pedal the instant your vehicle starts to veer or crab. (Don't try it at higher speeds—just take our word for it). If you survive this test, you'll understand why any extra distance between you and the vehicle ahead is real accident insurance.

c. Safest speed is a variable. The best speed depends on the pace of other traffic, the weather, the lighting, the legal speed limits, the condition of your vehicle (tires and brakes), the load on your vehicle, and your personal condition (sober—wakeful—unhurried—alert).

To ascertain the correctness of your speed, look at your passengers. You are probably going too fast when they instinctively apply imaginary brakes, or when they brace against the dash in anticipation of a possible crash, or when they hint that the police are tough on speeders in this area. You are speeding when tires or brakes "sqund off." Probably, you are speeding if you constantly watch for police. Like fast women, fast cars simply don't get that way without someone's help.

5. *Avoid Collision.* Despite these safeguards, the time will soon come when you will face a crash situation. What you do when the chips are down will determine whether yours will be a hit or a near miss.

a. Leave yourself an out. Like the aircraft pilot, you should constantly select emergency "landing sites" where you'll go —if and when the chips are down. This target area should always be the least of all the evils confronting you.

b. Expect the worst from other drivers. Studies show that drivers who avoid collision expect the worst from others. They may drive fast, but they drive scared. They expect others to turn without signal, have a tire failure, stop without warning, sneeze, or veer into the wrong lane. They anticipate that the other driver can be lost, or drunk, or sleepy, or in love, or worried, or drugged. Surely, it is safer to be wrong in this respect than to be dead.

c. Expect the worst from vehicle and road. On the average, one out of each four tires will fail before it wears out. About half of all drivers experience brake failure. Are you statistically overdue? In cold weather, expect shady areas and bridges to be iced over. Expect pedestrians and cyclists to be on the wrong side of the road. One third of all drivers have experienced headlight failure. Diamond-shaped signs warn of hazards ahead, so slow down whenever you see the "cockeyed" square sign. Expect rain, snow, sleet, and ice. Be prepared for the worst. A small box of sand helps to conquer icy grades and prevent your becoming target zero. To expect the worst is to prepare for it.

d. Choose safe options. Each driver constantly chooses his course of action from numerous options, some of which are more hazardous than others. Wise drivers seek the safest option. They choose expressways where possible to avoid the higher risk of two lane roads, even though this requires traveling a greater distance and paying tolls. They travel by day instead of night (when accidents tend to be more severe). They are first to dim lights; they help others to pass; they don't tail-gate. They clean windows before wishing they had done so. They tap horns instead of riding the horn button. They choose to steer instead of skid. They don't contest the right-of-way. They know that the other driver may be hurrying someone to the hospital. They don't get "mad" at others—particularly when they hold a dangerous weapon called a steering wheel.

They drink coffee instead of cocktails before driving. If romantically inclined, they don't drive, they park and "spark." They slow down before they have to. They don't make other drivers guess where they're going.

6. *Crash Survival.* Despite your best laid plans, there's likely an accident ahead in your future. It's a 50-50 chance that it will be this year. If not, it likely will be next year. If we're headed for a crash, what can we do to survive?

a. Minimize impact. Our first line of defense is the fact that, as drivers, we have control over speed and direction of our vehicles. We can lessen the impact by using more moderate speeds when the probability of collision appears. We can minimize the smashup by not befuddling our early warning radar sensors (our eyes and judgement) with drugs or drink. The sooner we can spot and identify the hazard, the quicker we can slow down—and the softer will be the shock. Gentle impacts are products of moderate speeds.

The lethal impact is particularly prevalent in the head-on crash, and collisions where the vehicle is hit at right angles from the side. To survive, avoid head-ons and intersection-type crashes. Take to the brush to avoid the head-on crash. Plough into the dirt bank instead of a stone wall or a big truck. The ditch may be rough for travel, but it will be gentle compared to being hit by an oncoming vehicle.

b. Avoid the side swipe. The side swipe accident, particularly one which involves an oncoming vehicle, usually carries away the steering linkage and puts the primary impact point right where you sit. It's better to leave the road because you may regain control. At least you can pick a more yielding target than is offered by the side swipe.

c. Use seat belts. If you knew where and when your next accident will be, you'd need only to fasten seat belts slightly in advance. If you are not certain just where and when that next accident will be, then fasten belts everytime, to be ready. Those who fail to survive will be unbelted, and they will be slammed around in a tumbling vehicle until the doors fly open. Part or all of the victim will be ejected beneath the rolling wreck. The wild gyrations of a tumbling vehicle will unseat the unbelted driver, and deprive him of any chance to retain or regain control. The belted driver is held in place, away from wheel and panel. As the vehicle crushes and decelerates, the belt slows him down with it, exposing him to lesser impact forces and increasing his chances for survival. Shoulder harness adds greatly to survival by lessening the impact forces to which the head and face are subjected. Use of seat belts has reduced injuries to chest areas, but head injuries continue at about the same rate. The shoulder harness should be worn to restrain and protect the head.

d. Employ crash de-energizing equipment. Not long ago, I saw a demonstration of energy-absorbing water-filled pneumatic bumpers. These simple but effective devices greatly reduce impact forces which are characteristic of those vexing bumper benders. Apparently, they largely offset impact effects of 20 to 25 miles per hour. Other devices on the market which lessen impact or increase survival chances include energy-absorbing steering wheel assembly, the padded dash, the frangible rear mirror, the recessed instruments on the panel, the safety lock doors, the safety glass windows, the jettisonable windshield, the X or box frame, and the hard top on the vehicle.

It's not a very promising future, is it? But, since you've made it to this point, try for another mile, then still another. Miracles are not expected of you—merely become an expert driver. Expert drivers do not consider themselves expert—they just try harder. Thus, they survive!

In summary, we have reviewed the problem of how to drive and survive. We learned that each year, 50 million vehicles are wrecked while another 50 million survive. It is within your power to do more than all other forces combined to assure that you drive and survive. Above all, make sure that you: see well; are seen; keep awake; need not hurry; avoid collision; and survive the crash.

It is not particularly easy, but it is perfectly possible to drive—and survive.

MICHIGAN'S SAFETY RENAISSANCE

By ROBERT A. BEAUMONT
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Boiler Safety

Before 1965, Michigan had a 48-year old law dating back to 1917 and covering only steam boilers. It didn't cover hot water heating boilers, and it didn't cover nuclear reactors (of which we have several now in Michigan). We had a 10-member advisory board which very seldom gave advice, and the advice that was given was very seldom accepted. We had one chief, one inspector, and one secretary; that was our total boiler staff and they accomplished approximately 1,200 inspections a year.

In 1965, we got a brand new Boiler Safety Act which repealed the old act and created an 11-member statutory Board of Boiler Rules with the power to promulgate up to date standards and codes. The staff was expanded to some 35 people (remember, we had only three). We have one executive consultant, one chief, four field supervisors, [illegible] supervisors, 15 field inspectors, and [illegible]taries. Inspections have jumped to [illegible] per year, and we also make 9,600 canvassing calls for the purpose of discovering boilers that no one knew existed before.

The Board of Boiler Rules has accomplished the re-writing of all of the boiler standards and codes. There are 50,000 known boilers in the State of Michigan. We cover steam boilers, forced circulation hot water heating boilers, and nuclear reactors. We are the first state in the Union under this act to license boiler installers. There are some 1,653 known boiler installers in Michigan, and all must be registered. They all must come up to certain minimum standards in order to be registered to do business in the State of Michigan. We also license boiler repairmen—we are the second state in the Union to do this. There are about 105 boiler repairmen in Michigan and they, too, must come up to minimum standards before they are allowed to pursue their trade in Michigan. The new act provided for a fee system which makes this whole activity virtually self-sustaining. Many states have copied this Michigan law, especially with regard to the licensing of installers which is, as I have stated, a brand new feature of boiler safety.

Elevator Safety

For elevator safety, we had a 30-year old law, enacted in 1937 and amended in minor fashion three times. We had a ten-member advisory board which, again, provided very little advice, and what they did provide was probably 100 per cent ignored. We had one chief, one inspector, and one secretary for the whole state, and accomplished approximately 1,000 inspections per year.

In 1967, a brand new Elevator Safety Act was enacted which repealed all previous laws and amendments. It created a 10-member, statutory Elevator Safety Board with the power to promulgate safety codes and standards. The staff was increased from three people to 19, including one chief, one assistant chief, ten inspectors, and seven secretaries. All elevators in the state are now inspected by state inspectors; approximately 8,500 a year. We now have a statutory board with the power to promulgate good, up-to-date safety codes. There are no more exempt elevators in Michigan. We did have a group of freight elevators that were exempt from inspection under the old law, and they were some of the raunchiest pieces of equipment in the state. This is no longer true, and all elevators must now measure up to all provisions of the code. The Board adopted the United States of America Standards Institute Code (A17.1, 1965), with certain amendments promulgated by the Elevator Safety Board. Again, we have a fee structure in this law which makes this whole effort a self-sustaining one. Belt man lifts for construction operations are considered unacceptably hazardous and are now banned in Michigan.

Ski Safety

Skiing is big business in Michigan. There were 82 ski areas in Michigan in 1962, and more were being added every year. We had no legislation, no board, no personnel, no investigations; we did have, however,

several serious accidents involving bodily injury to women and children. These were accidents attributed to equipment (ski lift) failures, not those incurred while skiing down the slopes. But the ones of primary concern were the accidents attributable to improper and faulty equipment, lack of safety devices, etc. This triggered considerable emotional reaction which led to the passage, in 1962, of the Ski Area Safety Act, creating a seven-member, statutory Ski Area Safety Board with the power to promulgate codes and standards. They adopted United States of America Standards Institute safety code for aerial passenger tramways, with certain few exceptions and a few recent amendments. At present we have one chief and four inspectors to implement the provisions of this code throughout the state. These are trained, technical men in the classified civil service. They accomplish the total annual inspection of all 439 ski lifts in the 111 ski areas. In a typical year they will write 144 safety orders covering about 329 violations. Permits are issued for each individual ski lift. Accidents: zero personal injury since 1962. We're very proud of that record!

Carnival Safety

Carnivals, too, are big business in Michigan. Forty-three touring carnival companies enter Michigan each year, and we have 20 fixed amusement parks located in the state. We had no law, no safety standards or codes, no personnel, and no inspections. Again, though, we had accidents; yes, we had those! In 1965, two fatalities occurred to children in the Detroit area due to mechanical failure of carnival amusement rides; there was also a lack of safety devices on this equipment.

These tragic losses again sparked a large emotional reaction which led to the passage of the Carnival Amusement Act of 1966. This bill went through the legislature in near record speed and with virtually no opposition. It created a seven-member, statutory Carnival Amusement Safety Board. The board proceeded immediately to promulgate some 100 safety rules tailor-made to the Michigan operations. They have done a wonderful job. The division has one chief and three inspectors; they perform 100 per cent inspection of all 552 amusement rides and devices that come into Michigan in the 43 touring companies and 20 fixed amusement parks. Some 116 safety orders were issued last year, and 1,076 recommendations for improvements. They perform non-destructive testing on all equipment that is operated in the state. Permits are issued for each carnival amusement company allowed to operate in Michigan. Individual rides are inspected, and a fee is charged for this inspection. Engineering analyses of plans and specifications for new rides are also checked out and necessary changes recommended. Testing is done on each component part and load bearing member before that ride is assembled. This has proved to be very effective. The evidence of this effectiveness lies in the fact that we have had no bodily injury to carnival patrons in Michigan since 1966 when this law went into effect.

Mine Safety

A 19th century law, passed in the late 1800's, covered iron and copper mines only. The law was administered in each of the 83 individual counties in Michigan, with politically appointed inspectors. There was no uniform approach to enforcement, and the inspectors had an uncertain training and background. There was no board, and very few inspections were made. We finally awoke to the fact that there was a prospect for Federal legislation of the mining industry under the Federal Metal and Non-Metallic Safety Act; this triggered the demand on the part of mining interests in Michigan for passage of Michigan's own Mine Safety Act. We don't like big brother to run the show in Michigan anymore than other states do. The trick is to get your own act in there first, and promulgate standards that are at least as stringent or more stringent than the Federal provisions would be. Then, you are allowed to run your own show.

The Mine Safety Act in Michigan was passed in 1967. Again, it created a five member, statutory Mine Safety Board. The Act covers all forms of metals, plus all preparations for marketing and development of mineral properties. That's pretty extensive coverage and includes metallic and non-metallic minerals, gravel pits, quarries, peat bogs, and salt mines. An advisory committee was appointed from the mining industry to compile suggested rules for presentation to the board. The board worked through the advisory committee, comprised of safety experts of the mining industry to be regulated

by the standards. We have one chief and five inspectors in this area—they are trained specialists in the classified civil service. Their goal is the total inspection of all 385 mines in Michigan.

Significant features of this act are the coverage of both metallic and non-metallic metals and the provision of uniform codes and standards. Abandoned mine shafts are all being safeguarded now. We have had no serious bodily injury accidents since the passage of this act.

Construction Safety

Before 1963, we had no specific construction safety legislation, no board, no personnel, virtually no inspections. We had, though, a very high accident frequency and severity rate in Michigan, and it was increasing every year. There was also the likelihood of some Federal legislation. All these factors combined to push for the Construction Safety Act, which was passed in 1963. This is occupational safety type legislation, primarily for the protection of employees. It created a five-member, statutory Construction Safety Commission with the power to promulgate up to date safety standards and codes. The Board promulgated an entire code selected from various passages from standards of the United States of America Standards Institute, the Association of General Contractors, and the U.S. Corps of Engineers, but specifically tailored to the construction operations in the State of Michigan. There are 24 people on the staff: one chief, an assistant chief, one supervisor, 15 inspectors, and six secretaries. These people perform both inspections and consultative work in the construction industry. They service 12,000 contractors in the state. One unusual feature of the law is that there are no penalties for failure to comply. They write no correction orders. They try to convince the contractors —and I think that they have been very successful in this—that the big penalty is the accident itself, with the economic loss and other losses attendant to the accident.

Receipts taken from contractors in registration fees amount to about $300,000, and our annual operating budget is $289,000. So, you can see we are self-sustaining.

The primary concern is the elimination of unsafe conditions. How successful have they been? The 1964 accident frequency rate was 19.6; the 1968 accident frequency rate is down to 14.3. They have left some room for improvement, but they have stopped that upward climb we were experiencing every year. The estimated insurance premium saving is almost $6 million dollars to contractors. 1964 workmen's compensation insurance rate was $4.67 per $100 of payroll; this is now down to $4.10 per $100 of payroll. Inspections are performed on the basis of job activity. Where it is discovered that construction is under way or about to be started, the inspectors make plans to visit these sites, make the inspection, and assess the nature and degree of job-site safety problems.

Occupational Safety

Prior to 1967, we were laboring along with a 58-year law that dated back to 1909. The antiquated language in this law was something to read. The coverage was almost totally inapplicable to present-day needs and requirements. We had no board at all. We had one chief and 16 inspectors to cover the entire state. The law required an annual inspection of all employers, of which we have some 135,000 in the state. Approximately four per cent of these employers were covered annually by this small staff. Attempts to apply this vague, antiquated law to jet-age needs and requirements of today's employers was a very frustrating thing for both the Department of Labor personnel and the employers. Whenever it came to a court test of this law, we were sure to lose. Fortunately, we didn't have too many of those.

In 1967, we did get an Occupational Safety Standards Act which repealed this old act and created a nine-member, statutory Occupational Safety Standards Commission with the power to promulgate up to date safety standards and codes. Also created in this act was a Board of Safety Compliance and Appeals. This is a five-member statutory board created to hear complaints from employers who feel they have been aggrieved by a safety order written by a state inspector. The employer would feel that strict compliance with the code would be prejudicial to his operation and that he could possibly comply with the code in a slightly different fashion and still be in compliance with the spirit of the code. Prior to this, the only alternative the employer had was to go to court. This is both costly and time con-

suming. He now has this other avenue which, I would imagine, would solve the problem in 99 per cent of the cases. Of course, the employer can always go to court if he still doesn't feel the board has done him justice. So far, we have had no complaints to the Board, but that mechanism is there in the event the need should arise.

Staff personnel were increased from 17 to 50—one chief, an assistant chief, four area supervisors, eight senior inspectors, 31 field inspectors, and five secretaries. They accomplish approximately 39,200 inspections a year. The Board has just promulgated a code on abrasive safety wheels. This was adopted from the United States of America Standards Institute almost in toto. The Board has also promulgated a code covering hours for women. There are 16 more codes in the process of promulgation, and ultimately we will have some 45 occupational safety codes in Michigan. These codes are all up to date and pertinent to today's needs and requirements. Employers and inspector personnel are equally aware of the terms and provisions of these new standards. Employers have an additional avenue of appeal short of court action in the Board of Safety Compliance and Appeals. Safety standards are compiled by advisory committees representing the industry that will be governed by the standard. For example, any code promulgated for the petroleum industry would be put together by safety experts from the petroleum industry and then submitted to the Commission for their approval and placement into the promulgation pipe line.

Summary of Seven Safety Laws

We have enacted, then, four brand-new safety laws and three complete revisions of old laws. We have had seven statutory boards created, with the power to promulgate safety standards—safety standards that are current, up to date, and in step with our rapidly advancing technology. We are freed from the stagnation of past years where we had only safety *laws*—laws that only grew older and more inapplicable; laws that were seldom amended or revised. The legislative process is a slow process, and it has been extremely slow when it comes to safety. But, we have solved that problem in Michigan. These seven statutory boards can keep us up to date with good safety codes and standards. Where we had only 21 persons, we now have 136 people to implement these standards and codes throughout the state and to more adequately protect the public and the employee—about a 650 per cent increase. These are well-trained people. They are well-trained by way of (1) in-service training that has been adopted as a standard training procedure in the Department of Labor; (2) through attendance at National Safety Council courses; and (3) special courses. For example, a man was recently sent to a school on nuclear reactors to learn something more about the nuclear reactors that are being built and are already in service in Michigan. And, of course, with the increase in personnel, we do have more and better safety coverage throughout the state. But, most importantly, we have succeeded in lowering accident rates in all areas covered by these laws. We are looking for an even better experience with the passage of time—as more codes and standards are promulgated and we gain more experience in these areas.

Occupational Safety Standards Act

In a provision described as "unique" by the National Safety Council, a Safety Education and Training Division was created by the Occupational Safety Standards Act. The act further cited the "consultative, professional safety approach" as the best way to solve occupational problems in Michigan:

> The following is declared to be the public policy of the State: Occupational accidents produce economic and social loss, impair productivity and retard the advancement of standards of living. Both humane and economic considerations recommend the establishment and implementation of effective injury control measures. A unified continuing, professional effort is required. A dynamic program of safety education and training is the best known solution to control of occupational accidents.

The Act describes some of the principle functions of the Safety Education and Training Division; I say "some" because, while the law mentions specific things that we must do, the door is left open for us to get into any other aspect of safety that may prove to be effective in Michigan.

Development of a statewide safety education and training program to acquaint

employers, supervisors, employees and union leaders with the most modern and effective techniques of accident investigation and prevention.

Development and promotion of the consultative educational approach as a desirable, effective, long-range solution to occupational safety problems.

Definition and establishment of necessary research projects.

Development of specific occupational safety programs for employer groups and individual employers.

Development of training programs for state safety inspectors in the Department.

Provision of occupational safety pamphlets, booklets, brochures, and other appropriate safety media.

We are not limited to these missions. We can get into anything that would prove to be helpful to employers in occupational safety:

To assure the availability of accurate, timely statistical data concerning occupational safety, all employers having one or more employees simultaneously employed shall submit annual reports of all disabling work injuries as defined and in accordance with the "standard method of recording and measuring work injury experience" (Z16.1 latest edition) of the United States of America Standards Institute.

These statistics enable us to go where the real safety problems are, and allow us to measure effectiveness of our overall effort.

This whole safety education and training activity is financed by a levy of ¾ of one per cent on employers—with those employers having the worst accident experience paying a proportionately greater amount of money into this fund than those that have the smallest number of accidents. With no accidents, no workmen's compensation losses, ¾ of nothing is nothing! So, the levy is fair.

Our efforts to-date include: management safety seminars throughout the state. This is an effort to get management into a seminar situation and alert them to the economics of accident losses. We have held Supervisors Safety Workshops, where we get key supervisory personnel in, train them in accident investigation and, also, emphasize their supervisory skills and responsibilities. We have a Safety Director Program on-going. Here we go into the individual plants with our consultative safety efforts for individual employers, to determine their specific needs and requirements, develop a safety program to satisfy these needs and requirements, and then assist them to get their safety program going. We have a Safety Council Program where we foster and encourage safety council activity throughout Michigan. Every employer can benefit from the services of a safety council, and we would like to see all employers in the state have a safety council to which they could belong and go to for those services that are provided by a safety council.

We also have under development a supervisors safety seminar. This will be similar to our management safety seminar except that it will be slanted for supervisory personnel. A union management seminar will acquaint union executives with safety responsibilities and various aspects of safety. As we develop our staff, and as the money is appropriated to us in the proper amounts, all these activities will be expanded.

Conclusions

Why this recent proliferation of safety legislation? After all, many attempts were made in the years past to pass appropriate safety legislation in Michigan. It has been a frustrating, long, hard road. These efforts were all unsuccessful until the past six year period. I think there are some reasons for this, and I would like to share them with you.

First of all, there was a willingness recently on the part of all interested factions to cooperate and resolve their different viewpoints. I can name as an example the Boiler Safety Act. In the boiler spectrum there are architects, labor, the American Society of Mechanical Engineers, and management groups. They would all write their own legislation, introduce these bills into the legislature, and then fight like fury to get their bills passed while, at the same time, attempting to knock down all the bills introduced by other factions! Great credit is due the Michigan Department of Labor personnel in getting all these warring factions together in one room and assisting them in

hammering out a piece of legislation that all factions could agree on. In fact, our chief boiler inspector said these factions got to where they referred to this legislation as "our bill!" Of course, when it finally was introduced into the legislature there was no serious opposition to the bill. It went through very quickly and Michigan, for the first time in many years, had a good Boiler Safety Act. This was a pattern that was repeated in some of the other acts passed in Michigan.

Another reason was accidents themselves —serious ones, involving women and children and all the emotional reaction that emanates from this sort of thing. This strikes down opposition, and a bill will just swish through a legislature with almost no dissenting votes. It is a regrettable and melancholy fact that safety standards are usually written in the book of the injured and dead and this, unfortunately, was the case in Michigan with respect to our Ski Act, Carnival Act, and Construction Act.

Another reason is Federal safety legislation, or the prospect of Federal safety legislation. This really spurs a desire on the part of a state to enact their own safety legislation first, promulgate their own safety standards and codes which are at least as stringent or more stringent than the Federal provisions are likely to be—and this was true in the case of our Mine Safety Act.

But, probably the most important of all, the "tide is in" for safety. More and more, safety is being considered a human right, along with life, liberty, and the pursuit of happiness. Who says so? Well, the courts say so. Many people are paying thousands of dollars for damages because of unsafe appliances, automobiles, etc. The legislators say so. They are passing safety legislation. The insurance industry says so. They are writing policies to protect against liability in that area. Manufacturers have accepted this premise.

This favorable climate may not last indefinitely. The Romans thought Rome would go on forever. The Nazis thought the Third Reich would last for a thousand years, but it didn't. And we can't be sure how long the current safety-mindedness climate will prevail. So, I would say "let's get on the band wagon" and, to use another cliche, "strike while the iron's hot!" We owe it to our children and unborn generations yet to come. Safety legislation, once on the books does tend to remain there—and if it is good, sound safety legislation, we will have done more for the health and safety of our children and future generations than any other group of people since the beginning of time!

SAFETY MANAGEMENT IN PUBLIC WELFARE INSTITUTIONS

By HAROLD M. GORDON
Chief, Safety Management, D. C. Government
and
PETER EVANS
Mgr., Dept. of Public Welfare, District of Columbia

A prime objective in implementing the new management approach to safety is to spread the responsibility for safety in the organization to as many functions as possible. An effective method of involving functional staff managers is to provide them with analysis feed-back of accident information broken down into causation factors which relate to their particular area of responsibility.

Most safety managers already have in use a built in system for obtaining this needed data for feed-back reports—the Supervisor's Report of Accident. If properly designed and utilized, it furnishes a wealth of data that can be consolidated into management improvement information. This type of feed-back information is of prime interest to functional managers, because each wants to improve his program area.

For example, let's study the various elements and components of the management system such as training, procurement, personnel, and budget. By our definition, an accident is an indication of an error, failure, or breakdown somewhere in the management system. The goal of a safety manager is to identify failures in the management system and feed this data back to those managers in the functional areas which allowed them to occur.

Too often, the first line supervisor has been the scapegoat for most accidents. However, under this new management approach it is demonstrated that most factors which cause accidents are beyond the first line supervisor's control. Think about it—does a first line supervisor control training requirements? Is he responsible for the quality and safety features in tools and equipment? Does he control and set up the physical standards used for hiring employees? The obvious answer is, "No."

It is the safety manager's job to understand the organization and stimulate all functional managers to correct the weaknesses in their respective areas of responsibility.

(There followed a presentation of accident cases for group discussion of causation and corrective action, followed by an application of the latest techniques of accident prevention.—Ed.).

FACETS OF POLICE SAFETY

By FRANKLIN M. KREML
Vice Pres., Planning Development, Northwestern University, Evanston, Ill.

From the mental exasperation of recruitment to the physical dangers and public understanding of riots, a policeman's lot is less a happy one than in the days of Gilbert and Sullivan.

External problems are nothing new to a police department, but internal problems are something else again. Generally speaking, the policeman is so busy protecting the public that he has little time to think about safeguarding himself. Police administrators are giving inadequate attention to health preservation and accident prevention, for instance. Today, there is much argument as to wether policemen should be given bullet-proof vests, but little concern as to whether the men should be given flu shots. As a result, many departments have accident and absence rates that are unacceptably high. This exacts a heavy price. Manpower is by far the most expensive departmental resource.

The proper use and conservation of a department's manpower can only result from planned effort. As an essential of good judgment, effective administration as evidenced in many segments of business and government is required. It is no longer a question of whether such programs can be afforded, but whether we can afford not to have them. The loss in time and trained manpower through accident, injury, and sickness has reached a new record.

Actually, far too little is known within the departments about safety measures and accident prevention. Statistics are virtually non-existent, except for those covering fleet operation which, of course, is but one facet of police activity. Police leadership must keep up with the times as well as the techniques. I would like to compliment our Chicago Department for the work done under the direction of Sergeant Walter T. Hayes, Safety Officer. This is the correct and realistic approach to the situation.

Major Adam Klimkowski, Director of Training for the Miami Department, was one of the more popular speakers at last year's Safety Congress. You may remember this quote from Klimkowski: "In reality, safety is *not* a unique problem, and it should be approached in the same manner as all the other responsibilities of management."

I thoroughly agree. I urge that departments develop a new administrative approach, one which is equipped with an Internal Accident Review Board. This Board should have authority equal to that accorded the Firearms Review Board.

Safety programs for police departments are a "*must*" *today*. No officer should be exposed to injury through the neglect of his superiors, through failure to supply adequate clothing and gear, failure in mounting realistic and effective training, or failure to back with proper staff help and command leadership.

HOW POLICE AGENCIES MAY BENEFIT FROM NSC MEMBERSHIP

By RAYMOND LASCOE
Staff Representative, Public Employee Section, National Safety Council, Chicago, Ill.

For the last 55 years industry has organized for safety rather effectively. There are no trade secrets in industry in matters pertaining to safety.

As an example, the Industrial Conference is the watch dog for industrial safety throughout the nation. This consists of a group of over 150 safety engineers and management specialists, representing all the major industries in the United States, who meet twice a year to study ways and means of reducing accidents. This committee has shown a great deal of concern recently over a 15 per cent rise in the industrial frequency rate; namely, from 6.00 to 6.91. Compare this record with police frequency rate of 39.0, which is the situation as obtained from a 1967 national survey. Who in the nation shows concern about this high frequency rate? What national agency reacts to this high frequency rate among police officers? Apparently, many accept this high frequency rate as a condition of employment and do not show much concern. This is an unfortunate attitude.

The Public Employee Section was organized in 1947 as a component of the Industrial Department of the National Safety Council, 34 years after the Council was formed.

Purpose of Police Division

In 1966, the Executive Committee authorized the formation of new divisions as contemplated in the bylaws of the Public Employee Section. These new divisions are as follows:

a. Police Division—activated in 1967.
b. Fire Division—activated in 1967.
c. Sanitation Division—to be activated in 1968.
d. Parks and Recreation Division—to be activated in the future.

Although the need for a Police Division has existed for many years, it was extremely difficult to find appropriate leaders. Walter Hayes, Chicago Police Department, was persuaded to form the Police Division and John R. Travell, New York City, was persuaded to form the Fire Division.

It was soon recognized that a need existed for an appraisal of the safety efforts of police and firemen on a national basis. This, then gave the new divisions purpose:

1. To provide knowledge, resources, and to exchange safety experiences.

2. To develop standards acceptable to police and fire officials.

3. To provide a source of statistical data which will be available to researchers and police officials.

4. To accept the Z16.1 as a work injury measurement standard.

5. To provide uniformity in record keeping. For example, according to the Z16.1 standard, if a police officer is killed entering a home in the performance of his duty, there is a time change of 6,000 man-days, since his duty is in connection with his work. However, it is known that many cities do not take such a time change. Consequently, the results show a discrepancy among police departments submitting their statistical report to the Council. The Z16.1 Standard therefore should be applicable to all.

A Safety Program for Police

An urgent need exists for a safety program for police. Industry has learned over the years that through an organized safety

program it is possible to use and apply modern techniques in accident prevention. Through the years, industry has been able to reduce their accident frequency rate to the present rate of 6.91. The Public Employee Section made a startling discovery in 1967 when the results of a safety program survey were tabulated: 540 safety programs were submitted by municipalities; however, not one came from a police department! It was learned that small cities have virtually no safety programs in police departments; however, many police officers have expressed a desire to start a safety program. Can we infer from this that police have no need for safety? Does this mean that no one cares? No, not at all. It means that police departments are behind the times in their approach towards safety. Yet, it is never too late to start; we therefore recommend that safety programs be the first order of business for the newly created Police Division.

Municipalities have also learned that a positive safety program is the best opportunity for improvement of the accident record among public employees. The same principal may be applied to police departments. The Council, therefore, recommends that Police Departments initiate safety programs for their departments. The Council has considerable material to help police departments in this effort. A data sheet provides sample copies of policy statements. The Public Employee Section has a pamphlet, *A Program Guide For Public Employee Safety.* Additional guidelines for the information of safety programs may be obtained by writing to the Public Employee Section.

Basic to any accident prevention program is the establishment of statistical data which will pinpoint problem areas of police departments, so that remedial action may be taken. From the statistical data accident analysis may be made in order to determine where the problem exists. Paramount to any safety program is a training program which will include the proper use of firearms, motorcycle driving, defensive driving, and traffic safety.

Do police have a safety problem? National statistics for police departments of 17 cities which have submitted data show a frequency of 39.0 which, by any standard, is very high.

How can police departments benefit from NSC affiliation? The NSC suggests the following benefits which may be derived by police departments by their association with the Council:

1. A centralized, uniformly applied method of record-keeping in accordance with the United States of America Standards Institute (Z16.1-1967), to be maintained by members.

2. These statistics will then be made available to all member police departments through National Safety Council publications such as *Accident Facts* and the work injury rates. The submission of data for member police departments is a necessity in order that the Council be in a position to furnish such data to others who request information. Requests for information are considerable. The identity of the department furnishing data is never divulged.

3. Motor Transportation Service. Can furnish literature for drivers. This section sponsors fleet safety contests among police departments. Safe Driver Awards are also sponsored by this section. Examples of training films available are: "Preventable or Not," "For Experts Only," and "Expert Seeing Series."

4. Listed below are agencies which participate in the Defensive Driving Courses:

Public Employee Agencies	*Number*
State Governments	18
Department of Highways (State)	14
*State police	12
County governments	7
*County police	4
City government	22
*City police	6

5. Police officers would receive considerable benefit from attending the NSC Safety Training Institute, which specializes in teaching fundamentals of safety. Although the school is geared primarily for industry, police officers would also derive considerable benefit.

6. Posters primarily suitable for police are currently available only in the normal traffic area. Many poster designs are thus immediately ready for use. As membership increases in the police division, other and more specific types of posters will be considered from suggestions submitted to the Council by member police departments.

7. The Traffic Department can provide assistance to police departments in develop-

ing off-the-job programs. Program aids, such as leaflets dealing with specific traffic safety problems, are available. Although these now are slanted toward the normal traffic area, such aids could be specifically directed toward police for use in off-the-job safety programs.

Through the facilities of the Traffic Department, police departments could be kept informed of the latest developments in safety equipment for vehicles and motorcycles and protective equipment for the driver. In addition, the police departments would be kept informed of the latest research results in driving hazards.

8. Several cities have good safety programs; for example, the City of Dallas. A subcommittee of the police department could study this program and develop a model safety program to be utilized by other police departments.

9. Membership in the Council provides for consultation service. Whatever police problem one may have, it is possible to transmit this problem to the Council and through various staff members and the Library it is likely that the particular problem will get a speedy answer.

10. The need for literature in the field of police activity is great, yet such literature is virtually nonexistent. Subcommittees should develop the type of literature that will put police safety on the map.

11. We have seen that once the police division was formed it was possible to attract national leaders such as General Kreml, Major Klimkowski, and Dr. Carroll to the Congress program. Other prominent leaders would be available to this national organization and certainly U. S. police officers can benefit considerably from this exposure.

12. The Public Employee Section publishes a *Newsletter* which can be the media for the exchange of information to all police officers throughout the country. We therefore urge all police departments particularly in major U. S. cities to join the Council for the purpose of exchanging ideas and sharing information with other police officers of the nation.

How Can The National Safety Council Help?

The Public Employee Section, through the police division, invites the police officers of the nation to make the Council the national headquarters for police safety. We urgently request that they send in their statistical data to the Council, on forms which the Council will provide, in order to be uniform in application. We urge that they form subcommittees in order to develop the literature which, at the moment is nonexistent. Through their affiliation with Council activities, they would be in a position to exchange knowledge and obtain safety tips from other police departments. I have observed a great many individuals who have a great deal to contribute toward police safety. Many police departments are vitally interested in safety and each prepare literature, but the exchange of this literature and the exchange of safety tips is a great possibility which offers much to the police departments of the nation. There is no better place than the National Safety Council where police officers could meet on so called neutral ground for the exchange of ideas and experiences which would benefit all.

Summary

As the Staff Representative for the Public Employee Section, I extend a hearty welcome to the police division. We urge their active participation in the development of a safety program for police officers throughout the country. We urge the preparation of safety literature which is sorely needed for police officers throughout the country. We urge a uniformly applied method of statistical reporting. This can be obtained by applying the United States of America Standards Institute Z16.1 (1967). This is the best work injury measurement device that is currently available. The Public Employee Executive Committee is proud of cities like Chicago, Philadelphia, Cedar Rapids, Baton Rouge, and Dallas, who have provided the necessary leadership to promote police safety. Police officers of the entire nation are looking to you for continued enlightened leadership.

UNION'S OUTLOOK ON FIREMEN'S SAFETY

By CAPTAIN EDWIN F. JENNINGS, NYFD
Uniformed Fire Officers Assoc., Local 854, IAFF, AFL-CIO, New York, N. Y.

The Uniformed Fre Officers Association, Local 854, IAFF, represents 2,563 fire officers of all ranks in the Fire Department of the City of New York. The Uniformed Firefighters Association, Local 94, IAFF, represents 10,800 firefighters in the New York Fire Department, whose uniformed force is over 13,000, the largest fire department in the country.

New York City, known as the melting pot of our great country, has a population of about eight million people from all walks of life who reside in all types of dwellings, from palatial private homes in the suburbs to crowded old law tenements in the ghetto areas. Within the confines of 320 square miles are varied structural and occupancy hazards, including high rise commercial and residence buildings, non-fireproof factory buildings, industrial complexes, 650 miles of waterfront with numerous piers which accomodate our largest passenger ocean liners, and the most complex subway system in the world. Numerous vacant buildings, widespread demolition, and new construction is evident in all sections of the city. The New York Fire Department protects life and property from the ravages of fire and administers a fire prevention program with a force comprised of 379 companies, 52 battalions, and 15 divisions.

It is evident that all large cities present many hazards to the firefighting force. The firefighter is constantly exposed to serious injury while responding, returning, or operating at alarms; and in recent years has been assaulted, struck by thrown missles, harassed and, too frequently, the victim of serious injury during civil disorder occurring from coast to coast.

Contemporary urban society, like an alarm sounding, is warning us that metropolitan fire department problems, far from being solved quickly, are growing in complexity. Fire departments caught up in the fire storm around them are having a difficult time in holding the line. The increase in fires, emergencies, and false alarms, with the resultant increase in accidents, injuries, and deaths, is appalling. As cities deteriorate and fire incidence climbs, the hazardous occupation of the firefighter becomes more and more hazardous.

In 1962, an intensive program was initiated by the Fire Officers Union in New York City for the creation within the Fire Department of a separate Safety Division, whose primary goal would be an effective safety program to reduce accidents and injuries. Many sources of reference material were consulted to convince the administration that a Safety Division was necessary. *Industrial Statistics,* published in 1962 by the National Safety Council, revealed that underground coal mining, whose accident frequency rate was 35.86 per million man hours, was exceeded by the New York Fire Department, whose accident frequency rate during the same year was 82.77 per million man hours. Industry has long recognized the value of a safety program administered by a Safety Department. Consolidated Edison of New York, through the efforts of its Safety Division, reduced the accident frequency rate from 25 to 2.7 in a short period of time. The Fire Officers Union contended that such a Safety Division in the New York Fire Department could also achieve similar astonishing results.

The intensive, persevering program finally paid off when, on January 13th, 1964, the Fire Commissioner established a Division of Safety whose stated objective was "to inquire into causes of accidents and injuries involving uniformed and civilian members of the Fire Department, City of New York, and make recommendations to reduce frequency and severity." An enlightened management once again responded to the demands of a union to improve the welfare and safety of the firefighter.

It is an unfortunate fact that there never has been a nationally organized program of safety designed for the personal safety of the firefighter. All programs classified as "fire safety" by the National Safety Council, National Fire Protection Association, American Insurance Association, and various fire insurance companies, have been related to the safety of industrial workers, blue and

white collar employees, and other civilians exposed to fire hazards as occupants. The Fire Officers Union, by means of representation to the National Safety Council concerning firefighter safety, has been the first to take steps to correct the obvious omission. The Public Employee Section, with the recently organized Fire Division, should influence many fire departments in the United States by promoting safety of the firefighter and encouraging the establishment of safety units.

At a convention of the International Association of Firefighters, the Fire Officers Union introduced a resolution to encourage the service to conform to the practice employed by private industry by reporting accidental injury and death statistics to the National Safety Council according to the USA Standards Institute specifications Z16.1 and Z16.2. Information reported is classified and tabulated by the National Safety Council and permits analysis and comparison between industries and within groups and occupations. This classification is the necessary base to establish corrective action by industry to eliminate careless or unsafe practices and conditions and thus reduce injuries, cut costs, and increase efficiency.

Firefighting is the most hazardous "industry" in the United States, but the method of recording and measuring work injury experience as outlined in Z16.1 and Z16.2 is not generally employed by fire departments, nor do they report such data to the National Safety Council. A resolution was adopted at the International Convention to strongly urge all fire department administrative heads to promptly establish reporting procedures according to the USASI and to submit such information to the National Safety Council. As this procedure is adopted by fire departments throughout the country and the method of recording and reporting injuries is standardized, a strenuous effort can be made to reduce or eliminate the causes of accidents, injuries, and death which firefighters face daily in the course of protecting life and property.

A "Creed for Firefighters' Safety" was also introduced by the Fire Officers Union and adopted at an International Convention for dissemination to all state firefighter locals in the United States and Canada, and reads as follows:

1. When a man enters the service of the fire department, he has the right to expect the fire department to continually make every effort to protect him from any predictable hazards of the firefighting profession.

2. It is the union's intention to see that proper training and safe equipment is provided and to insist upon the establishment and enforcement of safe methods and practices for and from all ranks and units.

3. It is a basic responsibility for all fire officers to make the safety of all human beings involved in fire department operations a part of their daily and hourly concern, whether this be in firefighting, fire prevention, fire education, or routine operations. This responsibility is shared by all members of the department.

4. The union rejects the theory that injury and death is the unavoidable cost of firefighting. While tragedies will continue to occur and firefighters will die protecting the public, we believe that firefighter deaths and injuries can be reduced by means of safety, education, and training.

5. The traditional disregard of the firefighter for his own safety in order to rescue persons in imminent danger is commended and extolled; however, that which is praiseworthy where lives are in danger, becomes foolhardy and reckless under fire conditions where only property is involved, and must be discouraged.

6. A safety bureau, division, or unit must be an integral part of the organization of every professional fire department. Its prime objective would be to anticipate and recognize potentially dangerous apparatus, equipment, conditions, or practices and insofar as is possible by engineering, education, and example, eliminate the objectionable features and reduce the excessively high toll of injuries and deaths. All statistics, studies, and investigations are to be directed toward this goal.

7. Through cooperation with the International Association of Firefighters and the National Safety Council and by education and training of all members of the fire department, a positive program of firefighter safety shall be advanced by the union and the fire department.

It is recognized that the formation of a division is only the first step in firefighter safety. Problems to be solved include:

1. The enrollment of every fire department in the United States.

2. The adoption of a standardized method for recording and reporting injuries.

3. The development of a system through which the International Association of Fire Fighters record and report firefighter injuries, with the ultimate goal of improving safety standards for all firefighters.

4. The establishment of safety bureaus with trained safety officers with sufficient authority to investigate accidents and injuries, determine causes, and make recommendations to prevent accidents and reduce injuries.

There currently exists a high incidence of injuries and fatalities among officers and members of municipal fire departments. It is impossible to ascertain the severity and frequency rate, since all fire departments do not maintain injury records. Many of the fire departments who do maintain records do not use the Z16 method of recording and measuring work injury experience, and only a few report to the National Safety Council.

To correct the problem of excessive injuries it is first necessary to have the facts. Unions, through a joint labor-management program, can be the medium through which an effective safety program is formulated in fire departments, based on standardization of recording and reporting injuries. Injury statistics properly applied are the guide to future safety activities and have a very significant role in accident prevention. Statistics themselves will not prevent accidents, but they will provide a factual base upon which an effective safety program can be built. Carefully applied injury statistics will disclose trends toward or away from serious injuries. The basic objective in recording injuries in the fire service is to reveal the type and prevalence of accidents which result in injury to the firefighter, and to identify the areas in which corrective action must be taken.

Without the utilization of a standard of recording and reporting injuries, all comparison between fire departments become almost worthless. No meaningful comparison can be made unless the unions continually strive for the adoption by all fire departments of a standard method of recording injuries. The unique problems and inherent dangers in firefighting, different from other professions, have been recognized by the National Safety Council with the establishment of the Fire Division within the Public Employee Section. Efforts to make available to all member firefighting unions or fire departments suggested safe procedures for all operations should result in reduced injuries. More advanced and progressive departments will submit their experience with programs and procedures which have proven safer and reduced injuries. Such progress, after analysis, would be made available to all firefighting organizations.

The goals of the Fire Division are:

1. To include in its membership every professional fire department in the United States and Canada and every International Local Union.

2. To inform these fire departments of the advantages of proper statistical recording of firefighter injuries and fatalities and need to report them to the Public Safety Services Division for tabulation.

3. With the information extracted from the statistic, the National Safety Council safety experts, in conjunction with interested, experienced firefighters, would work to reduce the terribly high toll of injuries and deaths suffered by firefighters.

In 1963, the New York Fire Department responded to over 117,000 alarms. This figure rose to 172,000 alarms in 1967 and will reach almost 250,000 alarms in 1968. As response increases, so does the firefighter's exposure to serious injury. It is a well known fact that high production and accident prevention go together. Morale, a most important factor in firefighting, is reduced when injuries increase. No fire department can ignore the welfare of the firefighter.

Training starts the day a fireman enters the fire department and continues till the day he leaves the department. During his career, he participates in drills and instruction covering all phases of firefighting and related subjects.

The New York Fire Department has the most up to date facilities to train firemen, and in addition provides an emphasis on safety. Frequency and severity of injuries and apparatus accidents have not increased, despite a tremendous increase in response. It is evident that the Division of Safety, through successful programs, has prevented a marked increase in accidents and injuries.

Deputy Chief John Travell with a staff of 21 dedicated men has reversed the upward trend of injuries to the firefighter. The future looks bright.

Each firefighter must accept the fact of possible injury before he responds to his first alarm. Situations develop that cannot be predicted or avoided. A wall may collapse unexpectedly. Gases may explode. The very nature of firefighting is dangerous. Edward F. Croker, former Chief of the New York Fire Department described the principles that motivate firemen when he made the following observation: "I have no ambition in this world but one, and that is to be a fireman. The position may, in the eyes of some, appear to be a lowly one; but we who know the work which a fireman has to do believe that his is a noble calling. There is an adage which says that 'Nothing can be destroyed except by fire.' We strive to preserve from destruction the wealth of the world, which is the product of industry of men, necessary for the comfort of both the rich and the poor. We are the defenders, from fire, of the art which has beautified the world, the product of the genius of men, and the means of refinement of mankind. But, above all, our proudest endeavor is to save lives of men — the work of God Himself. Under the impulse of such thoughts, the nobility of the occupation thrills us and stimulates us to deeds of daring, even at the supreme sacrifice. Such considerations may not strike the average mind, but they are sufficient to fill to the limit our ambition in life and to make us serve the general purpose of human society."

Firefighting safety has a long way to travel, but every journey starts with the first step, and that most important first step has been made, due to the unremitting efforts of the Fire Officers Union, Local 854 and the consideration and understanding of the National Safety Council, who gave direction and encouragement to our efforts.

Union's outlook on firemen's safety is the promotion of joint labor-management involvement to create safety divisions in all fire departments, to standardize recording procedures, and to reduce the great number of painful injuries which occur while firefighters are engaged in the most hazardous peacetime profession.

ASPECTS OF FIREFIGHTER SAFETY

By SAMUEL CAHAN
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How do we identify the limits of safety for the firefighter? To what extent is the fireman "special" in relation to the other employees with regard to safety? Are safety principles applied to the federal firefighter significantly different from those pertaining to the non-federal firefighter?

Safety for all federal employees, including firefighters, is of utmost concern to the federal sector. The September 1967 *Federal Work Injury Facts* pamphlet, issued by the U. S. Department of Labor, reports these statistics for calendar year 1966 for all federal establishments:

Injury Cases	109,913
Deaths	207
Injury Leave Days	308,306
Total Direct Costs	$46,316,823

These are troubling figures and of concern to all including our chief executive: He therefore established the Federal Mission Safety-70 Accident Reduction Program. With 1965 as the base year, the Mission Safety-70 goal is to reduce the number of accidental injuries to federal employees 30% by 1970. On February 16, 1966 the first anniversary of Mission Safety-70, President Johnson stated:

> "I am more than ever convinced that the waste in manpower and in the government's material resources arising out of accidents can be reduced and must be attacked relentlessly."

In the case of my own agency and locale —the General Services Administration, region two, we have been experiencing a low

accident frequency rate in relation to the national pattern.

With respect to injuries associated with fire extinguishment, it has been said there is a lack of full analysis of fireground injuries with specific breakdown of those fireground accidents resulting from personal carelessness, poor supervision, failure to obey *ordinary* safety rules and similar controllable incidents. In other words, one can equate the head injury of a firefighter who failed to wear his helmet with the civilian employee who fails to wear his hard hat. Therefore, when we say of the fireman, "He got hurt at a fire," should this always be classified as an injury related to fire extinguishment? Or might it rather relate to unsafe work practices?

What are some of the factors constituting the accident potentials affecting the firefighter? We might include the following:

1. Total fireground operations.
2. The current civil unrest "fallout."
3. Operating at emergencies, other than fires.
4. Training operations.
5. Routine assignments out of quarters.
6. Routine activities in quarters.
7. Special details.

We are pleased to note that our regional firefighters to date, are not experiencing the hazards involved with heavy fire duty. This does not mean that the potentials do not exist. They face formidable fire problems related to our storage of sizable quantities of raw rubber, sisal, hemp and similar highly combustible, fast-spreading materials. Why our fire incidence is low will be brought out in this paper.

However, every other accident potential relating to fire department duties is present. Aside from special training with "live" fires, our approach to fireman safety parallels that of his civilian counterpart. We attempt to provide our men with (1) proper mechanical and optimum physical surroundings, (2) broad safety indoctrination, safety training and instruction, (3) supervision to note and eliminate faulty acts and conditions, and (4) supervision of line supervisors to check failure (or lack of follow-up action) in correcting mechanical and physical deficiencies, check instructional effectiveness, utilization of firemen, discipline and morale.

Meanwhile, the reason for our fire department's existence is to be professionally ready to confine and extinguish any fire which may develop despite our rigid fire prevention and inspection programs. This readiness must be accomplished with due regard to safety. It is at this point that our safety picture should parallel that of non-federal fire departments.

A properly educated and trained firefighter is less prone to accidents. Evolutions, theory, practice, repetition, strategy, evaluation—all add up to ease and facility in the use of tools and equipment, standardization of procedures, automatic response and actions to given situations. It develops coordination and teamwork, and insight into operations and practices affecting the world of the fireman.

It is often the dangerous nature of the job that marks a fireman for injury. He can hardly see in a smoke-filled atmosphere: he cannot immediately tell whether supporting beams have burned through or that collapse may be imminent. But he can readily prevent the preventable accident by training and attitude plus the right tools and equipment. We attempt to concentrate our efforts in these areas.

We start with the proper protective clothing: GSA purchases and supplies our firemen with approved garments, boots, helmets and gloves designed to protect our men from the effects of extremes in heat or cold, to keep fire streams or the elements from wetting him. Our latest order for new helmets now includes attached adjustable shields for eye and face protection.

We emphasize the proper use of tools and appliances, laddering techniques and standard evolutions to help improve and maintain good safety practices. As a training tool, we have taken 16 mm movies of our firemen during outdoor drills for review and critique purposes. During the film showing, firefighters seek out their individual actions. Performance errors are often self-evident. Commentary during, and discussions after the movies, help correct errors and improve techniques.

Professional fire service theory and practices are covered during scheduled indoor drills, with safety underscored. Our firefighters often join fellow GSA civilian employees during monthly safety meetings. These sessions are important since the com-

mon safety denominators affecting all personnel can be reviewed and case histories discussed. These reviews may range from electrical hazards, the safeguarding of machinery, the handling of materials, to arousing and maintaining safety interest. As a subscribing member of the National Safety Council, we regularly utilize at these meetings the many articles, posters and technical reviews prepared by the National Safety Council. Also upon our request, the Department of Labor, Bureau of Labor Standards, periodically visits our depots and conducts safety courses for employees, including firefighters. Subjects are varied and are germane to overall safety.

Visual aids help support our firefighter safety program. For example, many 16 mm movies related to drill subjects are shown and discussed. Recently, with the cooperation of the New York Fire Department and the U. S. Army Pictorial Service, we transcribed to 16 mm movies several key television training programs developed by the New York Fire Department. These included the proper (and safe) use of self-contained masks, the proper use of tools, and appliances, and other related films.

To make up, in part, for the lack of fire incidence within our depots, we lean heavily on outside sources to give our firemen "live" firefighter and specialized training. For example, our firefighters, by pre-arrangement, "roll" with members of the busiest fire units in Newark, New Jersey. We have also scheduled "live" training with the U. S. Navy MSTS Firefighting School, Bayonne, N. J. and "live" mask training at the New York Fire Department Training School at Welfare Island, N. Y. Furthermore, our firefighters attend the various University of Maryland fire training schools and the specialized sessions conducted by the New York State Office of Fire Safety. At present, we are arranging for participation at the "Firemen's School of Instruction" in Nassau County, N. Y. This is a professional school possessing a variety of full-scale mock-ups which permit replication of actual fire situations.

I mentioned fire codes and fire prevention. A fire that never gets started or a fire that is confined to its fire area because of good fire prevention and building codes lessens exposure to firemen. This automatically reduces injuries. It is no accident (no pun intended) that GSA has few depot fires. We have a rigid fire inspection program. Inspections are conducted at four levels: by the fire department; the depot manager; the area manager; and regional inspectors. There is a strong reporting, review and follow-up procedure. This interaction helps insure solid safety practices.

Likewise, our building firesafety criteria strongly contributes to the prevention of development of large fires. Major considerations include sprinkler systems, fire walls, limited fire areas, automatic fire alarm reporting and similar devices. Our aim, to quote our own GSA criteria, is "The provision of programs and physical facilities which will result in the minimum danger of fire injury for GSA employees, occupant agency employees, all others using GSA facilities, and firefighters called on to fight fires in GSA facilities." I must emphasize that the last sentence refers to *all* firefighters, both civilian and federal.

We are exceptionally proud of our firefighters, many of whom play a dual role as volunteers with their local fire departments. They avidly keep abreast of fire technology changes and help infuse interest into their profession. It is this total feedback that underscores training effectiveness.

In summary, although firefighter accidents may not always be controlable, especially on the fireground, because of the environmental factors involved, we attempt to insure total safety where the factors and elements involved are controllable. This requires management and the firefighter to work together. GSA recognizes its responsibility in providing the best safety conditions possible for its employees.

THE MUNICIPALITIES LOOK AT SAFETY

By CURTIS E. VOLKAMER
Chief Fire Marshal, City of Chicago, Chicago, Ill.

An examination of the statistics of accidents to firefighting personnel reveals that contrary to public opinion, the greatest number of accidents are due not so much to dangerous equipment or the absence of safeguards on this equipment as to some very simple causes, such as falling or slipping; walking into unguarded openings at the fire scene; falling of objects, tools, and materials from overhead; careless use of tools; removal of safeguards; neglect to use the safety features provided; improper clothing [and this to apply to helmets, boots, and gloves]; stepping on projecting nails; lack of adequate inspection by those in supervisory capacities; and carelessness on the part of the firefighters themselves.

I could cite instance after instance in which firefighters were burned because the fire coat was still on the apparatus; it was too hot to wear. Where firefighters stepped on nails, received electric shocks and, in some cases, were electrocuted because the boots were still on the apparatus; it was too hot to have them on, or for some reason or other, the firefighters didn't think it was necessary to wear them. Or of firefighters who had hand and finger injuries; no gloves, or gloves which by any standards should have been discarded long ago.

The Chicago Fire Department records will show that, every year, between 800 and 900 firefighters are taken to hospitals for treatment, duty connected. Many, of course, are given first aid and released for duty; others are hospitalized for varying lengths of time, some quite prolonged. I am sure that other communities, from New York, Detroit, Philadelphia, etc. to their smallest counterparts could match this figure, ratio-wise and percentage-wise, without the slightest difficulty.

A word here, I think, would be very appropriate about the person who is "accident prone." Some time ago, a national publication had an interesting article entitled, "Accident Prone—Fact or Fallacy." It proved nothing. Nothing, that is, beyond the fact that in about 95 per cent of these so-called accident prone cases, the injury could be attributed to just plain carelessness or, what is worse, stupidity. The other cases were the exceptions that proved the rule. I am of the firm opinion that a good, sound, practical education program tailored to meet the needs of the Fire Service would work wonders in helping firefighters do their work safely and carefully.

The installation of protective devices and other provisions of safety does not by any means offer a complete solution of the problem of accident prevention. Safety devices can prevent accidents only to a limited extent; they will not, they cannot compensate for carelessness on the part of firefighters themselves. The intelligence and character of firefighters are as important elements of safety as all the safeguards put on fire equipment and tools. Carelessness, in some form or other, has been responsible for the greater proportion of accidents. In a hazardous occupation such as ours carelessness sometimes takes the form of downright recklessness, but truth compels me to say that it more frequently arises from thoughtlessness or complete indifference. In this dangerous business, we have taken an oath to protect life and property, and we are morally bound to save a life, even at the risk of our own. This we have done, this we do, this we will continue to do. Calculated risks are the order of the day; foolhardy attempts, never.

We have conducted safety programs based upon the fundamental principle of accident prevention—the education of the firefighter in habits of caution and thoughtfulness. He is impressed with the fact that his own safety, as well as the safety of his fellow firefighters, depends on his carefulness. We stress the responsibility he has for his actions while engaging in work of a hazardous nature. I have written many articles and have spoken to countless numbers of candidate firefighters. The one thread that runs through orientation talks is teamwork: his utter dependence upon the other members of his company and theirs upon him. He is

a cog in a giant wheel. He is a member of a team. Every candidate who comes into the Fire Academy receives an *Orientation Manual* which contains this information on teamwork, which I wrote years ago. The principles I used then as a criterion are just as forceful today.

During a candidate's probationary period (which by law is 6 months), 60 days and upward of which are spent at the Fire Academy, he is educated by practical means to co-operate with other candidates, soon to become firefighters, in the interest of safety. Candidates found guilty of dangerous practices are promptly disciplined. Flagrant violation is sufficient cause for dismissal. There is a right way and a wrong way to do everything. The right way is synonymous with the safe way. When a candidate is assigned to a company in the field, he continues his education along these lines, putting into practice the safety theories which he has had instilled in him. This is a gruelling test, a sort of final examination, especially for those who are assigned to units which have more than 6,000 "runs" each year. How well he performs under emergency conditions depends upon how well we have done our job in the primary stages of his education and, of course, how well he has learned the lessons which are taught in the school of experience.

When municipalities look at safety, many factors influence their viewpoint, not the least of which is the cost to the municipality when safety rules are violated. In the dangerous business of fire-fighting, which by some authorities has a 7 to 1 ratio over other occupations, this amount can assume astronomical proportions. Needless to say, the misery and the suffering resulting from injuries can never be measured in dollars and cents.

However, let us turn our attention for a moment to the financial involvement. The municipality has an obligation to the taxpayer to accomplish the ultimate of good with the taxes collected. The administration appropriates certain monies for each Bureau or Department for the fiscal year. These monies are allocated on the basis of the cost of operation for the previous year and anticipated additional costs relative to expanded activities or new purchases, such as equipment. Only in that manner can an equitable figure be reached to insure sound economy. If unusual circumstances occur, such as a rash of injuries, the economy is disrupted, and there is a serious threat to the tax structure. Like a spiralling chain reaction, this could lead to a revision of the tax component, necessitating the levy of additional taxes on an already over-burdened public. Little wonder, then, that municipalities are deeply concerned for the safety of their firefighters.

The municipality has a commitment to the firefighter himself under the broad term of Employers' Liability, whereby the municipality is compelled to indemnify firefighters for injuries incurred in the line of duty. In the event of a multitude of claims, this can become unduly burdensome; yet, it is fair and reasonable. Actually, it is based on English common law, and although it has continually undergone changes by rulings of some courts as to refinements of the rights of employer and employee [the municipality and the firefighter], it narrows down to some obvious pronouncements, both general and specific.

The municipality has a duty to the firefighter to use reasonable care for the safety of the firefighter while he is performing his work. This includes the duty to provide a reasonably safe place to work. These quotes are from old English law, and one might say they are out of step with the fire-fighting field. But, are they? Certainly, the fire station must be a safe place to work. We know from our own experience that the scene of a fire is not a very safe place to work. Yet, we know that an outgrowth of this has led to suits in which the courts find for the plaintiff. You may remember this headline which appeared in July: "$620,000 award to widows in two fire deaths." This, of course, was a judgement against a corporation, not the municipality, and was based on, "the building owners were guilty of negligence in maintaining the beams and joists of the structure." As I said, this is an outgrowth of the law, and there have been similar suits establishing a precedent.

The municipality has the duty to provide reasonably safe tools and appliances. This is accepted as a matter of course. Every effort has been made to provide the firefighter with the latest in modern equipment,

making changes to insure the maximum in "fire-power" consistent with safety. The evolution of Chicago's ten Snorkels and Snorkel Squads is prime evidence of the municipality's insistence that every avenue of safety should be explored.

The municipality has the duty of being reasonably careful in hiring personnel fit for the work they are to do. This stipulation has been met by rigid Civil Service laws which provide that applicants pass certain physical and mental examinations; no applicant may be placed on the eligibility list who does not receive a passing grade, to the second decimal point, of 70.00 and over.

The municipality has the duty of providing suitable rules for carrying on the work. Here, I think, the municipality has complied with the law to the fullest extent. The specifics which I will give refer to Chicago; other municipalities have their own rule books and their own drill manuals, some quite comprehensive, others fairly elementary, depending upon the size of the municipality and its fire department. In Chicago, the municipality has provided a *Book of Rules, Regulations, Practices and Procedures* with over 400 sections covering almost every contingency as regards a firefighter's conduct, many of them safety-motivated. There is also a *Drill Manual of Evolutions* of 339 pages which is now being revised and rewritten, to consist of 15 separate *Manuals*, as well as other material, including the *Candidate-Probationer's Orientation Manual*. All this, plus the construction of a $2½ million Fire Academy to implement the safety methods and procedures best calculated to achieve our objective, the suppression of fire, with the minimum of risk to our personnel. We can say with conviction that municipalities are truly concerned with the safety and welfare of the firefighter; indeed, it is in their best interests to do so.

A quick look at the other side of the coin reveals some inescapable facts. The firefighter assumes all the risks and hazards incident to his type of employment. He also assumes all the risks and hazards arising out of the carelessness and negligence of his fellow firefighters, fully realizing that he cannot, by any degree of care, protect himself from the faults of his co-workers unless he isolates himself, which, of course, is obviously impossible. However, under modern conditions the individual firefighter consents and assumes the risk only because he has no option to do anything else. These are all quotes from the common law. I, personally, like to feel that a firefighter consents and assumes the risk freely and willingly, without reservation, because he wants, more than anything else, to be a firefighter.

The problem presented by accidents in the fire-fighting field is a three-fold one, affecting the municipality, the firefighter, and the general public, the taxpayer. From the point of view of the municipality, the problem is one of efficiency. Accidents interfering with the stability of the fire-fighting force constitute a form of waste, reflected in increased budgetary appropriations. For the firefighter, the problem involves his own physical and mental well-being; the consequences of an accident to him are personal and could be irreparable. For the public, the taxpayer, the problem assumes a financial aspect because it is he who ultimately pays the price, bearing the burden of added expenditures necessitated by these unfortunate incidents.

We still remember the headlines, October 17, 1966, carrying the tragic news that 12 firefighters had lost their lives in a fire in an Eastern metropolitan city. This toll of 12 dead was the greatest single loss of lives ever suffered by this Eastern metropolitan Fire Department. Some quarters even speculated that this may have been the greatest single loss of firefighters' lives in any department in the nation's history. However, this is not so. As far as any research could reveal, the greatest single loss of firefighters' lives occurred here in Chicago on December 22, 1910, when 21 firefighters were crushed to death by a falling wall while fighting a fire in the Stock Yards.

When I say firefighters, I use the term in the broadest sense. Actually, the victims included the Fire Marshal, the Assistant Fire Marshal, three Captains, and four Lieutenants. This also stands as a record for a single fire loss for Officers. Chicago has suffered other severe losses of personnel in fires: 10 firefighters perished in the Curran Hall fire, nine at Superior Street, nine more at Hubbard Street. The list goes on and on.

Some years ago, a precedent was set whereby the family of the victim could sue

the owners of the buildings or, if the firefighter survived, he could bring a personal injury suit against these owners. The charges were always on the grounds that said owners failed to maintain the premises in a safe condition. At the fire mentioned earlier, in which a $620,000 judgement was handed down to two widows, a personal injury suit was sustained for $20,000 for a firefighter who suffered back injuries when he fell three stories in that tragedy. Another personal injury claim I recall was paid to a firefighter for severe and extensive burns; a record $250,000.

The municipality would rather see its firefighters return from these alarms unscathed. It therefore extends its protecting arms to the Building Department and the Fire Prevention Bureau. The City of Chicago has almost 300 personnel in the Bureau, 50 of whom are detailed directly to the Building Department. Thorough, frequent inspections are held so that buildings are maintained, insofar as is humanly possible, in a safe condition. The municipality has already supplied the firefighter with proper tools and equipment, has already taught the proper method of handling those tools and equipment. Now it attempts to protect the firefighter from unforeseen dangers on the fire scene. It also attempts to safeguard the lives of the occupants of these buildings.

Sometimes it is tragedy that leads to the realization that effective measures must be introduced. For example: The Iroquois Theater fire in 1903 brought about panic hardware and outward travel of doors in places of public assembly, after 602 lives were lost. The Boston Night Club fire in 1942 saw 492 perish. This brought about more stringent rules on flame-proofing scenery and decorations. The La Salle Hotel fire in Chicago in 1946 claimed 61 lives and gave evidence of the pressing need for smoke-proof towers and enclosed stairs. And of course, the Our Lady of Angels School fire is still fresh in our minds. The deaths of 92 children and three nuns alerted municipalities in the nation to the urgency of providing protection to our schools in the form of sprinkler systems and alarm devices.

The municipality has a duty at all levels when it looks at safety, not only to the firefighter, but also to the public. Serious consequences have far-reaching effects. Law suits, in the millions of dollars, eventually are paid by the public, some way or other, in the form of increased premiums. What affects one must affect all. One thought that crosses my mind now, one to which not much attention has been given, is: What would be the reaction of the municipality if, suddenly, there were a drastic reduction, an acute shortage, in the number of applicants for the profession of firefighter? What if the profession of firefighter became less desirable or, actually unsought because of the municipality's utter disregard for the safety of the firefighter? This is a sobering thought.

We do know that the number of applicants that the City of Chicago receives continues to grow less and less; however, this is no cause for concern. I am convinced that it is a product of our times; an economic adjustment to the labor market. For example, in the 1930's, approximately 50,000 young men made application to be firefighters in the City of Chicago—a record still unsurpassed. Of these men, 1,687 achieved a grade of 70.00 and over and were placed on the eligibility list, which was exhausted before another examination was held. This was during what is commonly referred to as the "depression era." The salary for a first-class firefighter then was $2,500 per year. A comparison of recent applications [from 2,500 to 3,000] and the current salary in Chicago of $9,000 per year would certainly seem to indicate that the position of firefighter had lost some of its former appeal. The reasons, of course, are too vague and problematical to be discussed, and certainly have no bearing on the subject at hand. As yet, the municipality of Chicago has not had to resort to undue or unusual methods to insure a full and adequate quota of applicants every time the books are open for a firefighter's Civil Service examination. This is not true of some other protective services.

Certainly, the municipalities have more than extended themselves in this subject on its viewpoint of safety for the firefighter. From the time, in 1881, when the first mobile ladder unit was built, down to the present moment, with our 144-foot aerial ladders, the municipality has striven with might and main to introduce safety measures in its use. This can be projected to modern times, when, in 1958, the Snorkel was first intro-

duced into the Chicago Fire Department. This incredible, fantastic, maneuverable unit has completely revolutionized the fire-fighting concept of the progressive fire department. The innovations and changes include: an aluminized shield for protection against searing heat or flame; double complement of men in the basket; breathing apparatus for firefighters in that basket; dual controls; a quick-acting water spray or fog device, for protection of men in the basket from a flash fire or an upsurge of flame; safety belts for operators; and an inter-communication system between basket personnel and the ground-control operator, indispensable for pin-point accuracy in extinguishment.

OPENING REMARKS

By JOHN PHILLIPS
District Engineer, Virginia Dept. of Highways, Lynchburg, Va.

I hold the position of District Engineer for the Virginia Department of Highways, located in the Piedmont Section of Virginia, at Lynchburg. I have worked for the Virginia Department of Highways for 39 years, as foreman, superintendent, etc. where I have had an opportunity to work men, and see them get hurt. The Virginia Department of Highways has been very good to me. They let me come to Chicago each year to the National Safety Congress and Exposition.

This is a great country, a great city and state. The Illinois license plates proclaim it as the land of Lincoln. The 16th President of the United States was indeed one of the world's truly great men. Born near Hodginville, Kentucky, with a short stay in Indiana, then going up in the State of Illinois on the banks of the Sangamon River. He developed into a man whose memory the entire nation reveres. He was sober and hard-working and respected by his neighbors. He never hated anyone, nor did he want any revenge. He was called "Honest Abe," and "Father Abraham." He was a man of few words and plenty of action, and quite often I believe that this is what the National Safety Congress and Exposition needs.

Mr. Lincoln was a participator. He knew the meaning of hard work. They did not call him "rail-splitter" for nothing. He once said that an axe was a most useful instrument. He was a man of some humor and could tell some homey stories, stories that drove the truth home. He enlisted to fight in the Black Hawk War, and while he never shot an Indian or had an Indian shoot at him (as far as I know), he did describe his sojourn in the militia, of two or three months duration, as frequent attacks upon the wild onion and a good many bloody battles with the mosquitoes.

The Street, Road, and Highway Division has some talented and experienced speakers who will be discussing topics and subjects with which they are intimately acquainted —acquainted by participation. You will be hearing Safety Directors from the different States, and organizations. We are honored by having these trained and qualified safety engineers, safety directors and safety coordinators take time from their busy lives to talk with us on some very vital and interesting subjects.

I mentioned Abraham Lincoln. I am not suggesting to anyone that they give their topic or talk in the brief time that he did at Gettysburg. There are not many Abraham Lincolns in our life time or generation, but you will remember that in speaking at Gettysburg he followed Senator Everett, who had prepared himself by walking over the battlefields for about a month and stu 'y-ing every point of topography, every obstacle; had made maps and accumulated data, the positions of the Southern Confederacy and the Union Forces, how the battles swayed back and forth; and then he took one and a half hours of oration to tell the people gathered there all about it.

As I said, Abraham Lincoln participated. He had been a part of the Civil War, like a lot of us who have been a part of this crusade for safety. He got up with a few well chosen words which were so well said and so well received that they have gone

ringing down through the ages, and almost every school child committed to memory this oration. At Oxford University they have put it in bronze.

So some of us, I expect, would not even know that Senator Everett was at Gettysburg, but we know that Abraham Lincoln was there, that he had been there in spirit before he arrived there in body, because he had lived through the Civil War.

I often wonder how a district engineer from the State of Virginia became so fortunate as to be associated with so many qualified safety supervisors and safety coordinators throughout the nation. I have one story to tell you. In southwest Virginia one day, a gentleman who lived in a small village walked up into the mountains. Along the path he met a mountaineer who was coming into town to get some provisions. The mountaineer was leading a flea-bitten hound with a twine string and the city dweller said to him, "What are you going to do with that dog?" The mountaineer said, "I am taking him down to the dog show." The city man said, "This dog won't win any prize at the dog show!" "I know," replied the mountaineer, "but he will have a chance to become acquainted with a lot of good dogs!"

THE USE OF SIGNS, CONES, AND BARRICADES ON HIGH SPEED HIGHWAYS AND STREETS

By J. A. MOORE
Safety Dir., Nevada State Highway Dept., Carson City, Nev.

In our State of Nevada in the last ten years, we have recorded eight fatalities and two permanent total injuries. Of the eight fatalities, four were due to accidents within signed areas. One occurred in a snow storm, when an employee drove over a cliff. One was struck by a drunk at a signaled intersection. One was crushed between two trucks during a stockpile operation, and one had a tree limb fall on him. The two total permanent accidents were attributable to vehicle accidents. It is, therefore, understandable that we in Nevada are concerned with protecting our men working on the roads. Not one of the aforementioned employees were working on contract jobs, but were doing routine maintenance work with which we are all familiar.

Four of these fatalities were directly due to the driver of the vehicle being drunk. In one accident, two men were killed due to a drunk driver driving through three different barricades, ignoring the flagman, and striking the two men working on the roadway. One of these employees was thrown up over the hood of the vehicle and the other was crushed between the vehicle and the state truck. There was nothing that any of us could have done in the way of signing or barricading that would have prevented these, as the driver ignored signs, flagman, and barricades and ran right through and over them into our employees. The driver received five to 10 years on each count. He is now serving time in the state prison.

Enough of these gory statistics. Let us look at this problem as it pertains to all of us now and in the future.

Our problems are similar due to local prerogatives allowed in the *Manual of Uniform Traffic Devices for Streets and Highways.* We find many different types of warning devices being used throughout our states. I believe we should try to conform to the manual as close as possible, but additional signs, and even change of shape and color, are desirable for unusual situations.

The color of yellow background and black lettering, after many miles of travel, all take the same meaning to the motorist. Therefore, it is important that when we have a situation that is unusual, or when we have an area in which we want to make sure the traveling public understands the hazard ahead, we be allowed the prerogative of changing the color or the shape of that particular sign. These signs should be used in conjunction with the standard warning devices that we are currently using, but it is important that we make the motorist aware of the situations. I believe a change

of sign, a change of color, or some other means will possibly break him out of his lethargy enough so that he will be more apt to slow his vehicle down and keep it under more rigid control.

Manpower for maintenance purposes is apparently not a problem with some. I envy them—the placement of warning devices is done by special crews in advance of the crew starting work. It is another matter when your work crew must carry the warning signs, cones, barricades, and all their equipment, and set up signs and get to work.

The placing of warning devices creates a hazard to the employees and equipment. Good judgment on the part of each crew member is essential, from the first stop made to place a sign until the last sign is picked up. Then the driver has the responsibility of returning the crew safely to the station.

Spacing of signs is important, particularly when on high speed roads. In Nevada, we have speed zones only in specific locations, otherwise the power of the vehicle limits one's speed.

Advance warning is of the utmost importance. Protecting the work sites with the use of cones, barricades, and flagmen depends upon the type of road the crew is working upon. Unfortunately, we cannot isolate our crews, and they are required to work in close proximity to traveling vehicles.

Our crews are small, generally two to five men, and protective devices are carried on trucks along with the crew and material necessary to do the job. Protective devices are therefore shown as the minimum, and if the foreman or supervisor believes the hazards warrant the use of more protection, he has the prerogative to secure additional units.

Signs should be placed approximately 500 to 600 feet apart, and the sign closest to the job site or start of channelization or barricade should never be closer than 500 feet. Flashing lights on vehicles are kept on during the entire operation. All signs are flagged with fluorescent flags. Signs are placed on both sides of the roadway. Optional use of no barricades is permissable. Used by small crew, or in an emergency. We must depend upon our signs and, hopefully, an extra vehicle to place between the work site and the last sign.

When work is done along the shoulder of a roadway, it is still necessary to place signs and cones around the work area. Additional signs may be required. It again depends on terrain and traffic. Men assigned to this area are generally cognizant of their hazard and, therefore, take exceptional precautions in safeguarding themselves from the traveling public.

When leaving their work site, if gravel and loose chips are left on the road surface, warning signs are a must. The advisory speed is usually placed 500 feet from the area, as well as the advance warning signs. At night, flares are left at both signs. This gives the motorist an opportunity to slow down for this particular hazard.

On July 10th an accident occurred that was almost a tragedy. A large transcontinental truck and trailer with a cab sleeper was coming out of Reno, traveling east. The driver ignored the advance signed and flared warnings which clearly indicated to him that he had to make a stop very shortly. These flares and signs were placed 7/10 of a mile from the loadometer checking station. The station was well lighted. A motor vehicle carrier officer was at the site. Apparently the driver, upon seeing the officer and all of the lights, suddenly slammed on his brakes, jack-knifed, and turned over in the median strip. This resulted in injury to his companion, who was in the sleeper. However, this accident could have been a real tragedy if the operator had swerved into the lane where our men were checking other vehicles. Again I say, warning signs, flares, and flags do not answer our problems.

A new sign holder we have adopted throughout the state is a high level warning sign placed upon the delineators along our roadways. Due to the winds that periodically plague our state, we have experimented to no end on high level warning signs and flags, and find this one meets most of our requirements. It is not the ultimate answer and cannot be used in every situation but they are visible from a long way off and they stay where we place them.

I have tried to emphasize the importance of physical barrier guards or warning devices for highway work crews. Continued training and re-emphasis to the workmen of the importance of these signs and barricades as safeguards to them as individuals will reap rewards and fewer accidents to your crews.

BUILDING SAFETY INTO YOUR TRAINING PROGRAM

By D. C. FORBES
District Personnel Supvr., Virginia Dept. of Highways, Salem, Va.

Each of us is faced with a serious dilemma. That is one of living or dying. One out of every 1,800 people in the United States was killed accidentally last year. One out of every 20 suffered a disabling injury. And yet statistics show us that less disabling injuries occur on the job than in any other walk of life. Out of the 112,000 accidental deaths in the United States last year, 14,200 of them occurred on the job. In addition to 14,200 deaths, 2,200,000 suffered disabling injuries. It makes me shudder to read statistics like these but they are there and we can not ostrich them away.

A good rule of communications is to not tell someone something bad unless we can offer a suggestion on what to do about it and how to accomplish this. Safety training may not be the entire answer but will aid us greatly in achieving a safer world in which to live.

Training for training's sake is not worth the time it takes to put on the so-called course. Safety training, if not properly planned and conducted, can be the same way. None of us accepts everything that is told us. Safety training today too often is separated and put off by itself. It is a special course or courses used as a supplement to our other training. Very few of us like to keep our lives compartmented, by separating our action into narrow segments and having a rigid schedule when to do any one thing. The same must apply to safety training. It must be pertinent, comprehensive and comprehensible. Safety training must not be relegated to playing second fiddle to production training but must be an integral part of all training programs.

It is up to us as safety people to insure that safety is taught and taught properly. We must see that safety is a part of each training program. The old axiom that says, "If the learner hasn't learned, the teacher hasn't taught" applies each time an accident occurs.

The key to training is the supervisor. The key to safety training is the supervisor. Most workers are directly influenced by what the supervisor feels and this applies to training. Probably 90 per cent of the training in the world is done by first line supervisors in the work situation. This is where safety must start and grow.

From the time we are born until the time we die, we are involved in the training process either as a trainer or as a learner. We learn in many ways that all we do and all we say affects the people with whom we associate. No one person knows it all even though I've met a few who say they do.

Training is a way of life in industry today. Gone are the days that we are able to hire qualified people for all of our jobs. Let us assume that an adequate definition for industrial training is the process of fitting a man to the particular job that he is to perform. Note that we said a process—this, I think, is the key to successful training. No one learns all there is to know in a class, conference, correspondence course, etc. It is a continuing effort that will pay off in more efficient, profitable and smooth operation.

As we talk about training we may stop for a moment and look at the various types of training that we use on the job. They are orientation, job instruction, supervisory and executive training.

When we discuss a new job with a man, we take for granted that what we tell him and show him will stick in his mind like flies to fly paper. If we are honest with ourselves we will realize that this is not the case. Men, particularly new men, will assimilate some of what we tell them but so much will be learned from doing, whether it is done right or wrong. Practice makes perfect. We've all heard this. For example, I've played golf for approximately 15 years and, if this is correct, then every shot I hit is a good one and par is a common practice with me. None of you have seen me in the $100,000 tournaments on TV lately, have you? The reason you haven't is because I have practiced and practiced but have not learned properly by hitting a good shot every time. Practice makes perfect but only if it is done properly every time.

Since we have a new man here let's talk about putting safety into our training pro-

gram at the beginning, before the man even starts to work.

All of us have some type of orientation program whether it be an elaborate program involving handbooks, charts, tours and movies or a simple session with a personnel man telling the new employee what he is getting into.

Where is there a more logical place to begin with safety than at the beginning of a man's career? Safety must be emphasized from the beginning. We can do this in many ways, copies of the safety rules, employee handbooks, brochures, specialized pamphlets or any combination of these. Audio-visual aids, such as slides, movies, chart presentations, have proven very effective. Every new man must know and understand safety rules and policies before he goes on the job.

After the man is placed on the job then comes the most important and most impressive part of training—job instruction. The four step method of on-the-job training has been widely accepted and is used by most supervisors whether we realize it or not. The job breakdown sheet is a necessary part of this method. When using a job breakdown sheet, we set the job up by steps and key points. Wouldn't it be just as easy when analyzing a job to also pick out and [illegible]c down the hazards and preventive cures as we are looking at the overall job?

Job instruction training does not end with placing a new man on the job and getting him into the flow of production. It, again, is a continuing process of correcting and guiding him in the performance of his duties. New men are not the only people who need job instruction; old men should be constantly kept apprised of changes or slips from an approved format of operation. Safety can be built into this type of training. I remember seeing a National Safety Council poster stating "Accidents happen fast—be alert." This is very true and any deviation from accepted and approved job methods brings about situations which cause accidents.

Supervisory training has blossomed into the largest field of formal training that we have today. It is rare to see an organization that does not have some form of supervisory training. These courses usually include such sessions as production, planning, scheduling, leadership and human relations. These are good and necessary subjects but what good are any of them without the manpower to carry them out? Safety is a necessary and integral part of the supervisory training process. Safety should be covered in each of these areas. Safety should also be a separate and distinct segment of any supervisory program. Look at your supervisory training program and see if safety is included, not as an afterthought but as an integral part of each segment.

Executive training is the last, but not least, type of training I would like to discuss. Some of you are thinking, why should this be included for the "wheels" that run an organization? Of course, I am not talking about including on the job safety but am concerned over the overall administrative responsibility. Here is where the safety program is made or broken. Here is where we all get our guidance. Our executives are busy individuals and quite often relegate safety to an ancillary position.

Executive training should include segments on organizing, coordinating, influencing and administering safety programs. It should inspire executives to become involved in the actual performance of the safety organization. They should not be so concerned with statistics that they become numbers. Human beings make up these numbers. Lost production and wasted money make up these numbers. Broken homes, mutilated bodies and suffering make up these numbers.

Training is used to accomplish three things: (1) to teach someone a specific operation; (2) to change an operation; and (3) to change attitudes. Seldom is safety mentioned that someone will not mention attitude. Attitude—a predisposition to see things one way—affects us in every thing we do. Safety attitudes can be changed. They are taught. They are learned. What better way to teach or to learn than to include this in our present training vehicles?

We all know that we learn better if we see, accept and believe that what we are learning will help us accomplish what we want to accomplish. Safety training must be presented in this same manner. We can't tell a man that if he doesn't work or drive safely he will be injured or die. He knows this but often will forget for an instant. Safety must become habit. Habit is formed by training.

Training, and particularly safety training, must be unique, different because everyone is aware of safety in one form or another. It should not be a carnival but should be interesting—Think, for instance, of a frame —FRAME. Draw a picture of it in your mind. What frame did you draw? A door frame? A window? A picture? A prisoner? A girl? This is the way with safety. All of us have ideas as to how safety training programs should be conducted but they may not be the same. At the same time we may reach the same goal from different directions.

We can use the standard methods such as conferences, classes, textbooks, posters, pamphlets or correspondence courses. These are good and have value. The Virginia Department of Highways, right now, is involved in a N.S.C.'s Driver Improvement Course for all operators of motor vehicles. This is paying off in frequency and severity of motor vehicle collisions. In 1966-67 our accident loss experience for the fleet was over $190,000 and for the year 1967-68 our loss experience was less than $40,000. This is in spite of a slight increase in frequency. We are not saying that this was the entire reason for our decrease in severity but I'm sure it helped.

The use of models and mock ups for analysis of accidents and to develop training sessions is a good tool. When we have something to show and tell our message is far more effective than simple lectures or written instructions.

Games have become very popular in management training. Why not use them in safety? One of our Assistant Resident Engineers made 35 mm slides of posed unsafe acts and conditions and then made up multiple choice questions for his men to answer. This can be done for almost any operation or for any trouble spot or to implement a change in policy. We like to learn and we like to have fun. Why not do both and learn twice as much?

Motion pictures and even recordings can be included into our programs. In an article in the October 1967 issue of *Better Roads* magazine, Ray Stose, Safety Officer with the Oregon Highway Department, reported that his office is using 8 mm cameras to film actual work on the roads. They are edited and shown to employees and they can pick out their own mistakes and mistakes made by their fellow employees.

Recently safety films have gotten away from the hard sell and have resorted, much to my pleasure, to almost subconscious suggestions. It is much easier for us to see someone else's mistakes and to learn from them than to make these mistakes ourselves and learn.

As you can see I have a very loose definition of training. Training occurs anytime a person learns. An integrated training program is, I believe, the answer to safety training and accident prevention.

SAFETY INSPECTIONS OF HIGHWAY MAINTENANCE STORAGE BUILDINGS, SHOPS AND GARAGES

By HARVEY M. KUESTER
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It is a tragic statistical fact that every day many industrial plants across this land experience situations which involve the destruction of human and material resources. It is also a tragic and real fact that public agency operations are not immune from this waste of men and resources. Usually the investigation of the cause reveals a hazard which could have been easily corrected and the occurrence prevented if a proper inspection of the working environment had been made. For this reason, periodic inspections of highway maintenance storage buildings, shops, and garages are an important phase of any safety or accident prevention program and properly the job of the safety officer.

This task cannot be delegated completely

to the foreman, superintendent, or maintenance engineer for several reasons: (1) Only the safety officer can approach the ultimate of calling a spade a spade; (2) The safety officer is the only individual on the district or divisional level who is technically qualified to pass judgment on the numerous potential fire and casualty hazards in these areas; (3) The safety officer has the interest, the contacts, and the necessary sales ability to sell his findings to top management.

We all want to enhance the effectiveness of our safety programs by the utilization of sophisticated methods; but when performing these inspections, it is necessary to go back to the basic fundamentals of safety. Certainly we cannot begin to cover every exposure associated with our subject nor can we examine corrective measures in depth in this discussion, but we can alert ourselves to certain categories and exposures within which are the major causes of destruction to property and causes of injury and death.

Many forms are used as a guide for making inspections, and procedures vary, but after 15 years in the fire and casualty insurance field, I have found it to be more effective if one approaches a building inspection first from a viewpoint of fire prevention and then from a casualty hazard viewpoint.

Common to both approaches is the basic requirement of good housekeeping. Without good housekeeping, very few parts of an establishment can operate in harmony. With good housekeeping, those factors not in harmony can be corrected with little effort because a positive attitude which is characteristic of good management has already been established.

Fire prevention involves not only the prevention of destruction to physical plants, which in many instances are uninsured, but fire takes lives as well. When conducting a fire inspection the following points should be carefully considered:

When it comes to construction, no building is fireproof. It may be fire resistant, but not fireproof. All-metal buildings are many times considered fireproof but when subjected to 1,200°F, less than the heat in the tip of a cigarette, steel members collapse like wet noodles. What causes this collapse is dependent on the fire load; in other words, heat given off by the amount of flammable material or liquids within the building. Open areas contribute to the rapid spread of flames, while parapeted walls and approved fire doors help greatly to prevent fire spread.

The heating plant can be one of the major sources of fires if not properly installed or maintained. Preferably, the heating unit should be installed in a fire resistant room with an approved self-closing firedoor on the opening. Clearances must be checked, storage of other flammable materials within the fireroom should be discouraged, and a regular maintenance program for the furnace or boiler should be established. Other types of heaters on the floor or overhead must also be checked for clearance. Portable, unvented oil-fired heaters can not only cause fires when operated too closely to flammables but can also be a real health hazard to employees in the area of operation unless the building is well ventilated with fresh air.

The figures which are compiled relating to electrical fires may not be entirely accurate, but this hazard nevertheless warrants our respect. Good and adequate wiring, whether permanently installed or in the form of extension cords, is a necessity. Adequate feeder service and circuits must be provided and properly fused. Be on the lookout for fuses that are hot to the touch, as well as protruding fuses which in most cases indicate a coin has been used as a jumper. Taping circuit breakers is another unpardonable act.

Many a fire has been caused by a motor which has not been kept clean, or which was not given adequate ventilation. Compressors are a good example.

The use of spring-loaded safety cans for the actual use of highly flammable liquids cannot be overemphasized. Proper storage of flammable liquids is equally important. Horizontal storage of barrels containing lacquer thinner, petroleum naphtha, cleaning solvents, gasoline, and other highly flammable liquids should be discouraged. These barrels should instead be stored in an upright position and equipped with upright pumps.

Insist on approved solvents for parts cleaning, approved oil absorbent, and approved solvents or chemicals for cleaning floors. Butane or propane tanks should never be stored or installed within buildings.

Some older buildings still have inside gasoline pumps. Provisions should be made to protect these pumps from vehicle damage by the installation of barriers.

Smoking, which includes the careless discarding of cigarettes or matches, is a major cause of fires. If No Smoking signs are posted, the rule should be strictly enforced. This enforcement is especially important around flammable liquid storage areas and inside gasoline pumps. Employee rooms should have steel lockers, steel waste cans, and sand-filled containers for cigarette stubs and matches. Overstuffed furniture should be discouraged. The storage of waste materials in all other areas should be accomplished with steel containers.

Fire fighting cannot be overlooked. The first five minutes of any fire are more important than the next five hours. For this reason, adequate fire extinguishers for the class of fire exposure anticipated should be provided. Standpipe hoses if provided, should be periodically tested. The telephone number of the local fire department should be posted on or near the telephone. Whether the fire department is local or city, invite the firefighters to make a familiarization tour. Last but not least, conduct regular fire drills and building evacuation exercises.

Casualty hazards which include industrial injuries are more frequent than fires, and because of this, are not as dramatic. They do, however, receive most of our attention because of the frequency factor. Let's touch on these hazards and see if we are observing the fundamentals in this part of our operation:

The importance of good housekeeping has been emphasized. Certainly, this basic factor has no less importance when associated with hazards other than fire hazards.

Material handling and storage involves both mechanical and manual lifting. Are mechanical fork lifts equipped with overhead guards? Is there an absolute No Riding rule pertaining to the arms of this machine? Mechanical and hydraulic hoists and lifts should be checked for wear and leakage. Be sure auxiliary jacks are provided and used.

Manual lifting exposures are almost too numerous to mention, but let's try a few. In the warehouse, check the salt and reflective bead sacks to see if they are properly stacked. This includes proper height and stacking with cross-ties. In the Washington State Department of Highways we insist on a 50 pound maximum weight for these bags. The lifting of signs must many times be a team effort.

Shop exposures are many and varied but heavy wheels, especially those with calcium chloride in the tires, can be a bugaboo. Changing plow blades is another. Suffice it to say that additional help or mechanical lifting devices should be utilized whenever possible.

Machine guarding is worthless if the guard has been removed for some reason and not replaced. The exposures in this area are primarily in our shops where there are mechanical hacksaws, lathes, grinders, and portable saws. Stenciled instructions and warnings on machines are very often overlooked.

Hand tools must fit the job to be performed. Watching for mushroomed heads, cracked handles, sharpness of tools, files without handles, and guards will pay off in fewer hand and eye injuries.

Personal protective equipment cannot be utilized by personnel if it is not available or improperly maintained. Eye protection in the form of safety glasses, goggles, and shields is basic. Earmuffs, ear plugs, or mineral cotton should be provided for ear protection. Hands require protection with gloves designed to meet the exposures. Bump caps should be provided for head protection. Respirators for various uses should be supplied. And, certainly, the wearing of loose clothing should be discouraged and safety shoes encouraged.

Proper ventilation at the source of exposure will eliminate or at least reduce the need for respiratory protective equipment. When welding cadmium, lead, or lead-painted materials, local exhaust systems are essential. Engine exhaust hoses of the floor or ceiling type should be an integral part of any shop building. U. L. approved spray paint booths provide for cleaner working conditions. And last, but not least, the trichloroethylene exposures in the materials testing laboratory must not under any circumstances be overlooked.

Slips, trips, and falls are the number one cause of accidents in the Washington State Highway Department. Needless to say, many of these occur in the warehouses, shops, and

garages. Oil and grease on floors, the use of sawdust instead of an approved oil absorbent, welding cables, manually operated horizontal sliding garage doors, parts of vehicles, etc., are but a few of the causes.

It is the duty of the safety officer not only to verbally bring to the attention of the supervisor those hazards which were noted in the survey, but also to prepare a written report of corrective measures to be taken. A copy of this report should go to the division or district engineer. Needless to say, follow-up procedures must be instituted to assure that all recommendations are completed within established time limits.

These principles, although not new, must be taught and conveyed to employees. It is our duty to make these safe practices an integral part of operations. We must not relax our vigilance or determination by saying, "It hasn't happened to us, therefore no action is necessary."

We must educate and re-educate, inspect and re-inspect if we are to provide a safe and healthful working environment for the employees of our highway departments.

THE 5 TYPES OF UNSAFE ACTS AND HOW TO CONTROL THEM

By RAYMOND M. BUSSEMER
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While unsafe conditions as well as unsafe acts are responsible for accidents, almost six times as many industrial work accidents are a result of unsafe acts of employees as compared to those caused by unsafe physical conditions in the plant. An understanding of how and why such unsafe acts are committed is essential to the success of any accident control program.

If we review industry's accident experience over the years we find that a reduction in accident rate has occurred as a result of advances in engineering and design, improved physical inspection of facilities, intensive on-the-job training, comprehensive medical examinations and selective job placement. Yet, in spite of these noteworthy efforts a large number of accidents continue to happen each year. Workers who are protected by safety devices remove them or fail to use them. People who are told about hazards seem to ignore the warnings. Well trained workers at times seem to forget what they have learned. It would appear that people *want* to hurt themselves or get involved in accidents. Attempting to analyze this behavior from its outward appearance without first understanding human nature (what makes men tick) can lead to only one conclusion—*man is an illogical being* doing many things without rhyme or reason, and at times it would appear he deliberately attempts to destroy or injure himself.

A look at ourselves through the eyes of a psychologist shows that man in relationship to his environment is seeking consciously and subconsciously to satisfy certain needs and desires. Needs are those things that his physical body cannot do without, which, if not obtained, will result in rapid deterioration of mind and body. Needs include air, water, protection against temperature extremes and a feeling of well-being. Desires are those things he thinks he wants which include an abundance of money, fame or notoriety and love or admiration. Failure to achieve a minimum of his desires may eventually have similar deteriorating effects over a period of time.

The method by which man attempts to achieve his needs and desires depends upon instinct, reflex action and learning. Instinctive and reflex actions are universally common to all men. The knee-jerk, reaction of pupil of the eye to light and the startled reaction to explosions are reflex responses. Learned reactions, however, differ so widely as to make each man a complex individual. A learned reaction is one that the individual has found, from experience, will help him satisfy a need or desire. Crying as a baby is instinctive, but finding that crying brings

comfort in the way of food or attention is learned.

The way in which an individual will learn to satisfy his needs and desires will be influenced by his family, friends, neighborhood, race, religion and the overall culture and laws of his society. Acceptable ways of responding may differ greatly from one society or culture to another.

Habit patterns. Man encounters thousands of recurring situations every day which relate to the satisfaction of his needs and desires, such as putting on his clothes, shaving, operating his car, eating, walking. To attempt to consciously handle each one in detail would tax his mental ability to the point of collapse. The habit formation process frees man from much of the tedious conscious attention needed to attend to every detail of a situation.

Habits, therefore, are easy ways of doing things. If the original response to a situation achieves the desired results and is repeated often enough to become a habit, it makes little difference whether or not it is an unsafe one or one more difficult than necessary. To the individual it becomes the easy way, and he will automatically use the same actions each time the situation arises.

It is evident that while growing up many habits are being developed, and whether or not these are good or bad depends upon how we were taught and by whom. A great number of our habits are developed from mimicking our parents.

One bad habit that is easily acquired by almost everyone is improper lifting, the basic reasons being that lifting an object—from childhood to adulthood—is looked upon as requiring brawn rather than brains, and in many cases is used by an individual to prove his manliness.

When trained in proper lifting methods, weightlifters have been known to lift unbelievable weights in comparison to their body size, while so-called "musclemen" have suffered serious injury from lifting insignificant weights improperly.

Considering the depth of training the average driver of a motor vehicle receives to operate a car and to drive it in traffic, it is no wonder we have so many accidents and deaths on the highways. Yet, few people admit to having unsafe driving habits.

Employees with unsafe work habits must not only be made to recognize that they have them but must be convinced it will pay them to change to a safer way, for it will require a tremendous effort on the employees' part to make the change, at least until the safe way becomes a habit. The breaking of unsafe habits in most cases requires assistance and a concentrated program of retraining. Rarely, if ever, do threats of discharge by the boss ever bring about corrective action by the employee. Continual reminders and repetitions of the safe way will be necessary until the unsafe or inefficient way fades from lack of use and the new way becomes a habit. Even when the unsafe habit appears to be completely erased, reflex action in moments of stress may cause reversion to the old habit.

Lack of knowledge and misunderstanding. As an individual goes through life he meets situations not previously met in his experience to which he must respond either physically or mentally. If he is not told or shown, he will proceed in a trial and error manner to make an appropriate response. In this trial and error process he will usually utilize the previously learned methods and ideas from what might appear to be similar experiences to solve the problem at hand. It is interesting to note that the first automobile was a replica of a carriage, the first steamboat a mechanized paddle and the forerunner of the rifle, a mechanized bow—the crossbow. Elias Howe in developing the sewing machine met frustration and temporary failure by attempting to utilize the needle in its traditional way with the eye of the needle at the top rather than at the point. On placing the eye at the point, which was recommended by his wife, he found success in the perfection of the sewing machine.

A new or old employee encountering a job situation for the first time will, therefore, if left to his own initiative, make trial and error responses until he eventually accomplishes the task or ends up by causing injury or damage.

If he succeeds in accomplishing the task with certain responses, he will consciously repeat the same response when he meets the situation again. If repeated often enough, all or parts of these responses will become habits. If his original response was a safe one, he has developed a safe work habit, if

it was not, he has developed an unsafe work habit which eventually can involve him in an accident. If his original response is the most efficient way to accomplish the task, he will be an efficient worker at the task. If his original response is an inefficient one, he will needlessly waste time or materials every time he does the job.

With the tremendous technical advances and the many new fields developing it is impossible for any one man to know all the "right" ways of doing things. Yet, people hesitate to admit that they do not know something lest it be a reflection of their overall ability.

How many of us have chased after smoke shifters, buckets of steam, left-handed monkey wrenches and sky-hooks in our early days in industry? One can do some rather foolish things when you do not know, and will not admit you do not know, something about a certain job. Every field, too, has its jargon that is readily understood by those experienced in the field.

To those not familiar with the meaning of the terms as used in that trade or industry the words may be familiar but the meanings of the words are not as they had learned them previously. For instance, sweat the joint, kill the motor, break the hose, drop the transmission, crack a valve and bleed the brakes may, if taken literally, prove disastrous.

It is said that three fourths of the mistakes of man are made as a result of not knowing what he pretends he knows. Unfortunately, this side of human nature can cause many unnecessary problems and accidents.

Closely akin to "not knowing" is the misunderstanding or misinterpretation of what one has been told to do. A major problem in dealing with people has been communication and the greatest single reason for poor communication is that meanings are not in the words but within the individual that uses or hears them. For example:

"Let him have it."

"Turn the right valve."

"Tap the drum."

Inflections of the voice, the place, the time and the situation all may have a modifying effect on what would appear to be a simple statement. Punctuation in written communications allows for difference in interpretation.

Only through good training programs and good supervision can we prevent accidents arising out of lack of knowledge and misunderstanding. Unfortunately, some plants' training programs consist of a haphazard passing on of job information to the employee by the supervisor or by a fellow employee who takes him in-tow.

Under such a system, no two employees receive the same indoctrination. The unsafe acts that are possessed by the instructing employee are usually passed on to the new man. Under such conditions part of the job performance, by necessity, will be trial and error. Such lack of organized training not only breeds a high probability of accidents but almost *insures* inefficient and wasteful performances.

Incentive to do wrong. While we have seen that unsafe acts can be committed unknowingly we also know that unsafe acts have been knowingly and deliberately committed, such as an individual deliberately passing a stop sign, or exceeding the speed limit, or removing a guard from a press, or not wearing safety goggles in a required area or smoking in a No Smoking zone. Have you ever deliberately violated any safety rule as above? Why?

There are a number of situations the employee meets each day which will provide an alternative to the known safe way of responding to a task. The way that he chooses will depend on which offers the greater incentive.

For example, an employee must get a part from a shelf seven feet above the floor. He knows he should use a ladder but the ladder is at the other end of the shop. Near the shelf is a three foot high wooden box. He is tired. He is faced with two responses: stand on the box (which could collapse) or walk to the other end of the shop for the ladder. What if the boss is watching him, and there is a three day layoff for violation of a safety rule?

To insure that the employee when faced with such situations will choose the safe way, the incentive to do the right thing must be greater than the incentive to do the wrong thing; if not, we should not be surprised to find that the wrong way is chosen.

In many instances, management itself creates strong incentives for doing a job the unsafe way. A few examples are: not providing sufficient scrap barrels throughout the plant; using easily removable machine guards without interlocks to stop the machine if the guard is removed; insisting on unrealistic production schedules; not holding supervisors responsible for accidents in their department.

The incentive value of objects, situations and activities are not the same for all individuals, as each is influenced by his background and training. Furthermore, the incentive value varies at different times with the same individual.

On the whole, actions done knowingly are not as dangerous as those done unknowingly, for if one recognizes he is taking a chance he attempts to take some safeguards to protect himself. A person deliberately running a stop sign or red light will see that there is no traffic coming first (and assure himself that there is no officer at hand).

Habit interference. Another factor growing out of the habit-forming process is responsible for those unsafe acts that are hard put to explain as anything other than "completely illogical." Habit pattern interference refers to the unpredictable and uncontrollable actions produced when the conscious mind is unable to select or maintain the right sequence of actions for the task at hand. Day dreaming, sudden shock, emotional and physical upsets can cause the conscious mind to temporarily lose control of habit selection. The wrong habit may be picked for a given situation or parts of the correct habit pattern may be skipped or repeated. Panic on the one hand and the antics of the so-called absentminded professor on the other illustrate habit pattern interference.

To better understand how habit interference works, consider the subconscious mind as a long-playing record and the conscious mind as the playing arm. A selection of music is playing; when someone jars the cabinet, the playing arm will jump the present groove and play another part of the record, interrupting or discontinuing the original selection.

A familiar exhibition of habit interference is illustrated by the over-sensitive individual, commonly referred to as being "goosey". If while in the midst of performing an operation he is touched in a particular area, he will react in a rather erratic manner. Any tools he may be holding may be thrown or dropped and he may jump or swing his arms wildly, unable to control any of his movements.

While effective supervision, good employee relations, and health and welfare programs can reduce some of the incidents of unsafe acts caused by habit pattern interference, it is impossible to completely eliminate or control them by working with the individual. It is for this reason that guards, protective clothing, and all the physical aspects of the plant and its operations are necessary, even for the most experienced workers.

Physical and mental impairments. Unsafe acts committed because of congenital or acquired disabilities of mind and body can cause accidents. The causes of these accidents cannot be placed in the four areas just described. Poor eyesight, defective hearing, muscular incoordination, physical imbalance, and mental deficiency are all prime examples of subnormal situations that have the potential to cause waste and inefficiency which may result in accidents and injury to employees.

Running a red light, for example, might well be traced to a color-blind driver, and the failure to heed audible warnings may be caused by impaired hearing of the employee.

Some physical or mental impairments, then, that may not be outwardly noticeable, or known even to the individual involved, might well be of great concern to a prospective employer. Proneness to committing unsafe acts due to these conditions can, in many cases, be determined by pre-employment physicals, mental tests, and careful job placement, designed to minimize the effect of individual disabilities.

Habits, knowledge, incentives, habit interference, and physical and mental health are the five basic factors influencing the behavior of man in his environment.

The logical approach. Understanding how these factors control human behavior, we can see that is it management who is acting illogically. It is they who attempt to attack the problem with generalities instead of specific instructions, reprimands instead of restraint or better incentives, and slogans instead of a safer working environment. Platitudes such as "Work Safely" and

"Drive Carefully" can do little or nothing to control the human element. Remedial action, to be effective must be based upon the reason the unsafe act was committed. Was it a lack of knowledge?—teach him the right way. Is it a habit pattern?—help him break it. Is there a greater incentive for doing it the wrong way?—change the incentives. Was he crossed up by habit pattern interference?—redesign the protection or restudy the operation. Has he a physical impairment?—consider examination, treatment, or reassignment.

Since the greater part of the industrial accident experience is attributed to unsafe acts, an understanding of the human element and its control is an essential part of the supervisor's training.

Programs that rely on controlling only one aspect of the accident producing problem can only do a partial job at best.

For example, total guarding of machinery will control some accidents in the areas of lack of knowledge, habit, and habit interference, but its primary effect is in the area of those acts caused by habit interference.

Enforcement of the rules and incentives and award programs can affect those acts committed deliberately, by providing the additional incentive to do it the right way; but cannot affect those resulting from lack of knowledge or habit pattern which are done unknowingly or those done through habit interference over which little control can be exercised.

Education and training programs will, of course, handle the lack of knowledge and training on the job in addition to forming good initial habits, but will contribute little to incentive or prevent habit interferences.

Physical and mental testing and checking on the qualifications of the employee can reduce accidents caused by physical and mental impairments (detecting poor eyesight, defective hearing, high blood pressure, etc.). Such testing programs cannot, however, bring to light all his bad habits or all that he does not know about his job, nor can they eliminate all the unsafe acts deliberately committed because of the incentives involved.

In summary then, the most effective and efficient program of accident control is one that concerns itself with both the physical and the human elements and, in the area of the human element, considers all five basic reasons for employees committing unsafe acts.

The program should be designed to make the employee more receptive to being trained in safe practices, more willing to try out new ideas, and more favorably inclined to participate in the safety activities.

To succeed, it must be based on a plan of action developed from all the available information relative to the accident problems of the plant. Accident information should be developed through a good physical inspection of the plant and from the plant's past accident records.

From an analysis of this information, a program can be developed. The necessity of this pre-planning makes the obtaining of accident information of prime consideration. The more accurate the information, the more accurate and successful the program based on this information will be.

The question, "Why is there never enough time to do it right, but always enough time to do it again?" is a sound philosophy to be remembered and used when initiating an accident control program. It can save a great deal of money, time, and suffering when you are tempted between a haphazard program and a program that accomplishes a goal—eliminating accidents and their causes.

OFF-THE-JOB ACCIDENTS: ARE THERE NO SOLUTIONS?

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Last year, large sums of money were spent by employers to help reduce the number of industrial accidents. In spite of these expenditures, on-the-job accidents produced 2.2 million injuries and 14,200 deaths. Pretty horrible? Try this. At the same time we had some three million accidents producing injuries away from the job. In addition, we had 39,800 deaths. These statistics are for workers only and are for accidents away from the job.

I do not pretend to be an expert on the statistics of accidents, but I am convinced that something must be done to stop the rate at which we are killing ourselves. I am convinced, too, that a new approach must be discovered. Obviously, the present tack is producing very little by way of tangible results.

Let's take a rather quick peek at where the experts say these worker off-the-job accidents are occurring. Some 24,600 deaths and 900,000 injuries occurred with motor vehicles. Another 7,500 deaths and 1,100,000 injuries occurred at home. Other causes of death in lesser numbers were aviation accidents, railway accidents, falls in public places, and firearm incidents. Home accidents kill about half as many workers as on-the-job accidents.

The most obvious cost of off-the-job accidents is in personal suffering and family tragedy. There is, however, a not to be overlooked financial cost. This cost is enormous and many faceted. One of the faces of this cost appears to the family in terms of hospital and/or funeral costs and long-term losses of income. Wage losses in 1967 from all types of accidental injuries totalled six billion dollars, of which four-and-a-half billion were off-the-job. Medical expenses for off-the-job amounted to 1.4 billion dollars.

Another of the faces of the cost of accidents stares at the employer in terms of lost production. How much production would have taken place if there were no persons injured off-the-job?

There is a national cost, too. Reduced earnings and increased medical expenses have a direct bearing on federal income tax collections. In addition, there is a not too subtle loss in gross national product.

Finally, another cost of accidents can be found in the increased costs of insurance. Even those of us who have no accidents pay an ever increasing premium because of those who do.

I fear that the general field of safety is replete with answers to the problem. Unfortunately that problem has yet to be defined. There is a need for in-depth probing of accident causes rather than overviews of accident statistics. We have been guilty of attempting to cure accidents by the treatment of accident symptoms — statistics. This is much like the physician who would treat a tubercular cough with a throat lozenge. The symptomatic cough would be relieved but the patient would die—ever so quietly. Until we understand the root causes of accidents, we will do little but administer cough drops to our accident "tuberculosis."

We have approached our workers to be safe away from the job. We have used posters, payroll stuffers, pamphlets and mailings. Those of us who were unusually bright encouraged our people to be concerned about their families as well as themselves. Some of our literature uses scare tactics. Scare tactics have had no more value in the field of safety than anywhere else—they simply do not work. Cleveland's traffic law violators repeatedly see gruesome films of vehicular tragedies. Victorian England's pickpockets best pickings occurred at the hangings of pickpockets. Certainly, some more fruitful approach must be sought.

Please do not misunderstand me. I do not propose here any sweeping program of correction. I do not say that I even understand the problem fully. However, I do say that there is a need for research into causation that will be far more intensive and better coordinated than anything we have

seen to date. This coordination must come from somewhere and somebody. Responsibility for the job of research and education for these kinds of accidents must placed.

We need to know why men appear to be more vulnerable to fatal accidents than women. Why is it that home accidents for workers outnumber their work accidents? Is it because of the constant emphasis on safety in the plant? Is it because of safety devices and safety engineering? Is it because the worker knows he can get hurt on the job but thinks nothing can happen at home? I do not know the answers to these questions, do you? Certainly, we should know the answers.

There are areas of attitudinal reasearch that should be done. If a man works in a relatively safe environment, he is somewhat isolated from accidents; yet, he is very much aware of the potential for accidents. What are his attitudes about safety as he leaves work? He doesn't watch home accidents often. Does he believe that it "can't happen to me" because he doesn't see home accidents?

Much has been said by psychologists and psychiatrists about those who feel guilt about something, real or imagined, and create accidents at an unconscious level. The present state of the art is such that some of these persons can be identified and, most importantly, helped.

Emotions, strong feelings of the moment, influence behavior in a dramatic way. People who are in an emotional state with fear, hate, rage, or even preoccupied, can pay less attention to their surroundings than necessary and be prone to fall victim to an accident. All of us have heard the warnings about not driving while drinking. How many of us have been told not to drive or anything else dangerous while *emoting?* This is a difficult message. Much hard work and research will be required before the message registers well enough to change behavior enough to reduce accidents.

No one is surprised to find drinking and accidents of all kinds intertwined. People won't stop drinking just because they are told drinking increases the possibility of accidents. We've been shouting the message for years but drunken drivers persist. Drunk drivers are not alone in their susceptibility to accidents. Alcohol is a significant cause of home accidents among young and middleaged adults. We have a job to do. We cannot put all people on the wagon; hence, we must educate people as to the problem of accident proneness of all kinds while drinking. Of course, this educational task goes beyond the drinking problem, it eventually must include all we can find out about accidents, their causes and prevention. This education means more than just telling—it means developing an understanding and a way of behaving based on that understanding.

At this point in time, I fear we have more people who are equipped with the language of safety than an understanding of safety. They can quote statistics, play the game of safety dominoes and recommend safety equipment, but they do not truly understand because they have been content with information instead of answers. They have confused their own actions with accident prevention. They do not interest themselves in causation and, until they do, there will be no realistic program of accident prevention away from the job as there is on the job.

While I cannot support my contention, I suspect that accidents breed accidents. Having had an accident, it is possible that tensions and fears could lead to further accidents. Off-the-job accidents are important matters for employers, not only for their employees, but for their families as well. The worker whose wife or child is hurt cannot be as attentive to his tasks. This might precipitate an accident on his part. How many times have we read of people getting killed in their cars on the way home from the funeral of a loved one?

The employer who is concerned about off-the-job safety would do well to include his workers' families in his communications. The families' safety relates closely to the employees' safety and to their production.

A comment is in order about the growing complexity of the world in which we live. Our homes contain many outlets for electricity of enough strength to kill. We have laundry rooms, bathrooms and kitchens with scalding hot water available at the twist of a knob. Poisons can be found in several points in most homes. Stoves and irons can sear flesh in a split second. Our automobiles travel at speeds that were unbelievable not too many years ago. Closing speeds of automobiles on our highways can be in excess

of 150 miles per hour. You and I live in this modern maze of technology with a physiology that suited our forebears well when running was the fastest mode of locomotion and one ate what one caught.

Even with all these modern dangers in the home, about half of the home fatalities occur in falls on poorly lighted and cluttered stairways.

In recent years, primarily since World War II, there has been an emphasis on the mating of the human work place to the human being. Most of the early work was done in the cockpit of airplanes. Some of this work has been applied to the industrial work place. This endeavor, called human engineering, needs to be applied to our homes and their appliances and to our autos.

Even demography can have its influence on accidents. As the central cities grow larger and less desirable places in which to live, there is a movement to suburbia. This means longer distances to and from work. These distances provide greater exposure to automobile accidents, particularly while enroute home, tired from work. Does this mean moving plants to the suburbs, too? Does it mean better rapid transit systems? Does it mean safer highways? I do not know; however, you safety experts had better find out.

There is an obvious need to coordinate safety work in a number of disciplines.

Some time ago, a bright young safety reporter asked me how I would get workers to listen to the off-the-job safety message. I told him, "I'd hire listeners." I believe it is possible to include history of freedom from accidents along with other hiring data. Freedom from accidents, if it were to become one of the hiring criteria, could provide some motivation, perhaps.

All of us wish we could find the one hot button to push to turn off accidents. Unfortunately, there is none. There are as many different causes for accidents as there are motivators and situations. This does not mean that our job is hopeless or unending. It does mean, however, that the attack on the job must be coordinated by those concerned. It must begin with an understanding of the root causes—that means research. The researchers will come from psychology, medicine, sociology, engineering, and the profession of safety, itself. Somehow, in our haste to build a bigger and better new world, we forget it was for people and didn't design it to consider human tolerances and their effects on safety.

PROBLEMS OF KEEPING STANDARD SAFETY RECORDS

By GERALD L. HUGHES
Safety Officer, Philadelphia Police Dept., Philadelphia, Pa.

The United States of America Standards Institute and National Safety Council have laid splendid groundwork concerning record keeping guidelines which should be utilized by all police departments. These standards, however, have been established for conditions far afield from police work. I do not intend to infer in my remarks that they are not excellent standards, but rather intend to discuss some of their most obvious shortcomings regarding police work. I also have formulated some practical solutions to the problem. I feel that some background and definition of standards will be most useful in creating a thorough understanding of the subject. When I speak of standards I am referring to those published by the USASI. They have been endorsed not only by the National Safety Council and the Federal government, but have also been accepted throughout the world.

The word standard carries with it numerous definitions. I prefer the one stating that a standard is, "that which is established by authority, custom, or general consent as a model or example; a criterion, a test; in general, that which is proper and adequate for a given purpose." This definition reveals that a standard is a many faceted word having several meanings and applications. I

intend to refer to the standards concerned with record keeping.

For example, the USASI method of recording and measuring work injury experience presents minor problems to police organizations, who were not available for advice and counsel when the standards were established. This creates a discrepancy in meaning between the accident figures compiled and published by industry and those of law enforcement agencies. The very nature of police work creates an unavoidable increase in the tendency toward certain types of injury which would be impossible to reduce without a curtailment of necessary service to the community; although this does not change the meaning of the standard, it does penalize the accident statistics obtained from police sources.

The obvious conclusion is that in using the standard, the law enforcement groups, with their high inherent hazards, will result in a higher frequency rate than that encountered in private industry. We must not infer, however, that a penalty is a cause of changing a value of a standard which is the only meaningful method of record keeping that we have. The combined results of well-collected data reveals a clear message to all who consult them. Their value is shown in the fact that one isolated incident or material drawn from a limited source can create a misleading picture.

It is my opinion that Z-16.1 should be adopted by all police departments for the sake of standardization. We should then note the problems it presents in the definition of work injury and occupational disease and secure rulings from the Interpretation Committee, as this will focus attention on our problems.

Z-16.2 American recommended practice for Compiling Industrial Accident Causes presents major problems to all police departments. It should be noted that it was established primarily for industry, but is of little significant help to our problems. The standard is presented in five sections. The agency and agency section is of little use except in our related machine shops. The Unsafe Mechanical or Physical Condition section is an aid and is applicable to about 50 per cent of the accidents we experience. Under the Accident Type section I have proposed a classification broken into finer detail, which I believe is more practical for police record keeping. I believe a new classification should be added in the Unsafe Act section in regards to fleet and fleet operation. The Unsafe Personal Factor section has limited use for us.

Today, the task of accident prevention is hampered by a scarcity of statistics having direct bearing on the issue. This statement was made by H. W. Heinrich more than twenty-five years ago and is as applicable today as it was then. Today, however, the true causes of accidents are not always indicated by the published statistics. All too frequently, the type of accident becomes confused with the cause classification because similar wording is used in the definition of both terms. An example would be that of the accident cause codes, which are actually indicators of the accident types or agencies involved in the occurrence of accidents, rather than listings of the actual causes.

The *how* and *why* of accidents is a necessity for effective accident prevention. The most recent *Accident Prevention Manual for Industrial Operations* published by the National Safety Council contains an interesting chapter concerning accident records and injury rates which states, "Records are the foundation of a scientific approach to accident prevention." The basis for such records should be USASI Z-16.1 Method of Recording and Measuring Work Injury Experience, and Z-16.2 Method of Recording Basic Facts Relating to the Nature and Occurrence of Work Injuries.

These contain suggested record forms and, in my opinion, are a splendid guide in the field of industrial operations. We experience not only those operations presented in the standard but also many unique to the situation, such as those encountered by men assigned to duty in helicopters, on the river, in the subway, and the many unusual types of street duty. We operate a large fleet of cars, motorcycles, jeeps, trucks and buses, a chemical and ballistics lab, and a K9 unit, each presenting its own specialized problem. Therefore, a large police department has need of specialized standards other than those found in the present standard guide lines.

One major objection is that deliberate or malicious injuries for personal reasons do not count in industry but do count in police work and, therefore, result in a greatly en-

larged frequency rate. But more important, if they are not separated statistically, they cause misleading conclusions when under review.

I do not intend to imply that the existing standards should be changed, but I do think that a corollary should be formulated to take into consideration the unique problems faced in police work. This would separate the injuries received while making an arrest from those sustained in other accidents because, although both may be judged by the same standard, they necessitate different preventive measures, just as a fall suffered in the course of normal activity requires a consideration different from that encountered in the course of police action. Also, many injuries sustained in a riot or other emergency situation are deliberate and premeditated rather than the result of chance. This type of injury accounts for approximately 30 per cent of those reported in Philadelphia in 1967. Many of these occur in the classes I refer to as resisting arrest, civilian assaults on an officer, and in certain types of vehicle accidents. These are accidents which take place in the course of legitimate police action. This serves not only to classify situations for accident prevention but also as a means of reporting situations to command personnel.

Many times it is necessary to violate safety rules in the course of police action, but proper performance of police duty would be impossible if the rules were strictly adhered to. I do not condone this practice, but as yet we have found no way to give proper police service without violating certain safety rules. However, the data we gather may lead to this goal. Until that day dawns, the statistics should be kept separate. I hope that you will examine my proposed standard and offer any suggestions for improvement. Possibly USASI may request a committee to study the safety problems of police work as they relate to type and cause.

Another area which poses a problem is that of the proper communication between departments for the exchange of meaningful statistics. I hope to aid in the organization of a police division under the Public Employee's Section of the National Safety Council. I feel that the National Safety Council's excellent performance record in related fields makes it the ideal organization to perform such a task. Even though each police department has its own special problems, our basic areas of difficulty are quite similar and can be readily compared. If our only immediate result is the establishment of a clearing house for the exchange of information concerning our problems through the National Safety Council, we will have taken a major step toward our goal.

Record keeping in a law enforcement agency poses its own unique problems. My gathering of safety statistics appears much the same as police work because of the great similarity between crime prevention and accident prevention. Both areas are concerned with people and their behavior, yet both lend themselves to statistical predictability. This predictability has, in both areas, been our greatest aid to prevention. Therefore, all information, no matter how seemingly insignificant, should be collected in order to obtain a complete picture of the overall situation. The most pertinent of this information should be statistically reduced into report form so that we can see the increase or decrease in certain areas and take steps to correct the problems. A third area is the problems singled out for special attention; those that have shown a marked or dangerous increase or that have attracted a special attention from higher echelon command personnel.

The Public Employees Section and the USASI should meet for a discussion of police statistics, to clarify the existing standards and their relationship to the unique situations encountered in police work. The existing standards should be carefully reviewed to determine their exact application to police work. Working together, I know we can formulate a safety program which will not only foster cooperation between law enforcement agencies in this country but will aid us in the creation of a clear and useful safety program that will not only benefit the member agencies but greatly increase the efficiency and safety of every American law enforcement officer.

Let us all rededicate ourselves to this end.

LET'S LOOK INTO THE FUTURE IN POLICE SAFETY

By WALTER T. HAYES
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Chairman, Police Div., Public Employee Section, N.S.C.

Police administrators throughout the country have six major areas of responsibility to cope with: They must be certain that the streets of their jurisdictions are adequately patrolled. They must provide an ample amount of traffic regulation. They must provide for the proper follow-up investigation of crimes. They must control juvenile delinquency. They must suppress gambling, prostitution, narcotic and liquor law violations, and organized crime. Lastly, they must effectively maintain those ancillary police activities which are necessary to the efficient accomplishment of their first five areas of endeavor. Certainly, these six areas of responsibility are enough to keep any police administrator occupied, and, perhaps, they spell out why many of them do not give the time and effort required to add a safety program to their already crowded schedules.

Because of the universal belief that danger and extreme hazard are inherent to police work, there is a preponderance of evidence which suggests that safety within policing agencies throughout the United States is lacking or totally ignored. The truth is that many hazards faced by police officers can be greatly reduced through development of proper safety procedures and through training in these procedures.

I think with this reasoning and this evidence, our position as safety officers is clear! We have before us the task of convincing top police admininstrators of the need for safety within the organizations that we represent, and after we have convinced them of this need, we must set ourselves to the task of developing a safety program to suit our individual department needs. I know from personal experience that this is more easily said than done, and I know that many have had the same experience.

It is appropriate, then, that we should address ourselves to these two questions. First, let's look at the "how" question. How do we sell top management on police safety? How do we convince them of the need for police safety?

This question is not difficult. Its answer exists in documentation—documentation to your superiors that a good, aggressive safety program will result in more efficient operations in the six major areas of police responsibility, by *manpower, equipment,* and *budgetary* gains. It will require a little research, but once this research is completed, I am sure that a forward-looking police administrator will give the go-sign to develop your program.

Identify the problem by an analysis of records and reports. This will point-out the need for a continuing program, and it will provide direction for the major emphasis on the program. For instance, take one vehicular accident in your department and document it well. Consider the cost of repairing or replacing the vehicle; the medical costs necessary to restore the injured officer back to health; the cost of his salary while convalescing; the cost that must be paid to the citizen victim, if the facts warrant this action; and, lastly, add in all the hidden costs and administrative costs. This approach is factual and should convince most progressive police administrators of the need for a safety program.

Once the need for a safety program is accepted, we must seek the answer to the second question. What program will suit my department's needs? All of us have different problems that require different solutions. There are, however, general principles that apply in developing any safety program, and a look at these is the best approach in answering our second question.

A key beginning is the placing of your safety unit within your organization. It must be placed at a high level, in order to command the respect and attention of all members, and its commanding officer must have department-wide responsibilities in conjunction with the requisite authority to meet

these responsibilities. However, regardless of the organizational position of the safety unit, top management must let it be known that the safety problem is a management problem, and that cooperation in the control of accidents is expected from both management and employees as well.

After the safety unit has been placed within the organizational structure and its commanding officer appointed, a staff must be provided to accomplish the goals of the program. The size of the staff will depend upon: the number of members in the organization; the geographic area to be covered; the number of vehicles in the organization; the number of building facilities; and the number of non-safety functions to be performed by the safety unit, such as accident claims, warrants for collection, etc.

When the size of the safety unit's staff is determined and assigned, the real work begins—developing the safety program. Let's consider some of the things that should be done:

Record Keeping. Every safety program, without exception, must be built on a firm base of statistics derived from a good system of keeping records. Development of a sound record keeping system should be a "first" on your schedule, with a top priority rating. For without it, you will not go very far over the long run. Every effort should be made, initially, to develop the best record keeping system available—even if it takes a year. Not enough emphasis can be placed upon this area. Good records are the bread and butter winners for any safety man or safety program.

Revision of Accident Records. Simultaneous with the development of a good record keeping system, and just as important, is the revision of accident records. This must be done by incorporating into your reports the type of information that will yield meaningful statistics for your record keeping system. As with the development of a sound record keeping system, the revision of reports may consume much of your time at the beginning but, again, it will be time well spent. Not only will this act as an aid in securing valid information, but it will also force the report-maker to give a concise account of the accident, and avoid the "rosy" version, which occurs so often in a poor reporting system. Object lessons ascertained in accident investigations must not be whitewashed, because such tactics make a sham of the whole accident reporting process.

Set-up an Adequate Filing System, whereby cases and individual histories are readily available. Your file should enable you to identify those employees with an accident problem, so that extra help may be provided. Accident information may be used in training sessions by discussing what can be done to prevent future accidents of a similar nature.

Write-up Office Procedures to give your safety program a sense of direction. Have definite goals, with action geared toward the attainment of these goals. Make sure everyone in the safety unit knows his job, and knows it well. Don't allow your safety program to become a hit or miss affair. Its "how" and "why" must be spelled-out to those who are involved in its direction.

Develop a Safety Review Board with teeth in it. If an accident is "preventable," it should be realistically classified as such. Members involved in preventable accidents should be held accountable for these accidents by this board, and they should be disciplined accordingly. Make sure, through a department directive, that the employee is thoroughly familiar with the makeup and penalties doled-out by the Safety Review Board.

Safety Training Program. Maintain a continuous safety training program at all levels within your organization, such as: recruit, in-service, supervisory, roll call, multiple accident employees, and Safety Review Board referrals. Roll call safety training within the Chicago Police Department has been most effective. Also, discussing safety before the Superintendent's staff meetings, as well as before the various division staff meetings, generates interest in our safety program.

Publish Selected Statistics for command personnel, with suggestions as to how certain accidents and injuries can be eliminated or reduced. Refer to these statistics at various staff meetings. Emphasize leading accident causes, and concentrate on high accident units.

Write a Safety Manual for all members, wherein safety guidelines are given which conform to your organization's previously issued directives. Though it is impossible to reduce to writing a standard operating procedure for every activity in which a police

officer is involved, guidelines of a general nature can be written for most police activities that, when followed and used to form decisions, can materially reduce the hazard to the incident.

Join Professional Safety Organizations to gather information and exchange ideas. The Chicago Police Department's membership in the National Safety Council has been most helpful to our safety program. Other organizations we work very closely with are: the American Red Cross; Greater Chicago Safety Council; Citizens Traffic Safety Board; National Association of Fleet Administrators; and The Chicago Motor Club.

Maintain a Field Operation for purposes of safety training, inspections, and accident investigation. Our Communications Center notifies the Safety Section whenever a serious accident occurs. Our field unit meets with commanders, and their accident problems are discussed. Any hazards in our buildings or parking lots are inspected by our field unit, and recommendations for their elimination are forwarded to the responsible party.

Secure equipment necessary to run a safety training program. This would include sound and slide projectors, safety films, magnetic board, 35 mm camera, and testing equipment, just to mention a few. Our field unit takes color slides of department accidents, and these slides are used in our roll call training program. A room used exclusively for safety purposes, preferably located in your training area, would help your safety programs.

Publish a Safety Bulletin, or use an established publication within your organization to get the safety message across to all members. We distribute National Safety Council safety posters to our 101 units on a bimonthly basis. We use posters that cover all facets of safety, whose themes are applicable to a particular season or occasion (child safety, winter driving, lifting, eye care, etc.). We have our dispatchers issue periodic safety messages to units in the field. Our daily bulletin, weekly training bulletin, and monthly magazine all contain safety information. We have issued driver calculators to all members, with safety messages thereon.

Establish a Safety Awards System, where possible for both the individual and the units or groups into which your department is organized. As far as units are concerned, awards received as a result of the unit working together as a team will provide the double benefit of both safety and efficiency, because one begets the other.

Develop a *Compulsory Eye-Care Program.* Ninety per cent of our actions are based upon visual observations. This fact certainly warrants special attention in the field of safety.

All of these stated points will have little value without safety supervision. When safety instructions come from the first-line supervisor to the employees, safety becomes part of the job. However, when these instructions come directly from the Safety Section to the employees, they are considered over and above the job, and to a large degree optional to take or leave. Officers elevated to a supervisory position should be given special training in the techniques of supervision, and this training should include a healthy portion of safety responsibility.

A safety program, even though well-planned, cannot succeed, unless it is firmly established as a management function, keyed in operating procedures. The safety problem must be given the same kind of attention received by other management problems.

The control of accidents, both injury and non-injury, is good business, and such control reflects good management. Conversely, the lack of management support is the reason given by most safety people for failure of their safety programs. When management has a strong desire for safe operations, and gives the problem genuine management attention and priority, safety comes to life. The reverse will be true where poor management attitude prevails.

Management—top management—must have strong convictions on the necessity for placing safety first, above all other business considerations. They must work at the job of translating and communicating these convictions into policies and actions and expressed views, so that the entire organization is aware of safety's fundamental importance within the department.

Therefore, without proper basic concepts by top management, safety objectives will continued to be construed as misunderstood dreams of the safety officer, having no connection at all with other operating objectives. No safety program ever amounted to a hill

of beans without strong and continuous management participation.

What we have talked about thus far is far from complete. It represents a starting point only. The points discussed must be expanded upon and never considered complete. Each job and each idea put into action must be constantly analyzed and watched, with a view toward performing it better, in order to have the best overall safety program working for you at all times.

Money alone will not buy a good safety record—it takes a lot more than that. Good attitudes are a much more important factor in accident prevention, than are safety devices. I firmly believe that the manner in which an employee is supervised and the extent to which he is held accountable for following sensible behavior patterns have a direct bearing on his attitude—good or bad

When safety policy is left to the employee's discretion as something optional that he can take or leave, he will have little or no respect for it and is usually headed for disaster. I contend that good safety attitudes and the good safety performance that results are primarily nothing more than the reflection of good management attitude.

It is appropriate that safety be considered in every police operation, and it behooves the safety officer to display a keen interest in his specialty as it applies in all matters. If action in your safety program is injury-oriented—an after-the-fact approach, your accident reduction efforts may not be as successful. You can't manage something that has already taken place. There is little doubt that the primary police functions are adversely affected by all types of accidents, and safety must be recognized as an integral part of any police operation. Without proper planning, predicting, and anticipating with safety in mind, unreasonable manpower and equipment losses are sustained by policing agencies.

It is my sincerest hope that what I have said to you will aid in providing a base upon which safety programs can be sold and built to further the cause of accident prevention within your organizations. Much of what I have said has been broad, but when these concepts are related to your own organizational needs, in a manner of sound judgment, a specifically worthwhile safety program can evolve.

All safety policies, procedures, and practices must be sensible, operable, and pertinent to operating conditions and should be aimed at the control of basic safety hazards. Safety should be the responsibility of all employees.

Some of the most costly and annoying accidents do not result in personal injury. These accidents, however, usually bring to light mistakes and inefficiencies that must be corrected to forestall future losses, possibly including injuries.

Finally, every person has the obligation of safe-guarding himself, his family, his fellow workers, the citizenry, and the organization for which he works. As leaders or as workers in safety, we are in unique positions to generate this attitude in people—an attitude which will save lives, maintain whole and healthy bodies, reduce mental anguish, and save millions of dollars. This is certainly a worthwhile goal, and any thinking below these standards is not acceptable in the field of safety.

Everybody's life is spent in the pursuit of self-fulfillment, but not everyone reaches his objective. The man or woman who succeeds is a person who has realized, in time, that satisfaction does not arise merely from being good at something but also from being a certain kind of person. Such a person is not content to dedicate his life to small purposes. He has quality in his ambition. He does not strive to amass goods to feed his vanity, but does his best to become somebody who is esteemed. He wishes to be, not merely to appear the best, for this is the mark of quality. The person of quality realizes that there is something beyond success—it is excellence. This excellence was typified in what the goddess Athene said of Ulysses—that in him "deed and word notably marched together to their deliberate end."

It is my belief that this excellence can be reached by each member of this group, and by the group as a body, and eventually people looking-in, at this newly created Police Division, will say: "In them deed and word notably march together to their deliberate end."

STREET, ROAD AND HIGHWAY DIVISION

OPENING REMARKS

By RALPH L. ALTHOUSE
Personal Injuries Advisor, Illinois Div. of Highways, Springfield, Ill.

One day I was talking to a person interested in starting a new Division of Public Employees. His complaint was that the National Safety Council had nothing on safe operations for his particular activity. My attempt at explaining that the National Safety Council was a sorter, an evaluator, a suggestion box, and a depository for ideas about safety procedures, and not an originator of treatises on safety procedures or safety programs, was met with looks of confusion. His disbelief increased as I attempted to tell him that if he wanted a manual on starting a safety program in his particular field, he would have to write it in cooperation with others engaged in similar fields. When I started to tell him about the *Data Sheet* business, he began looking for the man with the net. However, I finally persuaded him that I was not yet an escapee from the booby hatch, that Public Employees had some things he wanted, even though there was not an immediate solution to all his problems.

How many recall the days when Public Employees held a whole session in Parlor Three? How many recall the days when an entire Public Employees Congress would not have had one session with more people than attended our Executive Meeting this year? George Kuhns and I can recall when 16 was a good number for an entire Congress. This indicates how far we have gone and how much help the man who was attempting to start a new Division can get from us. He is in a much better position now than we were when Public Employees first began, since many people attending the Congress every year have problems similar to his and have some solution to his problem.

At the time I first suggested setting up divisions within the Public Employees there was considerable objection to the idea, on the basis that we would be dividing up Public Employees and, eventually, it would fall apart for want of enough people to support the individual divisions. We know now that this isn't so. We are the living proof that Public Employees has added to its membership, rather than dividing the few it had. Knowing this, we are anxious to aid existing members in starting new divisions, since each new division in Public Employees will add to the grand total of council membership and, thereby, increase the pool of experience which will aid us in making the world a safer place in which to work.

We have three active and viable divisions, even though some of the chairmen of the new divisions feel they are fighting an uphill battle in endeavoring to get their divisions off to a start. They should not feel discouraged, since each of the three existing divisions now has more people attending meetings than attended all of Public Employees a few years back.

It is my belief that Public Employees covers enough activities and enough employees and employers that, with the help the parent organization can give each new division, eventually Public Employees will justify a conference rivaling the present Industrial Conference of the National Safety Council. We should not be discouraged. We are just getting started.

EMPLOYEE SAFETY DURING EMERGENCIES

By C. P. FULKERSON
Safety Director, Montana State Highway Commission, Helena, Mont.

The Safety Department of the Montana Highway Commission works on the premise that there is no useful way to separate employee safety during emergencies from public safety during the same series of events. We train in one field and keep the other constantly in mind. We also attempt to equip ourselves with and use every facility available to promote safety in both categories.

Montana is a big state, the fourth largest in the Union, blessed with the widest variety of terrain and a weather cover that is a constant source of amazement over our 147,138 square miles of flat plains, bad lands, rampaging rivers, and shining mountains.

From 1950 to 1965, the mileage of state highways grew from 8,878 to 11,649 miles. During the same period, hard-surfaced mileage increased from 5,547 to 8,285 miles. The characteristic of vast distances and restricted population (707,000) make it mandatory that a large network of highways, roads, and streets not only be constructed but maintained to serve the state's transportation needs.

Motorists expect to drive the length of the state without interruption or barricade—the entire 550 miles of it, no matter what the conditions. They have also come to expect the roads serving the 275 mile width of the state to be open the year 'round for north-south travel. Thus, maintenance of the roads is of utmost importance. Maintenance requires the operation of a great variety of vehicles, machines, equipment — mowers, sweepers, rollers, motor patrols, sanding trucks and snow plows, bush cutters, cat's, trucks of all types.

As any safety director knows, training for safety is a process as continuous as washing dishes in a cafeteria. Instilling safety concepts in the minds of maintenance (and construction) men is an undertaking that depends heavily on constant effort. Our safety department functions in three phases: personnel training; equipment upgrading; and extensive use of communications.

When new men are hired for the department, they are expected to have chauffeurs licenses. They are then given the National Safety Council defensive driving course. A standard first-aid course is next in line. Following this, they are assigned to their work areas and will be considered helper-drivers, each working with a seasoned driver or equipment operator. At this point, the new man's on the job training begins. While aptitudes vary with individuals, naturally, a few student trips with an old hand works wonders in demonstrating proper techniques, speeds, maneuvers, explaining things to avoid, methods of handling the civilian driver behind and the one ahead. The best equipment operators, experience has shown are those who handle their machines with smoothness and operator consideration. These are also, by and large, the safe operators.

Each year the Safety Department conducts a "One Day of Safety" program in all eleven maintenance divisions of the highway plan. During the course of a safety year, field checks or "tailgate" talks are made continuously to all divisions, all section-houses, all areas. Safety members talk with crews on the road, during breaks, during lunch periods, and bring crews up-to-date on new techniques, new methods, new findings, new equipment, new ideas relating to use of flag men, barricades, lights, warning signals, and the like. When safety people discover an unsafe practice demonstrated before them on the open highway, they make an effort to correct it on the spot, promptly, tactfully, but firmly.

Emergencies in Montana usually are nature or weather caused or related. To a certain degree, our people can predict that we will have an "x" number of emergencies during the four seasons of the year. The unknowns, largely, are locations, nature, and extent. In winter, we have our just share of winter storms — heavy snowfall, drifting snow, ice formations, sleet, snow slides, rock slides, ice jams, restricted visibilities or, for brief periods, none at all, as well as extremely hazardous ice conditions on roadways. Emergencies can also be instant and unexpected, such as an out-of-control vehicle hurtling down a mountain grade. Workmen have been

faced with such situations, or have come upon a jackknifed truck-trailer rig and a blocked highway situation requiring immediate and positive actions, not only to protect themselves, but to protect the traveling public.

In spring, heavy stream runoffs are encountered. This very often results in road washouts, bridge destruction, flooding. The Treasure State is wealthy in experience with flooding and the destructive quality of floods.

While new construction techniques have helped materially in reducing rock slides in mountainous terrain, these dangerous slides still happen in the older cuts through the mountain passes in the western part of the state.

Flash floods have been known to take out sections of roads. Earthquake damage has been extensive in Montana. This earth movement is pure destruction where highways are involved — no respecter at all of careful road alignment. Almost everyone is familiar with the Quake Lake disaster. Not only did a mountain slide obliterate a road, but almost nearly filled a canyon, dammed a river, and required all new road building activity through the area. Our highway department has photographs of this area showing the ragged end of a highway above a rough dirt wall, and the continuation of the same highway in a serene ribbon of asphalt some twenty feet below.

Maintenance men in western Montana are never overly surprised to come across a section of their roadway charge lying curiously askew at the bottom of a canyon. Their job is clear-cut and simple; cut and build a new road through the area, using just about every technique and tool of the modern day roadbuilder as well as the full gamut of safety practice.

Emergencies march right on through spring and summer. This season, for example, rains were so heavy in certain areas of Montana that oiling operations in these areas had to be suspended completely.

Man-caused emergencies happen, too. We're thinking of highway mishaps which almost always end up with highway blockage, creating hazardous driving conditions for the motoring public. Gasoline tankers have upset on our roads — some have burned furiously. Cattle trucks have overturned with sad but otherwise spectacular results. In all cases, highwaymen must rush to the scene to put up warning signs or signals, remove debris when released or ordered by investigating patrol personnel, and make repairs to the roadbed in an effort to keep traffic moving without further interruption.

Therefore, in a state which is constantly besieged by one emergency after another in seemingly endless progression, safety department personnel have set up a program of continuous employee training — in schools, on the job, in the field; aided by a continuous spot-check activity in the field. The safety department also relies heavily upon the almost indispensable Montana Highway Commission radio net, which ties the entire state into a communications whole. Safety men in Helena may contact almost immediately an operator in Cut Bank or Miles City, Baker, or Lima — days apart in terms of miles. Each one of 11 divisions is staffed with a communications person who, while he or she uses spare time for clerical matters, spends most of the day manning a radio console and battery of teletype machines.

This radio net is actually the life blood of the safety program in the state. Not only are reports transmitted promptly to headquarters, but remedial measures may be sent out as needed, when needed. Most mobile equipment in the state is equipped with two-way radio. Each truck has an identifying number and may call in or be called up selectively. By far the largest use of this radio net is by the supervisory personnel in coordinating the work of the far-flung 2,000 man army. During critical moments, however, radio becomes a life saver not only for our maintenance and supervisory personnel but also for stranded motorists.

The Montana Highway Department is reluctant to close a section of road for any reason. Nevertheless, during extremely rough winter driving conditions, this closing stint must be done when it is beyond human ability to keep drifting snow from blocking miles of highway. Montana Highway personnel can almost always point a finger at the Cut Bank-Browning area of the state, for example, as one of the flagrant winter drift offenders. Almost no winter goes by without some blockage of this rigorous stretch of road. When closing is considered necessary because driving has become literally impossible, one highway plow with two men is sent through the area to check out

the possibility of stranded motorists. The truck is radio-equipped and can summon emergency help not only for any stranded motorist but for themselves if they happen to become stalled in car-height drifts, which are not at all uncommon.

Winter maintenance crews are usually well equipped for the weather in which they work. They start out in the morning with filled thermos bottles of coffee. They carry their lunches and dress to suit conditions and carry extra clothing. It only takes one or two bouts with highly proficient old man Montana Winter to be convinced about the wisdom of dressing for the jobs to be done.

Keeping Montana's roads open for winter driving is no small task. Right now, the Butte division estimates it is going to require at least 4,000 cubic yards of sand to maintain winter driving conditions on the Boulder Hill alone — a relatively short stretch between Butte and Helena. This sand presently is being stockpiled in sand houses and storage areas where it can be reached quickly and handily against positively certain needs.

The sand also has to be spread when it is needed. Conditions prevailing when spreading is required are seldom the best. An almost impenetrable cloud of blowing snow envelopes either a moving plow or sanding truck. Of course, highway travel comes to a crawl on such days, but danger is there for the unwary. Our operators are specially trained for the operation of either snow plows or rotaries. Relatively high speed plowing runs take a remarkable amount of experience, operating skills, and training. In mountainous terrain, this work can be very dangerous to the driver. Sand truck operation also requires well-trained crews.

Operators of both plowing equipment and sanding trucks are instructed to work a planned short stretch of highway and then pull out onto the shoulder of the road, in order to permit the passing of following traffic. During such periods of hazardous driving headquarters also fans out to press and radio to those portions of the state requiring the information, notices to drivers to avoid passing plowing or sanding equipment, because such equipment will pull over regularly where possible to permit much simpler, much safer passing.

In days gone by, the cab-mounted rotating warning light was obstructed by the lifted truck body while sanding, and its effectiveness was reduced to zero. Today, we mount the light on the box itself, permitting the light to raise with the lifted body. Thus, it is always as visible as a light source can be under the driving conditions experienced at the time.

Our safety department wants to keep highway equipment as visible as possible at all times. The very paint scheme itself (Montana Orange), used on all equipment, is a safety device. It shows up well under all conditions, especially so during winter "white" conditions. Beyond this, drivers are also required to switch on their headlights whenever their vehicles are in motion. Flashers, rotating lights, warning signs, lighted barricades, well-trained flagmen, are among the safety tools employed religiously by the maintenance crews of our highway department. Fluorescent safety vests and red-orange safety hard hats are required for on-job personal wear.

Our department is experimenting continuously with lighting with the development of newer and better lighting systems, especially for ice and snow conditions. Our present system, [illegible] employs a device similar to the [illegible]'s revolving light, works out quite satisfactorily. Our needs require compromise to a certain extent, as does the runway lighting systems of airports. There are lights available today of such high intensity that they can penetrate all but the most dense cloud of fog or blowing snow conditions. The disadvantage inherent in such high intensity lights is that they also effectively blind drivers during sudden moments of clearing.

We cooperate with maintenance crews, shop foremen, engineers, and technicians in the development of new methods of installation and mounting. We always try to be aware of all avenues of safety — instruction, day-to-day work practice, spot checks, equipment aspects — so that our men and equipment and work habits are up to standard in the work and safety climate.

New employees of the Montana Highway Department receive, with their employment paraphernalia, single copies of the Department's *Safety Manual.* The employee tears out and signs the receipt in the back of this manual as evidence that he has received it. It is his personal property. Evidence that

our personnel study this manual and put its precepts into practice comes with the annual records of better-than-average accident loss experience. Figures from our insurance carrier have been more than satisfactory.

The philosophy underlying army training is to develop reflexes that operate ahead of conscious thinking or planning, ahead of fear, ahead of confusion. This is what we attempt to accomplish in our entire safety effort: to bring about a condition of proper reflex action under emergency or stress situations and develop this in the bulk of our employee charges.

In practicing this overall safety job, we testify to the effectiveness of regular, routine, continuous, night and day, day-in-day-out plugging of the all-aspect message of safety — safety in thinking, safety in planning, safety in working, safety in driving. We do this with a relatively small staff, but we do it continuously, statewide.

To summarize, our tools consist of training, class work and on the job; tailgate checking, day-to-day working with personnel; communications, using to the utmost the convenience and practicability of a statewide radio network; annual refresher, the conduct of "A Day of Safety" within each of 11 divisions as well as headquarters; innovations, regular work in the areas of new equipment development and lighting applications; and continuous effort, a program embracing "safety every day in some area" on a regularly planned basis.

Under this program, employee safety during emergencies is thoroughly phased-in and goes hand-in-hand with safety considerations of the traveling public. We not only think this activity is important — we find it works!

FLEET SAFETY AND FLEET CONTESTS

By RICHARD E. WEBB
Safety Director, Nebraska Department of Roads, Lincoln, Neb.

The Nebraska Department of Roads first entered the National Fleet Safety Contest during the 1964-1965 contest period. At first we were dubious as to what was accepted in the method of reporting, accumulation of vehicle miles, and correct interpretation of reportable and non-reportable accidents. We were fortunate to be able to obtain information and guidance from the Nebraska State Patrol. The Nebraska State Patrol has won eight out of 14 National Fleet Safety Contests in which they have participated. Therefore, the State Patrol was well qualified to give assistance to the Department of Roads.

The normal procedure for reporting accidents within the Department of Roads probably coincides with the reporting policies of other highway departments. All accident reports, vehicular and personal, are initiated by the supervisor of the employee involved in the accident. The reports are forwarded to the division level and in turn are sent to the Lincoln office. The original report and two copies of the vehicular accident are received by this office from the division level. The original and one copy of the report are then forwarded to the department Legal Section. At this point, procedure may vary from that followed by other highway departments. The Legal Section of the Nebraska Department of Roads handles all compensation cases, collection of all property damage cases, and the settlement of damage claims against the Department. One copy is retained in the Safety Director's office for review and any action deemed necessary. It is at this point that vehicular accidents are classified as either reportable or non-reportable for contest purposes. As vehicular accidents are received, a running total of reportable and non-reportable accidents for that particular month are tabulated. This eliminates the necessity of reviewing all vehicular accidents for the current reporting month.

All mileage tabulations used for contest purposes are received from central accounting. The mileage totals received are divided into three categories: 50000 numbered equipment, which are passenger cars and station wagons; 40000 numbered equipment, which

are pickups, carryalls, and light trucks (one ton or less); 20000 numbered equipment, which are all trucks over one ton. For fleet contest purposes, the mileage totals for the 40000 and 20000 series are combined. After the mileage reports are received, the contest report cards are completed and forwarded to the Statistics Division of the National Safety Council.

The additional time spent in reviewing and tabulating vehicular accidents for fleet contest purposes has not proven to be excessive. In fact, it is an extension of the material information already gathered. From our experience, time and effortwise, it would appear that all highway departments could enter the fleet contest without any additional inconveniences.

The Nebraska Department of Roads has been fortunate to place first in the fleet contests for state highway departments since this group was first established in 1965.

During this period, interest in defensive and safe driving seems to have increased. The fact that the Department of Roads has been the recipient of the awards, coupled with participation in the Defensive Driving Course by employees, has helped to create an awareness among personnel as to the dangers involved in everyday driving. More discussions involving driving habits of our personnel and the traveling public have been noted on safety meeting reports from Department supervisors.

Whether the winning of the awards has helped reduce vehicular accidents, is debatable. The frequency rates and total reportable accidents for the reporting periods from 1965 vary up and down. The frequency rates for the Department of Roads have been: 1965/1966 — 4.63; 1966/1967 — 4.39. The total number of reportable accidents for these periods were: 1965/1966 — 62; 1966/1967 — 51; 1967/1968 — 56.

Regardless of the finishing positions of the various highway departments in the fleet contest, it is felt that all participating highway departments profit. The comparison with other highway departments and with your own department's record in the preceding years provides a tool to check the progress being made in reduction of vehicular accidents. Also, it should be emphasized from our experience that participation in the Fleet Safety Contest did not create or add any appreciable amount of work for our office.

FLEET SAFETY TRAINING

By G. F. KUHNS
Safety Supvr., Bureau of Training & Assignment, Illinois Div. of Highways, Springfield, Ill.

Many of us represent highway departments which are concerned with the construction and maintenance of highway systems free of hazards; however, many of our activities create hazards to the traveling public which are as great or greater than those we are attempting to remove or correct.

Many highway departments throughout the nation have the largest vehicle fleets in their respective states, and the most important ingredient of effective and efficient use of this equipment requires safe-driving skills.

It would be nice if there were enough qualified drivers for every motor vehicle fleet and if hiring practices permitted all fleet operators to select only those drivers who possess a high degree of driving skill; however, the source of skilled drivers in many areas are limited. If such a condition does exist, then consideration must be given to up-grading the driving skills of the best applicants selected.

If a training program is comprehensive, even a driver who shows below average skill may gain the necessary skill for a driving job. The training program should provide the driver with the knowledge needed to do the job, the skill necessary to do it properly, and an appreciation for the importance of the job and the necessity of doing it safely.

Both behind the wheel training and classroom instruction are needed if highly skilled drivers are to be developed. Although behind the wheel training will require considerable time and personnel, I know of no other way to teach a driver with limited experience, such basics as how to apply trailer brakes properly, how to operate a two-speed axle and, I am sure, some will need to be taught how and when to shift.

Even if you are fortunate enough to hire highly skilled truck drivers, they may have had no experience in operating trucks equipped for and engaged in snow removal. We are most fortunate that our first few snows each year are rather light, and the new operators have an opportunity to get the feel of the equipment before the heavy snows set in; however, it isn't necessary to wait until the snow starts to fall before starting behind the wheel training. At several sites in the Chicago area our maintenance engineers have had wind-rows of cinders placed and, prior to the snow removal season, new drivers are sent out with snow plows to practice by pushing the cinders with their plows.

The most effective classroom training requires a room which is sound proof, well lighted, and well ventilated. It should be equipped with tables and comfortable chairs because, if trainees are not comfortable and the environment is not conducive to learning, then a great deal of training effort will be wasted. Also, the training must be tailored to specific needs.

Many of us must use the lecture method in our training because we can cover a great deal of material in a short time; however, there is a danger that the lecture can become monotonous and boring. To guard against this, the instructor must strive to make his lecture interesting by keeping to a few basic points, selecting good examples or anecdotes, and utilizing visual aids.

For example, what vehicle movement contributes to the greatest percentage of accidents in your fleets? Within our fleet, it is backing. We have prepared a series of slides on "Backing." (Shows slides.—Ed.)

Although I suggested that you limit your presentations to a few basic points, be certain that you do give enough information on each point.

FLEET SAFETY

By D. F. TURNBULL
Engineer of Highway Safety, Florida State Road Department, Tallahassee, Fla.

The State Road Department of Florida has been quite happy and proud of the progress we have made. Not only have we had statistics to substantiate a good fleet safety program, but the department has been getting a substantial amount of cash refunds from our insurance carrier. We all know that a fleet safety program has really two objectives. The first is to save lives and reduce property damage; the second is to keep the employee from losing time from work as well as losing the use of the equipment. We can measure our program, then, in two ways: the cost of insurance; and accident records of the equipment and time lost by the employee.

I would like to go back over 14 years to 1954. In 1954, we had 2,094 pieces of equipment and registered 200 accidents, or a 9.5 per cent ratio. Put another way, we had 0.85 accident rate per 100,000 miles traveled. They were both chargeable and non-chargeable accidents. Our premiums at that time were $86,800 and our losses were $26,900, for a loss ratio of 31 per cent.

The bottom seemed to drop out for the next ten years. By 1963, we had 3,632 pieces of equipment, 396 accidents, and an accident rate of 1.05. Our premiums were $227,300 and our loss was $250,793, a loss ratio of 110 per cent. In the meantime, during that ten years, we had gone through 12 insurance carriers, paying a total premium of $1,068,000, with losses of $997,700 and a loss ratio of 92 per cent. Our fleet safety program during this time was a hum-drum sort of thing carried along with other safety programs because it was like motherhood, but nobody was really

interested except the safety administrators.

In 1964, we entered a new contract with a group of carriers. The contract called for a full pledged fleet safety program, with the insurance carrier assigning an expert full-time as a consultant in carrying out this program. In addition to the full-time consultant, the insurance carriers would periodically assign its field employees to review the driving habits of various operators as they handled our equipment on the road. These reports came into the highway department, and action appropriate to the degree of criticism was taken, short of a penalty without the required due process of a hearing.

Since Florida does not have a driver's license re-examination requirement, the Florida State Road Department requires a driving certificate. This certificate is issued periodically, every two years, and operators must pass a written test based on the regular driver's written test. With the purchase of 22 ortho-raters and reactor indicators, we are able to give the same visual and reaction tests as required to get a Florida's driver's license. In addition, some people may be required to take a road test. We have gotten tremendous results from this — a number of people have been terminated or shifted to other jobs, but at least we know that our drivers are qualified.

Adequate driver's selection standards were established for all new drivers. Our penalty program for chargeable accidents became very strict; however, consideration of no penalty was given on the first accident, for minor accidents, for our long-time faithful employees, and some other considerations, all judged by a safety committee. We initiated safety awards for individuals, ranging from engraved cigarette lighters and fountain pen and pencil sets, to expensive plaques to hang in the unit headquarters. We held many driver training conferences with the use of many posters and other fleet safety techniques. In addition to the insurance company's full-time consultant, we have a director of safety with a staff of five inspectors handling our fleet safety program on a statewide basis, along with personnel safety. We asked the various police agencies to vigorously enforce traffic laws to those driving road department vehicles. Periodically, the governor sends out a safety message to the employees of the highway department, emphasizing safety. A periodic performance report is furnished the department by the insurance carriers, listing accidents, data pertaining to the driver, cost of the accidents, causes of the accidents, etc. When a man has an accident, the data sheet, in the form of an IBM report, lists his name for everybody to see.

What has all this led to? It led to the point that last year we had 4,275 vehicles, 266 accidents, with a loss ratio of 41.9 per cent and an accident ratio of 5.4 per cent or an accident rate per 100,000 miles of travel back down to a 0.99. We were quite happy with the result of our safety program, and had just received a $28,000 refund on our $157,000 premium.

Would you believe that now, as a result of four severe accidents, we have a loss ratio of 97 per cent and our premium is going to cost us an additional $80,000, without realizing any of the $28,000 refund? In short, we are out an additional $108,000. We now have, for the year ending in July, 4,743 pieces of equipment and only had 209 accidents for a 4.4 per cent ratio of accidents. But, as I said, our loss ratio is 97 per cent.

We must design a special extensive educational program to reduce severe accidents. In addition to our regular program, we have added a defensive driving program. We believe that this has brought results. This is in addition to the National Safety Council D. D. C.

We feel that we must remove the leeway on first accidents on our penalty plan, even though this might grab off a member of the higher echelon. We hope to be able to work out an additional reward of time off for safe driving.

In addition to the full-time consultant, we are proposing to put on a full-time fleet director. Above all, we are going to institute training courses for our field inspectors. The curriculum will be set by our insurance carriers consultants. Until the severity is reduced, our field men will investigate each accident over X number of dollars to determine the unnecessary damage to the vehicle or the property. To determine if it is a chargeable or non-chargeable accident, investigate the previous driving record of the operator and anything else pertinent to the driver and accident in determining the penalty action to be taken if chargeable.

SAFETY IN AN ALL AMERICA CITY

By ALAN F. KIEPPER
City Manager, City of Richmond, Va.

Last May *The Personnel Man,* published by the Public Personnel Association, contained an article which discussed the lack of safety training in the public service. Charles J. Setzer, the author, showed attendance records for the National Safety Council's "Fundamentals of Industrial Safety" courses for a year. He pointed out that industry occupied 80 per cent of the student seats, while state and local government represented only six per cent of the total enrollment. Less than two per cent of the attendance came from city and county governments.

The NSC courses and the concept of industrial safety are paying off in Richmond, Virginia. I shall explain to you how we use the industrial safety approach and some of the results we have had with it. Sometimes government people think industry's approach to a problem will not work for them. We in Richmond know that is not true of accident prevention. With some modification of terminology it can be amazingly successful.

Records

Records are the cornerstone of an accident prevention program. Because they must be developed before a logical program can begin, we will consider them first.

Some fourteen years ago, Richmond surveyed its experience and discovered its highest accident factors. We tackled them right away. A city-wide committee was formed to assure that every agency approached its major problems with adequate information and good techniques.

Although our organization has changed over the years, we have maintained a regular system of reporting. Naturally, we use USA Standard Z16.1 for personal injuries. We feel the need for comparison with other employers outweighs any weaknesses of this particular standard. While some supervisors occasionally forget some portion of the standard, we have found it relatively easy to administer.

Vehicle and machine accidents ought also to be included in a reporting system, even if they do not result in personal injury. Something went wrong. We cannot find the cause unless each incident is reported.

And this means records do no good unless they are used. They must be studied, then acted upon. Are machine accidents primarily the result of poor design of the machine? Of inadequate maintenance? Of human failure? We attempt to buy sound vehicles. We have a preventive maintenance schedule for each one. Yet, each year we have an embarrassing number of vehicle accidents. Why? Our experience agrees with national statistics: human failure is the primary cause. More specifically, Richmond employees fail to yield the right of way, and they tailgate. We haven't licked this problem yet, but we know what it is.

Over a period of years we noticed that several employees had died while working underground. Two men were caught by a flash flood in a sewer; two firefighters entered a hole which appeared in a residential area and they didn't come up. Investigation of all these deaths showed clearly the need for testing the air before descending below ground, and for the use of life lines when working below the surface. We have put these techniques into practice.

Engineering

Industrial engineering related both to work flow and to working conditions is important to safety. We have learned two things about engineering a job: (1) if the employee sees that the work flow is logical he understands it; (2) a logical work flow makes a job easier to handle, and the worker is apt to use the correct procedures because they make sense to him.

We know, too, that environmental conditions have a bearing on the prevention of accidents. The size of the work area, adequate light and ventilation, and the orderliness of the work area are some of these conditions. A surveyer standing in the middle of a narrow bridge is concerned for his life: how can we protect him? Ventilators have been developed for men who work in man-

holes. Even a sewer maintenance man can do a better job if we let him block off enough of the street so that he feels reasonably secure.

Then what of the physical condition of our people? Richmond determines the physical requirements of each job and communicates them to our medical examiners. All new employees must pass a physical examination appropriate for their duties before they go to work. At any time a supervisor questions the physical ability of an employee to continue his duties, he can request and get another physical. We give annual physicals to all police and fire personnel above age 40, as well as to certain other categories of hard working people.

Safeguards

Another fundamental part of Richmond's approach to accident prevention is our insistence upon safeguards: both for the worker, and built into equipment. Guards have become a normal part of grinders and saws. As a matter of fact, we write our safeguarding requirements into every set of specifications for new equipment. A couple of years ago we received a new fire pumper, tested it, and rejected it quickly. The gasoline supply was near the water pump, and the heat from the pump actually raised the temperature of the gasoline to the boiling point! Needless to say, we required a relocation of the gasoline tank.

Last year, we received a small fleet of loadpackers. The manufacturer had located the controls of the packing mechanism inside the cab, contrary to our specifications. After some negotiation, the manufacturer agreed to pay for local conversion of these controls. We require them at the back of the truck, because the men who load it know when they are ready, and *they* start the process. In another case, a stairway was built into a new sewage treatment facility. Employees had been using it for some time before the safety man came through. He noticed that it lacked a hand rail. We had overlooked this item in the plans and in our inspections during construction. The rail is there now, however.

In addition to physical guards, we protect our employees with safe equipment. Our safety administrator reviews all requests for metal ladders, weed killers, etc. Only when he is satisfied that they are suitable does our purchasing department buy them.

Richmond supplies to its employees any type of protective clothing that we believe is both useful and practical. Our fire chief says we could completely protect his firefighters, but they would be so loaded with safety equipment they could not fight a fire. We are careful to avoid making protective clothing and equipment too burdensome for the job to be done.

Employee Interest

All of the nice atmospheres and safeguards in the world will not result in freedom from accidents if your employees are not interested in your program. Somehow, you must make it their program. In Richmond our first approach is to give the employee adequate training when he first comes to work. We send our safety men to the NSC "Fundamentals" course, for instance. We appeal to the common sense of our people when we explain our way of doing things. Then we show them that we approve when they do things correctly.

Most employers use some form of tangible incentives, and we do, too. This month our drivers are receiving safe driving awards. Over 400 of them have received 14-year cards — the highest we have attained. Special gifts have gone to those completing 10 years with no chargeable accidents.

Our public works department completed 1,500,000 man hours without a disabling injury last August. In addition to commendation of the department by the National Safety Council and others, each employee received a pin recognizing his contribution to this record. Some agencies have a picnic; others have contests, or celebrate a goal with coffee and cake.

How many of you use "table teasers" in your cafeteria or in public waiting areas? Do you use posters and change them frequently? How well do you use your employee newspaper, or payroll inserts? We have found "pop" posters useful on doors, file cabinets, and stairs.

We have found that employees become enthusiastic about accident prevention if they have some influence upon it. They like safety committee assignments, and they like to make suggestions when the suggestions are used. We have discovered, however, that we

must explain *why* if we are unable to use a suggestion, and it better be a good reason!

Save by Spending

The City of Richmond has proven that we can save money if we are willing to spend a little for safety. Our public utility has received awards from both the American Gas Association and the American Water Works Association for its outstanding safety achievements. Through a concerted effort and the annual expenditure of one dollar per employee, our public utility gradually reduced its injury frequency from 44.00, until last year it reached 0.91. Their expenditures for personal injuries have been reduced from $288 to one dollar per capita.

We believe, too, that the time has come for us to give full-time direction to accident prevention. Last week our first full-time safety administrator reported for work. One of his first assignments was to attend the National Safety Congress. We believe the addition of this position in our budget will allow us to save several times its annual cost. If this is true, Richmond's government will be able to put more public funds into services and less into overhead.

Reduce Suffering

The guiding force of a good accident prevention plan must be the avoidance of human suffering. Fortunately, someone came up with the idea of workmen's compensation nearly 60 years ago, and employers were forced to think of their employees as human beings. They found that it paid off. In Richmond, when an employee is injured we give him the best medical attention available. We insist that he stay home until our doctor thinks he can resume work, and we continue his pay while he cannot work. We feel that we can contribute in these ways to a happier life for him.

Richmond is trying to reduce costs and suffering in our public employment. We are having some success. In the next two years, we are going to have greater success. You, too, can succeed with a methodical and positive approach to your safety problems. Try it. It works.

HIGHWAY SAFETY: TODAY AND TOMORROW

By BRADFORD M. CRITTENDEN
Director, Highway Safety Programs Service, National Highway Safety Bureau, U. S. Dept. of Transportation, Washington, D. C.

We can understand better where we are today, and the directions in which we must move tomorrow, if we take a hard look at yesterday and face up to some of our critical failures of the past. As the inscription on a pedestal of the National Archives Building in Washington reads: "What is past is prologue."

The first and most pervasive failure has been a failure of concept, which led us to define the highway crash problem too narrowly. The highway system is made up of three elements: the driver (and other highway users); the vehicle and its load; and the highway and its appurtenances.

This being the case, we reasoned, with some logic, all crashes must be due to failure of the driver, the vehicle and its cargo, the roadway, or to a combination of failures in these elements. All right so far, you will say, and a fairly useful concept. But then we reasoned — and here is where we strayed — obviously, all highway safety measures must be directed to improving the performance of the drivers, vehicles and their cargo, or the roads if we are to reduce accidents.

The concept here failed us in at least two respects. First, it limited our approach to the prevention of crashes rather than to the prevention of death and injury, which must be our prime concern. When it was shown that many, if not most, highway crashes could be rendered relatively harmless by feasible changes in the vehicle, the arena for constructive action to reduce highway deaths was vastly expanded.

But the new concept is slow in gaining acceptance: witness the failure of so many to use seat belts and upper torso restraints.

A second respect in which the old concept was inadequate was that it restricted our thinking too narrowly to the highway system and its basic elements.

It may sound like heresy, but I for one have lamented the decline in passenger rail service in the United States and have viewed with dismay the decline of mass transit in our metropolitan centers. I even confess to a secret satisfaction that cable cars still operate in San Francisco, and to a certain nostalgia for the passenger ferries that used to ply San Francisco Bay.

But regardless of personal views, there can be no doubt that a substantial part of the explanation for the annual highway death toll lies in our failure as a nation to develop an integrated national transportation system — a system providing optimum utilization of existing modes of transportation, plus the rapid development of additional new modes — in brief, the mission of the newly created U. S. Department of Transportation.

I might continue for sometime to discuss additional factors in the highway death toll not directly attributable to the vehicle, roadway, or driver as such, but let me mention only one more. Dr. William Haddon, Jr., Director of the National Highway Safety Bureau, has pointed out that even under condition of jungle warfare members of our armed forces receive swifter and better emergency care, transportation, and definitive medical treatment than do victims of traffic accidents here at home. Literally thousands of crash victims die needlessly each year because of deficiencies in our emergency response systems. Although it will take some time for the states and communities to correct the situation, we now have a national standard for emergency medical services.

Still under the heading of failures of yesterday which brought us to our present critical situation, let me say something about highways.

It has often been said that the United States has the finest highway system in the world. To this I would reply, yes, but no other nation relies on highway transportation to the extent we do, and if anyone doubts the truth of my assertion that even the best parts of our best-of-all highway system are far from good enough, I would suggest a careful reading of recent testimony submitted to the Special Subcommittee on the Federal-Aid Highway Program of the House Committee on Public Works.

Let me outline basic reasons why the highway contributes to the annual death toll. In doing so, I will take the position that much of the nation's street and road mileage, considering the use to which it is put, remains in a very primitive state.

By 1900, when automobiles were still a novelty, over two million miles of rural roads were already in use in the United States. Many of these roads followed animal trails and Indian paths. By 1921, the rural road mileage had increased to nearly three million miles and motor vehicle registrations had risen from 8,000 in 1900 to more than nine million in 1921.

Today, rural mileage is only slightly over three million miles. Thus, two-thirds of it predates the automobile, and nearly all of the remaining one-third was laid out in the early years of the motor vehicle — prior to the introduction of the 1921 model motor cars. As a matter of fact, since 1916, when Federal-aid for highways was first authorized, only about 700 thousand miles of new highways have been constructed, bringing our present total mileage, both rural and urban, to 3.7 million miles of roads and streets of all kinds.

Most of the investment in highways during this period has been committed, not to new routes, but to improvements of an existing system. In other words, the joint effort by the Federal and state governments has been directed largely toward improving — in terms of capacity, utility and safety — the basic network that we have had since horse and buggy days.

Quite understandably, in the early years when virtually all of our rural mileage was originally laid out and constructed, road builders generally followed lines of least resistance. Part of the resistance, of course, was land topography, which they disturbed as little as possible, thus accounting in part for the numerous and often abrupt vertical and horizontal curves still characteristic of much rural mileage.

But, perhaps even more important than topography, cost considerations influenced right-of-way acquisition and highway geometrics. The quality of foundations, availability of materials, the type of traffic and traffic volumes expected are some of the

factors which have important bearings on the design, the construction, and the cost of the highway.

Viewed from some distance, perhaps the most conspicuous change in the nation's road system since the invention of the automobile has been the surfacing of streets and roads originally laid out for horse-drawn vehicles. At the turn of the century, less than seven per cent of the rural roads were surfaced; today about 75 per cent are surfaced.

The highways in the rural and unsettled portions of the nation have been the one relatively lasting element of the highway safety matrix. They have served the public twenty-four hours a day every day of each year. Although there are obvious advantages in this arrangement, there are also some disadvantages. For example, highway hazards that are built-in, without sufficient application of human engineering principles, endure in their effect as rigidly as those geometric features which are found to sustain safety.

Thus far I have considered only our three million miles of rural highways. When we turn to the nation's additional half-million miles or so of urban streets, the outlook is even bleaker. Much of this mileage also predates the automobile, and here it is even more difficult and expensive to adapt the streets to the requirements of today's vehicles and drivers. Complicating the urban traffic problem has been the explosive — and generally unplanned — growth of the suburbs.

In summary then, from 8,000 vehicles in 1900, we now have some 97 million which are driven nearly one thousand billion miles per year by more than 102 million drivers.

When one considers the astronomical number of possible conflicts in a movement of the magnitude I have described, it must be apparent that the majority of drivers — most of the time — are doing a magnificent job of avoiding serious injury. Their performance is all the more remarkable in view of the possibilities for vehicle failure, the lack of uniform regulations, the bewildering array of non-standard signs, signals, and highway markings, and the built-in booby traps remaining in much of the nation's road and street mileage.

If I have painted a rather dismal picture up to this point, I have done so deliberately to show that a major part of our problem has been due to the explosive growth in the number and use of motor vehicles and the attendant lag in the development of adequate facilities on which to operate them safely.

Now, what about today and tomorrow?

The great challenge in highway and traffic engineering lies in adapting existing roads and streets to present day needs, and here I would mention the spot improvement program which was begun in 1964 and which continues to gather momentum. Directed to traffic engineering improvement of high accident locations, 11,000 such safety projects have now been programmed or completed at a cost of $872 million. A recent nationwide inventory shows 20,600 high accident locations which are proposed to be corrected at a total cost exceeding two billion dollars.

Will spot improvements reduce accidents? Let me cite some recent facts from one state which has had a well-established system of accident location surveillance and follow-up, resulting in considerable savings in lives, injuries, and property damage. Projects initiated under the program were each under $50,000 in cost, and many were less than $1,500. In fact, projects in the $1,500 range seemed to have the more desirable cost/benefit ratio.

Improvements ranged from simple channelization, delineation, traffic signals, lighting, guard rails, all carried out on low volume roads. I would like to quote some of the findings from a one-year before and after study on 221 traffic safety projects: total accidents reduced by 23 per cent; fatal accidents reduced by 53 per cent; fatalities reduced by 62 per cent; injury accidents reduced by 25 per cent; property damage only accidents reduced by 21 per cent. Overall, the benefit/cost ratio for all projects in the study was 0.78; in other words, the benefits received from the improvements exceeded three-fourths of the total cost in the first year of use. In less than two years the projects will have paid for themselves.

Other programs, including the TOPICS program directed to improving the safety and capacity of urban arterials, and the joint development concept for design and location of urban freeways have been launched and will greatly modify our traffic environment for the better.

But highways are only a part of the total traffic environment and here I would like to mention the Federal safety legislation of 1966. The National Traffic and Motor Vehicle Safety Act reflected a perhaps belated, but rapidly burgeoning awareness, that the motor vehicle itself is a most important element in our highway traffic environment, and that modifications in vehicle design offered a potential payoff — in terms of injury reduction and lives saved — at least as great as that possible through modifications in the roadway.

Specific consumer information should be made available concerning safety characteristics of competing makes and models. To date, the Bureau has awarded a total of 106 research contracts totalling $14 million. One of these, involving the Bureau and the New York State Department of Motor Vehicles, calls for a study of the crash experience of at least 27 makes of passenger cars. Actual crashes will be analyzed to provide data on the relationship of vehicle design variables to the frequency and severity of crashes and injuries.

Pursuant to the Highway Safety Act of 1966, a total of 13 standards for highway safety programs conducted by the states have been promulgated by the Secretary of Transportation. Standards cover Periodic Motor Vehicle Inspection, Motor Vehicle Registration, Motorcycle Safety, Driver Education, Driver Licensing, Codes and Laws, Traffic Courts, Alcohol in Relation to Highway Safety, Identification and Surveillance of Accident Locations, Traffic Records, Emergency Medical Services, Highway Design, Construction and Maintenance, and Traffic Control Devices. Standards covering three additional areas are now under review: Police Traffic Services; Pedestrian Safety; and Accident Cleanup.

As of September 30, a total of $30.7 million in Federal-aid matching funds had been made available for approved projects meeting standards in the 50 states, Puerto Rico, and the District of Columbia. Additional Federal-aid totaling some $8 million for pending projects is being processed.

As of this date, a total of 22 initial and revised motor vehicle safety standards are now in effect, incorporating well over 100 specific safety requirements. In addition there are — in various steps of the legal process required — a total of 23 amendments to existing standards and 24 proposed new standards.

Without detailing specific safety requirements, preliminary studies by the Bureau indicate that we can eventually expect to drive vehicles far more forgiving of driver error — to enable us better to avoid crashes in the first place — and which will be crash proof at speeds most conducive to crashes.

Time will permit only limited discussion of highway safety standards, but there are several which I would like to expand on briefly.

In the Highway Safety Act of 1968, driver education was singled out by Congress as an area requiring special consideration — reflecting an altogether proper concern for the safety of our youth and an awareness of their higher accident rates.

Broadly stated, the assumption of driver education is that by skilled training, information exchange, and inculcation of safety values, the attitudes and performance of the driver trainee will be favorably influenced. Such influence will lead to fewer accidents, violations, and anti-social driving behavior. While efforts have been made to evaluate the effectiveness of driver-training courses, and although some question the design, or the controls, or the lack of statistical treatment in these studies, the contention that driver education will help the driver make safer use of his vehicle is entirely plausible. The practical course available to us is to turn attention to the development of improved instructional programs and, more fundamentally, on driving behavior itself.

The use of alcohol has long been recognized as an important factor in fatal and serious injury automobile collisions. Not generally understood, however, is the fact that the alcoholic, to a greater extent than the social drinker, constitutes a major part to the relationship of alcohol to vehicular death and injury. Nonetheless, both the social drinker and alcoholic are involved in the tragic violence on the highway. A study by the California State Department of Health recently disclosed that 650,000 persons with alcoholism are among the 10 million licensed drivers of the state. Even more disturbing is the study finding that alcoholics, though representing 6.5 per cent of the driver population, account for 10.4 per cent of the total mileage.

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OCCUPATIONAL MEDICINE IN THE ELECTRONIC AND ELECTRICAL INDUSTRY

By HARRY E. TEBROCK, M.D.
General Telephone & Electronics Service Corp., New York, N. Y.

Probably no other industry has developed so rapidly, made greater inroads into the intricacies of science, or taxed the imagination and ingenuity of man more than the electronics industry. From the simple, humble beginnings of the crystal set radio and vacuum tube to the complicated marvels of TV microwave devices, computers, lasers, etc., electronic engineers continue to push back the barriers of the seemingly impossible to accomplish the incredible.

However, in the course of such achievements numerous safety hazards, toxicological problems and industrial hygiene difficulties have been encountered. Naturally, in any electronic operation one has to deal with a variety of solvents, gases, plating chemicals, caustics, acids, fire and explosive hazards, industrial and diagnostic x-ray, noise, toxic plant effluents, etc. I shall treat hurriedly of these common universal hazards in order to provide time for the more exotic issues in the electronics industry.

The common chemical hazards include mercury, lead, arsenic, cyanides (plating), hydrogen sulfide, molybdenum, germanium, trichloroethylene, beryllium, magnesium, phosphine (deborane), methylene chloride, photo resist (mixture of polyvinyl, alcohol, ethyl alcohol and ammonium dichromate), caustic, hydrofluoric and other acids, sulfur dioxide, ammonia, amyl acetate, amines, vanadium, yttrium, europium, barium, strontium, calcium, cadmium, zinc, manganese, nickel, the epoxy resins, polyurethane resins, radioactive materials, and phosphors.

Phosphors

With the exception of the phosphors, you undoubtedly have had experience with all of the aforementioned chemicals, both as to their degree of hazard and the safeguards necessary to control these hazards. However, to some the word phosphor may be a relatively new term, as it is primarily confined to fluorescent tube and TV tube manufacture, both monochrome and color. By definition, a phosphor is a combination of chemicals blended together to produce a new chemical structure with characteristics different from its constituents and capable of luminescence.

In the early development of luminescent phosphor chemicals, you may remember beryllium and the resultant toxicological hazards it presented before eventually being brought under control. Hard on the heels of the fluorescent lamp came a new electronic device: the television receiver. Furthermore, the development of color TV in 1954 entailed the use of new and exotic phosphors not previously employed. Looking back upon the history of beryllium phosphors, one may anticipate that new industrial hygienic problems will come with the new phosphors. Regrettably, as in the early days of beryllium use, no toxicological information of sufficient scope is available to give one a background in the approach to management of the clinical problems of workers who are exposed to these new materials in their occupations. The physician in industry, therefore, must devise an approach to determine the level of toxicity and the extent of a medical engineering control program to protect employees as well as any potential product liability. Let me outline briefly how occupational medicine might attack such a problem.

Two main issues present themselves:

1. That of exposure to the raw materials used to make the powder or phosphor covering the face of the TV tube — in this instance europium-activated yttrium orthovanadate, used to produce a superior color and brightness as compared to the older and relatively less toxic silver-activated zinc cadmium sulfide.

2. That of exposure to the finished phosphor after it has been fired and a new chemical structure formed — new in crystalline structure, solubility particle size, and new in its toxicological properties.

As the name implies, this new solid state compound europium-activated yttrium orthovandate consists of a mixture of the metallic

element vanadium as an orthovanadate combined with yttrium, all activated in the presence of specific quantity of the rare earth europium. The three components of this new luminescent phosphor all contain their own individual toxicology, with vanadium being the only one of which we have some depth of knowledge. The literature and scientific experience is conspicuously devoid of data regarding the rare earths yttrium and europium. However, particularly in the electronics industry, the rare earths are being utilized to an ever increasing degree in the production of new types of alloys, microwave devices, lasers, masers, insulators, capacitors, semiconductors, ferroelectrics, and probably most of all in the manufacture of powders or phosphors for color TV screens in order to produce more vivid color reproduction.

Pharmacology and toxicology reveal that the rare earths possess a relatively low level of toxicity. Vanadium and its compounds, on the other hand, are known to be definitely toxic. Therefore, we must gear our controls to the most toxic element of the phosphor; namely vanadium.

The human response to vanadium has been well documented. The symptoms are usually as follows: conjunctivitis; irritated nasal passages with mucous discharge; irritation of respiratory tract with bronchitis and bronchospasm; chest pain with pneumonitis, dyspnea, and paroxysmal cough; weakness persisting after exposure; and, occasionally, palpitation. A greenish black discoloration of the tongue is frequently present, as is a contact-type dermatitis with associated hypersensitivity. Allergy is a factor, as some people may react positively to patch tests with a sodium vanadate solution.

Because of these facts and because so little else is known particularly in reference to the finished TV phosphor and its application, the medical department decided upon the following medical control program:

1. Initial selection of workers is made to exclude from exposure any new employees having any chronic disease of the lungs or respiratory tract such as chronic bronchitis, pulmonary emphysema, nasal or sinus infections, conjunctivitis, allergic disease of the skin, or other allergies.
2. Complete pre-employment physical examination repeated annually.
3. Chest x-ray (14x17 PA) repeated annually.
4. Vital capacity — repeat every six months.
5. Body weight and blood pressure — repeat every six months.
6. Complete blood count at pre-employment — repeat annually.
7. Thymol turbidity annually.
8. Urinalysis annually — urine albumin every six months.
9. Urinary vanadium levels repeated annually or at any time signs of vanadium intoxication may appear.

As a result of this type of medical program in effect for the past five years we can now report that:

1. Exposure of a plant population (3,000 employees) has resulted in an incidence of 30 per cent annual rate of minimal injury by vanadium — all reversible.
2. No chronic or systemic disease effects were found.
3. No significant x-ray changes were observed over a five year period. No blood dyscrasias or elevation of blood pressure or changes in pulmonary function.
4. The incorporation of vanadium as the orthovanadate into the crystalline lattice of the phosphor apparently results in the formation of a compound of much lower toxicity than that of vanadium pentoxide alone.
5. Operations were begun in 1963 and to date the population at risk averages 3,000 people with 20,000 man hours of exposure. No toxicology of a permanent damaging nature has been observed in any of our exposures during this time.

With the foregoing experience and the fact that we can keep our exposure levels to below 0.5 MG/M_3, the calculated safe level, we now can relax our medical program to some degree. However, in spite of the excellent prophylactic effects of preventing occupational disease from this toxic material, it is necessary that continuing study be exercised to ascertain if delayed effects will occur such as those which occurred with beryllium phosphors.

No discussion of occupational medicine's part in the electronics industry would be complete without considerations of hazard

control in laser production and use; also the use of epoxy resins and, as you will recall, the recent apprehension regarding x-radiation from color TV sets.

Lasers

Laser, or "light amplification by stimulated emission of radiation," is an incredible device developed as recently as 1960. There are many projected and actual applications for lasers. For instance, in the field of communication as a possible technique for range determination of both terrestrial and satellite vehicles. Also as a clinical tool in certain ophthalmic or other biomedical procedures. For the welding of refractory metals, or as a military tool to fit into selective weapons systems as a new weapon or as the ultimate in anti-ICBM weapons.

Prevention is the most important aspect of laser safety. Laser is potentially a serious hazard to the eye. Specific levels for safe viewing have been calculated and may be achieved by a combination of distance or suitably optically-absorbing lenses. Specular reflections of laser beams possess health hazard potentials. Subjective brightness of the lesser spot or lack of immediate sensation is no measure of its physiological hazard. The laser working environment should be considered off limits for all but those trained and associated with the instrument.

Procedures involved in setting up a control program against laser hazards in industry are much the same as for other toxic exposures. Success depends on complete orientation, understanding, and cooperation by all concerned. The essentials are:

1. Responsibility for safety rests with the supervisor, assisted by medical safety and the industrial hygienist.

2. All persons assigned to laser operations to be formally indoctrinated on hazards and controls, especially as they apply to the equipment in use.

3. All such persons to receive a medical evaluation prior to taking up these activities. This will include visual acuity, a complete ophthalmological examination, and whatever other procedures are necessary to elicit evidence of pre-existing disease or conditions which might be aggravated by laser exposure. Persons legally blind in one eye are not suited for assignment. The medical evaluation to be repeated at yearly intervals and immediately after accidental excessive exposure.

4. Each laser source and its characteristics to be reported to the medical and safety department before activation. As with all significant industrial hazards, the best control is at the source; personal protective devices are to be regarded as "just in case". Some of the principal points include:

   a. Details of output capacity of each device should be attached thereto.
   b. The beam should be controlled so as to eliminate exposure to operators, bystanders, and the public.
   c. Warning signs should be posted for employees and anyone approaching the area.
   d. Direct or reflected viewing of the beam must be eliminated.
   e. Protective laser goggles may be used for specific wave lengths up to their rated power resistance.
   f. Electrical hazards should be eliminated by locked switches, procedures for bleeding off capacitors, etc.
   g. Lasers should never be left unattended when energized.
   h. Light pumps (flash tubes) should be shielded to protect eyes from glare.
   i. Exposure to cryogenic materials (for cooling) may be avoided with gloves and aprons. Eye shields will protect from splashes or explosions of flash tubes.
   j. High voltage supply equipment should be checked against x-ray examination and suitable shielding provided as necessary.

Epoxy Resins

Epoxy resins or thermosetting plastics have considerable application in the electronics industry and do present a problem to industrial medicine. Epoxy resin systems contain two reactive components — the uncured basic resin and a curing agent (also known as a hardener, catalyst, setting agent, or activator). When the two components are mixed together, the resulting cured product is a hard plastic having excellent chemical resistance, hardness, adhesive qualities, electrical properties, and strength. When completely cured or hardened, these materials pose no appreciable toxic hazard.

The uncured resin is usually the condensation product of "Bis Phenol-A" and epichlorohydrin which, at room temperature, can be either in the liquid or solid state. Fillers such as fiberglas, silica flour, abestos, and diatomaceous earth may be added to the uncured resin. Diluents such as organic solvents may also be added.

Curing agents commonly used include aromatic or aliphatic amines, acid anhydrides, organic acids, polyamides, and organic peroxides. The chemical process of curing can be done at room temperature (cold cure) or at elevated temperatures. The curing time will vary from a few minutes to several hours, depending upon chemicals and temperatures used.

Health Hazards. The principal hazard associated with epoxy resin systems is a skin reaction or dermatitis. Epoxy resin dermatitis is largely due to curing agents and solvents. The condition is simply irritation or allergic reaction of skin rather than a general systemic toxicity. Amine compounds, acid anhydrides, organic acids, and organic peroxides which are used as curing agents are both primary irritants and skin sensitizers. Probably the most troublesome of the chemicals are amine catalysts.

Skin contact with these curing agents is responsible for the majority of dermatitis cases associated with epoxy resin systems. The completely cured epoxy resins are relatively inert and do not constitute a dermatitis exposure. However, dermatitis cases are common among workers machining or cutting resins thought to be cured, but which still contain free catalysts, Amine vapors, which are usually abundantly liberated during hot curing processes, cause irritation of the eyes and mucous membranes. In some individuals, they also can cause a lung reaction resembling asthma. These vapors may cause dermatitis among sensitized workers.

Exposure to dust from fillers such as silica flour, asbestos, and diatomaceous earth may present potential health hazards. Fiberglas, which is used in laminating operations, can cause irritation to the skin, eyes, and mucous membranes. Dust resulting from cutting, grinding, and shaping of completely cured resins is relatively inert. If an excess of curing agent is present in the resin, the cured product may contain unreacted curing agents which present a dermatitis exposure.

Explosion Hazards. Most uncured epoxy resins have flash points above 300°F and do not present a serious fire hazard. Some diluents, curing agents, and solvents used with epoxy resin systems are flammable. The fire and explosion hazards associated with epoxy resin systems are normally considered to be slight.

First Aid. If skin contact with unreacted epoxy resin system components occurs, affected areas should immediately be thoroughly washed with a mild soap and water. If eye contact occurs, wash for at least 15 minutes and refer to a physician.

Preplacement Medical Procedures. Workers with a history of skin diseases, allergies or abnormal pulmonary conditions should not be employed in areas where epoxy resin materials are used.

Health Hazard Control Methods.

1. Good general ventilation is necessary for areas using epoxy resin systems. Local exhaust ventilation may be needed at mixing stations and curing areas, especially if large quantities of materials are involved. Curing ovens should be exhausted to the outside.

2. Adequate wash facilities should be provided in the area where epoxy resin systems are used. An ample supply of mild soap and disposable towels should be provided.

3. If possible, areas using epoxy resin systems should be isolated from other areas of the plant.

4. Good housekeeping is essential. All spills should be cleaned immediately. The use of disposable paper overlap on work areas is desirable. Contaminated paper should be removed and stored in covered metal containers. The scrap should be removed from the plant daily.

5. All gloves or tools contaminated with epoxy resin components should be washed in a suitable solvent such as acetone or alcohol, followed by soap and water.

6. Workers should be thoroughly instructed in proper handling techniques for epoxy resin systems, be acquainted with potential hazards, and have close supervision.

Personal Protection.

1. Rubber or plastic gloves (preferably cotton lined) or disposable surgical gloves and arm protection should be worn where

skin contact is possible. After use and before removal from the hands, the gloves should be washed in solvents (acetone or alcohols), followed by a water rinse. Before re-use, gloves should be inspected for leaks.

2. The use of eye protection, aprons, or uniforms may be indicated if this is a potential splashing hazard.

3. Smoking should be prohibited.

4. If skin contamination cannot be removed with a mild soap and water, small areas of the skin may be washed with acetone or alcohols, followed by washing with mild soap and water. Petroleum solvents should not be used to clean the skin.

5. Barrier type protective creams have been used with success for dermatitis control in many plants. However, they are not intended to be a substitute for protective clothing or good personal hygiene.

X-Radiation

At this point I would like to take you into the controversial field of x-radiation from TV sets. This is a medical engineering problem; one that has occupied the attention of the medical department over the past many years. It is necessary at this time to separate the facts from fiction and the fantastic.

Man pollutes his world gradually, almost imperceptibly, and in many different ways. One of the least obtrusive ways he has yet invented is the introduction of man-made radiation into the environment. Attention was called dramatically to that kind of pollution last year when a major TV producer placed on the market more than 100,000 TV sets suspected of emitting x-rays. It is a fact that color sets require higher voltage than black-and-white and are capable of producing some x-radiation. In the case of the aforementioned sets, the problem had to do with a shunt regulator tube which regulates the high electron voltage to the picture tube. Due to engineering error, this tube was poorly shielded and mounted in a position which permitted x-rays to escape from the set. Further investigation with other manufacturers' sets revealed that different kinds of design or servicing problems could account for defective control of color TV x-radiation.

TV set x-radiation can be thoroughly controlled by proper shielding, set design, and monitoring levels at time of manufacture. The level of radiation from the vast majority of defective sets as identified by the United States Public Health Service represented no known risk to the health of viewers, though in a few cases there were high levels of excessive radiation—as high as 25 or more times the accepted limits. The main concern was over possible harm to descendants of the viewers, but even that seemed highly improbable. It is the medical department's responsibility, in cooperation with the engineers, to keep radiation from TV sets at the proper level. This level can easily be maintained below 0.5 milliroentgen per hour, the limit accepted by science, government, and industry as prudent in a world where man is adding significantly to the radiation dose bequeathed by nature. TV set producers are now providing consumer and technician-proof sets incapable of producing excessive radiation despite the most flagrant tampering. However, the problems of x-radiation still exist in the manufacturing and testing area, and therefore require constant monitoring, medical engineering supervision, and control. We have demonstrated that a properly constructed color TV set offers no health hazard whatsoever.

The following letter, authorized by a competent medical authority, is for the edification of our customers and available for general public information:

"Color and black-and-white television sets manufactured by Sylvania Electric Products, Inc., G.T.&E., more than satisfy all the safety requirements of the National Council of Radiation Protection Measurements, as well as those of the International Commission on Radiological Protection."

Sylvania subjects its television production lines to exacting scientific tests for emission of x-radiation. In addition, we periodically employ outside scientists to make independent tests of our sets, both in the plant and after they have left the factories. These tests employ stringent government-accepted and industry-accepted methods of measurement. Constantly, our engineers conduct tests for x-radiation on our color television sets in production and as consumer products. All tests showed that in more than nine out of ten instances the Sylvania sets showed no detectable x-radiation whatsoever. The only reading in these tests was the background

level of radiation normally present in the atmosphere. Even in the very few sets where an actual radiation reading was detected, the level of radiation was well within the acceptable levels established by government and quasi-government bodies. In other words, Sylvania television sets are safe. We shall make certain that sets we produce in the future also will be safe.

In conclusion, I trust we have briefly summarized some of the major medical aspects and safety problems peculiar to the electronics industry. There are others, to be sure, such as control of cadmium, the general overall control of plant effluents, etc., but we must necessarily limit our discussion to the major and newer toxicological problems; establishing the facts, and discarding the fiction, along with the sometimes fantastic misconceptions.

THE ROLE OF THE INDUSTRIAL NURSE IN THE ELECTRONIC AND ELECTRICAL EQUIPMENT INDUSTRY

By PATRICIA M. TUOHEY, R.N.
Health Consultant, Loss Prevention Medical, Liberty Mutual Ins. Co., New York, N. Y.

To those who represent the electronic and electrical equipment industries and who expect to hear magic words just for them alone, I apologize. I know of none. The problems of industry are people — all people — not so much the exposures, nor the environments, but the people who work in those exposures and environments.

To handle the people we need a good medical program. To handle the medical program we need a good industrial nurse. To have a good industrial nurse we must understand what her role should be. Let us discuss some of the industrial nurse's major functions.

Nursing Care

Care for occupational and non-occupational injuries and illnesses will always be a major function of the industrial nurse. She has a responsibility to initiate prompt and skillful emergency care, consistent with her professional training and knowledge of first aid techniques, until the services of a physician can be obtained. The nurse's interest in and concern for the welfare of the ill or injured combined with prompt attention, good judgment, and sound management can be a step toward prompt and uneventful rehabilitation.

The nature and extent of the nursing care provided for non-occupational injuries and illnesses should be determined by the company physician. Generally accepted practice allows for the simple (palliative) treatment of minor complaints that are not expected to require the services of a physician. The more serious ills that merit medical attention should be referred to the family physician.

In addition to her technical skills, the nurse should recognize the possibility that each visit to the health service may represent a problem of deeper significance than the symptom for which attention is being sought. The so-called "chronic complainer," the employee who suffers frequent minor injuries, or even the daily visitor to the scale may well be an individual crying for help. Careful listening on the part of the nurse may help to uncover an underlying emotional problem and avoid a major tragedy. For this reason, enlightened management has learned not to discourage non-occupational visits to the medical department, no matter how simple the complaint.

Medical Examinations

Medical examinations are an important component of a sound occupational health program. Their value as an aid in providing criteria for safe job placement, in uncovering early physical and emotional changes, and in detecting the effects of harmful working conditions contributes to the maintenance of a safe, healthy and productive employee population. The plant nurse becomes an active participant in the company examination program as she conducts the health interview and performs the preliminary evaluations

designated by the company physician. The health history elicited during the interview is a necessary complement to the physician's comprehensive evaluation. In order to secure the best possible personal and occupational health information, the nurse should know the individual's job assignment and be familiar with its requirements.

Further, the nurse's responsibility is extended to include timely follow-up on employees with known remedial defects as well as the physically handicapped. These periodic health checks provide an opportunity to determine if the employee's disabilities are adversely affected by his work and also ensure continued medical assistance where the need is indicated. In instances where the individual's physical abilities and job demands are not in harmony, the nurse will notify the physician, so that he can work with those responsible for job adjustments.

Medical Records

A good medical record system is a basic requirement of an effective occupational health program. The supervision and maintenance of employee health records is a responsibility of both the physician and the nurse. When the services of the company physician are limited to an on-call or part-time basis, however, the nurse's responsibilities are, of necessity, increased. The information the records contain is confidential in nature, except where otherwise provided by law. While only members of the medical department should have direct access to the records, the nurse will discuss with the personnel director, safety director, and supervisory personnel that information from the medical record that might relate to job safety without violating confidentiality. Medical records should be concise but detailed enough to provide adequate information for the detection and control of occupational disease and accidents, the identification of individual and group health needs, and the protection of both employer and employee in case of litigation. In addition, they serve to demonstrate the effectiveness of the existing program and determine the objectives for future planning.

Counseling

Her interest in the preventive aspects of health maintenance combined with a concern for the welfare of the employees places health counseling among the major functions of the occupational health nurse. Her frequent and direct contacts with the employees enables the nurse to learn a great deal about them and their health needs. This places her in an ideal position to recognize the individual who is struggling with underlying anxieties. Although the nurse will not attempt to make a medical diagnosis, she is well qualified to utilize such important skills as listening, providing information, advising and, of course, referral. Through her utilization of sound interviewing and counseling techniques, the nurse can assist the employee to see his problems objectively so that he will be able to make the decisions necessary to resolve them.

The safety engineer has a unique opportunity to contribute to this aspect of the nurse's role. His intimate knowledge of employees, and frequently of their on the job difficulties, can provide the nurse with invaluable background information to help in her handling of the medical department visit.

Health Education

Another facet of the occupational health program in which the nurse maintains a responsibility is health education. Most visits to the health service avail her of an opportunity to educate the employees in such areas as safe working practices, proper health habits, and the need for prompt attention to minor injuries. She will also plan and arrange educational programs for group participation. The type of program selected will be influenced by prevailing conditions within the plant. The educational content, however, should be designed to meet the specific needs of the company and its employees. To be effective, group educational activities must have management approval, supervisory support, and employee acceptance.

Safety

Participation in both the preventive and curative aspects of occupational case care places the nurse in an advantageous position to make significant contributions to the company safety program. She cooperates with the plant physician and safety personnel to facilitate the detection and control of accidents and occupational disease. In addition, she promotes safe working practices among the employees.

Periodic tours of the plant keep the nurse informed of the plant environment, its operations, and existing or potential health hazards. Equipped with this information, she can obtain accurate accident histories that can contribute to the prevention of similar injuries. She is also in a position to recognize the relationship between seemingly nonoccupational complaints and a work related exposure. Significant findings are brought to the attention of the plant physician and safety engineer, so that proper investigation can be initiated and appropriate preventive measures instituted.

Utilizing her educational skills, the nurse motivates the employees to work safely on an individual need basis. Areas in which she can effectively be of assistance include: the use and care of protective equipment; stressing the need of meticulous skin care for those exposed to epoxy resins, solvents and acids; the need for immediate copious rinsing following chemical splash contact to the skin or eye; and the utilization of proper lifting and bending procedures. Further, as a member of the safety committee, she collaborates with the safety engineer and other members of the committee to plan and arrange safety educational activities for group participation. The planned programs, of course, should be designed to deal with specific plant problems.

Community Resources

Community health agencies can often be of assistance to an occupational health program. The industrial nurse should be familiar with the health agencies in her community and establish good working relationships with them. Employees frequently have problems which are greater in scope than those for which she can provide direct help. These agencies are often in a position to offer the needed assistance. The nurse, who is aware of the services available to her and is familiar with their referral procedures, can direct her employees to the appropriate source of help with a maximum of ease and efficiency. It is a well accepted fact that the worker who has unsolved problems can be a hazard to both himself and his fellow employees. Here too, the nurse can abet the cause of accident prevention.

Briefly, these are the major functions and responsibilities of the industrial nurse. Although the nurse's primary responsibility rests with the guarding of employee health, she is strategically placed to promote good will and facilitate a better understanding between management and the workers.

There are specific areas of the electronic and electrical equipment industries which demand particular medical and hygiene controls and considerations. This panel will cover them most expertly. Certainly, the nurse working in these industries must be constantly aware of them as they relate to the health of the individual employees. But to me, as a nurse who has worked in industry and is now working as a consultant with many different industries, including electronics and electrical equipment, the gut issue remains the overall quality of the medical program. And the primary determinant of this quality is the role of the industrial nurse.

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fibrillation probably is the effect responsible in most cases. He reviewed the differences which might be expected if the shock occurred in man rather than in four footed animals. Dalziel and Lee, in a paper to be published soon,[13] have added further analysis to the data available and have proposed a maximum allowable current which will not cause fibrillation. Most available data indicates the minimum current which will cause ventricular fibrillation.

Dalziel and Lee[13] have proposed that the best data available, although quite limited in amount, indicates that for the average man the maximum allowable 60 Hertz current which will not produce fibrillation is given by the equation

$$I = 116T^{-0.5} \qquad (1)$$

where I is the current in milliamperes flowing through the subject arm to arm; and T is the time of application of the shock in seconds. Obviously, safety standards would suggest a smaller value than that given by equation (1), and the Underwriters Laboratories[14] propose

$$I = 20T^{-0.7} \qquad (2)$$

Other considerations might suggest even lower values for this arm to arm limiting current but will not be discussed here.

When the current flow is from an electrode inside the heart to the body surface, the allowable current is very much smaller. The extent of studies of this sort is somewhat less than those previously discussed, although data is beginning to appear.

In 1962, Weinberg and associates published a report of studies of electrical shock hazards in cardiac catheterization, concluding that currents as low as 35 microamperes could produce ventricular fibrillation when the current was through the heart wall.[15] Other studies,[16, 17, 18] including some recent ones, state that a current as low as 12 microamperes at 60 Hertz has been known to produce fibrillation in the canine ventricle. One case is reported in which 180 microamperes has been known to produce fibrillation in a human being.[16, 17] These data then suggest that most certainly no current larger than 20 microamperes should be allowed to flow through a cardiac catheter.

The current which flows through the body is a function of skin resistance and internal body resistance. It is difficult to be precise in this because so many uncontrolled variables exist. For example, the resistance from an electrode on the surface to the tissue just beneath the skin can range from less than five hundred ohms to over five hundred thousand ohms. The variation will be due to the presence or lack of perspiration, dead skin, oils, etc. If the skin is thoroughly cleansed and contact from the electrode is made through a bridge of saline soaked padding, or an appropriate electrode paste, the skin resistance may be as low as 500 ohms. Needle electrodes reduce it to zero. Besides the skin resistance, the internal path resistance from ear to ear is of the order of 100 ohms, while the resistance from hand to foot is about 500 ohms.[19] Thus, it is reasonable to assume that the electrical resistance from a catheter electrode on the inside of the ventricle to a ground or indifferent electrode on the right leg of the patient may be less than 1,000 ohms, skin resistance and all.

Some simple applications of Ohm's law to the case of the fibrillation current can now be made to compute the order of voltages which may be dangerous. Consider first the endocardium-catheter situation. As mentioned above, a 60 Hertz current of the order of 20×10^{-6} amperes (20 microamperes) probably will produce fibrillation. This means that, applying Ohm's law, a voltage given by $E = IR\ (20 \times 10^{-6}) \times (10^{3}) = 20 \times 10^{-3}$ volts, or 20 millivolts, can be deadly when it is applied between a catheter electrode and a leg electrode (and values as low as two millivolts may be disastrous).

Where both electrodes are on the body surface, a higher voltage obviously can be tolerated. Using the previously quoted figure of 20 milliamperes as causing a degree of muscular paralysis and possibly causing fibrillation of the heart if the flow is across the chest, by Ohm's law we get a voltage of $E = (20 \times 10^{-3}) \times (500) = 10$ volts as dangerous. Fifty volts will probably be fatal when the electrode to electrode resistance is 500 ohms, a condition easily attainable with modern electrocardiograph electrodes.

To summarize: perhaps in the interest of ultra safe conservatism, one should then say that body currents of two millamperes and endocardium currents of two microamperes should be considered dangerous. Thus, whenever electrical instrumentation is connected to a patient through a cardiac catheter and

THE ELECTRICAL HAZARDS OF MEDICAL INSTRUMENTATION AND THEIR PREVENTION

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Safety has been of major interest to society for generations. Perhaps the greatest monument to this fact is the extensive work of the National Safety Council which has functioned in many areas of safety since 1913. However, recent years have seen a marked rise in safety activity. No longer is it satisfactory to report accident statistics only. Through the efforts of many organizations, insurance companies, and individuals, society has been stimulated to demand and obtain legislation aimed at providing safer automobiles, highways, and aircraft. Public opinion has led manufacturers to adopt higher standards of safety in many products. None the less, there remains a residual accident rate which, although lower per unit operation, is still unacceptable. For example, while the number of persons killed annually in automobile accidents in increasing, the rate of increase is much smaller than the rate of increase in the number of vehicle miles traveled. Yet society cannot accept the 53,000 deaths recorded in 1966.[1] The ultimate target is Zero accidents.

United States vital statistics reports continue to show only moderate increases in the number of electrical fatalities over the past several years in spite of the exponential growth of the use of electrical devices. However, evidence continues to mount charging the subtle effects of very small electrical currents with numerous deaths. Unfortunately most of these occur in the hospital environment. Hospital accidents appear to be on the increase. One must ask, "Does this also apply to patient accidents?"

Thus the Zero Accident target should, and does, loom very large in the design, manufacture, and use of electrical equipment in the medical profession. The many sided nature of the dangers of electricity are not well known to the general public, and this applies to medical and hospital personnel. Perhaps because of news stories from the past of the electrocutions of criminals or for other reasons there is a popular misconception that only large currents and high voltages are dangerous. It may be this conception that leads so many to be so careless with electricity. Whatever the reason, more than 1,000 persons are killed by identifiable electrical accidents every year in the United States. In the past four months, Indiana alone has had at least twelve electrical fatalities, including three lightning strikes. But of more concern today is the startling statistic that perhaps more unrecognized electrical fatalities occur in hospitals than in all other situations together. Indication of this comes from an examination of reports of deaths from cardiac arrest, showing that in many of these a catheter had been inserted into the heart of the subject for diagnostic purposes prior to the onset of ventricular fibrillation and heart stoppage. The literature has carried reports of some of the few specific cases, of which more will be said later.[3, 4, 5, 6, 7] Other possible situations will also be pointed out.

The hazard here often goes unrecognized because of the extreme sensitivity of the heart muscle to an electrical current through it. The hazard of electrical shock is measured in terms of the current which flows through the body or heart. The magnitude of current which causes fibrillation is a function of the point of application to the body.

One of the early studies of the subject is the doctoral thesis of B. G. King in 1934.[8] Ferris, King and others published a report of this and subsequent work in 1936.[9] Twenty years later, Kouwenhoven and his associates[10] made significant contributions to the knowledge of the effect of electric shock on the living animal, with special attention to the problem of cardiac fibrillation. Dalziel, who has been active in the field for many years, published a summarizing and analyzing paper in 1960[11] in which he noted that there are three major measurable parameters upon which the effect of electric shock depends; namely the current, the time of flow, and the weight of the animal. Lee pursued the subject further in 1966[12] and concluded that while death from electrical shock can occur from other physiological effects, ventricular

a skin electrode, a potential difference between the two of two millivolts is dangerous; and a potential difference of 10 volts between body surface electrodes is a serious electrical hazard.[20]

The obvious question is, "Can such potential differences (voltages) or leakage currents occur in a hospital room (regular or operating room)?" The following cites some possibilities, examples of which can be found in the literature.

In all equipment, the distributed capacity of the transformers and power cords provides a path for a small flow or leakage of current to ground. The insulation also will allow some, though very small flow. This leakage current must be held to a very small value for hospital instruments in the light of the calculations made above. It seems reasonable to suggest that the extremely high standard of not more than two microamperes leakage current is desirable and that the maximum should be less than 20 microamperes for the equipment that might be used in heart catheterization locations. Two milliamperes must be the absolute maximum for other installations. A much more desirable figure is one-tenth of this, or two hundred microamperes, and in the interest of ultra safety, the leakage should be kept to twenty microamperes. Kahn and Murray[21] suggested that household appliances should have an upper leakage limit of two hundred microamperes, while a Japanese committee[22] has set a maximum standard of one hundred microamperes for medical equipment.

Consider now the installation of a cardiac monitor of the sort to be found in most hospitals attached to a patient who is undergoing cardiac catheterization. Assume that the AC supply is not an isolated line in accordance with operating room code standards, but does meet other electrical standards. The circuit is shown schematically in Figure 1.

Now let condenser C_1 develop a leak of 100 ma., a not impossible situation, which will cause no noticeable impairment in the operation of the equipment. There will then be a current flow through C_1 to a ground through the thin wall conduit. Half-inch thin wall has a resistance of 6.5×10^{-3} ohms per foot, about equivalent to a No. 18 copper wire. If the conduit is 100 feet long, the

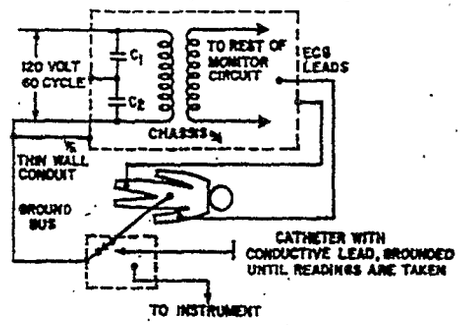


Figure 1

current flowing through it will develop a voltage above ground on the chassis of the monitor equal to $E = (100 \times 10^{-3}) \times (6.5 \times 10^{-3}) \times 100 = 65 \times 10^{-3}$ volts. (65 millivolts). If the catheter is of the sort that either a wire or conducting fluid connects to the inside of the ventricle and is grounded on the outside, a circuit is now completed from ground to inside the ventricle to the body to the chassis of the monitor. This places 65 millivolts across the ventricular wall or 30 times the dangerous value.

A very common fault in power cords on equipment, especially where the plug is molded onto the cord, is a failure of the ground connection in the third prong. This, of course, leaves the chassis of the equipment and the patient ground lead ungrounded, and where heart catheterization is involved, failure of the ground is dangerous.

An example showing the urgent need for positive ground connections is illustrated in Figure 2. The capacitors in this circuit form a bridge which places a high voltage across the patient if either of the ground connections is broken.

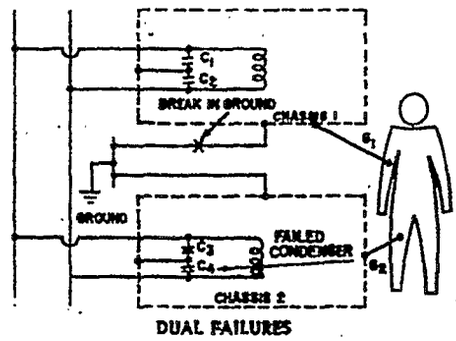


Figure 2

If one allows two failures at one time, even the use of an isolated AC line does not prevent the shock hazard. Consider two pieces of equipment plugged into the same isolated line and the ground of each connected to the patient, G_1 and G_2, respectively. Assume that each AC cord is connected to the ground through capacitors and that each chassis is grounded.

Now suppose that the ground (third prong) on the cord to the No. 1 instrument is broken. This would not impair the operation of the instrument except to introduce some noise in the output. However, this would be no disturbance in some instruments. Further, suppose that one of the four condensers fails; that is, an open circuit develops.

If $C_1 = C_2 = C_3 = 0.1$ μfd, the line voltage is 120 volts, and R = 1,000 ohms; a current of nearly 20 ma. will flow through the patient. As noted above this could be fatal.

A much less complicated case was reported in which a cardiogram was being taken in a regular hospital room. The technician attempting to attach the leads found that she received a severe shock each time she touched the patient while holding the ground lead. The problem was traced to the fact that a bed lamp frame was shorted to the AC line, and was touching the bed frame. The patient's arm was also touching the bed. Since the ECG machine was grounded through a three prong plug, and the lamp was not, 110 volts was being applied through the patient and the technician, enough to have been serious for both.

The examples cited so far have dealt with failure of equipment; however, poor design can also be the source of dangerous situations. For example, one electromechanical injector used in angio-radiography may allow up to five milliamperes to ground, due to the fact that the parts were anodized before assembly, thus effectively insulating the parts. Evidence of such leakage may appear in the form of noise on the electrocardiograph, beginning at the time of entry of the dye into the heart. (The dye has a good electrical conductivity). Fibrillation has been reported under this circumstance.

Other examples of poorly designed equipment include: defibrillators which produce excessive shock energies, or prolonged shock with possible attendant myocardial damage unless a very low resistance path between the electrodes exists; equipment in which chattering relays cause high voltage transient currents; AC operated pacemakers which are sensitive to pulses on the power line. Data exists indicating that, after some months of use, in only 15 per cent of the electrically operated beds having three wire cords will the ground wire have good continuity.[23]

The foregoing examples are given simply as a start toward the setting of standards for hospital electrical safety. Many items have been omitted. For example, no attention has been given to the static problem, although the grounding recommended and the use of non-explosive anesthetics essentially eliminates it from further consideration. The subject of explosive atmospheres due to certain anesthetics, and problems of the high concentration of oxygen occasionally used in oxygen tents, and many others have been omitted from examination. All of these must come under the scrutiny of the engineer who is thoroughly conversant with the dangers, the special nature of the problems, and the difficulties of the operating room or the coronary care unit of the modern hospital.

The shielding and grounding of patient monitoring equipment to eliminate noise and AC interference is an important problem also. In a recent case of open thoracic surgery where the surgeon was working in such a way that he could not see the ventricles, he was dependent upon the cathode ray scope cardiac monitor to tell whether the heart was functioning properly. But due to his having his hands in the patient's thorax, he was introducing so much stray 60 Hertz voltage that the electrocardiogram was completely obscured. The solution, obvious to the electrical engineer, was complete grounding of all instruments to a common ground, and to ground the surgeon and his assistants.

But the grounding must be complete and with low resistance circuits for, as shown earlier, high resistance circuits can result in the generation of voltages which can produce serious shock hazards. However, the standards for buildings are established for static electricity only. Therefore, the code calls for resistance between 25 K and 1 Meg for a floor with electrodes three feet apart.[24] Actually, the resistance should be less than one ohm, but *all* equipment well grounded.

Perhaps this is enough to indicate the magnitude of the hazards which exist in the hospital or clinic where electrical instrumentation is attached to the human patient. The danger exists and the problem warrants orderly and intensive attention. George Peters and Frank Hall of the Rocketdyne Corporation have recently suggested systems engineering approach to the safety problem.[25] Their proposal, applicable to the general field of safety, contains many excellent concepts for use in the field of electrical safety in the hospital environment, for they point out that safety is a function of equipment design, but also of equipment use, user attitudes, and many other factors. The following quote from their paper is significant:

"The primary objective of system safety engineering is the reduction or elimination of all hazardous consequences of equipment operation. System safety engineering characteristically involves a systematic application of special analytical techniques, scientific data and derived criteria, specific engineering principles, evaluation methodology, management skills, and experience retention devices. Since it emphasizes prevention rather than the correction of problems, particular attention is placed upon early engineering design and procedural analysis. It is broadly conceived to take into consideration all aspects of the planning, design, development, fabrication, test, installation, maintenance, operation, and system evaluation of complex man-machine systems."

Application of this definition and the general principles of systems engineering to the problem of electrical safety in the use of medical instrumentation will lead to a number of steps.

First, there needs to be a clear cut definition of the problem. It must be obvious that the evidence presented thus far has led the author of this paper to believe there is a problem. However, there should be a careful study to determine whether the data hinted at from time to time really exist. Is the number of electrical fatalities caused by medical instrumentation on the increase? Is it as large as some fear? Hopefully, some sort of organized search for the facts will be mounted so that the problem of electrical hazards of medical instrumentation can be defined.

Secondly, there needs to be a more precise identification of the parameters of the problem. This step seems to have three major components:

a) The sensitivity of the human body to electric shock with special attention to the maximum non-fibrillating current. This is not to be critical of existing data and its analysis. However, it seems that a new study with emphasis on the medical instrumentation problem is called for.

b) A study of existing and possible future medical instrumentation combinations and the possible hazards which would thus be generated, including those due to catastrophic failures.

c) Examination of existing electrical distribution systems in hospitals with special attention to devices not classed as medical instruments such as electrically operated beds, television sets, etc. The nature and actuality of ground connections should be investigated.

Third, based upon the findings of steps one and two, design standards should be established for both the instrumentation and the hospital or clinic location where it is to be used. These standards should aim at the target of zero accidents, and if not wholeheartedly accepted by all manufacturers and users of medical instruments, should be enforced by law. Hopefully, the latter should not be necessary.

A safety design program such as proposed above will take time. Meanwhile, immediate steps should be taken to reduce as much as possible the hazards of existing instruments systems. The list of actions which could be inaugurated is large. However, the following will go a long way in providing a safe operation.

1. Train all personnel using electrically operated equipment in the fundamentals of safety. This may include giving special courses in electrical technology to nurses and hospital technicians, and for that matter, physicians. The instruction should include reference to the possible hazards which may be generated by electrically operated beds, or bedside television sets or lamps. Emphasis on proper grounding is important.

2. Provide a positive earth ground and a single ground reference for all equipment connected to one patient.

3. As much as possible, provide isolated and monitored ungrounded power for hospital rooms. This should be without excep-

tion in those rooms where patient monitors are used, or where cardiac catheterization is performed. Admittedly, the installation of such power circuits in existing systems may be costly, perhaps too costly to consider. However, temporary or portable units exist in which isolation transformers are packaged with ground fault detectors and circuit interrupters and which provide a good safety measure. Some such units will detect leakage currents as small as 200 microamperes, and will interrupt the circuit if such leakage exists. Obviously, a system incorporating such a unit is much safer than one which does not.

4. Employ adequately trained personnel to provide specifications for the purchase of electrically operated equipment and to provide preventive maintenance on such equipment. Instruments which have capacitors in the power input circuits in such a manner that they might give rise to a shock hazard should not be purchased. Instruments which place a potential on the ground line, even though it is with the good intent of detecting the failure of the ground connection, should not be employed in the intensive care units of a hospital.

5. Consider any area where electrical instruments will be used on a patient as a hazardous area for the patient, and act accordingly.

Hopefully, this review and these suggestions will generate action in each one who is concerned with hospital electrical safety, so that the word can be passed that the target of zero accidents has been struck in the bull's-eye.

References

1. Vital Statistics of the United States, Department of Health, Education & Welfare, Washington, D. C.
2. Indianapolis Star, August 10, 1968, Indianapolis, Ind.
3. Anon.; "Fatal Shock from Cardiac Monitor," *Lancet* 1, 872, April 16, 1960.
4. Rowe, G. G., and Zarnstorff, W. C.; "Ventricular Fibrillation During Selective Angiocardiography," *JAMA* 192, 947, 1965.
5. Bousvaros, G. A., Conway, D., and Hoppe, J. A.; "An Electrical Hazard of Selective Angiography," *Canad. Med. Assoc. J.* 87, 286, 1962.
6. Mody, S. M., and Richings, M.; "Ventricular Fibrillation Resulting from Electrocution During Cardiac Catheterization," *Lancet* 2, 666, Oct. 6, 1962.
7. Hoppe, J. A., and Roy, O.; "Electrical Hazards in Cardiac Diagnosis and Treatment," *Med. Electron. Biol. Engng.*, 1, 133, 1963.
8. King, B. G.; *Effect of Electric Shock on Heart Action with Special Reference to Varying Susceptibility in Different Parts of the Cardiac Cycle.* Ph.D. Thesis, Columbia University, 1934, Aberdeen Press. New York.
9. Ferris, L. P., King, B. G., Spence, P. W. Williams, H. B.; "Effect of Electric Shock on the Heart." *AIEE Trans*, 55, 498, 1936.
10. Kouwenhoven, W. B., Knickerbocker, G. G., Chestnut, R. W., Milnor, W. R., Sass, D. J.; "A-C Shocks of Varying Parameters Affecting the Heart, *AIEE Trans*, (EE) 55, 498, 1969.
11. Dalziel, C. F.; "Threshold 60-Cycle Fibrillating Currents," *AIEE Trans* (EE) 79, 667, 1960.
12. Lee, W. R.; "Death from Electrical Shock," Proc. IEEE, 113, 144, 1966.
13. Dalziel, C. F., and Lee, W. R.; "Re-evaluation of Lethal Electric Currents," *IEEE Trans* (IGA) 4, Sept./Oct., 1968.
14. Smoot, A. W., oral presentation, Annual Meeting IEEE IGA Group, Sept. 30, 1968, Chicago.
15. Weinberg, D. I., Artley, J. L., Whalen, R. E., McIntosh, H. D.; "Electric Shock Hazards in Cardiac Catherization," *Circ. Res.*, 11, 1004, 1962.
16. McIntosh, H. D., Starmer, F., Whalen, R. E.; "A Comparison of the Electrical Ventricular Fibrillation Threshold With and Without Anesthesia," *Amer. Heart Journal*, 72, 419, 1966.
17. Starmer, C. F., Whalen, R. E., McIntosh, H. D.; "Hazards of Electric Shock in Cardiology," *The Amer. Journal of Cardiol.*, 14, 537, 1964.
18. Burchell, H. B.; "Electro Shock Hazards," *Circulation*, 35, 227, 1967.
19. Bruner, JMR; "Hazards of Electrical Apparatus," *Anesthesiology*, 28, 396, 1967.
20. Stanley, P. E.; "Hospital Electrical Safety and Shielding," *JAAMI*, 2, 8, 1967.
21. Kahn, F., and Murray, L.; "Shock-Free Electrical Appliances," *IEEE Trans*, (IGA), 2, 322, 1966.
22. "Draft of Provisional Safety Standard for Electro-Medical Apparatus," *JJMI* 36, 673, 1966.
23. Stated in discussion period after Panel Discussion, Annual Meeting, IEEE, IGA, Sept. 29, 1966, Chicago.
24. *Code for use of Flammable Anesthetics*, National Fire Protection Association Sci. 2221, P 56-27, 1965.
25. Peters, G. A., and Hall, F. S.; "System Safety Engineering as a Technical Discipline," Paper presented at National Symposium on Flight Safety etc., Space and Flight Equipment Symposium, 1964, San Diego.

LOSS CONTROL IN THE ELECTRONICS & ELECTRICAL EQUIPMENT INDUSTRIES

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In this discussion, I will attempt, from an insurance carrier's standpoint to provide an overview of the more important loss control problems facing the electronics and electrical equipment industries today — to draw whatever analogies may be appropriate with other industries — and to perform a little crystal ball gazing in terms of what the future may hold.

In approaching this subject, I have naturally attempted to draw upon the specific experience which my company, a large fire and casualty insurer, has had in working with various large and medium sized electrical and electronics equipment insureds.

The first thing which becomes readily apparent is that these industries must deal with an extremely wide variety of loss control problems which arise out of this diversified operations. These run pretty much the full gamut of fire protection and safety hazards. In addition, they are being required to cope with many of the serious loss control problems being created in all industries today due to the constant influx of new production materials and processes, the trend toward larger and larger plant facilities, an ever tightening labor market, and increasing interest and concern on the part of regulatory bodies of the relative safety of plant working environments.

More peculiar to these industries, I think, are the relatively large number of chemical and toxic metal hazards, radiation and laser exposures, and electrical shock hazards found in various operations. In addition, they appear to have more than their share of headaches arising out of having to cope with extensive R&D operations and large amounts of classified government contract work, which at times makes it difficult to exert much control over operations in certain sections of the plants.

Major fire protection problems, especially on the electronics equipment side of the picture, include the categories of hazard producing production materials and processes. The problems inherent in the proper storage, safe handling, and use of flammable solvents, gases, and hazardous chemicals is a basic responsibility to which each industry must continually address itself. Pressures to maintain excessive amounts of these materials on hand in production areas must be resisted at all costs. We see a definite need for new emphasis on finding ways to improve storage location and material flow techniques to economically meet increasing production demands without exposing vital operations areas to excessive combustible contents loadings.

Processing hazards are generally of the conventional type associated with hot metal-working, application of flammable finishes, ovens and dryers, and the operation of high voltage equipment. Nevertheless, we continue to note the need for greater emphasis on employee training and supervision in these operations to reduce human operator error which is responsible for too high a proportion of fires occurring in these areas.

One of the predominant fire protection problems arises from the extremely high water and smoke damage potential found in many plant areas. This has led to resistance in some cases to the provision of automatic sprinkler protection, even in instances where large unsubdivided production areas are involved. The potential trade-off involved in water vs. fire and smoke damage to electrical and electronics equipment components is such that this can prove to be a costly short-sighted viewpoint. Nevertheless, this problem does place much more importance on the need to maintain automatic sprinkler systems in good condition at all times and to avoid any possibility of sprinkler leakage due to mechanical damage. In addition, it certainly increases the importance of stressing employee training in the use of portable fire extinguishing appliances and achieving quick reaction to the outbreak of incipient fires.

For the past ten to fifteen years, since the General Motors Livonia fire, there has been much reference in fire protection literature to the problems of the trend of increasing plant values being placed under one roof, the absence of proper fire cut-offs, and the growing interdependency of one plant on another in large corporate operations. These problems have certainly not diminished during this period; in fact, they have become more and more critical in nature until today there exists some question as to whether or not adequate commercial insurance markets can continue to be found to insure some of these risks. We can't help but feel that at least a part of this problem arises from a failure on the part of the loss control engineering profession to establish a better dialogue with industrial engineering and production management interests which normally dictate plant layout decision making. All too often, both corporate and insurance fire protection needs are plugged into this decision-making process too late or at too low a level to significantly influence these problems.

Another fire protection problem which is increasing in its nature is that created by the presence of outside contractors in the plant. Labor costs and the shortage of skilled maintenance and construction personnel have reached the point where industrial corporations are greatly increasing their use of outside contractors to perform routine maintenance, equipment installation, and small construction jobs. Thus, greater stress must be placed on supervising and controlling the operations of these contractors on plant premises, especially where hot work operations are involved.

Finally, a new industrial fire hazard phenomenon has come upon the scene since 1964, in the form of widespread civil disturbances. Much discussion could be devoted to the various facets of this problem and the range of countermeasures required from a loss control standpoint. However, let it suffice to say that "you have a whole new ball game" insofar as evaluating company loss control problems is concerned. The formidable arson and property damage risks which exist for any industrial plant located within or on the fringe of a riot area both give renewed importance to the normal fire protection facilities and program provided within your plant and underscore the need to take a completely fresh look at this new source of fire and property damage peril which can emanate from without or within the plant. It goes without saying that plant fire protection and security programs must be tightly integrated; personnel evacuation programs completely revised; exterior exposures and means of access re-evaluated; and the location and security of valuable contents, operations, and materials which could serve as potential fuels and missiles carefully reassessed.

Turning to the subject of occupational health and safety problems, it is only appropriate to first take note of the current interest and action being displayed at the federal level. Although it now appears that neither the administration's 1968 *Occupational Health & Safety Bill* nor the subsequently introduced *Hathaway Clean Bill* will be passed this year, there is little doubt that some federal legislation will be enacted in this area no later than 1970. In addition, the recent announcement by the U. S. Department of Labor of proposed revisions in their required administrative safety standards under the *Walsh-Healy Act* clearly indicates that the federal sector has no thoughts of abandoning their desire to make an entrance into this arena.

The electrical and electronic equipment industries have a vital stake in this entire area as their operations, especially on the electronics side, are certainly of such a nature as to include a fairly wide range of potential occupational health hazards. Our experience in dealing with various industrial hygiene problems indicates that the predominant problems arise from the use of acids and caustics; chemicals such as phosphorus, chromates, and epoxy resins; metals such as mercury, lead, cadmium, beryllium, and thorium; isotopes, lasers, and x-ray radiation producing equipment; gases such as ozone and hydrogen; and, of course, various types of solvent hazards. In addition, noise and heat stress problems are beginning to be of increasing concern as both industry and government become more aware of their long term physiological effects.

Generally speaking, we have found that these major industrial hygiene hazards receive considerable interest and attention by our insureds, especially in the larger companies, and their managements are quick to take corrective action when the need is in-

dicated. However, I should like to stress the importance of always conducting a good pre-I.H. evaluation of any new materials and processes which are contemplated so as to avoid the possibility of employee exposure and costly process equipment or ventilation system revisions after a process is in operation. This necessarily implies the need for integration of the loss control viewpoint into the corporate decision-making process early in the planning stage.

The more important conventional accident hazards found in these industries appear to be mainly those of electrical shock, machinery, and material handling.

Electrical shock hazards arising from the considerable amount of electrical equipment testing and high voltages encountered in operations, though of considerable magnitude, are generally found to be well cared for, probably because of their obvious and predominant nature.

Machinery hazards arising from punch presses, shear machines, etc., are usually adequately guarded but still subject to the continuing problems of operator carelessness and circumvention of safety devices and circuits. In most cases, this is traceable back to supervisory deficiences. In addition, we have found that inadequate machinery maintenance can, at times, be an important contributing factor to machine accidents.

Material and traffic flow hazards, without question, constitute the single most important source of accident in these industries as they do in most others. Through the use of our company's computer facilities, we recently conducted an analysis of the leading causes of both lost-time and medical-only workmen's compensation accidents for approximately fifteen of our larger electrical and electronics equipment manufacturing policyholders and found that five out of the seven top causes were related to basic material and traffic flow problems.

Thus, we find that the relatively common safety hazards, those that are intimately tied to the basic problems of unsafe human acts, continue to prove to be the largest single source of accidents. The reasons are fairly clear and, for the most part, are amenable to solution: heavy production schedules; high work force turnover; inadequate job training; inadequate supervision; and lack of meaningful safety program support from top and middle management.

The future growth rates for the electrical and electronic equipment industries look quite bright, and thus it is reasonable to expect that these companies will encounter increasing loss control challenges in the coming years. However, it is also clear that many difficult problems lie ahead. The increasing role of governmental agencies in occupational health and safety; the liberalizing trend of compensation coverage to *per se* include all heart attacks, hearing loss, lung cancer, hernias, etc. as work incurred; continued tight labor market and labor turnover; and the constant development of new production materials and processes all will contribute new headaches.

Also, the entire field of product liability and consumer safety, which is rapidly replacing automobile liability claims as a source of business for the plaintiff's bar, will soon have to become of paramount concern to each company. I hope that each loss control manager if he has not already done so, takes it upon himself to interject the importance of including a product safety type analysis into the development of any new product within his company, and that he obtains the opportunity to perform this role himself. Product safety begins on the drawing boards and certainly should not be completely left in the hands of the product designer who may not have much appreciation for potential accident hazards.

In essence, as we look ahead into the future, there is no question but that the role of the corporate loss control manager must necessarily continue to broaden itself to the point where he and his staff have responsibility for participating in every conceivable corporate activity and decision which has a direct or indirect relationship to the preservation of property, profits, and employee health. This will become an established fact only in those companies in which their top management becomes convinced that a comprehensive corporate loss control program is vital to its future stability and profitable growth, and the responsibility is yours to see to it that the loss control story is told.

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FOOD AND BEVERAGE SECTION

HOW TO MAKE AN INDUSTRIAL SAFETY FILM

By GLEN D. PERKINS
Engr., Loss Prevention, The Mill Mutual Ins. Group, Chicago, Ill.

It is not my intention to tell you the actual mechanics of making an industrial safety film. There is only one way to do that: hire a professional. If you want to make home movies, then do it on your own time. Home movies come out just exactly as home movies. Certainly, you don't wish to attach your firm name to a production of this type.

We will start out with the premise that you are going to use a professional to do the actual work. You still are far from being finished with your part of the project. In fact, the major part of the work in making an industrial safety film is still your responsibility. All of the major decisions rest with the sponsoring company. The professional merely takes your ideas and packages them into a slick presentation.

Five very basic decisions will be your responsibility before you are ready to get started with your film project. Each of the five decisions have at least two clear cut and almost opposite ways to go.

The first decision is, "What is the purpose of this film?" This sounds simple enough, but the answer will almost always generate friction within your own company. It may even be the most difficult one to resolve. Are you sincerely interested in promoting safety, and have you absolutely no other motive in mind? You may be, but isn't top management and the Advertisement Department thinking about corporate promotion or outright advertisement? This has been one of the major problems in our shop, and has been one of the hardest to overcome. Film making is an expensive undertaking. More will be said of this aspect later, but the problem is usually a seesaw battle internally about where the firm will derive the most benefit. You, as a safety man, are interested only in promoting safety, while management is equally or perhaps more interested in promoting company good will or products.

Let us assume that you have won the argument internally and are now ready to go on with the business of making an industrial safety film. You have probably had to concede to using 10 per cent of the film to firm goodwill or product promotion. If you have held it to only 10 per cent, then you probably should have been in sales instead of safety to begin with.

Your next major decision is, "What will the film be about?" This question may have answered itself when you first got the idea to make a film. In our case, it is a major problem because there are so many subjects available that could and should be covered. One of the mistakes most often made is trying to say too much about too many subjects in a short period of time. When this mistake is made, the usual result is that the end product actually says nothing that the viewer walks out remembering. You simply can't make a film entitled, "How to Work Safely in a Grain Elevator or Mill." The two factors that will not permit this is cost and viewer interest.

At this point, you are almost back to the first question of "What is the purpose of this film?" You have to make up your mind that you can cover one major point with perhaps two closely associated secondary points or you can go to a distant pan shot of most of the hazards found in your entire operations. If you choose the latter, you risk failing to really offer a solution to any problem. We have tried both approaches, and I still am not sure which offers the most for the money spent.

If you choose to cover only the one major point with the two closely related points, often you will not reach the plant employees that normally are not connected with this phase of your operations. To use an example, you can do an excellent job of covering the subject of "Safe Operation of a Car Puller" as your primary subject and also insert the use of car brakes and hooking and unhooking boxcars as naturals for sec-

ondary subjects. In so doing, you may have lost the interest of the people working in the headhouse or scale floor. On the plus side of this direct approach you probably have completely covered the one dangerous job classification in your plant to a point that only refresher showings and new employee training will suffice. As we will point out later, the unit cost using this approach is less, but overall cost may be more.

Should you decide to try to cover all major hazards in an elevator, you will surely not be able to cover specific hazards on any job classification. The individual employee will not be able to completely identify himself, and you risk losing complete interest in what you are trying to say. If you are going to be able to make additional films over a period of time, then I would favor the idea of one major subject, covered well. Eventually, you should build up a library that will really assist you in making safe operations a reality.

We have now decided on the purpose of the film and what we want to cover. We are still a long way from receiving the master print from the laboratory. The next hurdle is "How to cover our selected subject." In order to reach an answer to this problem, we must sit down and do some soul searching about employees. Are you aiming at rank and file laborers or supervisory people? How many employees are illiterate? Are you going to sell this film through viewer interest, or are you going to give it as a dose of medicine? These three questions alone will almost completely change the approach of a film.

First, let us analyze our employee. Let us be honest and admit that the average employee in a grain elevator is in the lower strata of the available labor in the area. The job is dirty. The job is in the lower pay bracket in the area. His educational level is low. In many areas of the country, you have an abnormally high percentage of illiterates. With these facts in mind, we must gear our approach to the subject. If we are aiming strictly to rank and file employees, we must keep the vocabulary at a point where all will understand, but at the same time don't talk down to the remainder of our audience. We must use a minimum of "reading" shots and graphs. If the situation permits, where we use reading shots, narration should accompany them. Graphs, if used at all, usually require narration. Most important of all, we impress upon the employee about what is in it for him to do what you are saying on the screen. Usually, he could care less what is good for the company or good for you.

To accomplish this last point, there are two major approaches: fear or personal gain. We have used both, as well as a mixture of each. The fear element is self explanatory. You graphically show the employee that he will get killed, lose an arm or leg, or be fired if he doesn't comply with your wishes. This approach is direct and usually effective. The personal gain approach usually shows him a bigger paycheck, a new car, vacation, happy family, or implied sex. This approach requires that the employee associate himself with what you are saying, and he may not always do this. Also, this approach usually costs more to produce as will be seen in a minute. It will probably better reach your more literate employee more effectively.

This brings us back to whether we are going to sell our film or give it as a dose of medicine. Probably nothing will affect the end cost of the film more than the answer to this question. If you are going to sell it through viewer interest, then you will have to use a plot or story line. This costs money—a lot of money. It means that you will have to use lip synchronization, and this will raise your cost by about one-third. You will also have to devote at least some time to development of a story line that really has little, if anything, to do with hard line safety. This also costs money. It is sometimes, but not always, a more effective way to tell your story.

If you choose the course of a dose of medicine, you will have decided that your audience is captive and you can get straight down to the business of "do this and don't do that." There is almost no wasted effort and certainly no wasted money on frills. I like the straight approach, with perhaps not more than one minute devoted to trying to get the viewer to associate with the film.

Our next factor is "Cost." As we said in the beginning, there are almost always two avenues to follow. This also applies to net cost of making a safety film. The cost can vary by as much as 40 per cent, depending upon how and who makes the film

for you. We still insist that you use a professional, regardless.

There are two major categories of film makers. One is the strictly commercial film studio; the other is the Film Production Units of various state universities. Almost every large university has such a department in their curriculum, and all are seeking work of this type. There are advantages and disadvantages to each.

If you use the commercial studio, you have the advantage of maintaining strict control of everything that goes into your film. They will furnish script writers, directors, filming crews, and everything necessary to turn out a good professional job. You can depend on them to do their best because their name is also on the film. Still, the final decision on all phases of the film is yours to make.

If you use the state university approach, they also furnish the same services outlined above, along with narrators from school owned radio or TV stations, casts from their stations or drama departments and props, visual aids, and any other available goods or services from the entire university. The script is a joint approval, with the university having the final word. Our experience has been that this is little problem.

The two major problems concerning the use of the university approach is that they, being a tax supported institution, can permit no advertisement in the film other than credits, either in front or back of the film; they own the copyright to the film, and anyone can purchase it. Since it is copyrighted, no changes can be made in the film by the purchaser, but he certainly can add a trailer of two or three minutes in length about any subject he chooses. If this is done professionally, he can literally let the audience leave thinking that he made the whole production. We have had some sad experience with this. Again, if your sincere motive in making the film is to promote safety, then this may not be a problem. Usually, top management doesn't strictly subscribe to this.

Perhaps the deciding factor in deciding which approach, commercial studio or state university, to use lies in cost figures. Based on 1968 figures, it will cost you just about $1,000 per minute plus traveling expenses, for crews, to hire a commercial studio to make a film for you. This includes scripts, narrators, actors, props, etc. Add 10 per cent for expenses and you can expect $1,100 per minute to cover the entire project up to the master print laid on your desk. Add $90 to $125 per print for each copy of the film you want, and you own the thing. Your competitor can't get his hands on it to further his own cause. You will have done as much or as little firm promotion as you see fit and told your story exactly as you wanted. If it is a good film, you can take all the bows; if it is bad, you will have a little difficulty in passing the buck.

If you choose the state university approach, figure your basic cost at $600 per minute. Normally, the university will pay the expense of the crews. Your cost per print for copies will be just about the same. The university will retain the master print. You will have made a film that is strictly for its own merit with almost no firm promotion. It probably will have a story line and at least some lip synchronization. If your experience is anything like ours has been, your competitor will perhaps show the film before you get around to it.

The cost figures just given mean very little unless they are tied into the length of the film. How long should a film run? Again, there are two approaches. Rather, we have already decided on the two approaches when we agreed to either sell the film through viewer interest or give it as a dose of medicine. If you are going to use the direct dose of medicine approach, then you should be able to cover one main point and two secondary, closely related points in about ten minutes, including titles, credits, and company goodwill or advertisement. This should give you nine minutes, at least, of hard line safety promotion. A commercial studio will make this for you for from $10,000 to $11,000 complete. If you use this direct approach, you probably will find that the state university will show very little interest in doing it for you. There is little in the way for training of students in making the film.

If you use the story line complete with a small plot, you will find that it will take about twenty minutes to get the same point across. Obviously, the cost is doubled as far as the commercial studio is concerned, and you now have from $20,000 to $22,000 invested. This is the type of film that the state universities are interested in. You

certainly will have a film with much more viewer interest, but your hard line safety work will be just about the same as the short film. You again must decide what you want to say, who you want to say it to, and how you want to say it.

We have tried both approaches on almost everything mentioned here. We have made a Cecil B. DeMille, no holds barred, complete with a cute little girl parading through the film at one minute intervals and serving little else except as scenery. We have actually burned down a grain elevator just to show how *not* to fight a fire in a grain elevator. We have taken a single subject and limited the entire film to plain "do this and don't do that," with no story line at all. We have taken a feed mill and tried to show every possible way that a man could get hurt and let him figure out for himself how not to get hurt. We have faked, rather realistically, a man getting his hand cut off in a set of V-belts because of lack of guards, and even succeeded in making a few people in our audiences very ill by doing it, to utilize the element of fear. We have based our approach strictly on the better life if the viewer just does what we suggest.

What is the best approach? There is no clear cut answer. No doubt we will soon be making another film, and I don't have the faintest notion right now what our next approach will be. I strongly suspect that it will be made by a commercial studio, primarily because we can more closely control both film content and distribution of the film later. The rest of the questions will have to be answered all over again when the time arrives.

HOW TO PRODUCE INDUSTRIAL SAFETY SLIDE PROGRAMS

By D. E. SCHEINOST
Ass't. Safety Director, National Distillers & Chemical Corp., New York, N. Y.

The growth of the use of visual aids, more specifically slide series, has been phenomenal in the safety field during the past five years. We have reached a stage whereby a safety program that does not include the use of visual aids is lacking a component that can greatly enhance its possibilities of success.

But, as is the case in any growth, the problem of supply and demand soon arose. In spite of the excellent efforts of the National Safety Council, the insurance companies, and commercial film producers, requests soon overwhelmed availability. We many times found ourselves in the position of being unable to obtain a series to fit the particular problem or procedure that we wished to emphasize. For this reason, we in the safety department decided to institute our own internal visual aids program.

We predetermined that we must be able to supply the answers to three questions if we were to receive management approval: The first question we were asked was "Why a program?" Our answer was: To be able to visually depict proper procedures to be followed in specific jobs as they applied to our own particular operations. In addition, to be able to visually pinpoint hazards inherent in our areas of production. Also, to have what we needed, when we needed it. It would give us a program that was both flexible and portable and could fit any time schedule.

Next came the question, "What results can be expected?" You may be somewhat surprised at our answer. We replied that one of the biggest problems we attempted to combat in administering the safety program was maintaining employee interest in the program. We expressed the opinion that we could arouse employee interest in the subject by showing our own people doing their own jobs in an environment they recognized. This has certainly proven to be true.

You have probably guessed the third question. It was the perennial management inquiry, "How much?" We said we could begin the program with an initial investment of less than $250, including the cost of a camera, a carrousel projector, six trays, and

12 rolls of film. After brief but due deliberation we received our answer: "Get started!"

Armed with equipment and the blessings of the hierarchy we started our program — and immediately encountered our first major problem. Nobody knew how to load the camera. Several phone calls later, our problem was resolved, and we continued on to our second problem: What would be the subject of our slide series? We soon discovered that every job procedure, every safe practice, every machine operation was potential subject material. Through a process of elimination, we concluded that one of our universal problems throughout the plants was improper fork truck operation which resulted in damage to material, equipment, and buildings.

We now had our subject: "Fork Truck Safe Operation." Our objective in this presentation was to stress the right way of operation and to show what resulted from the wrong way. The comparison was made between a fine automobile and a fork truck — both were expensive pieces of equipment and deserved the best of treatment. Many facets of proper truck operation were presented including pre-checking the equipment before using, the proper way to mount a truck, the importance of reporting defective equipment, look where you're going — not where you've been, be alert for pedestrians — especially at doorways, watch for adequate overhead clearance, the wrong and the right way to push a disabled truck. The cost of material handling was stated and the truck operator was shown how he could help.

This series was composed of 80 slides and was produced at a cost of $35. It has been shown over 40 times to more than 2,000 employees.

Subsequent to the producing of this series, we experienced within our company a number of serious accidents involving employees entering tanks and vessels. The basic cause of these accidents was the failure to follow established procedures. We believed that the problem was of such significance that it required attention throughout the entire corporation. A letter was immediately forwarded to all plants to review the procedures and, simultaneously, the preparation of a slide series was begun on this subject entitled, "The Right Way."

Among the points stressed were the following: There are written safety procedures. There is a procedure for vessel-tank car entry. To enter a tank such as this, there are preliminary precautionary steps to be taken including chain locking valves on inlet pipes, locking out electrical pumps, placing blinds in inlet lines, opening all man-ways, taking vapor concentration readings, steaming the vessel if necessary, wearing proper protective equipment, wearing a harness with a life line attached, and having an employee on the outside as a standby man.

The series stressed the important fact that there was only one way to do the job — "The Right Way". This series also consisted of 80 slides and cost $35. It has been viewed by over 1,000 of our own employees and has been borrowed by six other corporations for use within their own operations.

We believed that our initial attempts had been successful. For this reason, a project was inaugurated to have each plant safety director produce his own slide presentation within his own operation. He was to choose a subject which he believed would be of the greatest value in promoting his individual safety program. Notification of this project was sent to all plant safety supervisors who, without exception, accepted the assignment with the greatest of enthusiasm.

In conclusion, I would offer you a few "do's" and "don'ts" that we had to learn from experience:

1. Itemize the list of pictures, in sequence, that you plan to take.

2. Carefully examine the area of your picture to determine that there are no undesirable conditions prevalent.

3. Shoot at least two pictures of each scene.

4. Do not talk your pictures to death with narration. Ten seconds of narrative per slide is sufficient.

To create your own slide presentations takes only two things — confidence and determination.

ROLE PLAYING: OUR SAFETY RECORD IS SLIPPING—WHAT CAN WE DO?

The Production Superintendent of the Exit Corporation has invited the Plant Safety Director and the Supervisor of the Widgitt Department to meet in his office to discuss the accident rate in the department. The Exit Corporation manufactures "whatsis" in a plant employing 624 persons. The plant frequency rate is average for its industry. It is January 15, and the plant production superintendent has reviewed the previous year's safety record. The Widgitt Department had a frequency rate of 26.18, which is about three times greater than the next poorer department. Here is that meeting:

Cast

Production Superintendent:

J. M. KROLO, Supvr., Safety & Training, American Maize Products Co., Roby, Ind.

Safety Director:

DONALD P. ESPINOSA, Safety Director, Pepsi-Cola General Bottlers, Inc., Chicago, Ill.

Supervisor, Widgitt Department:

HARVEY H. MARSDEN, Plant Safety Dir., Kellogg Co., Battle Creek, Michigan.

(The three men enter the room on the way to the meeting.)

HARVEY: Another meeting. We are having so many meetings that we are holding meetings to arrange meetings. *(The men seat themselves.)*

JACK: Harvey, Don has given me the accident reports of your department. Your frequency rate is 26.18. The rate in the plant is just slightly over 2.0. I want to get something done to improve your rate. What can be done?

HARVEY: Don, why didn't you come to me first with this problem? Why did you run to the Boss?

DON: You are always too busy to talk to me. I can't get to you. Let me point out the problem to you. These accidents are eating up the profits that your department is making. Your production is good, but if you lose the profit from this production by having too many accidents, it is the same thing as having low production.

HARVEY: I got out the production, didn't I? I don't think I'm too far out of line as to accidents vs. production.

JACK: That is so, Harvey. Don't let that production suffer.

DON: We just can't afford these high insurance costs.

JACK: We just have to cut these costs.

HARVEY: Well, for one thing, maintenance and everyone else comes into my department, do a job, and they always make a big mess and walk off and leave it. I can't spare men to clean up after these guys, and those messes cause some of my accidents. I've got to have some help.

JACK: I'll straighten this problem out. Other departments won't mess your area up.

DON: This is only a small part of the problem. Figures show that this clutter in your department accounts for only four per cent of the department's accidents.

HARVEY: O.K., Don, do you have any ideas as to what I can do to prevent the others?

DON: Your accidents are mainly caused by unsafe practices. They are caused by people.

HARVEY: That's it, but how do you get the people to think? I tell them how to do the job safely but as soon as my back is turned they do it their way.

DON: There is no specific pattern to your department's accidents. You are having hand injuries, back injuries, eye injuries; in fact all kinds of injuries, in about the same number.

HARVEY: I need more help in the department. I can't be everywhere at once. Jack is holding me responsible for production, quality, reports, and everything else.

JACK: This will cost more money. How can you make your department safer with more men? Every man should be responsible for safety.

HARVEY: All right then, if you won't give me anybody, I should be able to get some help from Don. How about it Don?

DON: Harvey, you have to make up your mind that you are going to reduce accidents in your department. You have to

set an example for safety yourself. You must hold safety meetings with your foremen.

JACK: I'm disgusted and mad about all this. We must solve this problem.

HARVEY: I have to spend too much time in meetings. I scarcely have time to do the work I must do to get production. I've got just so many people and all of them are assigned to a job. They can't be running around looking for accident causes and I can't be spending too much time in meetings.

JACK: Whether you like it or not, meetings are necessary. I must have them to coordinate things in the plant.

HARVEY: Perhaps, but you try to cover too much in those meetings. They are too long. In fact you hold meetings just to plan meetings.

JACK: Maybe you have a point there. I will review the meeting procedures, and try to come up with a system to hold down the length of these meetings.

HARVEY: Let's get back to Don giving me some help on solving my accident problems. What is he going to do? He's a staff man isn't he?

DON: Harvey, I still have to be able to get to you, and have you give me enough of your time so I can help you. You should set an example for safety in your department. You should read and review the accident reports from your department.

HARVEY: I can't take the time to read accident reports. Jack is pounding me on the back for production.

DON: You should read them to get an idea as to how to correct the conditions that are causing the accidents. Just a short time ago, one of your men lost two fingers in a work accident and you didn't even know it. You have people off work most of the time with injuries. Your department is overstaffed because of injuries.

HARVEY: This could be true, but each of my foremen has sixty people and he can't be everywhere at once; and because people get hurt, we have to have replacements to get out production.

JACK: We'll have to take a long look at this. If we can reduce accidents and cut down the number of people in the department, then we can increase profits.

HARVEY: Instead of making all those reports and making me waste time reading them, why can't we get a camera and take pictures of the hazards. You know the saying, "One picture is worth a thousand words."

JACK: There you go, wanting to spend more money. This will cost too much!

HARVEY: We can get a Polaroid Swinger camera for only fifty bucks. I don't think that's a bad investment and it's easier to read a picture than to read a lot of words.

JACK: Don, are we members of the National Safety Council? They put out lots of material to help a plant reduce accidents.

DON: We surely are members of the National Safety Council, and I send plenty of material from them to Harvey to read.

HARVEY: I don't ever see any of this material, and besides I don't have time to read all that junk.

DON: Harvey, you are too involved in the operations of your department to read any of this material. Why can't you teach one of your foremen to handle the operational problems and thereby give yourself more time to solve your safety problems?

HARVEY: If I teach one of my men too much, he will soon have my job.

DON: Remember Harvey, if you don't have a good replacement for yourself you can never move up yourself. I'll work with you and show you how to delegate responsibility. You will then have time for safety. Harvey, I want your ear. I want to work with you. I know we can reduce the accidents in your department.

JACK: Is it necessary that Harvey read everything in these publications from the National Safety Council? Can't you mark the articles, Don, that apply to Harvey's problems?

DON: I can do this and I will do it. Harvey will have to read what I send him though, to make it a two-way street.

HARVEY: Fine, I buy that. I would rather read one article than a whole magazine. If there isn't anything of interest to me, then don't send it. I want to say though, that I don't think that you get out into the shop enough Jack. People want to see you and know that you are interested in

set an example for safety yourself. You must hold safety meetings with your foremen.

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HARVEY: Fine, I buy that. I would rather read one article than a whole magazine. If there isn't anything of interest to me, then don't send it. I want to say though, that I don't think that you get out into the shop enough Jack. People want to see you and know that you are interested in

them and what they are doing. Your interest would promote safety and also help to increase production. I also think that you should arrange to take the foremen out to dinner. Show them that you appreciate what they are doing.

JACK: What! You want me to spend money to reward a 26.18 accident frequency rate?

HARVEY: I think we should get the men together to explain to them what we want them to do to promote safety in our department.

JACK: I don't understand what it is that you want. How would this help? They can learn what to do for safety at the plant.

HARVEY: Yes, but we should get them away from the plant. Get them relaxed away from the busy rush of work. We can put it over better. You should be at the meeting. The foremen want to know you are also interested in safety.

DON: I think this is a good idea. I am all for it.

JACK: Rewards don't have to be expensive things, I guess. A word of praise or a small token article can do the job if the meaning is made clear. Tell me, who do you want me to give this dinner to? How many?

HARVEY: Have the dinner for my ten foremen and for you, Don, and me. I know the men will appreciate it and it will show them you are interested in them.

JACK: When do you suggest having this dinner?

HARVEY: The sooner the better. How about next Tuesday?

DON: No, I can't make it on Tuesday. I just have to attend another meeting.

HARVEY: Well, how about this next Thursday?

DON: I think I will be free then. Yes, I know that I will. I'll make it because I want you to improve your accident experience.

HARVEY: Fine; we can have a few drinks and really get the boys to let their hair down and we'll plan this thing out. I think the fellows have got something they want to get off their chests. We don't want to hold anything they say against them, just a good old fashion bull session on problems.

DON: We'll have to cut the drinks off early. We can't send anyone home drunk from a safety meeting.

JACK: I'll make the arrangements.

HARVEY: Wait a minute; you said you would reduce the number and the length of your meetings. How are you going to do it?

JACK: Wait until after our dinner meeting. Perhaps some things will come up about this at our discussion there. If I do reduce the number of meetings and their length, and you find that you can't attend one of them, Harvey, then I want you to have one of your men there in your place. Do you understand this?

HARVEY: I understand you exactly, Boss! I think working together a little better will put us all on the same ground and we will get results.

DON: Remember, Jack, you are to spend a little time in the shop.

JACK: I will remember, and I will do it.

HARVEY: How about it, do I get that camera?

JACK: Yes, we will get you the camera, and I think we can make use of it to make up some posters showing things right here in our own plant. I think this sort of poster should be very effective.

Meeting adjourns with all agreeing to work together more effectively to make safety work in the department and in the plant.

HOW GOOD A SAFETY-MAN WERE YOU FIVE YEARS AGO?

By FRANK J. FESSENDEN
Mgr., Selection & Training, Kraft Foods Div., National Dairy Products Corp., Chicago, Ill.

What is it, in a group of top-notch professional people—who are good, who know they are good, who have been told they are good—what is it that causes such people to be reluctant to admit it? Aside from the few who, very simply, are just being honest, there is probably a combination of two reasons: on the one hand, we are inclined to adapt our behavior to the total immediate environment as we interpret it; on the other hand we are impelled to do this in a way which avoids risk of any kind of hurt. Obviously, we behave so as to avoid fights and physical embroilments, but as individuals we also protect our own psychological and emotional sensitivities—consciously or subconsciously. Even if we honestly believe our performance as a safety man is "very good," we still avoid creating a situation where someone might attack that position. And we work especially hard at it if the opinion we hold about ourselves is questionable.

We adapt our behavior to the total immediate environment as we interpret it. If we find ourselves in a group of recognized professional safety men, the risk of having our self-evaluations attacked is too great, and we cover our self-esteem with the protection of false-modesty and under-evaluation. Back home, in the management hierarchy of our own companies, we're in a different environment. We need no longer be concerned with reactions and possible threats from other professional specialists. There, we are Mr. Safety; there, we can bask more comfortably, since we're the only one on the beach; there, we have smooth sailing for there's no one to rock our boat; and there, too, if you will, because we are the only specialist, we risk the stagnation of mediocrity.

Let's look at ourselves—each of us, individually. Let's do some exercises in self-assessment. How good a safety man are you today? Are you "superlative" or only "superior"? Are you "exceptional," or just "very good"? How many "Big Daddies" do we have? *You* know where you stand. You can place yourself on any scale that anyone else can devise. And, even more important, you know if your place on the scale is above your 1963 place, or if it has remained the same.

In any case, the past is past. Dead. You'll recall the quatrain from the Rubaiyat:

> The Moving Finger writes; and, having writ,
> Moves on: nor all your Piety nor Wit
> Shall lure it back to cancel half a Line,
> Nor all your Tears wash out a Word of it.

We are, each, what we are, without regard to what we might have been. But likewise, fortunately, we can each become whatever we cause ourselves to become, without regard to what we are. As one political orator put it with his great wisdom, "Our future lies ahead of us." Who can argue with that?

The future is commonly said to be a vast unknown, but there are things we do know about the future. It will be different from the present, for example, and it will be different from what we think it will be. But probably the most important thing we know about the future is that it is always about to begin.

It is true that we can't call back the Moving Finger to cancel what it has writ, but we have the opportunity—in the ever-present now—to *cause* what it writes. In every fleeting instant, as the past and future meet, we control what we are, and what we can become. At this very moment, as you each hear what I say, that experience itself fades into yesterday, and the chance to react is lost unless it is met with reflection, with introspection, with resolve, and with determination to *cause* the future we too often only dream of.

When 1963 was the present, five years ago, a future was about to begin. Some took

actions to shape that future, others perhaps did not. Now, we are in another present, and can begin new futures, together, by looking at where we are. How good a safety man *are* you *now?* Any better than you were five years ago? Are you as good now as you want to be in 1973? Have you yet begun to plan the changes in you which you want to cause?

There are other ways to ask the question, "How good a safety man are you?" *How* good are you? What standard do you use? In a meeting with your peers do you fade meekly into the background to escape discovery of your weaknesses? Do you babble endlessly about trite and insignificant accomplishments to hide the inferiority you feel but don't correct? Or do you engage in frank and professional discussions from which you can learn and in which you can teach? On your job, back home, where you are Mr. Safety, "*how* good a safety man are you?" Is your assessment of yourself any different there? Do your standards change? In your job back home, do you relinquish all authority to line executives to avoid being blamed for unpalatable decisions? Do you just assume authority and throw your weight around to gain more status for the function—and for yourself? Or do you carry on as a professional manager who adapts his behavior to the overall objectives of the organization? *How* good a safety man are you?

Here's another way to ask the question: "How *good* a safety man are you?" How good are *you?* Of course, I recall, as you do, that Plato's *Republic* claims that there is no inherent good—that a thing is either better or less good than something else with which it is compared. That's fine as an intellectual exercise for philosophers. In today's world, I don't believe it. Today, in our society, I believe there *is* acceptance of inherent good. There are qualities like honesty, trust, faith, and loyalty which contribute to man's character, to his moral strength. How *good* a Safety Man are *you?* Do you bark harshly at an employee who breaks a safety rule? Do you hound a supervisor relentlessly to complete an accident report? Do you mope and sulk at adversity? Or do you offer a helping hand with understanding and compassion—with real feeling for the other person's viewpoint? Everyone is inclined to behave in a way which makes sense to him, and we're not very likely to change his behavior until we know why he behaves as he does. As safety men, our success is determined to a marked degree by the behavior of others; and our effectiveness in influencing that behavior is determined by the confidence they have in us, the respect they have for us, and the understanding they expect from us.

Finally, there's one more way to ask the question: "How good a safety *man* are you?" And when I say "man," I'm not speaking of the male animal, but of the stalwartness, stamina, and courage that builds solidity and strength in an organization—and in an individual. It includes forthrightness and objectivity; integrity and sincerity; and it is the difference between genuineness and superficiality. It may be what Khayyam was thinking in another quatrain from the Rubaiyat:

> I sometimes think that never
> blows so red
> The rose as where some buried
> Caesar bled;
> That every Hyacinth the
> Garden wears
> Dropt in her Lap from some
> once lovely Head.

How good a safety *man* are you? Do you ever back-pedal on matters of fundamental principle in order to play it safe? Do you sometimes fail to show the spunk and aggressiveness which many executives long to see expressed by their department heads? Do you on occasion pursue an unwise course, not recognizing that your motives are selfish? Or do you analyze each problem, weigh the alternative solutions, and arrive at decisions or recommendations that you can defend with vigor and fortitude? It's the *man* in "safety man" that gives the term meaning. Here is the character, the strength, the moral fiber of the individual's being.

So, we have a question. We have, in fact, four questions:

How good a *safety* man are you?
How good a safety man are you?
How *good* a safety man are you?
How good a safety *man* are you?

Only you can answer these questions about yourself. Only you can say whether or not you want different answers five years from now. And certainly only you can *cause* different answers then.

Easy, it isn't. But we're lucky. We all have help at our immediate call. To find it quickly, just look around you. There's not a person who doesn't know *something* that you don't know; and there's not a person whose knowledge you can't increase in some way. Yet, with this almost limitless opportunity before us, how freely we discuss the World Series, last night's TV show, the best restaurant in San Francisco, or the height of hemlines—although I concede that mini-skirts do represent hazards of varying types. No one here would walk to a library reference room, ignore the knowledge stored there, and sit down to read a comic book. But in our own group of acknowledged professional specialists, we too often continue to be self-centeredly content, neither seeking nor offering knowledge, satisfied with our mediocrity.

Surrounding you are knowledge and experience and opinions and self-improvement opportunities like you've never realized. Use it! Pursue excellence! Learn! Grow! Develop! *Cause* your future.

Remember the oft-cited John Donne quotation—but remember *all* of it:

> *No* man is an Island, intire of itselfe; every man is a peece of the Continent, a part of the maine; if a Clod bee washed away by the Sea, Europe is the lesse, as well as if a Promontorie were, as well as if a Mannor of thy friends or of thine owne were; *any* man's death diminishes me, because I am involved in Mankinde; And therefore never send to know for whom the bell tolls; it tolls for thee.

SAFER FOOD MACHINE DESIGN

By KEITH E. BARENKLAU
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The insurance industry is acutely aware of the existing and challenging implications of this subject. Though machinery-related accidents are not the major cause of injury in the canning industry today, about one in six of the injuries that take place in the canning industry are a result of getting caught in machinery. This of course, includes conveyors, chains, belts, and pulleys.

The general public is also aware of some of the hazards of working around machines in the food canning industry and others. I have only to look back at my high school history and economics classes to recall the rather horrid pictures that were painted with words about the terrible accidents that happened during the early industrial revolution. Textbooks of my high school days built quite a case about the horrors attributed to machines in the early factories. We can only assume that many other Americans were introduced to industrial accident implications in this same way. I think we are relatively safe in assuming that the general public is more conscious of machinery accidents than they are about the other major causes of industrial injury. This concern is not unfounded, but it may be a bit overstated.

As I said, although machine accidents concern us all, they are not the major cause of injury in the canning industry. Not long ago, Employers Insurance of Wausau studied 2,347 injuries in canneries. These injuries totaled almost $1,500,000 in cost and revealed that more than $800,000 of this loss could have been prevented if a few accident prevention targets had been concentrated upon. When we looked at the injury costs themselves in the canning industry, we found that back injuries accounted for 23 per cent of the injury cost. Eighteen per cent of the injury cost involved material handling. The major portion of these injuries developed from the handling of boxes and cases which would include the occasional crushed foot, smashed fingers, and other material-handling related areas.

About one in six injuries resulted from getting caught in machinery. These injuries in the large study accounted for 17 per cent of the injury cost. The accidents in-

cluded some of the equipment that service machines as well as the machines themselves, such as belts, pulleys, conveyors, and chains. I point out these facts to show that even though machine safety is a concern of us all, it ranks third as far as cost is concerned, related to injuries in the study. Machine designers and industrial safety people are not dragging their feet as far as machine accidents are concerned.

The insurance industry has a distinct advantage when viewing the food canning accident picture. Insurance safety people, by the very nature of their work, see many facilities, investigate many accidents, and talk to many engineers and safety personnel. From this vantage point, and since insurance handles the claims that result from machine accidents, some insights may be gained. We should all be concerned with machine accidents and particularly concerned in the canning operations, where seasonal employees make up the larger portion of the work force. The seasonal employee who is a machine operator causes some vital concern from a safe design and ease of operation standpoint. Canners of vegetables are those most likely to have large groups of seasonal employees. We might also conclude that in general, the meat packing industry and the canning operations which are a part of it are usually blessed with a more stable work force than are the seasonal operations.

Why is safe machine design so important from the seasonal worker's standpoint? Although their work is certainly necessary to our economy, seasonal workers have a certain amount of built-in disadvantages from a loss prevention point of view. They normally do not serve an apprenticeship on a machine, as do workers in many other industries. By and large, they are unfamiliar with the machinery and quite possibly are of a lower educational level than those who work in an established factory. Indeed, it appears that machine designers and canning safety people are faced with a problem of protecting the seasonal employee from himself to a much greater degree than those in a metal working operation, for example. With the seasonal worker, such items as machine guarding and simplicity of operation should be of vital concern. Where a regular employee knows the value of keeping guards in place, the seasonal worker may not. If he is a foreign national for instance, the work environment may be relatively strange to him. So might our normally accepted safety rules and regulations.

What can be done from a machine design standpoint to expose the worker to as little hazard as possible? Let's look at a situation that happened in a meat canning operation. An operator had shut off his machine and was attempting to clear a jam. The switch that activated the machine was a toggle switch. His jacket caught on the toggle switch, turning on the machine. The machine started and amputated one of his fingers. Insurance claims have resulted from employees turning on machines while other workers were repairing them.

Certainly accidents of this type are preventable. Why put toggle switches on machines in the first place? Why not design machine switches so that a lock-out system can easily be installed? Better still, let's build the lock-out system in when we design or modify the machine. Because of the amount of custom-built machinery found in canning operations, local plant engineering as well as machine design engineers have to be brought into the picture. We have to, in effect, design not only for proper use, but also to preclude possible misuse whenever and wherever we can.

We in industrial safety have long heard the old lament that machine designers make beautiful equipment, but they tend to forget that a man has to operate it. I would like to pass on some of the comments insurance people hear regarding the lack of human factors in evidence in machine design. A grizzled old foreman told one of our consultants recently that the switches and operating controls on the machine he recently obtained in his department appeared to be put on as an afterthought. By this he meant that, because of the location of the controls and switches on the machine, the operator was having some problems running it. He mentioned that some of the controls were not labeled and this, of course, would pose a problem to any strange operator. Electrical switches and operating levers should be labeled and arranged so that the operator does not have to be a contortionist or extremely fast on his feet in order to operate the machine.

We have observed many corn husking operations, for example, where the master

switch for the husker was located quite a distance away from where the operator had to work. In one case, the switch was located in an adjoining room. Such installations appear to have been made for the convenience of the installer rather than for the efficiency and safety of the operators. Of course, progress to correct and eliminate conditions like these is being made. However, we do need to continue our efforts in this area. Let us consider what the Wisconsin Administrative Code says, for example, regarding machine controls. Section IND 1.20 states:

1. Every machine shall be equipped with a loose pulley, clutch, switch or other adequate means within reaching distance of the normal operating positions of the operator for the purpose of disconnecting the machine from the source of power.

2. Machines on which two or more persons work shall be equipped with one or more controls, so located that more than one of these persons can quickly disconnect the machine from the source of power.

3. In each room where a line shaft drives machinery from a source of power located outside the room, means shall be provided to disconnect the power from the line shaft.

From this, we can see that Industrial Commission safety codes do indeed spell out safety information. Let's be sure that we check the appropriate codes prior to building or modifying machines.

Another complaint frequently heard is that grease fittings and other maintenance points on conveyor systems are frequently not well planned. Why should maintenance people have to shimmy up a conveyor several feet from the floor to put grease in a bearing each day? Wouldn't it be better to put a pressure cup or similar device on a hard to reach spot so that it only had to be serviced weekly? Lubrication lines could be run down to a level low enough so the maintenance people wouldn't have to climb. What about greaseless bearings for hard to reach spots?

Human factors in machine design have really come into their own as a result of our areospace program, for one thing. We dare not overlook these human factors when we build or purchase new machines.

Too often, complaints are heard about the lack of posted operating instructions on machines. Here again, isn't this an area where we can help to control misuse? Let's get engineering involved in developing instructions, and then let's post them where the operator can see them. The finest, most understandable and complete set of instructions ever developed are no good at all if the operator doesn't know them.

Large strides have been made in recent years in the area of cooperation between the safety man and the machine designer-buyer. It is important that the safety engineer and the machine designer work together when building custom equipment for a canning operation. Here again, we must point out the fact that a lot of canning equipment is custom made or severely modified once it reaches a plant. We must coordinate our work in the area of machine safety. Those safety people who have contacted and worked with engineers in machine design have, in general, found engineers to be very approachable. I guess we must have thought they were unapproachable at one time, since cooperation in this area is just now coming into its own.

For the engineer who desires specific help in the area of safety, there is no better source than the corporate safety people. They are approachable, too. At a recent products symposium a safety official was heard to say that because of cooperation between engineering and himself, they were now making rapid strides in the prevention of machine accidents. His exact words were, "What safety people need to do is go along on the honeymoon, rather than function as midwives." We must admit he has a very definite point. Consult your safety people on this aspect of design. You could well discover that they are better honeymooners than midwives.

Not long ago, an unusual machine accident happened in Europe. The machine involved was a mason's pulley. A worker had just finished laying some bricks on a wall several feet from the ground. Upon finishing his work, he filled his brick barrel with bricks, odds and ends, tools, etc., and scurried down the ladder to the ground. The barrel was resting on the wall several feet above him, and he took hold of the rope which ran from the barrel through the

pulley and down to him. With difficulty, he managed to hoist the barrel clear of the wall. It was so heavy however, that as it started down it pulled him up in the air. Being a conscientious worker, he was determined not to let it drop, so it came down and he went up. On the way past him, the barrel cracked him a good belt on the shoulder, nearly dislocating it, but he held on to the rope. When the barrel hit the ground it broke open, spilling much of its heavy contents. Thus, he became heavier than what remained, so he started back down and, in turn, pulled the barrel back up. On the way up past him, the barrel struck him on the shins and cut a nasty gash in his leg. He hit the ground with such force that he sprained his ankle and lost his grip on the rope; thus, the barrel came down on top of him as he lay there, hitting him on the head. Had he not been wearing skull protection he may have been killed. I doubt, in this case, that we can point a finger at the designer of the pulley.

We would be remiss if we didn't say a few words from the liability standpoint. In the July issue of the *National Underwriter Magazine* is a story about a lawsuit which has developed because a smoker found a human toe in his can of tobacco. The article doesn't elaborate too much on how the toe got in the tobacco can, but it would perhaps be a very safe bet that the toe was cut off during a harvesting operation. Undoubtedly, the person who now owns the toe feels he suffered quite a few dollars worth of surprise upon finding it.

Every year workers get their hands and arms caught in the snapping rolls of corn packers. Why does this happen? There are perhaps several reasons but among the reasons is the fact that they let the machines run while trying to clean obstructions out of them. The snapping rollers travel at a rapid rate forming a metal-to-metal pinch point and, occasionally, loose materials will form and ride along on top of the rollers. We must admit that an easy way to clean them is to take a stick or a cornstalk and poke the loose material down into the rollers; the rollers will then expel it out the bottom of the machine, and the rollers will be clear. The drawback comes, however, because the operator does not realize the speed at which the rollers are turning. As he jabs down on the loose material with his cornstalk, the rollers will occasionally grab the cornstalk and pull his arm into the rollers before he can release his grip. This happens all too often, and stumps of arms are usually the result. This type of accident is a hard one to prevent. It is perhaps more of a procedural problem than a design problem.

Another area of exposure which we also have to attribute to machines is noise. Some aspects of the canning operation produce a noise exposure. Noise exposure normally stems from the handling of empty cans. What is the best way to control noise? The best way is to control it at the source and thereby eliminate the need for workers to wear personal protective equipment. Where control at the source is impossible, workers should wear ear protection. Wherever possible, noise control should be designed and built into the machine.

What about feedback from the field? Are we making an effort to obtain loss prevention information from the users of machines that will help us in the development of safer machine designs? This feedback effort is well worth making. We all realize that controlled bench tests and field tests turn up most of the bugs—but what about the problems that present themselves later? After a machine—any machine—is used for a period of time under actual production conditions, things happen. Let's not be satisfied with catch-as-catch-can information fed back through informal channels. Program for feedback. This will pay dividends.

In summary, to cover every machine injury in so short a time is not possible. We would like to present a few guidelines, however, which, if used, would tend to measurably reduce machine accidents:

1. Design machines in accordance with applicable state and local guarding standards, and keep in mind the human element.
2. Install clearly labeled controls where they are convenient to the operator and include applicable operating instructions.
3. Construct or modify switches so that lock-out can be easily accomplished.
4. When new machinery is purchased, specify to the manufacturer, designer or modifier that it be designed to comply with safety codes and regulations as well as the job specifications.
5. Work to establish an environment in

which safety personnel can work closely with engineering personnel to make sure that the knowledges contained in both disciplines are brought to bear on the machine safety problem.

6. Make provisions for feedback of safety information from the field; information that can be used to supplement the loss control effort.

These guidelines encompass a few areas which we believe to be vital. They are applicable in almost every area of endeavor in which machine safety is a concern. We hope that you will use them.

SAFER MACHINE DESIGN: THE DESIGN ENGINEERING VIEWPOINT

By J. W. MARQUETTE
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One hundred and thirty-eight years ago my great-grandfather was born in Alsace Lorain, France. When he was fourteen years old, in 1844, two events took place. He came to this country to visit his sister in Centralia, Wisconsin; and England enacted a law to provide fencing for mill gears and shafts—Lord Ashley's "Great Factory Act." One hundred and six years ago my grandfather was born near Watertown, Wisconsin. When he was fifteen years old, in 1877, Massachusetts passed a law compelling the guarding of dangerous moving machinery. Eighty years ago, my father was born in Roadhouse, Illinois. When he was four years old, in 1892, the Safety Department of the Joliet Works of the Illinois Steel Company was formed. This has been called the birthplace of the American industrial-accident prevention movement. Fifty years ago, I was born in Aurora, Illinois, and the National Safety Council was only five years old. You might say that we grew up together.

My grandfather gave me my first lesson in safety. He started railroading in Baraboo, Wisconsin, in 1882, with the Chicago and Northwestern, and was Superintendent of Chicago & Alton at the time of my lesson: Granddad held up both of his hands, wiggled all ten fingers and said, "Julius, God gave us these ten fingers, and a careful man will have ten fingers when he dies." In the early days of railroading, the cars were connected together with a pin-and-link coupler—a more dangerous method would have been difficult to devise—and this coupler caused the amputation of fingers from the hands of a good many brakemen. Granddad was a proud railroader and a careful one—he had ten fingers when he retired at the age of eighty-five, after sixty-five years of service, and when he died ten years later he still had ten fingers. The introduction of the automatic coupler may have helped him maintain his safety record. I know his lesson helped me.

My father was also a railroader, a graduate of the University of Illinois in Railway Mechanical Engineering, and taught me how to hold a nail to minimize the possibility of smashing my thumb (that took a little practice, as I remember), how to start a saw cut, how to use a knife and a gun safely. He was the first of many safety instructors I've had, and all instilled in me an awareness of safety. So, I'd like to salute those men whose social awareness and concern for their fellow men, at a time when the death and injury of industrial workers was accepted as unavoidable, started the awareness of safety which has resulted in the huge strides made in only four generations.

Safer Machine Design

The machine designer should have a safety awareness similar to defensive driving—he should always be alert and watching out for "the other guy." Safety awareness is environmental, and the degree of awareness is in direct proportion to the emphasis top management places on safety. Most progressive companies have top management which is cognizant of the need for safety if their company is to survive in our economic system, and Campbell Soup Company is a most progressive company.

Just as the automatic coupler in railroad-

were interlocked with the machine motor starter. Now, there are machines which must be rotated for cleaning and, thereby, present an accident potential. We use a selector switch with "clean—off—auto" positions. In the "clean" position, the maintained-contact pushbutton must be engaged. This maintained-contact pushbutton is located so that the cleaner must remove himself from the danger area and thereby minimize the accident potential.

Just as more continuous processes and automation have reduced the accident potential for the operator by removing him from the point-of-operation to his instrument console, clean-in-place systems will reduce the accident potential for our cleaning personnel. However, there are a number of machines in the food industry which will require point of operation cleaning by hand in the immediate future. This is the hazard the designer should eliminate or minimize now.

Safer Machine Design for Maintenance Personnel

During the past summer, we had a little labor problem at some of our plants and the salaried personnel were attempting to operate our Sacramento, California, facility. They requested help from the engineering department and I was a member of the team sent there to augment their personnel assigned to maintenance work. This assignment lasted five weeks and was invaluable to me, since the facility I was to help maintain was one that I designed. This experience was not only beneficial from a physical rehabilitation standpoint—I lost ten pounds and never felt better in my life—but also gave me a deep sense of responsibility toward our maintenance craftsmen and a firm resolve to eliminate some of the hazards I encountered.

The educational level of our craftsmen is normally higher than that of our cleaning personnel. Our craftsmen are proud of their ability and skills and have proved to be a valuable source of suggestions to improve equipment and process. I suggest that the machine designer for the food industry equipment dialogue with the craftsmen in his own plant to discover where the assembler has had difficulty in assembling the machine. This might result in closer attention to fits, tolerances, and surface specifications—especially on those assemblies which must be taken apart in the field to replace the least reliable part—and to question the need for special tools and equipment used in the assembly operation, which may not be available in the field.

The state of Pennsylvania has a law which requires that all automobiles be inspected for safety twice each year. As most of you probably realize, a good, honest, and reliable automobile mechanic is becoming rather scarce; so I had made an appointment with my mechanic on a Saturday morning last July to have my car inspected. Like many engineers, I like to watch the mechanic repair my automobile, I like to inspect the various components with him, and often I learn something. On this day, the mechanic found, among other things, a defective turn indicator switch. The cost of the switch was about $1.15, but it took the mechanic 3½ hours to install the part. Now, some automotive engineer or designer had given very little consideration to the replacement of this part. Maybe he thought it would never become defective. The time required for assembly was probably minimal, but, like so many modern pieces of equipment, the replacement of such defective part was given little, if any, consideration. To end this little story, the garage mechanic, being an honest man, did not charge me for the 3½ hours of his time it took to replace this part because, as he said, "Most of my time was spent trying to determine how to do the job, not in actually doing it."

A similar situation exists for our craftsmen when they are repairing a piece of equipment. Oftentimes it is necessary to almost completely dismantle a piece of equipment in order to get at the defective part, whereas with a little more consideration on the part of the machine designer, the defective part could be reached without the need of a complete disassembly. Our craftsmen, in their zeal to get equipment back on the line as quickly as possible, may be tempted to overstress tools, strain themselves, or set up an accident potential. For example, at our Sacramento installation the first shift maintenance crew had started the disassembly of a large circulating pump in order to replace the mechanical seal on the shaft. As a member of the second shift maintenance force, the scene which greeted my eyes was reminiscent of the medieval days and the torture machine known as the "rack." Stretched out between four equipment support columns was the victim—the power end

of the pump complete with its shaft and the overhung impeller. A cable was stretched around the backside of the impeller and connected to a one-ton chain lift which was secured to two columns. One of my second shift associates, 6 ft. 5 in. tall and 270 lbs. of pure muscle, was exerting his considerable strength on the end of the chain hoist lever. To prevent damage to the impeller and to minimize the possibility of cutting the cable, two sections of 2x4 had been placed between the cable and the back shroud of the impeller. Because of his tremendous strength, the chains were as taut as steel rods; the two 2x4's groaned as the cable bit into them, and each of us knew that the accident potential was high. At any moment the cable or restraining chains could break, setting up a gigantic whip. Fortunately, through the application of heat on the impeller, and the fact that the impeller, when it did start to move on the shaft, moved only in fractions of an inch, the disassembly was completed without a personal injury. The reason for the difficulty in the disassembly of this element was quite evident. The stainless steel shaft was badly galled during the assembly operation of the stainless steel impeller. A tapered fit between the impeller and the shaft would undoubtedly make the disassembly less difficult. However, the removal of the impeller is incidental to the solution of the problem; that is, the replacement of the mechanical seal. A higher reliability factor built into the mechanical seal would have increased the operating time before the maintenance replacement was required. An alternate would be to design a mechanical seal which could be replaced without the disassembly of the pump.

Process or Equipment Operation

In order to assure that the process or equipment will operate in accordance with design, three important factors to be considered are: preparation of operating procedure manuals; instruction sessions; and process run. Of these three, the most important, from the safety aspect, is the preparation of the operating procedure manual. To the designer, a moment of truth occurs and he sometimes finds himself in the predicament of the lost motorist in New England. He stopped at the nearest farmhouse and made his predicament known to the Yankee farmer who replied: "Well, let's see, you take the road to the next fork and turn right until you come to the covered bridge . . . well, no, bridge washed out last spring so you can't go that way. Well, then you take the left fork and continue until you pass the large oak tree . . . no, you can't go that way, the tree blew down last winter and the road is blocked." After considerable reflection, the farmer then told the lost motorist: "Well, you can't hardly get to where you're going from here." Such is the case with operating procedures. Often times the engineer finds that the design is inadequate or that the proposed method of operation is not feasible.

Operating procedure manuals normally consist of five major subdivisions: management information; operating information; operating instructions; cleaning instructions; and maintenance instructions. The management information section deals with an overall summary suitable for top management and area supervisors and its intent is to give these people an overall idea of what the process design hopes to accomplish. Operating information is prepared for area supervisors and process supervision and gives a more detailed description of how the process works. Operating instructions consist of detailed step-by-step procedure to make the operation work. Cleaning instructions consist of detailed step-by-step instructions on how to clean the equipment and process. Maintenance instructions consist of parts lists, vendor drawings, and instructions, and company drawings and instructions on special equipment. The design engineer's responsibility in the preparation of these manuals covers not only the normal start-up and operating conditions, but also normal shut-down, emergency shut-down, and description of any man-failure accident potentials.

Prior to the initial start-up of a new design facility, instruction sessions are held for the operating, cleaning, and maintenance crews. The procedure manuals are used as a reference, and oftentimes these sessions are fruitful from the standpoint of design modifications brought to the design engineer's attention by the various personnel attending the sessions. These criticisms and suggestions are incorporated in the design prior to the process runs. The designer for food industry equipment could have a similar session with his assembly personnel.

Process runs are divided into two cate-

gories: limited and full scale. The limited process run is used to obtain approval of the technologist, inspectors, and research and development personnel. Only after the appropriate tests, incubation, and quality assurance have been met, is the full scale operation of the facility allowed. If any accident potential manifests itself, corrective action is taken at once. I would strongly recommend that the designer of equipment for the food industry subject his equipment to a hose test to determine the possible effects of water entering and damaging machine surfaces. This would apply to equipment to be installed in the wet areas of a food processing plant. It might be worthwhile to subject his equipment to the normal cleaning solutions used by the industry today to determine the effect on shaft seals, materials of construction, bearings, and on disassembly for cleaning.

Design Evaluation

After the process has been in operation, it is evaluated from the standpoint of the actual performance vs. the theoretical. It is further evaluated on the basis of cleaning and maintenance problems which may arise. As in most industries, the safety feedback is provided on all new process design facilities. From the design engineer's standpoint, the least desirable safety feedback information comes from accident reports.

Actual Performance vs. Theoretical. The first evaluation from the accounting department is the actual installed cost against the project estimate. This evaluation has little, if any, impact on the accident potential of the process unless the engineer has erred greatly by not giving adequate consideration to safety in his original design estimate. The second evaluation is provided by the industrial engineering department and furnishes the designer with information regarding operation, yield improvement, and labor saving. This evaluation has little effect on the safety aspect of the process from a design standpoint.

Cleaning and Maintenance Feed-back. Due to the greater reliability of equipment and machine components, it requires a considerable length of time before the maintenance feed-back from the field can be evaluated from a safety aspect. Any equipment design inadequacy which results in injuries to our cleaning crew is corrected by the local plant personnel. The feedback is in a more ominous form—an injury report.

Safety Feed-back. The plant safety supervisor must submit copies of all accident reports and injury reports to the manager of safety and training, who reports directly to the vice president of personnel. These accident and injury reports are also circulated throughout the design engineering group in order that we may be kept informed as to accident potential and the seriousness of injuries throughout the company. As previously stated, no design engineer likes to receive these reports regarding a process facility he designed.

Conclusion

Machine guarding from the standpoint of operator protection has become almost universally accepted by reputable manufacturers; however, the same degree of protection does not exist for our cleaning and maintenance personnel. This is a challenge to machine designers for the food industry, and I consider it one of the biggest challenges that face the industry today.

Automation has removed the operator from the point of operation on equipment to a rather remote spot where he operates the design facility from the instrument console. Unfortunately, the cleaning and maintenance crews have not been given the same degree of remoteness from the point-of-operation that now exists for the operator. Clean-in-place systems will reduce the need for the cleaning personnel to be near the point of operation on the more continuous type process facility; however, there will be in the food industry, for some period of time, the necessity for manual point of operation cleaning of equipment. Maintenance of equipment can be improved in the future by building into the design a higher reliability factor and by making disassembly easier.

The National Safety Council has estimated that occupational accidents cost the United States over $5 billion in 1963. If the 1912 accident rates had been left unchanged, and if there had been no organized safety movement, this annual cost might have been two or three times as great. The cost savings to society in general that could be accomplished with safer machine design for our cleaning and maintenance personnel can be estimated only vaguely. Savings in physical and mental anguish are immeasurable.

THE DOLLAR, THE MAN, AND THE WOMAN

By MILTON J. HATTIER
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This is a perfect combination: money—man—woman. If we as individuals had all the money we wanted, what a ball we would have. I am sure we would not be very safety-minded and perhaps not live very long. If industry had all the money they wanted and did not have any budgets, do you think they would have an excellent safety program?

This is only wishful thinking, as this will never happen. We all know that business today can spend only a part of its earnings on a safety program. It is our job to show management that safety pays. By reducing the number of injuries you will reduce your workmen's compensation cost. About 90 per cent of injuries are caused by unsafe acts (faulty behavior) and the other 10 per cent by unsafe mechanical or physical conditions.

The Insurance Company of North America recently made a pilot study in a new community. The average age was 35, and the people worked in large and small industries. The title of this study was "Industrial Workers Attitudes Towards Accident Prevention Programs and Mental Health." This study showed a surprising amount of employees were interested in their company's safety program.

Most industries have been working on their safety programs for many years and I feel that many employees appreciate what has been done to teach them to work safely and make it a safe place to work. Some of the unions are also taking an active part in accident prevention.

The Federal government tried to pass the Occupational Safety and Health Act of 1968. It was not passed this year, but it is expected to be enacted in the next session of Congress. We as individuals are fighting for freedom from pain caused by an accident. When a person is injured he usually only receives compensation. The amount varies in the different states. In most cases the amount he receives is very much less than his wages. Today, a man who has a family has many obligations, such as payment on his house, his car, insurance, food, clothing, and education for his children. When a person is seriously injured he needs money, as he is unable to live on workmen's compensation payments, so he starts to look around to see how he can get some real money.

I do not want to alarm you, but I understand that suits are now being filed against individuals such as the manager, foreman, safety engineer, etc. on the job. Suits are also being filed against the manufacturer of machinery or equipment which causes the injury. This is the reason why every company must have a sincere accident prevention program with teeth in it. Every supervisor must be accident prevention conscientious. He must show a good example and educate the persons under him; see that they work safely and not allow any horseplay.

The safety department should have a safety manual. I would like to discuss briefly part of our loss prevention manual:

The Injury Investigating Procedure. It is necessary to investigate an injury so that proper control measures can be established to prevent similar incidents from occurring in the future.

Housekeeping Control. Housekeeping control is the one essential element common to all loss prevention activities. It is necessary to train each employee that he must keep his work area clean and to furnish his containers for the disposal of trash. Each foreman should be in charge of his area.

Job Safe Practices. About 90 per cent of all losses, that is, injuries and fires, are caused by unsafe acts. Our safety director several years ago printed a booklet that we furnish each employee when he is hired. The title is *Job Safe Practices.* (Safety is an idea in action).

Each supervisor or foreman has completed a specific safe practice instruction for each job or department. This idea is not only helpful to the employees, but it is very beneficial to the supervisors and foremen, as it was necessary for them to study the safe way for each job to be done.

Engineering Standards. Each plant has been furnished a copy of the California

General Industry Safe Orders and California Electrical Safety Orders. These are to be our minimum safety engineering standards, but we are to use our own state's safety code if it is more stringent.

I would like to say a few words on state safety codes. I have recently checked with several southern states; they do not have a safety code and their entire safety program is very poor. I feel that this is a job we as safety engineers should help to correct. The Federal government is trying very hard to take over safety in this country, so if each state does not move fast to do the job, it will be too late.

It is also necessary to work closely with your purchasing agent to protect your plant from sub-standard or unsafe machinery, equipment, supplies, installation, and vendor services. The following clauses are inserted in our purchase agreements: "Equipment sold hereunder shall be constructed to conform with safety orders of the California Division of Industrial Safety. . . . Work performed under this contract shall comply with all applicable regulatory building and safety codes and the requirements of Factory Mutual insurance underwriters."

Some companies try to manufacture machinery with safety equipment included. However, competitors and the guy who wants to save a buck make it necessary that safety protection be optional, which means that the salesman must show the cost separately and the purchaser may say, "Leave it off."

Hazard Control. This is very important since the process involves the systematic tracking of unresolved loss prevention problems—unsafe acts as well as unsafe conditions—until they have been properly identified as to cause and have been brought under control. The ability to consistently follow-up on known or suspected injury causes is the weakest link in the entire loss control chain.

A few months ago, our plants were furnished a monthly Loss Control Summary Sheet which requires them to show: property losses—number of fires, explosions, power failures, damage by vehicles, etc.; and control action—welding permits issued, fire-prevention inspections, state safety inspections, etc.

We also require each plant to complete a Statistical Injury Experience Report, monthly. Our home office completes a monthly report which shows the standing by companies as well as individual plants. This has been very helpful since each plant is anxious to stay on top of the list.

I am sure we all agree that safety is here to stay. Please get into the act and do your best to avoid injuries not only in your plant but any other place where you can do something to prevent an accident.

QUESTIONS AND ANSWERS: FOLLOWING TALKS

Q. Today's automatic equipment that has an automatic sequence of "Stop" and "Go" should have standard warning lights as part of their package deal. What standard should be required?

A. (J. W. Marquette) California safety orders are the best to follow, as they are the most complete. A standardized equipment control should be established for suppliers to follow.

Q. Packaging lines that have a continuous operation find that when an employee becomes caught in the center of the operation and the machine cannot be shut off, the thought of placing dead man switches is brought up. There are mixed reactions on this as it would defeat the purpose of the equipment. How many and what type should be installed?

A. (From the floor) Safety bars and microswitches should be installed where necessary.

Q. What is new in controlling noise in equipment?

A. (J. W. Marquette) We have gone to nylon covered tables for our can tracks and guide rails. They not only reduce noise but wear as well.

Q. What are the machine design associations doing to bring safety into operation?

A. (J. W. Boyd) In a two year period, three papers have been presented on this subject to gatherings such as this.

GRAIN HANDLERS DIVISION

ROUND TABLE

Presiding: J. R. McCann, Gen'l Mgr., Loss Prev., Ralston-Purina Co., St. Louis, Mo.

This roundtable was an informal discussion intended to help anyone who had a problem, by letting him lay it before the group and then having members of the group who had experience with a similar problem tell how they solved their problem or how they attempted to solve it.

The meeting opened with Chairman McCann asking for the people present to present their problems to the group.

Stretcher Cases. Harvey Marsden, Safety Director, The Kellogg Company, said he was looking for a container for stretchers that would keep them clean and that could be seen through, so that one could tell at a glance the condition of the stretcher and that it, and the blanket that goes with it, was still there. He had considered obtaining a clear plastic tube to contain the stretchers but hadn't been able to find such tubes. Jack Krolo of American Maize Company said that they used aluminum tube containers for stretchers in his plant and placed them near the foremen's offices. The foreman then kept the blanket for the stretcher in his office, so that it would always be available. Werner Heck, of The Quaker Oats Co., suggested using a tough plastic bag to contain the stretcher and blanket.

Hammermill Fire Hazard. John Jensen, Corn Products Company, asked what sort of mills other plants were using to grind starch so as to avoid the danger from fire and explosion that was always present when mills with steel hammers and screens were used. The majority of the people present said that they used mills with bronze faced hammers and bronze screens to overcome these problems. A general discussion followed on the danger from fire and explosion in grinding hulls, starch, dry grain, etc. It was noticed that there was always danger that the air to the mill could be shut off enough so that the mill would plug. Friction in the plugged mill would then quickly cause fire to start. Usually, in such a situation the fire would be confined to the mill, but at times the fire could and would get out of the mill into other parts of the system such as air ducts, dust collectors, etc.

J. R. McCann, Ralston Purina Co. asked if any plants had changed over to mechanical handling equipment for grinding operations. Several firms have changed over to screw conveyors and bucket elevators to handle grain and ground products, and they feel that the fire hazard has been greatly reduced since they have abandoned the use of air to move materials.

Jack Krolo asked if anyone had trouble with their Fenwall explosion suppression systems getting set off by vibration. No one had met with this problem.

Bird and Insect Control. J. R. McCann asked if anyone had the solution for getting rid of pigeons and sparrows in a plant. Several of the people mentioned that exterminating firms exist which will contract to do this job. The names of several of these firms were given to him.

McCann said that they had investigated an electric bug killer to kill any insects that might be present in grain. This device consisted of an electrically charged grid over which the grain was run before going into the plant. This device is supposed to kill not not only the adult insect, but also the eggs and larvae. McCann wanted to know if anyone had used this device. No one in the group had.

Miscellaneous. Harvey Marsden asked what the people in the group do to protect men who must get up onto hopper cars to sample the contents from falling off, particularly when weather conditions make the tops of the cars slippery. No one had a sure-fire solution to this, but one firm does send two men out on this job, so that if one does fall he will not lie hurt without assistance.

R. D. Wiseman, of Cooperative Mills, gave some information on the use of payloaders to unload grain out of railroad cars. His firm has quit using LP gas fueled payloaders because of the fire hazard and has gone over to the use of electric powered payloaders. These payloaders are plugged in and use a

reel to take up and pay out the electrical cable as the vehicle moves back and forth.

McCann asked the group which type of car mover they considered to be the safer: the winch type or the capstan type? The overall opinion was that the winch type was safer, but that a trackmobile was the safest to move railroad cars around the plant.

E. Boulanger, of The Quaker Oats Company, asked what plants were doing about noise control. John Jensen made the point that a plant should have a hearing test program to make sure that no employee is suffering hearing damage from noise and then work hard to eliminate all of the high level noise areas in their plants.

A PSYCHOLOGIST LOOKS AT ACCIDENT PROBLEMS CAUSED BY TODAY'S CHANGING LABOR MARKET

By A. H. MALO, PH.D.
Chief Psychologist, Kemper Insurance Group, Chicago, Ill.

There are undoubtedly a number of reasons why today's labor market is different from that of yesterday, but one very significant reason is that it is now offering, with observable persuasion, the so-called hard core unemployed to employers. That the attempt to convert the hard core unemployed to the status of wage earner should be accompanied by many and serious problems is not unexpected. We are now addressing ourselves to one of these problems; namely, the accident potential of the group of workers society is presently helping to orient to the world of work.

This paper attempts to answer three questions:

1. What has been found to be some of the characteristics of accident repeaters?
2. What characteristics are being exhibited by the hard core unemployed after they are employed?
3. What can be done to reduce the accident potential of the new worker?

Characteristics of Accident Repeaters

Let us introduce our answer to the first question by stating that:

1. A few accidents are caused by mechanical failure.
2. Still fewer accidents may be regarded as caused by what has been called an act of God.
3. The overwhelming majority of accidents are caused by people who act unsafely.

Why do people act unsafely? One significant reason may be a lack of knowledge of what constitutes safe behavior. In other words, some people may have accidents because they have not an adequate knowledge of the safe way of performing certain tasks. They have been given inadequate job training.

Another cause may be a physical defect that interferes with safe job performance. It is not unusual for people to compensate adequately for physical defects. However, some physical limitations such as color blindness, inadequate physical stamina, poor coordination, and others have to be related, as factors in accident causation, to specific job requirements.

We have learned that people who commit unsafe acts are usually so preoccupied with their own feelings that they are inattentive or distracted when performing some task that requires attention, such as slicing a roast, driving a car, replacing a light switch, operating a punch press, or doing some other equally common task at home or on the job. We have learned that this preoccupation may be due to one or more of such conditions as depression, worry, sadness, excessive fatigue, high elation, fear, sleeplessness, irritability, headache, etc.

It is also fairly well known that people who have accidents may exhibit one or more of the following traits: impulsiveness, immaturity, excitability, aggressiveness, intolerance, insecurity, anxiety, irresponsibility,

impatience, revolt against authority, feelings of inferiority, guilt feelings, lack of consideration for others, and various other negative feelings and attitudes.

These are the kinds of attitudes and behavior that have been identified with the accident repeater. We are not saying, however, that every impulsive person will have an accident. What we have learned is that when people exhibit the conditions that we have described, they enhance what may be called their accident liability.

Characteristics Exhibited By the Hard Core Unemployed After They Are Employed

Many are unfamiliar with what may be called the ground rules by which workers guide themselves. They are unfamiliar with standards regarding tardiness, absenteeism, personal hygiene, housekeeping, productivity, workmanship, and other conventional aspects of the world of work.

Many are difficult to train. They are slow to learn what they need to know in order to do their job well. In an effort to appear to be learning, some may indicate comprehension of instructions without actually understanding what the supervisor or foreman is trying to teach.

Because the hard core unemployed tends to learn slowly, he may be more easily confused than other workers when he is placed in an unexpected situation. In such a situation he may be too eager to measure up and may take risks that he should not take.

The language barrier presents a training problem. A foreman may not be able to tell a Puerto Rican how to operate a machine unless he can instruct him in Spanish.

Some unemployed understandably have poor health habits. In one food processing plant, for example, it was discovered that some workers were using drugs. This by itself is a serious matter, but when the drug user is operating machinery, it can be catastrophic.

Some lack the desire to work. It has been verified in one plant that there is an absence of adequate motivation because of the ease of securing money from a government agency for an existence which, although meager, can be achieved with practically no effort.

A major problem in hard core unemployment is not recruitment, but keeping the worker on the job. One writer on this subject talks about the need to stop the revolving door. It has been estimated that the turnover of hard core workers is about 60 per cent or half again the customary rate in industry. We are inclined to think of this as a rather conservative estimate.

Many exhibit attitudes that interfere with their ability to adjust to their new roles as wage earners. For example, they may be placed in a work situation in which they do not feel wanted. It is not unrealistic to assume that, among the hard core unemployed, there are some who feel that companies do not really want them. They may feel that they are given a job simply because government agencies and other social forces are compelling the companies to hire the unemployed. As a result, they may feel subsidized and possibly inferior to other workers.

Another problem involves the possible absence of a give-and-take relationship between a foreman or supervisor and the workers who have been assigned to him from among the hard core unemployed. A foreman may find it difficult, for example, to establish rapport with his new worker. There is not the daily banter, the camaraderie, the easy give-and-take that exists between the foreman and the people who are so-called regular employees. The foreman may find it difficult to feel comfortable with his new employee. The foreman has established ways of disciplining his regular employees, but he has not yet learned how to discipline his new worker. Moreover, the new worker may in fact react quite sensitively to corrective measures and thus add to a feeling of inadequacy, on the part of both the foreman and the employee, with respect to making the required adjustments to each other.

What we have said so far is only a sampling of what characterizes the new worker and of the factors in his new environment that cause him to react in various ways that may interfere with his ready assimilation into the working environment. These are factors which, if not properly handled, may not only adversely affect his productivity, but may provoke tensions that cause him to perform unsafe acts.

It should become readily observable to people knowledgeable in the characteristics of workers who have the potential for accidents that particular effort must be directed toward the development of an effective acci-

dent prevention program geared to the particular needs of the new worker.

What Can be Done to Reduce the Accident Potential of the New Worker?

What might some of the ingredients of such a program be? To state that we should try to do better the things that we have been doing in our accident prevention programs is an incomplete answer that meets only part of the needs of the changing labor market.

We propose that one of the most important factors in accident prevention is the kind and quality of supervision that the worker receives. In other words, we need to train supervisors and foreman who will be able to handle themselves in such a manner that they can get along well with their men, that they can provide a climate in which the worker gets a substantial amount of job satisfaction. This favorable climate occurs when a worker feels that his boss is fair, is friendly, is understanding, is willing to listen, gives him adequate recognition for a job well done, and treats him with the consideration and respect that should be accorded every human being because of the fact that he is human.

Let us look at some of the specifics designed to provide such a climate. The level of teaching must be geared to the present skills of the new worker. Many of the jobless have inadequate reading and writing skills. Therefore, the skills that may have been taken for granted in the training of so-called regular employees, must now be taught.

In the psychology of learning, there is a principle called the Principle of Apperception. This principle states that new learning takes place to the extent that it can be related to what is already known. For example, before a man can be taught to nail two boards together according to some predetermined pattern, he has to learn to drive a nail. What we are saying here is that training must begin at the learner's present level of knowledge, skills, and attitudes.

There is a need to step up the quality of training and also to extend the duration of training. A more than usual amount of time may have to be spent on the easy jobs. The usual training program may have to be slowed down in order to avoid going beyond a man's current comprehension. There is, obviously, no substitute for sound job training that teaches every employee to do his job the safe way.

With regard to the language barrier problem, it is obviously easier to train a man to be a foreman than it is to train a foreman to speak a foreign language. What we are suggesting is that particular attention be paid to the rapid development of people who can speak another language. For example, it is necessary to try to identify the most capable Puerto Rican who works for you and to bring him along as fast as possible to the point where he can assume foreman responsibilities, if you are in an area where there is a preponderance of Puerto Ricans who do not understand English. One small manufacturer of metal products has successfully trained a Spanish-speaking assistant to help administer the safety program.

Many things are being recommended regarding the whole problem of improving job attitudes. Here we are referring to the attitudes of both the worker and his boss. At one plant, it is reported that "one of the most effective tools for getting results is simple kindness." It has been reported to us that at another plant, "kindness and understanding are two things that work successfully to reach the individual." We repeat these quotes at the risk of sounding pollyanish.

It is important that the new worker be made to feel a part of the company. One way to do this is to facilitate communication between the employee and his supervisor. Several plants now provide for group discussions, during which employees have an opportunity to talk to their foreman, the plant safety man, the assistant superintendent, or some other appropriate individual. This is a means for identifying what problems are being experienced by the new worker and for helping the worker to resolve them.

In one printing plant, the first two weeks of employment are spent in group discussions covering current events, politics, and other subjects. Then people are assigned to a shop foreman. The representative of this company stated that "the secret of success lies in the quality of the supervisor who, in addition to knowing the technical aspects of his job, practically has to be a psychologist." Incidentally, several hard core unemployeds who started in this program thought of it as a hand-out and admittedly had no intention of

succeeding. Now, word has gotten around that the program is worthwhile, and employees are taking it more seriously.

It has been suggested that the training staff "lead discussions of the workings of consumer credit, insurance, legal aid, and other matters of know-how that are part of everyday living to most of us, but mysteries to the worker with a ghetto background."

The same source reports that "workers from the ranks of the disadvantaged face a variety of bewildering problems in their changed status, both economic and social, and in their becoming part of a work situation in roles unfamiliar to them." He suggests that since "there are not enough professional counselors adequately trained to understand the hard core worker's accustomed style and adaptions to life's problems, his transition to new life circumstances . . . the first task of the training staff is to develop the new worker group itself as a major source of mutual help and reinforcement." The need is "to build an esprit de corps." Workers should, therefore, be encouraged "to meet formally and informally, in groups, to discuss the changes brought about by their jobs and their common problems."

It has been recommended that the supervisor or the foreman be appropriately rewarded for seeing to it that the new worker is successfully oriented to his job. This may guarantee maximum effort expended on a job that we may all agree needs to be done, but may not be given the attention it needs in order to be done well. It seems quite realistic to accept the comment that has been made to the effect that if the supervisor, manager, or foreman does a good job with the hard core workers it is not simply "because he sees the social issues involved, because he understands the background of the disadvantaged, or because he has had appropriate sensitivity or attitude training."

The proper orientation of the new worker also involves letting him see that he has the opportunity to grow on the job if he handles his present responsibilities in an effective manner. Very few men are happy with what they regard as a dead-end job. Even men who will not extend themselves in order to be promotable and who are in a sense dead-ending themselves, very often like to feel that they can move ahead if they choose to. They want to feel that the choice is theirs rather than it being imposed on them by frustrating circumstances over which they have no control.

What we have been trying to say is that the accident problem can be mitigated by the proper introduction of the new worker to his new status as a wage earner, by giving him the benefit of adequate training, by treating him with the dignity that should be accorded every human being simply because he is human, by facilitating communication between the employee and his employer, by providing him with the means for understanding and solving the problems that he encounters in everyday living, by placing him under leadership that is not only competent but highly motivated to help him adjust successfully to his job, and by giving him concrete evidence that he can grow on the job if he chooses to do so.

To do these things, business and industry must not only do better the things that are being done, and must not only do things that should have been done and were not done, but must adopt new attitudes and devise new practices designed to meet the specific needs of the new worker.

We reaffirm that if a boss handles his staff poorly, his people may exhibit the characteristics of workers with a marked degree of accident liability. If, however, a boss handles his staff well, he may have a relatively accident free staff. Through the manner in which he is handling his people, he may be contributing to the development of a favorable attitude pattern. A supervisor should concentrate on doing those things that will result in the development of positive attitudes in the worker toward himself, his family, his job, his employer, and his community. The more an employee can experience a sense of well being, a feeling of satisfaction with respect to himself and the various factors in his environment, the more likely he will be to act in the manner expected of him which, as it applies to accident prevention, means that he will more likely avoid the performance of unsafe acts and develop the habit of performing safe acts.

HOW TO COPE WITH ACCIDENT PROBLEMS CAUSED BY TODAY'S CHANGING LABOR MARKET

By RICHARD R. BUSTER
Wet Milling Division Superintendent, Grain Processing Corporation, Muscatine, Iowa

When an operating plant, desperate to acquire people to fill its required work force and even possibly to extend expansion requirements, faced with the mounting costs of overtime and the morale-breaking effects of long hours of work for its good, dependable and tried employees, resorts to hiring any person who comes along, it falls easy prey to the "fake claims artist." There are claims for old injuries not the result of current employment, increased injuries on the job due to physical and mental limitations, slowdowns in production efficiency, increased hazards to older employees, greater turnover rates, and increased labor costs. These problems demand a more thorough safety oriented training program for supervision.

In most plants the supervisor has his hands full just meeting production requirements. His time must be carefully budgeted and his efficiency the best, if he is going to do an adequate job. If, due to labor scarcity, below-standard people are taken into the work force, he must spend much more of his available time to properly train these people, making sure they do their job, both productively and safely. This means that some of his time must be diverted from other important tasks, so that his job functions could suffer.

If this should happen, he soon would realize he can't get his job done to his satisfaction—leading to lowering of his morale, which could result in the downfall or destruction of a good supervisor. This is especially true if more accidents start to occur among his people. He then would feel he is actually working harder and results seem to be getting less profitable. From hiring the sub-standard employee, an insidious, creeping disease in the department can slowly destroy the morale, the fine safety record, and the work efficiency which have all taken years of hard work to establish.

How does a production department cope with such problems? Three approaches are helpful here.

1. A more complete, thorough, safety-slanted supervisory training program, sponsored by top management.
2. Increased direct contact with the hourly employee by the safety department to alleviate part of the supervisor's work load.
3. An objective safety program where the individual himself can benefit.

The supervisor himself must be trained on how to aproach, handle and supervise the sub-standard employee. To do this, he needs help from top management, the safety department, and his own department head. By direct, thorough safety training, he can realize and use new methods to handle today's sub-standard employee.

Safety clinics sponsored by the safety department for all employees help immensely. The value of direct contact is shown especially with the newer employees.

Individual benefit for any program will make it more successful. An interesting fact has been established from safety records, the individual most likely to have accidents is the new employee with less than one year of work service.

By establishing benefits for good safety records, the older employee will guide, correct and help the newer, less experienced and perhaps sub-standard employee establish a safe work record.

The front line supervisor is the key man in a good safety performance, but to successfully establish this record, he must have help from top management, the safety department, and his subordinates, working together persistently as a group toward this goal.

MEAT PACKING, TANNING AND LEATHER PRODUCTS SECTION

HOW WELL DO YOU KNOW PACKINGHOUSE SAFETY?

By NORMAN J. KIRK
General Safety Supvr., Canada Packers, Ltd., Toronto, Ont., Canada

A packinghouse contains environmental conditions which are world wide: the heat of the Sahara Desert, in rendering areas; the cold of the arctic, in freezers; humidity at saturation level, as in the Tropics; water laden floors; steam and smoke to challenge a foggy day in London.

In addition to environmental problems, we have our share of unusual physical safety problems: men and women with sharp knives in their hands (I add women because a large packinghouse in Ontario employs several women on the beef kill line, and their injury frequency is much lower than that of men on similar jobs); rifles in the hands of stunners; reflex movement of animals in the first stages of the dressing line; people using hot water and steam; moving machinery everywhere you look; transporters moving continuously in every direction. Many more items could be added to this list.

How do we get people to dress properly for environmental conditions and be aware of the jungle of safety traps? We use several methods:

1. When hired, new employees attend a safety awareness session where slides of various parts of the plant are shown; also, the safety film "The Industrial Weight-lifter" is projected to demonstrate correct lifting, which is our most costly injury area.

2. The new worker is placed in the care of a seasoned worker so that he will become acquainted with the safety requirements of the job. Throughout, our goal is to fortify in the new worker and the older worker his knowledge of packinghouse safety.

The most effective method we employ is a slide set titled, "How Well Do You Know Your Packinghouse Safety?" I have selected some of the slides to show here and would like to demonstrate their use. Each viewer is given a score sheet, and requested to "X" what they consider the proper method opposite the number and under A, B, and C. The answer paper is for their use only and forms the basis of discussion afterwards. (Slides & discussion.)

Although several slides are of a general safety nature, we are injecting more and more packinghouse safety situations. You will have noted that the slides have their greatest value in the discussion period. When people are directly involved in a safety visual presentation, they are more likely to retain the message. We have found response to this slide series is excellent at all levels of management and plant.

In safety, once safety hazards are recognized, then correction can be made. With this in mind, our goal is to organize a program of safety awareness, of which the slide training series is an important facet.

GUARDING MACHINERY

By MAURICE F. LEAHY
Chief, Plant Protection, Oscar Mayer & Co., Madison, Wis.

We are concerned about preventing injury to our production, maintenance, and clean-up personnel working with and around machinery in our plants, as well as visitors to our plants. Specifically, our objective is to prevent injury from these sources:

1. Persons making contact with moving parts of machines.
2. Persons coming in contact with work in process.
3. Mechanical failure.
4. Electrical failure.
5. Human failure resulting from curiosity, zeal, distraction, fatigue, indolence, worry, anger, illness, deliberate chance taking, improvisation, impatience, imprudence, impulsiveness, conceit, complacency, carelessness, etc.

There is no question that the best safety device is a careful worker. However, our accident prevention measures must not be limited to careful selection and training of our workers; otherwise, we would learn all too soon how inadequate this approach really is! This approach makes no provision whatsoever for three of the five injury sources just mentioned: mechanical failure, electrical failure, and human failure. It has been our experience that even the best worker can have an "off" day or suffer a momentary lapse in his vigilance and thereby expose himself and others in his vicinity to injury. As a result, we must, in fact, protect people against themselves, as well as provide safeguards for them against the hazards present in our machinery.

The machines about which we must be concerned are those already in our plants and the new machines which will be purchased and installed sometime in the future.

First, we will consider the machinery already in our plants. You may have every reason to be confident that you are in good shape if you have not had an injury from an unguarded machine. However, from recent experience, let me urge you not to become complacent on this score. Our complacency was rudely shattered last winter when a 19-year old young man sustained a severe injury to his right hand from an unguarded set of gears. The piece of equipment by which he was hurt was installed over 20 years ago, and the gears were located so they were very inconspicuous. So much so that they were not noted by the safety inspections of the area. I, too, missed them, although I regularly have inspected the area. The employee lost his index finger completely and the distal joint of his ring finger, and sustained compound fractures of his middle, ring, and little fingers. Although he has returned to work since the accident, he has been off again for tendon surgery on his middle finger. He probably will have to undergo more remedial surgery and considerable physical therapy before this case is closed.

In addition to situations like the one just described, we are faced with the spectre of a guard being removed from a hazard so that a machine can be serviced, repaired, or cleaned, but then the guard will not be put back into place. As a result, some unsuspecting employee could be injured. It is a very common trait of people to assume that things are as they should be, rather than to make a point of checking to be sure that guards are in place!

The hazards about which we are concerned in our machines are: rotating mechanisms, inrunning nip points, pinch points, shear points, explosion, electrical shock, burns, and noise. Let us be more specific about these hazards.

Rotating mechanisms are capable of seizing and winding up loose clothing, belts, and hair. At one time we had to be concerned about the hair problem only with our female employees, but with the present-day mod fashion, it is also present with long-haired males. In the April 1967 issue of *National Safety News*, an accident to a long-haired male working on a multiple spindle drill was reported and illustrated—he was fortunate that he wasn't scalped! This hazard exists on rotating mechanisms wherever there is: a projecting key, setscrew, or shaft end; a wheel with unguarded spokes; unguarded

shafting; an unguarded coupling; and an unguarded screw and worm mechanism. Some examples of this hazard are: wheels on compressors, couplings linking motors to pumps, and screw-type conveyors.

Inrunning nip points are a special hazard created by a mechanism having one or more rotating parts. The danger of an inrunning nip is that it draws objects in and flattens or crushes them. Once an object is engaged, it is difficult, if not impossible, to withdraw it. Examples of inrunning nip points are: the points of contact between a belt and pulley; chain and sprocket; gear and rack; and the squeeze spaces between shafts or rolls which are rotating close together and in opposite directions. This hazard is present on all conveyors and machines powered by belts or chains.

Pinch points exist where a moving part approaches a fixed part. An example of this hazard is the point at the end of a slat conveyor where the slats close.

Shear points are present wherever a moving part passes a fixed object. For example: a frozen meat guillotine, breakup and splitting saws, meat slicers, bacon formers, meat grinders, meat choppers, head splitters, skinning machines.

Explosion. There is an explosion potential in our sausage stuffers, pressurized canning retorts, and closed rendering tanks.

In our electrically powered equipment there is a possibility of electrical shock from line current; there also is shock potential from static electricity generated by our operations if it is not safely eliminated by grounding.

A burn hazard is present with hot surfaces (such as heat sealing surfaces, glue heaters, etc.), uninsulated steam pipes, and rendering tanks (steam and grease).

Noise is a hazard which may have existed for a long time, but has been recognized as a problem only in recent years. For example, centrifuges and high-speed grinders.

There are five basic ways to safeguard machinery:

1. Engineer the hazard out completely.
2. Positively guard the hazard by some mechanical means.
3. Devise personal protective equipment to protect personnel against the hazard.
4. Develop a safe method for performing an operation so that the exposure is minimized.
5. Educate and require personnel to use the safeguards provided.

Let us consider in detail how to use these five ways to safeguard machinery.

1. To engineer the hazard out completely is the best way, if this can be done. This requires attention to the hazard potential in the initial design of the machine and then positive planning to eliminate the hazard — rotating mechanism, shear point, nip point, or pinch point, etc. Another important factor in design is to make the machine strong enough so that it is capable of doing its task and have a margin of safety to prevent its failure because of strain or fatigue. Another engineering technique is careful layout, that is, arrangement of the equipment so the hazard is inaccessible. For example, locate an inrunning nip point so this hazard is guarded by the frame of the machine; another example would be to locate a motor with the power transmission mechanism up out of reach of everyone.

2. There are a number of ways to guard a hazard by some positive mechanical means. First of all, enclose nip and shear points and rotating mechanisms. There are quite a variety of materials which can be used for this, such as guards or covers made of sheet metal, metal mesh, rigid plastic, expanded metal. To facilitate cleanup operations, these guards must be hinged or demountable. This fact then makes it necessary that these guards be equipped with interlock devices, so that the machine cannot be operated unless the guard is in place. This means is very effective for guarding conveyors of all kinds. For example, a guard over the point where the slats close at the end of the slat conveyor; a hinged cover on an auger-type conveyor; a guard where the belt goes around the drive drum of a belt conveyor so no one can get caught in this pinch point; a housing over the rotating knives of a chopper, so the knives are inaccessible; a large feeding pan on a meat grinder so the operator cannot reach the worm through the feed throat; a cover over the coupling connecting the motor to the machine. Another way is to equip a machine, such as a bacon former, with two-handed control. This prevents the operator from having a hand in the bacon former when it is operating. A micro-

switch can be incorporated into the control system and prevent its operation unless the micro-switch is closed. This safety device is incorporated into the Anco slicer, so that this machine cannot be operated unless the blade cover is closed and locked in place. We have also equipped our skinning machines with quick-acting micro-switches which are within easy reach of the operator so he can quickly stop this machine if necessary.

3. We usually think of items such as hard hats, mesh gloves, goggles, safety shoes, etc., when we consider personal protective equipment. However, none of these apply to our subject. Rather, these are some "don'ts." Don't wear gloves—mesh or other kinds—when working on machinery, because there is a serious possibility that the glove will be caught on a moving part and the wearer's hand pulled into the machinery. Likewise, don't wear loose, floppy sleeves around machines for the same reason just given.

4. There are some hazards which cannot be guarded by any device, so we must devise and use methods which minimize the exposure and rely on the operator to follow the prescribed method. Saw blades, by virtue of their usage, cannot be totally enclosed. However, it is advisable that as much of the blade as possible be covered so that the exposure is minimized. In addition, only careful, attentive operators should be permitted to operate saws. Lockout devices should be installed and used on electrical equipment so that machines cannot be turned on when they are being cleaned, serviced or repaired.

5. Educate and require personnel to use the safeguard provided. This fact is self-evident, so we will not spend time on it.

In closing, I would suggest these general safety rules:

1. The operation, adjustment, and repair of any machinery must be restricted to experienced and trained personnel or to trainees under close supervision.

2. Safe procedures must be established and shortcuts and chance-taking prohibited.

3. Supervisors are responsible for safe operation and for making certain that no deviation is permitted from rules 1 and 2.

PASSENGER AND TRUCK FLEET SAFETY

By CHARLES W. KEITH
Safety Director, E. D. English & Co., St. Louis, Mo.

Traffic accidents have been with us since the invention of the automobile, and they are producing over 53,000 deaths each year. Over 1.6 millions of persons have died due to auto accidents since 1900 in just the past 67 years.

Since one of the fundamental rules of humanity is to "Live and let live," it is held that no one should injure or destroy life or property in the performance of his task. Therefore, the basic purpose and motivation for any accident prevention program stems from humanitarian considerations. To this basic purpose must be added the important fact that no business can conduct its affairs successfully if waste created by accidents is not held to a minimum or eliminated entirely. To eliminate all accidents entirely is the dream of any safety man, but as long as we have men and machines we are going to have accidents.

It is not only the undue suffering of the persons involved in these accidents that we are concerned about. These accidents are costing us about $11 billion annually. The money paid out in settlement of damages incurred in accidents is only one measure of direct economic loss: management must bear many other hidden costs which overshadow the direct accident settlement costs. Some of these costs are: repair of vehicles involved, property damage other than vehicles; replacement of vehicles in case of a total. In the case of personal injury, it requires replacement of employee, cost of training new employee, interruption of service, cargo damage, public good-will, delay of service, and many others.

So, to be effective, accident prevention work must be organized. Collective effort must be guided by some system or plan to

encompass each and every person in the organization. To achieve this desirable goal, accident prevention work should be incorporated as a fundamental part of the daily routine and be strongly supported by management. Without the support and participation of management, the safety program will fail and all your efforts will have been in vain.

One of our biggest problems today and one of the most easily prevented accidents is the rear-end collision. However, 20 per cent of all accidents and 66 per cent of all interstate accidents, in which approximately 10,000 people will be killed, will be due to this type of accident in 1968. This is one type of accident that is inexcusable. Would you run into a "Police car with lights flashing;" or a "tractor and trailer with 10 flashing lights on rear," going 50 miles an hour? Of course not, but it has happened.

Tailgating, the practice of driving too close to the vehicle ahead even though all experience and common sense indicates that any emergency stop would require a far greater margin of safety, is the greatest single factor responsible for the rear-end accident—not enough following distance.

If I were to ask, doubtless you could name a number of causes for rear-end accident without hesitation. But can you name four factors that are always present in this type accident? They are *time, distance, speed,* and, of course, the *driver.*

Whenever an operator of a vehicle is involved in a rear-end accident he will say, "I didn't have time to stop." We all work with time every day. Almost anyone could tell me within 10 or 15 minutes the exact time. But, in an accident situation, we don't have 10 or 15 minutes in which to act.

What about distance? An operator will say, "I didn't have room," or, "I was too close to stop in time." Distance is not too difficult if you use association in known distance of some objects, such as automobiles (about 17 feet), poles (100 feet).

Speed is the most difficult. Yes, I know you have a speedometer. But you don't have time to look at a speedometer in an accident situation. Truck speeds are about 1-12 mph in 1st gear; 12-18 mph in second gear; 18-25 mph in third. Automotive speeds in direct drive are about 27-30 mph; passing gear varies—45 to 70 mph.

Now that we know a little about time, distance, and speed, what does it mean? To me it means one thing: reaction time. Reaction time is the delay in time from the moment you see something until you can do something about it. Reaction time varies, but it is generally accepted as requiring about ¾ of a second under average operating conditions. It is recognized by the courts as the legally accepted length of time it takes the average individual to react.

Many things have an effect on reaction time: being tired; daydreaming; mini-skirts.

For example

1 Sec. Distraction	@ 30 mph =	45 ft.
¾ Sec. Reaction	@ 30 mph =	33 ft.
2 x Speed Braking	@ 30 mph =	60 ft.
Total Stopping Distance		138 ft.

No one can stop on a dime. The average American car in a panic stop at 65 mph, excluding reaction time, is 181 feet; some heavier cars require 230 feet.

Perception ¾ Sec.	@ 65 mph =	71 ft.
Reaction ¾ Sec.	@ 65 mph =	71 ft.
Braking Distance = 3 x Speed in mph	=	195 ft.
Stopping Distance About		337 ft.

The only way we can cut this distance down is to stay awake to the conditions at hand. Be alert at all times and expect the worst. Don't take chances and, by all means, allow yourself plenty of following distance or margin of safety.

If you do not stay alert and maintain proper following distance, it is just like driving a horse over a cliff and then yelling "Whoa, dammit, whoa!"

HI-LIFT SAFETY

By JAMES OLIVER
Safety Coordinator, GENESCO, Inc., Nashville, Tenn.

Material handling is a term used to describe an activity that goes on in every plant or industrial operation—the picking up and moving of things. It involves moving raw materials, materials in process, finished products, tools, equipment, and supplies. It involves both manual and mechanized operations. Every operation that involves moving, lifting, or lowering an item is material handling. Material handling is important, as revealed by the fact it accounts for approximately 50 per cent of the cost of doing business.

Because fork lift trucks are self-propelled and require only one person to complete all operations of lifting, lowering, moving, stacking, and unstacking, they excell over other methods of material handling. A lift truck operates on the simple principle of the fulcrum, or teeter-totter. A load on the forks must be balanced by the truck weight and a counterweight. The load can be increased if it is moved toward the drive axle; thus, in effect, increasing the leverage of the counterweight. If the drive axle was placed halfway between the load and the counterweight, it would take 100 pounds of counterweight to balance a 100 pound load.

Lift trucks are rated by capacity in pounds and load center in inches. For example, the capacity of a truck may be 5,000 pounds at a 24 inch load center; it can lift 5,000 pounds if the center of the gravity of the load is 24 inches from the face of the load arms. Load center is necessarily an important consideration for every hi-lift operator. As the load center increases, load capacity decreases.

The side stability of a lift truck has to do with its ability to resist tipping sideways under various loaded and unloaded conditions. The height of the load, the levelness of the ground, the backward tilt of the load, and the wheelbase of the truck determine the ability to remain upright.

Lift trucks are built in different sizes and lengths. A long narrow truck would not tip over forward but might be prone to tip over sideways. A truck built short and wide would not tip sideways easily but would be easier to tip over forward. Of course because of the difference in operating space trucks must by necessity be of different sizes. An individual operator must know the limits of his trucks.

Most lift trucks have four wheels; however, they are suspended at three points. Two of the points are where the frame is fastened to the drive axle and the other point is where the front axle is mounted to the truck by a pivot pin at the center of the axle. If a truck is picked up by its center point of gravity, it will hang in mid air, perfectly balanced. It will not tilt forward, backward, or sideways, nor will it turn over like an unbalanced wheel. This center of gravity is probably located somewhere near the rear main bearing of the motor. As stated before, as the load is moved closer to the center of gravity, it increases load capacity.

A lift truck is unique, in that it is steered by the rear wheels and powered by the front wheels. This allows the truck to make much sharper turns. An operator who has not had the proper training is certainly in for some tricky driving until he has learned to handle the truck properly.

Safety is an important part of basic driving operations. The driver must constantly be on the defensive and expect the unexpected the moment his truck is put into motion. Basic driving safety is as simple as driving the family car. Added caution must be exercised, however, because of the close quarters in which a lift truck normally operates. Aisles are much narrower than streets, and there are no stop signs or traffic signals to control traffic. A lift truck operator's ability to avoid potential accidents is an indication of his alertness. Anyone can learn to drive a lift truck, but only experts can drive safely.

The hoist and tilt mechanisms are both operated by the same lever. Pull the lever back and the hoist lifts. Push it forward and the hoist lowers. The tilt mechanism is operated by pushing the lever to the extreme right, and pushing forward to tilt the up-

rights forward and pulling back to tilt backwards. Lifting speed is controlled by the speed of the engine and the extent the lever is pulled. Engine speed has no effect on lowering the forks. The control lever automatically returns to neutral when released. This is a safety precaution built into the machine.

Balancing the load on the forks is the key to fast and safe handling. The truck and forks must be positioned so as to balance the pallet when it is lifted up. The load should also rest against the heel of the forks. It is very important for the load to be as far back on the forks as possible, because of the load center factor. The upright should be tilted back slightly before engaging the hoist. The load will not slip off the forks when the upright has been tilted before raising. Many times, tilting the upright will clear the load off the ground or stack. If the load has been removed from a stack, the hoist should be lowered before traveling. Most loads should be from 4 to 6 inches off the surface for proper clearance in moving.

Lift trucks drive and steer easier when they are loaded. The load balances the truck, taking some weight off the steering wheels. Different loads will make a truck react differently. A driver must learn to feel how a particular load will make his truck react. Heavy loads are always moved with great care. In certain situations the steering wheels may bounce off the ground, leaving the driver with limited control. He may wish to turn but, due to lack of control, the truck continues in the same direction, resulting in damage to person or property or both. A driver should always remember to drive in reverse when traveling down grade, and forward if going up a grade.

The drive wheels can be used as a guide in stacking materials. If the driver makes a mental note as to how far out the load extends, he can position the load correctly when it is in the right place for unloading. A time saving practice is to raise the load as the truck is nearing the stack. New drivers, however, should use caution until the maneuver is learned. It is also not advisable to do this if the truck is handling capacity or near capacity loads. To unload after the load has been positioned, tilt the upright forward, lower the load, and back from under the load. Extreme care should be exercised in backing straight out from under the load.

Safety is everyone's business. The first step toward accident prevention is good working conditions. The second step is to use trucks that are in good repair, with proper guards and safety devices. The third step is to properly train drivers as to correct driving procedures and safety practices.

We are all very much aware that if we have correct driving procedures we automatically have safe drivers. Several safety factors that every driver must know have already been mentioned, but let us enumerate several at this point. (1) Putting the truck in motion must be done with extreme care. Unsuspecting bystanders or material may be hurt or damaged by a truck suddenly jumping into motion and possibly getting out of control. (2) Overloads can overbalance a truck, both forward and sideways. Never overload the truck. (3) Always tilt the uprights, to keep loads from slipping off the forks. (4) Only tilt loads forward when positioning for unloading. (5) Loads should be carried close to the ground. When they are carried high, the stability of the truck is greatly affected. There is the possibility of the load falling on someone or something. (6) Drivers should watch for poorly stacked loads. They can easily upset a truck or fall on someone. (8) Watch tail end swings, which can damage property or hurt bystanders. (9) Not watching where you're driving might just cause embarrassment, but more than likely someone will get hurt. (10) Avoid bumps, holes, and slick spots. (11) Loads have to be balanced on the forks and carried squarely against the heel of the forks. To keep loads against the heel, drive in reverse when driving down an incline, and forward when climbing inclines. (12) Never let anyone drive a lift truck who is not properly trained to do so. (13) Use the truck for the purpose it was made; never abuse it. (14) The driver should always be in the seat when operating the hoist or traveling. (15) The engine should be cut off and the parking brake set when the driver leaves the truck. (16) Many old floors will not support a truck; inspect doubtful floors. (17) Make sure you have plenty of overhead clearance. (18) Fast stops are sometimes needed for emergencies. Otherwise, bring the truck to a gradual stop. (19) Drive slowly around blind corners. (20) When driving into a highway truck or trailer, be sure the wheels of the highway vehicle are

properly chocked. We had a near serious accident when a trailer moved away from the dock when the lift truck was being driven into it. Fortunately, the truck hit the ground before the driver did.

One of the most infamous of social diseases is called "the great imitator." Sometimes it will show up as a rash, at other times it will turn up as a malfunction of a principal body organ. So it is also with an ineffective or malfunctioning safety program; it shows up as a thousand different excuses and it is difficult to correctly diagnose. "The last shift was supposed to check the equipment before they left," or, "I didn't think that just once would make a difference"—these and the thousand excuses like them are in reality unsafe practices masquerading as carelessness or thoughtlessness, and they should be correctly diagnosed as a safety program failure before the often fatal profit loss terminates the patient. Immunize now with a vigorous safety program.

AMMONIA REFRIGERATING SYSTEMS SAFETY

By F. P. NEFF
Engineering Consultant, Chicago, Illinois

Ammonia is an inorganic compound and is classed as a Group II refrigerant by the U.S.A. Standards Institute B9.1-1964 Safety Code. This code specifies three classes of refrigerants; Group I includes mainly the halogenated hydrocarbons developed by DuPont; Group II includes besides ammonia, methyl chloride and sulphur dioxide and Group III includes strictly hydrocarbons which are quite explosive; such as, butane, ethane and propane.

The chemical formula for ammonia is NH_3 and its molecular weight is 17.03061 as nitrogen has an atomic weight of 14.0067 and hydrogen an atomic weight of 1.00797. At a pressure of one atmosphere it has a boiling point of —28°F and a freezing point of 107.9°F. It is quite toxic and a concentration of about ½ to 1 percent by volume in air for durations of exposure of about ½ hour are lethal or produce serious injury. Explosions of ammonia in air are not common but there have been serious ones. The explosive limits of ammonia in air, percent by volume, are from a lower limit of 16.0 to an upper limit of 25.0. This is not a wide range and compares with other gases as follows:

Acetylene (HC-CH)	2.5 to 82.0 percent
Carbon Monoxide (CO)	12.5 to 75.0 percent
Hydrogen (H)	4.1 to 80.0 percent

You can readily see that with a concentration within the limits shown in a confined space and with a spark to set it off, a serious explosion could occur. The spark can readily be provided by the bursting of a lighted electric light bulb caused by ammonia vapor settling on the hot light bulb and exposing the red hot filament to the explosive mixture. Every means should be taken to prevent explosive mixtures of ammonia and air from developing, and as exposures of about ½ hour in mixtures of about ½ to 1 percent are generally lethal, every effort should be made to keep such lower percentages from developing in confined spaces where people are working. Nevertheless, ammonia is the popular refrigerant for refrigeration in an industrial occupancy.

The U.S.A. B9.1-1964 Safety Code defines *industrial occupancy* as follows:

> "*Industrial Occupancy* shall apply to an entire building or premises or to that portion of a building used for manufacturing, processing, or storage of material or products, including among others; chemicals, food, candy and ice cream factories, ice-making plants, meat packing plants, refineries, perishable food warehouses and similar occupancies, provided the entire building is occupied by a single tenant."

The machinery room for an industrial occupancy should have adequate ventilation, and the code specifies an independent mechanical ventilation system discharging 2050 CFM of air for a system containing 1000 pounds of ammonia and 9500 CFM of air for a system containing 10,000 pounds of ammonia. Data is given in the code for

interpolating or extrapolating the amount of air to ventilate with other quantities of ammonia in the system.

Ammonia compressors should be properly equipped with check valves on the discharge, and electric driven compressors should have high and low pressure cut out switches to stop them automatically in case of either excessive discharge pressure or a suction pressure that is too low.

All pressure vessels to be used in an ammonia refrigerating system should be constructed in accordance with the ASME Boiler and Pressure Vessel Code and should bear factory stamps indicating that they have been properly factory tested. High side pressure vessels should be designed for 300 psig pressure with a safety factor of five and low side vessels should be designed for 150 psig pressure with the same safety factor. All pressure vessels that can be valved off should be equipped with safety valves, the safety valves on high side vessels set at 300 psig pressure and those on low side vessels set at 150 psig. These safety valves can be arranged to discharge to the open air over a roof if the location is such that this would cause no difficulty. If the plant is so located that open air discharge over a roof could cause difficulty, then the discharge of the ammonia safety valves may be into a tank of water which has been provided for the purpose and to be used only for ammonia absorption. At least one gallon of water should be provided in the tank for each pound of ammonia in the system.

When a new ammonia refrigerating system is installed or when a portion is added to a system a 300 psig air pressure leak test should be made on the high side and a similar 150 psig test on the low side. When I was doing this kind of work I always liked to leave the air pressure on the system overnight. I think it paid off.

Every ammonia refrigerating system should be properly provided with ammonia masks with some in the machinery room and some outside where no ammonia concentration could develop in the air. All authorized machinery personnel and possibly certain maintenance men, as selected, should be properly schooled in the use of the masks and given refresher courses at least at monthly intervals. The cannisters of the masks should be renewed immediately after each use, or the seal broken, and if not used should be renewed not later than the date listed on the cannister labels.

In general, all equipment in an ammonia refrigerating system should be properly constructed in accordance with the proper prevailing code or codes and bear factory stamps indicating that this has been done. Leak tests should be made after installation and necessary corrections made. Safety valves should be installed on all pressure vessels and machinery in accordance with prevailing codes. These safety valves should be properly set and sealed and these settings should be checked annually. All authorized machinery room and maintenance personnel should be thoroughly briefed on the necessity of ventilation, where and when required, the condition of safety valves and the use and care of ammonia masks.

Highly populated work rooms, such as bacon slicing rooms, beef boning rooms and hog cutting and trimming rooms should be equipped for rapid ventilation as required. Ammonia mains running through confined spaces and infrequently travelled areas should receive periodic inspection for their condition and repairs made as required. There should be adequate signs in large letters at conspicuous places in the machinery room giving directions for operating the ammonia refrigerating system and the steps to be taken in the event of a break-down or leak. These signs should give instructions for shutting down the system in case of emergency; the name, address and telephone numbers for obtaining service and the name, address and telephone number of the municipal inspection department having jurisdiction, and instructions to notify that department if the situation warrants it.

RETENTION OF PROFITS THROUGH SAFETY

By A. J. DITTMER
Accountant, Des Plaines, Ill.

Accidents are termites that eat away at your profit structure. When business is good, they can go on unnoticed under the cover of manufacturing overhead; it is only when a slow down occurs or when a budgetary investigation is made that the presence of accident cost becomes apparent.

Meat Packing, Tanning, and Leather Products manufacturing are by their very nature among the industries that have intrinsic accident potentials which can and must be controlled if a full share of profit is to be retained.

The purpose of business is to make a decent profit for its owners, be they the stockholders of a corporation, the members of a partnership, or an individual owner, and it is the duty of management to conserve this profit.

Think of the sales needed to produce enough profits to overcome accident costs. A $1,000 accident cost may represent the equivalent of a $10,000.00 sale lost. Management strives to create a market for the sale of its product or services, producing what is known as gross income. From gross income we deduct selling and administrative expenses, cost of product, and Federal taxes to arrive at a net profit.

Let us concern ourselves with cost of product; the necessary expenditures required for the production of the goods sold or services rendered.

Cost of product contains an item called Workmens Compensation Insurance. This expense generally falls into one of three categories, according to the size and practice of a particular establishment:

1. Insurance coverage provided by the purchase of a fixed cost policy relating rates by classification of operations to the payroll thereunder and so produce the final premium.

2. Insurance coverage provided by the purchase of a policy where the premium is [illegible]d on accident cost in the form of experience modification and then raised or lowered by the use of a retrospective rating formula which is again related to the accidents produced.

3. In the past, only larger companies self-insured, but now medium sized companies with concentrated operations also do so. Usually, each of these will hedge on full self-insurance by arranging excess of loss disaster insurance with London underwriters or surplus lines markets.

Now, let us analyze. If your company is operating under the first plan, and if you are lucky and have had good experience, fine. You probably are operating at reasonable compensation costs. But a run of bad accidents can end this dream in a hurry. When your renewal premium is quoted by the insurance company at the end of the policy term, you are sure to yell, "Ouch!"

The effect on costs is the same on the retrospective and self-insurance plans, since these are primarily cost-plus measures with a lid on them for disaster consequences.

What records do you keep? If properly maintained, you can tell by looking at them what locations and what departments are giving you trouble. The manhours worked against the accidents incurred is of major importance, very similar to your watch telling you what time of day it is. No matter what methods you use, whether you keep records by ledger or whether you are using IBM cards, you should know what your direct accident costs are. These records should reflect:

1. Your insurance premiums or additions to your reserves
2. Cost of trips to the doctor
   a. Doctors fee
   b. First Aid costs
3. Cost of lost time

A clinical card record system should be maintained covering injured employees.

For companies on retrospective plans and for self insurers, records should reflect the following:

1. Cost of insurance or reserves
2. Cost of First Aid, employees and supplies
3. Medical expense
4. Compensation claims

5. Lost time
6. Cost of administration (self insurers)
7. A complete clinical record, referred to above.

What are some of the hidden costs? An accident occurs. Work stops—for the injured and for those in the department about him. It takes time to get the injured to first aid, at the first aid station or at the spot, if the accident happens to really be serious. The injured man must be replaced so work can resume while he is receiving first aid and, in more serious cases, sent home or taken to a hospital. Work will invariably slow down, at least for a while. Then there is the cost of making the various reports. All this costs money—think of it!

What to do? Organize and maintain an efficient and responsible safety committee. The committee must meet regularly and keep accurate minutes of these meetings. Plant inspections should be made on a regular schedule. See that guards and safety appliances are in place and in use, and that Safety Rules are being observed. Time permitting, the safety engineer or other designated member should make inbetween inspections on an irregular schedule. When you experience an accident, be sure that a member makes a complete inspection of the area where the accident occurred and include this report and recommendations with the accident record.

Join your Section of the National Safety Council and have the head of your safety committee participate. You will be surprised what information he will bring home.

Learn to recognize and analyze your hazards, and do something about them. It will pay off—and the profits saved will be yours.

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GLASS and CERAMICS SECTION

MAKE OBSERVATION PAY OFF

By A. TIMOTHY WAAD
Special Services Asst., Freon Products Div., E. I. Du Pont de Nemours Co., Wilmington, Del.

How important is the sense of seeing in your everyday life and, specifically, in your job? How much do you depend upon observation through your eyes to guide you in your daily assignments and decision making, whether they be mechanical, analytical, selling, management, or even clerical?

These questions are neither as silly nor as simple as they may sound. Everyone of us, consciously or subconsciously, probably depends upon vision more than any of the other senses to fit our actions and reactions into our environmental conditions, whether they be at work or at play. But how well do we really see the scenes spread before our eyes? How well do we perceive what we see? Or, to express it another way, how good is our perception in relation to our observation?

Perception—remember that word. It can be of vital importance and tangible value to you, for all-out application of sound principles of observation and perception can lead to increased safety, higher quality, greater efficiency, and cost reduction in your business operations and your job relations.

Perception is a companion of observation. It's the seeing beyond the mere visual image recorded by our eyes, seeing more than the bare outlines of a situation in a fleeting glance—seeing, if you will, the real meaning behind a scene, analyzing the conditions and translating our impressions into logical, meaningful, effective action.

Perception is within the range of capabilities of each of us. It is not a difficult taskmaster—but it is not one which will work for us without some effort on our part. Perception requires practice and self-discipline if it is to serve us well. But its practice is not difficult. It requires no superhuman, or even unusual, ability to master. All that is required is a little thought, a little concentration, a little patience, and an honest desire to become more than simply an observer of the passing parade of things about us.

From our own experience in many Du Pont locations over the last several years, we are convinced that employees, from messenger boy to management, can be trained to be more perceptive observers, and that the time and effort spent on such training will be repaid many times over in dozens of ways.

The observation-perception program lends itself to improvement of personnel in practically any area of operation. We have chosen three typical areas for discussion: safety, quality control, and cost reduction. These, we believe, are common to the interests of any type of business or manufacturing operation. The basic principles and techniques of such a program are the same, no matter in which type of area or operation they are applied.

All of us are born with the powers of observation, and by the time we take our first step we have begun to develop those powers in varying degrees to enable us to move about in and associate with our environment. We see with our eyes, we feel with our fingers, we smell with our noses, we hear with our ears. The experiences and sensations that come to us through these organs of observation guide us in our every waking moment.

Why, then, do people react differently to common elements of their environment? Show the same picture to a number of people, and you'll often get as many different descriptions and interpretations of the picture as there are viewers. Why do not all of us see exactly the same things in a picture? Why can some give us descriptions of the picture in minute detail, while others remember only vaguely what they saw?

The answer is our old friend, *perception.* It has been estimated that 80 per cent of our knowledge comes to us by way of the

eyes, so let's concentrate upon the single sense of vision—the immediate product of which is observation.

Visual observation is the recording in the brain of the images formed by the eye as it scans a scene. It is limited only by the range and physical quality of our eyesight. Assuming equal eyesight, all of us have the ability to observe the same things, but our observation can be sharpened or dulled by our emotions. Thus, we often see only what we want to see, permitting our brain to filter out those elements of a scene which we unconsciously wish to avoid, or which are of no interest at the moment.

Simple observation leaves much to be desired from an accuracy standpoint. Moreover, from the wide differences of opinion we express as to what we saw, it's quite evident that the powers of observation vary widely among individuals, and that the ability of the mind to remember what one thought they observed varies to an equally great degree among different individuals.

By definition, observation is the ability of taking notice, of gathering data, and of drawing inference from what we see. Perception is simply a refinement, a sharpening of simple observation to encompass a cold, accurate analysis of what is seen. Its ingredients are attention, concentration, and accurate memory retention.

It should, in fact, also be thought of as a mental skill, to be learned and refined just like golf, dancing, chess, or dozens of other skills. The degree of perfection can be attained by the amount of practice we devote to its development and refinement.

Another theory states that observation is expressed as:

Attention + Perception = Observation

Attention

Attention is the getting ready or preparation to observe. Suppose we examine each of these categories individually. For example, attention is the amount of concentration upon the image recorded by the eye; concentration upon details and their meaning. Attention, unfortunately, is not an automatic process. In fact, as all of us can attest, attention very often is a fleeting thing, influenced by internal as well as external factors. Many of the disturbances that block our attention or concentration are the result, usually unconsciously, of our individual interests and desires.

Desire for change. Consider our conscious or subconscious desire for change. Some people are extremely curious, always looking at things inquisitively, always looking for change. The existing situation never seems to satisfy individuals of this type. The grass always looks greener on the other side of the fence. This type of individual has an open-minded approach to things, and that's good, in a way, for they are able to see more as a result, and they usually can gauge the importance of their observations.

Resistance to change. There are others who are content with things as they are, unable to see how change can produce desirable results. These people, who enjoy happiness and security in a familiar situation, can scarcely be expected to observe effectively. Their resistance to change filters out of their attention pattern everything except the elements with which they're satisfied. Usually, they're poor observers.

Desire for action. Here's another motivating force behind our ability to observe. It is often times considered the urgency of a situation that sparks our attention to do something as quickly as possible. For example, have you ever noticed how much more attention is given to a situation on a plant where someone has been injured seriously—especially after the accident has occurred?

Suppose you knew your company soon would relocate its plant unless it could reduce costs at the existing location. If you were seriously worried about being left behind by such a move, would you suddenly concentrate more than before upon figuring out ways of saving money, or improving your employer's operations, of finding ways to reduce costs for him at the present location, in order to negate the proposed move?

Desire to belong. Nearly all of us enjoy being on a winning team, doing things together that single you out as being successful. Few of us are satisfied to run counter to the stream. The mere fact that we only have to look around us and see the number of people who belong to clubs, churches, civic organizations, etc., would indicate that as individuals we all have a certain desire to want to belong. It's when you dangle a

competitive spirit into a situation that, even though an incentive may be offered as a reward, the real motivation comes about through the desire of wanting to be on the winning team, and not necessarily the value of a reward. It's the old feeling—if John can do it, why can't I do it?

Self-interest. All of us have ambitions. We like to consider ourselves intelligent and attractive. In a sense, we're all a little egotistical. When a situation is recognized as an opportunity to improve our stature, we naturally devote more attention to it. Our observational power usually reaches new heights.

We can agree that attention certainly is important in observation, but equally so is perception.

Perception

Perception, in the layman's language, is what your mind interprets from an observation. It's the meaning that we place on a given situation as it appears to a visual observation. For example, we know that to drive a car safely and intelligently, one must be aware of potential hazards encountered in everyday driving. It's those conditions that appear before our eyes and the mind's interpretation of those conditions that we understand as perception. Making a faulty observation is rather easy to do, and surely not difficult. Observation perception depends on two things—the external situation and the mind.

What are some of the factors adversely affecting the quality or accuracy of our perception? We've talked a little about attention and concentration; let's take a look at another class of deterrents, which we can identify broadly as illusions.

Illusions. Illusions are nothing more than getting a false impression of the real facts of what we see, and there are a number of different types. We'll consider only three here as examples: illusions due to physical causes, total unanalyzed impressions, and those caused by habit or familiarity.

The first type are pretty easy to understand. They can result from an eye injury, from extreme fatigue, or from color blindness, and illusions of this type usually are temporary. For example, have any of you, while driving for extended periods, particularly after dark, suddenly swerved or slammed on your brakes to avoid hitting an object you're sure you saw in the road ahead, then found there actually wasn't anything there? That's an illusion, due most often to fatigue of the eye muscles. When it occurs, pull over to the side of the road and rest or, better yet, stop driving until you've had a good night's rest or at least a relaxing coffee break.

Illusions caused by total unanalyzed impressions sounds like something out of a psychologist's notebook. In this classification, we allow a quick first impression to be adequate without seeking out the real meaning, especially when there is a complex situation. In situations like this, it is necessary to dig a little deeper for the real meaning, by careful analysis. The answer is concentration, consideration, open mindedness. Don't jump to conclusions based upon a quick impression. Look for the unexpected. Think before you leap.

Of course, the mind can be conditioned to draw certain conclusions based upon habit and familiarity; the old human failing of concluding that, because things happened a certain way once, they'll happen that way again. Subconsciously, we translate a past performance into the present. The mind apparently calls upon its previous experience and assumes that what was true in the past must be true now. We make up weighted averages of our past experience and use them as a standard to interpret what we see. Of course, the conclusion sometimes is unreliable.

Certainly, if experience plays such a vital part in our ability to perceive, it is equally important in human relations. We frequently are puzzled by the fact that others cannot see a situation as we do. However, we better understand this when we know the reason—that their past experiences have been different from ours; therefore, their assumptions are different and their conclusions vary from ours.

Often, the view we take is prejudiced by our own personal interest in the object being viewed. Many of today's industrial problems grow out of the fact that a supervisor sees a situation in one way, and those working under him see it quite differently. The solution: open-mindedness—the ability and willingness to look at a problem from every conceivable angle; flexibility, if you will—the knack of seeing not only with your own

eyes but with the eyes of others, and avoiding judgments based entirely upon habit, familiarity, or prejudices. Up to now, we have discussed a number of facts, conditions, and situations that can and do effect our visual perception. But there is an orderly way that can help us to avoid these stumbling blocks when we are aware of, and recognize, their existence. The first rule is:

Be Selective. No one can be expected to observe everything. Observe what to you is important. The selection, of course, will differ from person to person and from time to time. Always select clear cut objects to observe, and don't try to absorb insignificant details.

A production supervisor, for example, may focus his attention on safety matters one day; and the next day, concentrate on the elimination of scrap or some other form of cost reduction. Another day, quality of product may be uppermost. The important point in observing any of these accurately is to be selective.

Know What To Look For. Because observation required attention, and because this depends upon interest, it is clear that a good observer must be interested in what is significant. The more we know about a particular subject, the more we should be able to observe. Remember, if you are ignorant of a situation, you cannot expect to observe it accurately. The control panels on a continuous chemical process will look much different to you than to chemical engineers responsible for its operation. You must decide what observations best suit your needs in relation to your responsibilities.

Practive Observing. The more we practice good observation, the better we'll become at it. It's little different from music or golf. You certainly don't expect to whack that old golf ball 250 yards down the fairway, straight and true, if you play golf only once a year.

Keep An Open Mind. Be aware of all possibilities in a given situation. An object can throw out signals which have two or more meanings. It's natural to see only what one wants to see.

Don't Be Satisfied With General Impressions. Close examination of facts and details is essential. So is thorough investigation, if the essentials of a situation are to be observed. Sometimes, a detailed study is required, in tricky and complicated situations.

Guard Against Habit and Familiarity. Be careful you don't see action that is just not happening. Your lifetime of experience can color perception and render it out of focus. To be a good observer, you must cultivate an inquiring mind. Don't jump to conclusions. Wonder about things, consider all the possibilities before coming to a conclusion. Don't be afraid to ask questions to be sure you and the other observers are operating on the same wavelength, or at least on the same plane.

Record Observations Systematically. Making notes and keeping records also leads to perception improvement. There's a limit to what the mind can retain. When you observe something that needs correction or action, jot it down to refresh your memory for later action. Furthermore, it permits intelligent discussion when you have all the facts.

Develop a Check List. For some types of observation, such as a safety inspection, a plant start-up preparation is necessary. Too frequently, an observer will look for nothing in particular and, so doing, will observe the non-essentials. Know what you are looking for, and conscientiously look for it.

Eight-Point Approach. Perceptive observation can be developed if you'll follow and practice this eight-step approach. It will pay off, both from a personal and a business standpoint. Good observation plus imagination equals ideas, and ideas are the backbone of all types, whether it be in business, in science, or in personal achievement.

An interesting case history is that of Clarence Birdseye, whose name many of you will associate with frozen foods. He attained much of his success through an observation made while he was vacationing in Labrador; an observation of the quick-freezing methods used by Eskimos to preserve their food. That simple observation, combined with Birdseye's creative imagination launched a whole new business, brought us fresh vegetables the year 'round, and completely changed the complexion and marketing practices of food stores.

The history of American industry abounds with such success stories: ideas, derived from observation and imagination, which

have resulted in new and better products; improved services; better, more economical processes.

In industry, as in science, the person who has trained himself to observe perceptively will find himself operating more effectively, more safely, and more comfortably than before.

Now that we have covered some of the reasons and conditions that effect one's perceptive observation and have suggested an organized method to follow when observing, let us briefly explain how this training can be applied constructively.

A group is divided into three sections. One group is given instructions to observe in the field of safety. This group will concern itself with safety violations, unsafe conditions, safety hazards, unsafe practices, and poor housekeeping which might lead to safety hazards.

The second group will be assigned the category of quality. They will observe for items that affect the quality of the product being produced, as well as the end user of the product. They should look for anything that could affect the quality in the eyes of the consumer. While this is broad in scope, it means observing materials, equipment, and people, and how each may affect product quality.

Group three is assigned to cost reduction. This means looking for anything that could affect costs and result in savings. Here, the group should aim its sights on material savings, people, and equipment.

Each group must observe without judicial thinking. Free wheeling of ideas is encouraged. Guard against habit and familiarity, since they inhibit our creative and imaginative approach.

The field trip is selected in advance and may be in a plant, office, or laboratory where each trainee can practice observation. It is important to select enough area so that each member of the group can spend about ten minutes of concentrated observation.

The groups do not observe as separate groups. Each man observes individually, on his own. This will allow more and different observations without influence from any other member of the group.

Upon completion of the field trip, the group returns to the conference room where they work as groups, preparing their observations for discussion. Each group is given an opportunity to discuss their observations and questions as to what, where, when, and who the observations apply and are either accepted as valid or rejected.

The observations are summarized in a report which is submitted later to the participants, the area visited, the safety department, or individuals responsible for safety, industrial engineering or equivalent, and management. The report serves as a document that permits follow-up by all those responsible for corrective action. Many of the observations can be corrected immediately, while others require additional investigation and study, particularly observations suggesting cost reduction improvements. To attain the greatest effectiveness from such a report, someone should be assigned the responsibility of following through on the valid observations, so the value of the training can be measured.

While this particular program demonstrates a technique based on proven principles, the real value comes from an organized effort in which observation teams are used continually to effect improvement. The three categories chosen for demonstrating the organized approach to better observation —safety, quality, and cost reduction—while important, should not be a limiting factor. The technique and approach can be applied to almost any problem.

There still is a long way to go to realize the full potentials of perceptive observation. A person trained in observation reacts with an outlook entirely different from that of the untrained person. He operates more safely, comfortably, rapidly, and effectively.

Today's stiffer competition and the "profit squeeze" exerted at every phase of our business operation makes it imperative that we use every available device for improving our performance. Perceptive observation is a highly effective tool in achieving this goal.

MAKING THE PLANT ENVIRONMENT PAY

By KENNETH ROBINSON
Ventilation Engineer, Industrial Hygiene Department, General Motors Corp., Warren, Mich.

Today, one must consider and improve his industrial environment. We hear a lot about it. We read a lot about it. We know that the Federal governmental agencies want it improved. The unions want it improved. And, in all honesty, management wants it improved. If we are really serious in talking about improvement of our environment, then we are really going to have to make some changes. We will have to change our attitude. For years, unfortunately, the design people were solely interested in the buildings in which we keep our machinery and our people. And to be truthful about it, we don't really care about this structure of steel and glass and wire and brick. It is just something to keep the birds and the rain out and give us a place where we can work, where our people can produce. As one manager put it, "Obviously, engineers are only interested in this plant at midnight after the shift has gone home. They really have done nothing for the people."

If we are sincere and wish to improve the environment, obviously we must consider man and how he reacts to his environment. The first thing we must accept is that we never have a heating problem — we have a cooling problem the year around. We are 98.6° animals, if you will, and we must lose heat to survive. We must lose it at a controlled rate to be comfortable.

You are probably saying, "Well, I paid a pretty big gas bill this winter." When you sat in your living room while it was zero outside and the fire was burning almost constantly, providing you with a 75° temperature, you, as a 98° individual, were not being warmed. Your surrounding atmosphere was controlled so that you could lose heat at a controlled rate and be comfortable. If you acccept that, it is obvious that we can design equipment that can be used twelve months out of the year to improve the environment. If you won't accept it, you are not going to come up with a satisfactory environment. It is as simple as that.

How can we improve the environment? We know more about living room comfort that than we do about working comfort. Most of our standards have been based on the body at rest or what generates an intolerable condition. In between, we are dealing with a no-man's land which is becoming more and more involved. No one knows in this no-man's land at a given time how much of a man's reaction is a biological response or how much of it is physiological or psychological. Obviously, if a man's wife found out he was running around and they had a fight last night, he is a little more difficult to live with today. Or, if he has a car payment due and he can't seem to meet it, things will be a little on the difficult side, too. But, if he is looking forward to a week's vacation and going fishing soon, then he is a little easier to live with. There are many things involved — things that we can't get into here — but let me assure you that as time goes on, we are going to become more interested in the psychological side of man which has to do with colors, with lighting, with housekeeping, and probably many more things that we haven't even thought of yet.

An arbitrary index allows us to compare different conditions. If we have a 70°F. dry bulb and a 70°F. wet bulb, we have a saturation condition and a comfort sensation which has become known as the 70° comfort chart or effective comfort temperature. An 80° dry bulb and a 63° wet bulb will fall on the same line of the comfort chart and we should have the same sensation of comfort. We can now intermix wet and dry bulb conditions and know where it falls and know whether a person should be too warm or too cold.

Most people are comfortable at the 71° dry bulb and 68° wet bulb temperature line in winter. We may have to change this a little bit because of the clothes we wear, or perhaps it would be more appropriate to say because of the clothes we don't wear. There are other changes, but this is close enough to be practical.

Air velocity and moisture affect the rate of cooling. In many hot industries, such as the Ford foundry, people have been allowed

to select air velocities. They have selected velocities between 3,000 and 4,00 feet per minute; more often above 3,500 feet per minute. This is in contrast to our text books and our code. With a 65° wet bulb and an 80° dry bulb we still have our 71½° comfort temperature. At 50 feet per minute, it is about 70°. At 100 feet per minute it is about 68°, and at 700 feet per minute it is about 60°, which is pretty cool. By increasing the air flow velocity, we thus increase the rate of cooling. By doubling the velocity, we increase the rate of cooling about 50 per cent.

A 74° wet bulb and a 100° dry bulb is equivalent to an 80° effective temperature zone at about 300 feet per minute velocity. The man who was perhaps the outstanding physiologist of England did a great deal of work on this, and I had the opportunity of discussing this with him on his last trip to this country before his death. He showed rather conclusively that when people work at temperatures of 80°, you can expect the rate of work to decrease and the rate of accidents and illness to increase. We do not seem to have accepted that in this country as yet. However, I have been involved in several cases which seem to prove the point. In one case, where people were working at 85° effective temperature, a change to 76-77° effective temperature brought the rate of work up to where it had been in cold weather. The scrap rate went from 19 per cent to six per cent. I think you will agree with me that, if all of this is not conclusive, at least it points to a direction which we might wish to go.

I have said that for years our design people have been interested in the building. They have used types of equipment where they take the hottest place in the plant, inject more heat in to it, project it out, and then with tongue in cheek say, "Yes, sir, you're going to have comfortable conditions down here." When we do not get comfortable conditions, and we are cold in spite of the beautiful catalog with the trained arrows, we wonder, "How do we get the air to follow the trained arrows?" I don't know. But when we complain, the salesman tells us that *his* unit (I don't care who manufactured it, but it's *his* unit) has a high velocity fan and adjustable louvers; if you would adjust those, you can blast the air on the poor fellow down here. If the same fellow told us that a ping pong ball would stay in a tub of water because it was pushed by a high velocity of air, we would say that he is crazy. Yet, we will create much light air, much cold air, and create a low pressure area, and because the man says this, because he has arrows to show us, we have accepted that this cold, dense air through some miracle will float up and fill up that low pressure area, and the warm air will settle down.

During a cold spell, our warehouse had a unit heater system. They had a lot of material, and it was interesting that on the end of every piece of material was a shipping tag. These shipping tags were fluttering, and they were fluttering at the same angle. You could see that the warm air was being sent down and coming right straight up again. With the same type of unit, where we get the hottest air in the plant, we add more heat to it and project it down. This man wants it up, and [illegible] man wants it turned down. What we [illegible] pretty close to a fist fight down [illegible]

We [illegible] tests. We've placed a [illegible] about 18 feet off the floor, and [illegible] only about 10 per cent of the [illegible] to the floor. Fifteen feet back [illegible] water line, we could neither see nor smell any of the smoke, even though it had sulphur in it. When the bomb burned out, the residual smoke came back about to the 10 foot level and recirculated. The standard procedure is to complain to the salesman, who tells you that he also has a unit with adjustable blowers, and as you can see you can adjust this to make many people uncomfortable with the same unit.

However, on the unit we were testing, we had the electrician adjust the motor so that the motor was running the opposite way. We knew that the fan wouldn't handle as much air, but it would handle some. Then we added more resistance, so we were handling even less air than that. We then put the smoke bomb down in the low-pressure area where the smoke picked up with the cold air. We filled the entire area with smoke and, where before we couldn't get it up 15 feet, we now had it up 30 feet. So, with less fan capacity, we fill more than four times the volume with smoke. When the bomb burned out, the smoke was still in this area until it was gradually dissipated, but now the smoke went above the level of the heater.

Another trouble with these heaters is that they went off and on. It was proven years ago that when a person is in stratified air, with about 1½° differential he would be uncomfortable. However, if air is in motion; if you can run the fan all the time and vary the heat input to it, keeping the air in motion, the same people will go up to 6½° differential before they will complain.

Exhaust from the plant gives you from two to four changes per hour due to natural infiltration before they put any equipment in. Increasing the exhaust will, of course, increase the infiltration of windows, doors, and crevices. (If a door is ten feet high and ten feet wide, air will enter at the rate of a thousand feet per minute while the door is open. This is a low velocity. But if these were the conditions on a zero day, it would require seven and a half million Btu's to heat the air entering the building in that amount of time. Maybe seven and a half million Btu's definitely doesn't mean much to you or to the management. But perhaps it would be easier to buy seven and a half million matches, because one match generates heat equal to one Btu.) But industry never lets well enough alone. They come along and put in another exhaust system, which increases the infiltration. All of this business doesn't help the people working in the plant. The only thing you may be assured of is that you will probably warm up this air by the time you throw it outside. The worst condition that I have ever run into was a plant so badly out of balance that the women on the outer edge of the plant were wearing winter coats trying to keep warm, while management kept putting in unit heaters until the center of the plant was some 90°. This was a typical plant: cold on the outside and warm on the inside. Webster defines ventilation as "the simultaneous supplying and exhausting of air from a space." He is a little smarter than the engineers, because he put the "supplying" first.

When the Labor Department of the State of Michigan closed a plant, we went over the scheme with the Health Department with a fine-tooth comb and reopened the plant. We wanted to put in air-supply equipment, as did the union, but the engineer said, "I can't do it. When it gets down to zero temperature now, we have to close the plant. We do not have boiler capacity to maintain the temperature to keep the people at work. I said that since we don't have much zero weather, we should put in the make-up air this year and, "If you're right, you put in the boiler next year. If I'm right, you won't need a boiler." They put in the air-supply system. In order to put it in, they had to move some of the heaters down to the shipping area, where they never had any heat.

The next spring, I talked to the plant manager and engineer, and he said, "We were heating more space than we ever heated before. We installed the make-up air units that you recommended. It went to —14° last year, but our people were comfortable and we had capacity left in our boilers." Think of it; they used to take pains to fill up every little crack, and now leave deliberate cracks to try to get the air out.

I was driving one night, and my daughter was in the back seat. She said, "Turn up the heater. I'm cold." I said, "Open the window." She said, "I'm already too cold." So, I pushed the electric button and opened the window about an inch or so. Inside of three miles she said, "Turn the heater down a little bit."

At a heat treat furnace, the men are too hot on one side and cold on the other, so they average out all right. I warn you about this averaging business. The statistician tells you that you can stand with one foot in a tub of cold water and the other foot in a tub of hot water and be comfortable. Don't you believe him. In Washington they are trying to keep it quiet that one of their best statisticians drowned in a stream that only averaged 2½ feet.

In changing the standards we are also changing other things. Our buildings used to be narrow and high. Now, they have the profile of a phonograph record. They are wide. They're low. They're flat. What happens along the outside wall doesn't do anything to help the inside. We keep adding equipment so that today an engine plant uses machines that generate as much as 100 Btu's per square foot per hour. In one of our air conditioning facilities, 800 watts per square foot was used as a criteria for designing refrigeration equipment. The latest addition was 38½ watts per square foot, or 130 Btu's per square foot per hour. So, remember we have a cooling problem the year round.

After you get effective fuel, smoke, and temperatures, you must put a curtain around it. You can put all the exhausts you can pile on the roof, but you cannot control the hot gases and fumes that travel around it if you do not or cannot put a curtain around it.

One plant had hot spots in places from 200 to 300 feet from such an area, and they were not generating heat over there. We found out that they had about 20 foot gaps in their curtain and a measurable airflow under the curtain was going in there, being heated, coming out of there, going up to the ceiling.

Radiant energy must be controlled by reflective material, because you cannot control it by ventilation. Certain aluminum will reflect over 90 per cent of the radiant energy and re-radiate less than 10 per cent. Black iron, and asbestos, and other similar materials will do just the opposite; they will re-radiate 90 per cent and reflect less than 10 per cent.

A high percentage of units manufactured will not deliver the rated volume of air. Some of the manufacturers have never bothered to test their own units. Be sure you get a unit that will deliver a rated volume. Watch your specifications. It wouldn't be a bad idea to send your specifications to the manufacturer's plant before it is shipped. It may save you a lot of money and a lot of headaches.

You bring in the best air you can get, and deliver it down to the man as close as possible. This eliminates any entering of smoke or fumes back on the man. In the summertime, of course, the heater is off. You may or may not elect to alter the dry-bulb temperature. But, even if you do not, you bring in the best air that is available and put it on the man at a reasonable velocity. We can supply air to the man on hot days within one degree of outside temperature. A plant thirty-feet high can have five air changes per hour by blowing the air up higher. That same volume of air, can give twelve changes per hour in the lower ten feet of the plant. We like to supply at least 10 per cent more air than we exhaust. In the summertime, our minimum standards have been twelve changes of air in the lower ten feet of the plant. We try, in some cases, to get a 20° rise. Sometimes, when the second shift comes into a warm plant they finish their shift in a cool plant.

We have done a great deal. There is more to be done.

HEAT — COLD FACTS ON HOW TO BEAT IT
A DEMONSTRATION

By W. G. HAZARD
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A word about what we *won't* discuss. Not heating and ventilating or air conditioning in the usual sense; nothing about working in cold atmospheres like wintertime logging, cold storage, frozen food processing, etc. We'll have a lot to say about radiant heat, but we won't touch on *useful* aspects of radiant heat: panel heating, gas or electric radiant heaters, etc.

What *will* we talk about? The plant or operation that's too hot for comfort—comfort of the person working there. How do you measure hot conditions, how evaluate these measurements in terms of discomfort, how do you reduce excessive heat? What I have to say is not new; it's all been published.

Consider man, "homo sapiens"—he's also a homotherm. His comfort and health depend on maintaining the same body temperature all the time. In fact, as we all know from childhood, a rise in body temperature (in normal surroundings) is a crucial sign he's sick. While so-called normal body temperature is 98.6°F, for engineering purposes we take his surface temperature as 95°F in summer. Important implication: indoor comfort range is 70° to 75°F. Our bodies are 20° above this. In temperate indoor areas, task is to cool our 95°. surface-temperature body, not heat it. Accept this fact and you change the whole philosophy of industrial-plant heating and ventilating. If you have inside-the-plant operations that generate and

release heat in addition to what occupants release, you have a problem. My plea is, design the plant for the man; don't force the man to fit the plant.

How important is it if a workman is too hot? In extreme cases it means collapse, heat stroke. This seldom occurs in manufacturing plants. But studies have shown that productivity in both physical and mental work diminishes in heat, and the likelihood of accidental injury goes up. Injury to workers is the first consideration. But involvement in hot conditions has no meaning except as it results in productive work.

The aftermath of discomfort is a return to normal. There is no lasting ill effect, fortunately. But remember, discomfort is different for different people. Is there such a thing as acclimatization, not only for athletes so they perform well in oxygen-deficient Mexico City, but acclimatization for resisting un-normal heat?

There are great differences in the way individuals react to heat-susceptibility. But this is the established fact: no chronic disease follows even severe heat discomfort; unlike chronic exposure to noise (that leads to hearing impairment), or chronic exposure to sand dust (that leads to silicosis).

Factors

What are the factors that make a person comfortable or uncomfortable? Air temperature; relative humidity; air motion (velocity of air or wind blowing on you); and the one least taken into account — heat radiated from surrounding surfaces to you.

Of these the most misunderstood is the last — heat coming to you by radiation. Let's explore the physics of this. Radiant heat, radiated heat, infrared, is electromagnetic energy, exactly the same as light, radio waves, X-rays, and gamma rays, except for its wavelength, which is longer than these others. Infrared passes through air doing no heating. When it hits a solid object the electromagnetic energy turns to heat — unless that object can reflect it. Fans are wonderful for moving air, hot air; they are incapable of moving radiant heat, just as a fan can't blow away *light*. With nearby sources of radiant heat — furnace walls, ovens, red hot metal or glass, blazing sun shining through a window — it's futile, nonsensical to call for "another fan," which is the inevitable cry on the first hot day of summer.

How are these factors measured?

1. Air thermometer — dry bulb.

2. Wet bulb-dry bulb give relative humidity.

3. Wind speed hitting you — velometer or other air gage.

4. Globe thermometer gives combination of air temperature and heat radiated to you from surfaces surrounding you.

How do you judge from these four measured factors if a person is comfortable or under heat stress?

1. Effective temperature chart.

2. Corrected effective temp. using t_g instead of t_a.

3. Wet-bulb globe thermometer index (WBGT)

4. Discomfort index (DI) — by weather bureau. (No good for hot industries).

Man is a homotherm. Heat gained by the person must equal heat lost or else our homotherm is in trouble.

$$M \pm C \pm R - E = S = O$$

If air and surroundings are above 95°F, the only cooling mechanism is from evaporative cooling due to drying of sweat. But there's a top sweating rate above which a body can't go — one liter/hr (for several hours). When one liter of water is dried, 2,400 Btu are released. A heat stress index was developed by Haines and Hatch, modified by Belding and more recently by McKarns and Brief. The required loss of Btu to maintain normal body temperature divided by 2,400 Btu/hr (maximum available) = HSI in per cent.

How do you control heat in an industrial plant? If discomfort is due to hot air, bring in outdoor air and release it in the work space, where people get direct cooling effect. Blow room air directly on people-so their rate of sweat drying is increased. Exhaust hot air through the roof, but beware of two misconceptions:

(1) a roof exhaust fan has no magic power to reach down and "suck" from any distance;

(2) for every cubic foot of air you take

Probability Curves for a Free Falling Projectile Striking a Grommet

PROJECTILE SIZE, 1/4" x 1/4" x VARYING LENGTHS

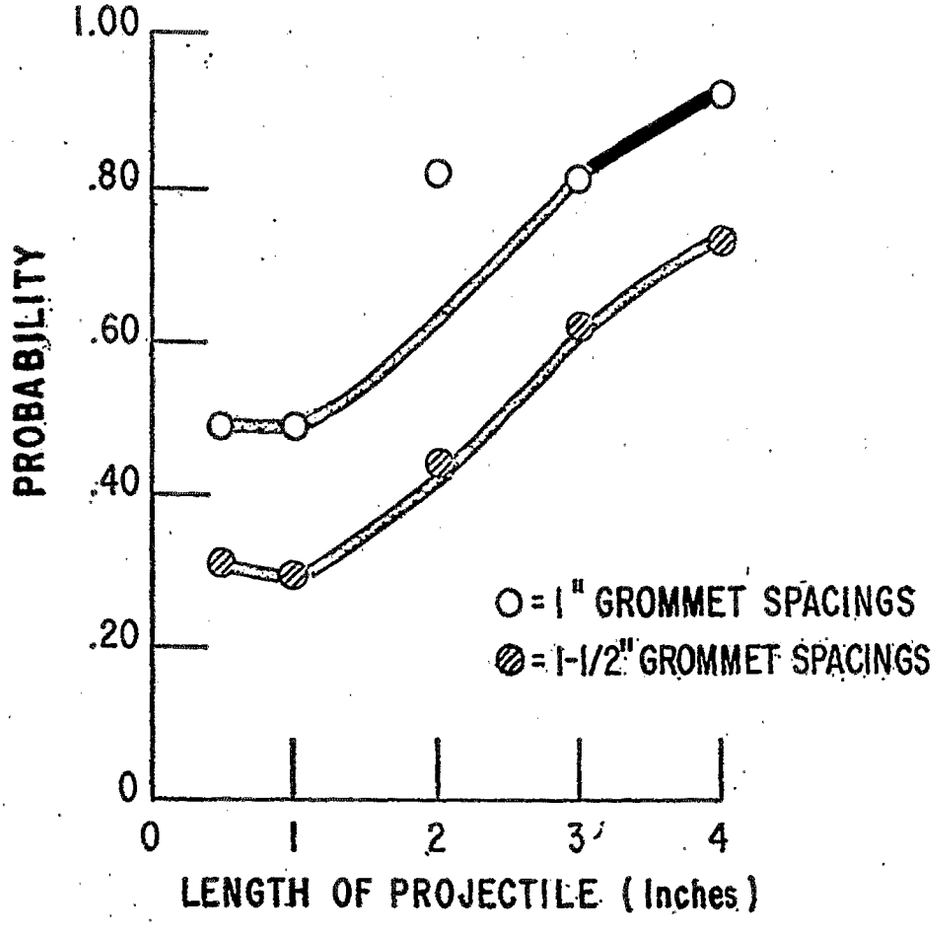


Figure 4

At this stage, we departed somewhat from the plan. It was apparent that sleeve fabrics could not protect against the force used in our experiments when it was concentrated in a small, penetrating wedge during point-first impacts. Therefore, we undertook another series of experiments to determine the highest point-first force the fabrics could withstand. In our first series, the lowest force used was about nine foot-pounds, which is the product of the weight of the projectile times the distance it fell. It represents, for example, the force of a nine-pound object falling one foot, or a one-pound object falling nine feet.

For the second experiment series, we made up a special set of targets designed to ensure a point-first hit most of the time. Rather than

out, you must let in a cubic foot of makeup air.

No matter if discomfort is due to hot air or radiant heat, blowing air on the person — "mancooling air" — helps dry sweat faster and so promotes evaporative cooling.

Another misconception: blowing high-velocity air on a man is uncomfortable, if not actually harmful. Those in the glass and ceramic industries know this is false, for there velocities of 2,000 to 4,000 ft/min are common and sought after by the men. But if the air you blow at him is above skin temperature (95°) — as it often is at some summertime hot operations — you're *increasing* his heat load.

Cooling through mechanical air-conditioning is impossible in a furnace area. But an evaporative cooling in a mancooling system is completely justified, though infrequently used.

If discomfort is due to radiant heat, the solution is totally different. Lower surface temperature of the hot object (say, an oven wall) either by less heat input (unlikely), or by thermal insulation. More fans to blow air do no good. You can't blow electromagnetic energy away. Set up an infrared shadow. But be sure the shield itself won't absorb heat and reradiate it to the man. Aluminum is the only commercially practical material for heat shields — reflecting 90 per cent, reradiating 90 per cent.

References

National Safety Council Data Sheet #D-381: *Radiant Heat Control* (1956).

U. S. Public Health Service, HEW, Public Health Monograph #72 (1964).

"Industrial Heat Exposure and Control." *Michigan's Occupational Health, 5,* 1960.

Lind, A. R.; "The Effect of Heat on the Industrial Worker." *Occupational Health Review, 13,* # 2, 1961.

Henschel, A., Duke-Dobos, F., Humphreys, C. M., Carlson, W., and Lees, D. H. K.; "Assessment of Industrial Heat Stress," *American Industrial Hygiene Association Jour., 27,* 13-16 (Jan.-Feb.) 1966.

Brouha, Lucien, Smith, Paul E. Jr., and Maxfield, Mary E.; "Heat Stress and the Industrial Worker." American Soc. of Mechanical Engineers paper #59-A-213, 1960.

Fuller, Frank A., and Brouha, L.; "New Engineering Methods for Evaluating the Job Environment," *ASHRAE Jour.,* 39-52, February 1966.

Belding, Harwood S.; "Research on Problems of Work in Heat — 15 years' Activity in the Department of Occupational Health, University of Pittsburgh." (Theodore F. Hatch Symposium), *Arch. Environmental Health, 15,* 660-669, 1967.

Industrial Ventilation — A Manual of Recommended Practice, Committee on Industrial Ventilation, Lansing, Michigan (10th ed.) 1968.

Engineering Manual, ch. 2 & 3, American Industrial Hygiene Association, Detroit, Michigan (to be published 1969).

McKarns, J. S., and Brief, R. S.; "Nomographs Give Refined Estimate of Heat Stress Index." *Heating, Piping and Air Conditioning, 38,* 113-116, 1966. See also comments on above by H. S. Belding, et al. in "Open for Discussion." *Heating, Piping and Air Conditioning, 38,* 77, 1966.

1968 National Safety Congress

THE WAY THE CHIPS FALL — A SCIENTIFIC APPROACH TO GLASS HANDLERS' PROTECTION

By JAMES T. DESTEFANO
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In the Glass Division of PPG Industries, 18 domestic production plants employ thousands of people working with and handling glass. Since it is a major item of safety apparel for these glass handlers, the protective sleeve received much attention from management and safety personnel. Consequently, protective sleeves of 21 different designs were in use throughout the 18 plants. To the Safety and Industrial Hygiene Department of PPG, Glass Research Laboratories, it was apparent that these different designs could not all be equally effective in protecting a worker. Further, for reasons of inventory control and cost cutting, it would be highly desirable to adopt a standard sleeve. Therefore, a project was started with the object of determining an optimum sleeve design for standardization throughout the company.

Of the protective sleeves in use, one was a three-ply, vat-dyed, herringbone twill cotton fabric with a sparse distribution of grommets. Others had only one or two layers of cotton twill. Some of these were vat-dyed, some bleached. Some had a dense grommet pattern; others, a sparse pattern. One experimental model included not only the sleeves but part of a jacket as well.

Of the steps outlined in the proposal for testing these sleeves, the first step was to evaluate the present fabrics. We needed answers for such questions as, "Are three plys of a given fabric three times as strong as one ply, or does resistance increase in a non-linear fashion? Is there a difference between vat-dyed and bleached fabrics?" Step 2 was to determine the optimum spacing of the grommets. Should there be a dense grommet pattern or a sparse grommet pattern? Should the pattern be uniform over the entire sleeve or vary for different parts of the sleeve? Step 3 involved evaluation of the data from the first two steps to develop the optimum design and fabricate prototype sleeves. Step 4 was to conduct practical tests on sleeves of both the new and the old designs; these tests involved actual glass dropping, with high-speed photography used to record results. Finally, Step 5 was to evaluate other materials of construction and carry them through Steps 2 and 4.

For assistance in the first step of the project, evaluation of the fabrics, we turned to a group of Glass Research people working on a "safer windshield" project. This group, under the direction of Dr. Raymond G. Rieser, had done extensive work on measuring the forces necessary to cut human tissue. Their approach involved use of an Instron Universal Testing Machine with a maximum rating of 15,000 pounds. This machine will maintain a predetermined speed, no matter what force, up to its maximum, is placed in the path of its travel. It records, therefore, the amount of force necessary to overcome an obstacle in its path while maintaining the preset speed.

In order to use the Instron for cutting human tissues, Dr. Rieser devised a jig, one part of which held the skin of cadavers from local medical schools in a vertical position, while another part, which traveled on a track, held three surgical steel blades. This jig was so mounted that when the crosshead of the Instron started to move it brought the surgical steel blades in contact with the skin in such a manner that the forces measured on the machine were the actual resistance forces of human skin to a cutting action.

Admittedly, three surgical steel blades are a long way from actual pieces of glass cutting a person in a factory situation, but it is not possible to obtain glass with the same edge uniformity to conduct a series of comparative tests. The surgical steel blades, therefore, constituted a reproducible edge for cutting into various fabrics to determine their relative performance.

Figure 1 gives the results of our experiments with the Instron, showing the range of force needed to cut a number of the fabrics used in protective sleeves. For each

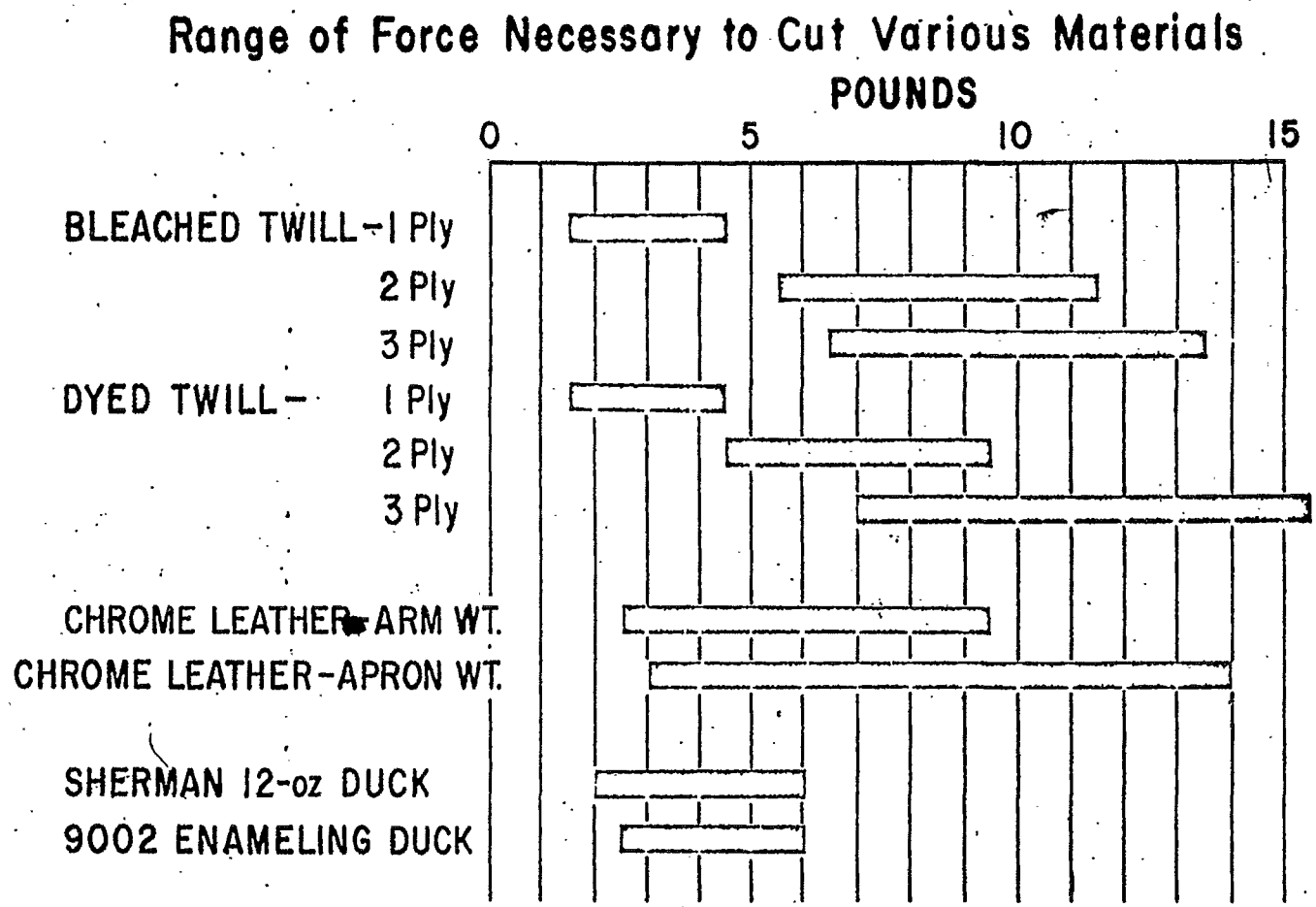

Range of Force Necessary to Cut Various Materials
POUNDS
0
5
10
15
BLEACHED TWILL-1 Ply
2 Ply
3 Ply
DYED TWILL-
1 Ply
2 Ply
3 Ply
CHROME LEATHER-ARM WT.
CHROME LEATHER-APRON WT.
SHERMAN 12-oz DUCK
9002 ENAMELING DUCK

Figure 1

of the samples, the black bar represents a range of force, since these materials did not cut in a very uniform or neat method. As the knife blades went through, they were hung up on the different fibers in the fabric, causing a somewhat erratic motion in the highly sensitive Instron machine. There is practically no difference between bleached twill and dyed twill; for only one ply of each, the forces are exactly the same. For two and three plies, there is a small difference, but the midpoints of each bar are practically the same. Three plies are three times as resistant as one ply, and two plies are twice as resistant as one ply.

One surprising result from this experiment is that chrome leather, used in arm and apron weights, is not much more resistant to cutting forces than twill. Further, the Sherman 12-ounce duck and the enameling duck, which are almost twice the weight of the twills, are not much more resistant to cutting than the single ply of twill. From this data, we concluded that, of fabrics currently in use for this type of protective garment, three plies of twill afford the best protection.

The next step then, was to investigate some synthetic materials on the market today and compare them with the twill and natural fibers used at present. Figure 2 shows results for some of the synthetics tested on the Instron by the same procedure described previously; they are identified by the catalog style numbers of a particular weaving company. Included for comparison are the results for the bleached twill and the dyed twill. One notable feature of this chart is the narrowness of the force ranges for cutting the synthetics. By comparison, the ranges shown in Figure 1 for present materials were fairly wide, covering as much as 10 pounds of force. Besides being much narrower, the synthetic ranges are much lower. Figure 2 also shows that the dacrons were not nearly as good as the nylons; but one nylon, the M-34 mono-filament, appears to be much better than any of the rest. Still, the synthetics do not show marked superiority over the natural fibers.

Several other factors were considered: price (cents per square yard), fabric weight (ounces per square yard; the twills that we have been using are 8-ounce fabrics), and cutting resistance per ounce of fabric weight. The material giving by far the best resistance per ounce, 1.12 pounds, is the M-34 mono-filament nylon. By comparison, the twills had a resistance per ounce of 0.37 pounds; ballistic nylon, 0.33 pounds; and the ducks, which are heavy fabrics, 0.33 pounds for the Sherman and 0.53 pounds for the enameling. Further, the dacrons were not nearly as good as the nylons or the twills; and the chrome leathers, despite their considerable weights of 36 and 40 ounces per yard, were as low as some dacrons. Therefore, if we think we are getting much better protection from leather, the data does not substantiate such belief.

Considering price, the twills are less expensive than any other fabric except the ducks, which did not have much better cutting resistance. Further, the bleached twill costs six cents per yard less than the dyed twill.

From this data, then, we derived the following conclusions: (1) there is no difference in strength between bleached and dyed twill; (2) three-ply twill is roughly three times stronger than one-ply; and (3) the chrome leathers and most of the synthetics do not appear to be much more advantageous than the cotton twill currently in use. We further concluded, therefore, that the optimum sleeve fabric is three-ply bleached twill. We chose bleached over dyed because the bleached twill has heat reflecting properties and is less expensive.

Having established the optimum fabric, our next step in the program was to determine the optimum spacing of the grommets. The grommets in protective sleeves have an inside diameter of ⅜-inch and an outside diameter of ⅝-inch, meaning that the grommet itself consists of a ⅛-inch ring. The test procedure involved holding a projectile a specified distance above a target, then dropping the projectile and evaluating the point at which it hit the target. A simple clamp was used to hold the projectile 12 inches above the target. The projectiles consisted of wooden blocks of 8-inch length with square cross sections, having ⅛-inch sides, 3/16-inch, ¼-inch, and ⅜-inch. The projectile of ⅛-inch square cross section was to simulate ⅛-inch glass landing on edge, and the same was true of the other cross sections. Each target consisted of a pattern of circles layed out at various distances on center.

Before testing could begin, we had to

Range of Force Necessary to Cut Various Materials

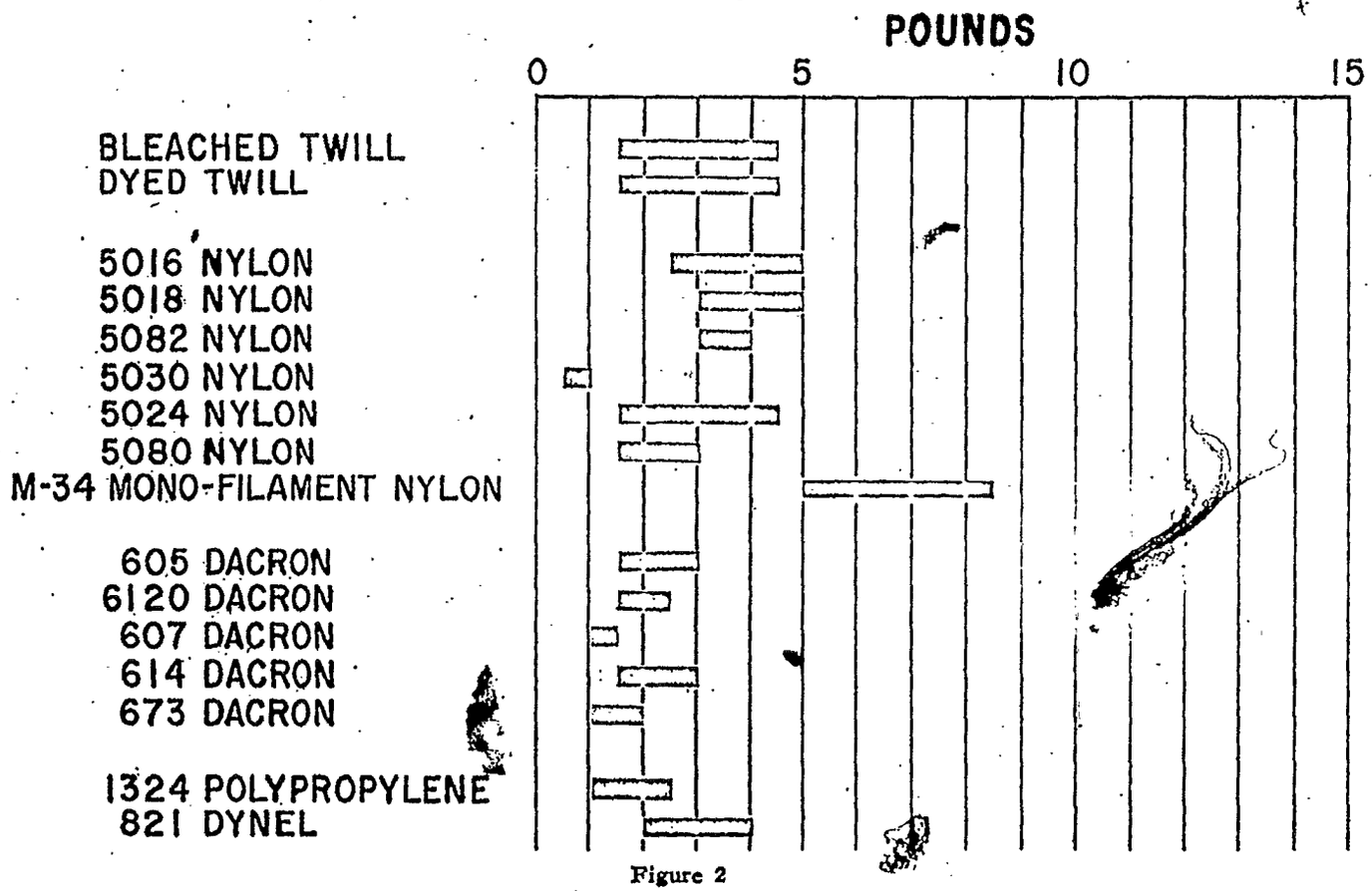


Figure 2

Probability Curves for a Free Falling Projectile Striking a Grommet

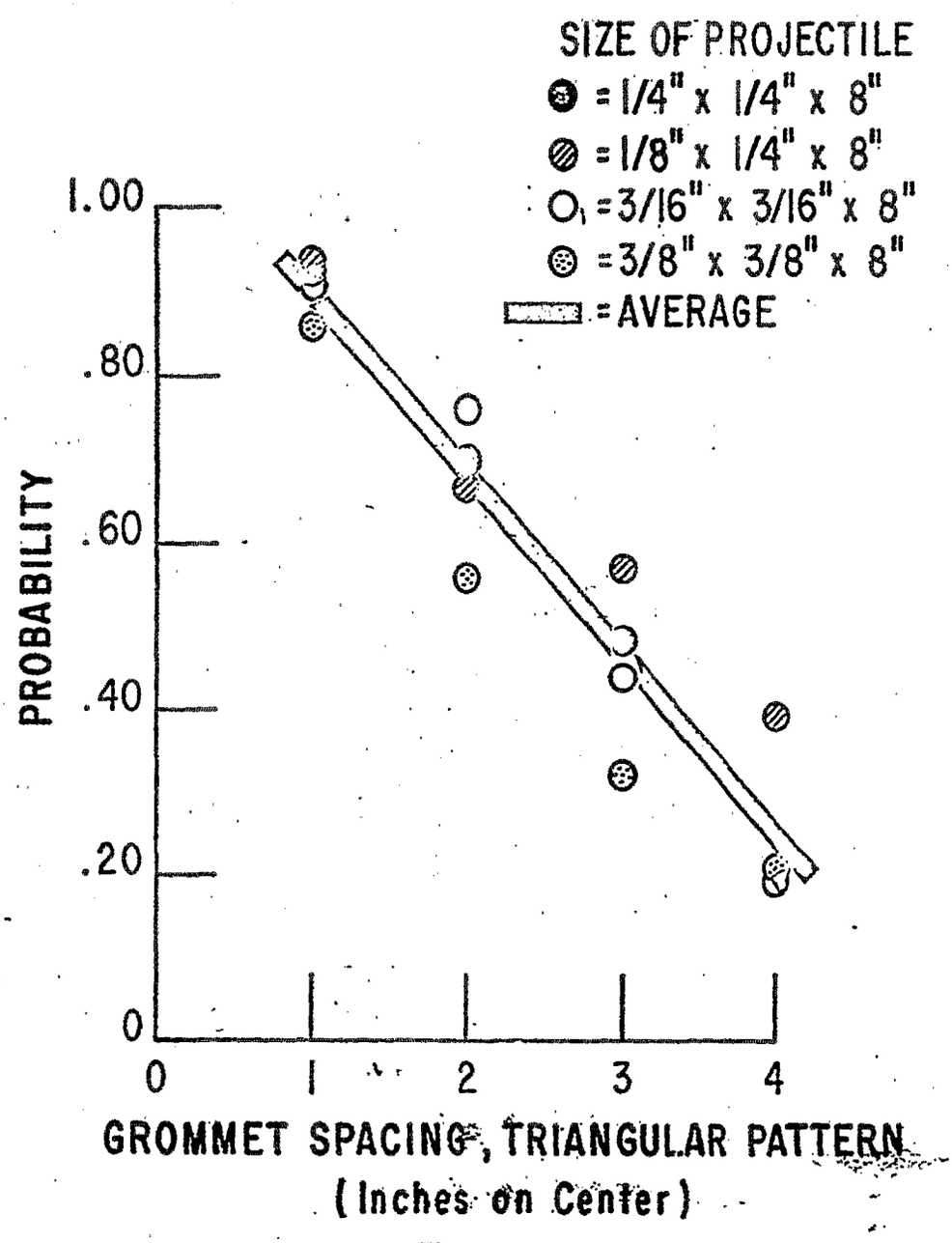


Figure 3

Probability Curves for a Free Falling Projectile Striking a Grommet

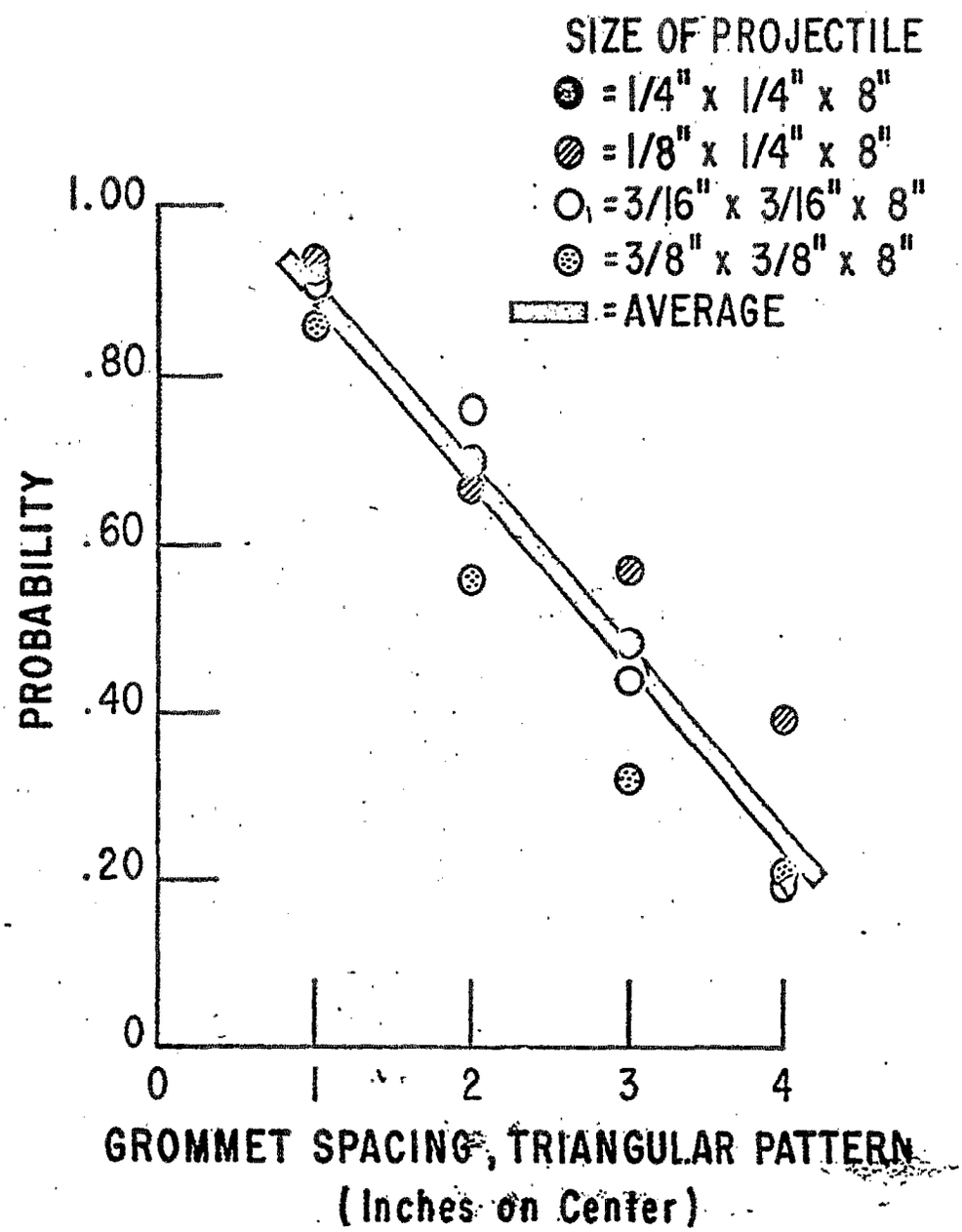


Figure 3

an arm, each target was a flat 12 x 12-inch plate coated with the artificial skin. With the projectiles aimed each time to fall point-first, we made 58 drops on flat targets protected by various fabrics. Despite being aimed point down directly for the center of the target, however, 12 of the projectiles hit either on edge or in some other way considered a bad hit. Of the 58 runs, 28 were on fabrics of more than one-ply, with 19 of these valid point-first hits.

None of the fabrics, for either one or more plies, protected the arms at one foot-pound or above. What is one foot-pound of force? Not very much. A piece of ¼-inch glass measuring 5 x 9-inch weighs about one pound. If you drop this one foot and it lands on the point, it will penetrate practically any of the fabrics available today.

In summary, the main purpose of this report has been to demonstrate the extensive research we have undertaken to make protective sleeves 100 per cent fool-proof. In our three plies of herringbone twill, we have a pretty good sleeve that has protected the arm from forces as high as 18 foot-pounds when the projectile landed either flat or on edge. Unfortunately, the desired protection from point-first hits has eluded us thus far; but we have demonstrated that the probability of a point-first hit is remote. Out of the first 18 experimental runs, less than one-half were point-first hits, despite aiming all projectiles to hit point-first. In the second series of runs, designed specifically to ensure a high number of point-first hits, about 25 per cent of the projectiles failed to land on their points. Furthermore, we have shown in our work on probability that, even if a falling projectile does come down point-first, there is about 30-40 per cent chance that it will hit one of the grommets on the sleeve, which will prevent injury to the arm. All in all, the new protective sleeve has survived some pretty rigorous testing.

DOES MANAGEMENT HAVE TO WORRY ABOUT SAFETY?

By JACK E. SPENGLER
Mgr., Industrial Relations, Tableware Div., Anchor Hocking Glass Corp., Lancaster, Ohio

Suppose an airliner were coming over the Atlantic for a landing in New York. The time is 2 A.M., visibility is zero and lightning is flashing all about. The craft has been rocking and dipping badly for an hour; suddenly the captain addresses the passengers: "Ladies and gentlemen, we are coming in for a landing at J.F.K. Please fasten your seat belts, do not smoke, inflate your life preservers, and brace yourselves. As part of our passenger service, we would also like to invite anyone into the cabin to help us maneuver the plane through the fog, across the harbor, between the tall buildings, and onto the runway. We want our guests to feel a part of ABC Airways, the total service airline."

Of course, no one would make such a foolish attempt. I'm sure they would all follow instructions to the letter, not only because they were frightened, but because they were safety conscious.

Why is it so easy to get airline passengers to conform to safety rules and so difficult to get employees to wear eye protection, buckle seat belts, wipe up grease spots, keep work areas straightened, and be careful homeowners? I believe that communications — or the lack of it — is largely the answer. In fact, I believe that safety is basically a communications problem. The challenge is one of trying to arouse a consciousness among supervision and the workers. Those people in the airplane didn't have to be motivated. They were already safety conscious. They already had the right attitude. A message that it is dangerous to try to land in a fog with an amateur at the controls had already been communicated to them, be it ever so subconsciously. Unfortunately, no such subconscious reaction comes into play automatically when home and plant safety are concerned. To help make that reaction automatic, we have sold and will continue to

sell safety through every medium available to us, and to sell it as often as possible.

Three of four plants in the Tableware Division won awards from the National Safety Council last year. Our largest plant, with 2,600 employees, recorded just six lost-time injuries. It recorded 51 in 1947 when the prevailing philosophy was to say little or nothing. We cannot claim that the saturation communications technique is solely responsible for these figures, but we can claim that our employees have never been so repeatedly exposed to the virtues, values, and methods of being safe.

The company newspaper, *Anchorscope*, is an eight-page bi-monthly publication which we hope will soon be monthly. In each issue we try to stress one safety point in a story. A recent story, for example, explained how the combined careless acts of two or more persons could cause a fire. We feel that the rifle shot approach — hitting home at one point — is more effective than the shotgun method of spreading a message too thinly.

We are currently sending out monthly letters over the general manager's signature on employee benefits, community campaigns, and safety. The letters are addressed to the entire family. Those going out before Christmas and July 4th stress off the job safety.

We plan this year to give a small, useful, gift to each employee the day before he leaves for vacation. This gift will carry the message that the employee is important to us, along with the warning to be careful and to enjoy a safe vacation. These gifts will be distributed by the employee's immediate supervisor.

We also use bulletin and sign boards as often as possible. Safety posters, often obtained from public service groups, are placed on departmental and company-wide boards so that no matter where the employee goes he is bound to be reminded of safety.

Showcases offer another slant. A recent display near the clock alley centered around the plant manager's simple thank-you letter for employees' safety efforts in 1967. Arrayed about the letter were the National Safety Council plaques which the plant has won in recent years. An upcoming display will feature a scattering of burned safety gloves, dented helmets, cut safety shoes, and cracked goggles. We will include a short description of how the equipment prevented injury.

Another medium is the Telecontrol public address system. Our general manager periodically tapes a two or three minute safety message, which is then played over the public address system during each shift.

The Lancaster newspaper and radio station are fed Anchor Hocking safety stories of community-wide interest when developments warrant. We feel that employee pride in his plant's safety record can be greatly buoyed when he enjoys the prestige of seeing his plant publicized by the local media. Recent research at Ohio State University suggests that the highest praise the public can pay to management is to say that a company "is deeply concerned about the safety of its people."

In connection with publicizing safety, we held a banquet this past summer to honor our employees for their 1967 safety record. The 100 or so who attended the function, both supervision and union officials, were given specially decorated tumblers as mementos. The following day, our general manager taped a short message of appreciation to all plant employees. As a token, he invited each to the cafeteria for a free cup of coffee. Twenty-three hundred coffees were consumed.

This one-way communication, however, is not enough. We are now in the beginning stages of fuller employee participation. Some of our present and future programs are going to be:

1. Family safety quizzes in the *Anchorscope*. No prizes will be awarded, but it should prove to be a popular feature.

2. Posters drawn by employees' children. We hope to take full advantage of this avenue at the dedication of a large distribution center we are building in Lancaster. Tentative plans call for having children draw and paint their conception of various safety aspects. Every child will get a prize for his efforts. We feel that bulletin board displays of such posters will give a good deal of fresh air to any safety program.

3. Safety slogan contests. Employees each month are encouraged to submit slogans, and the winners are displayed on signboards around the plant. Successful employees are awarded National Safety Council prizes.

4. Safety ideas also come to us through our suggestion system. Under this plan, employees will be presented with a specific

safety problem and then asked to submit suggestions for its solution.

Most of what I have said applies more appropriately to hourly employees. Perhaps equally or more important, as you know, are the front-line supervisors — the foremen. The communications problem with this group of men centers around an orientation of job responsibility. Foremen must be informed through such an orientation that they are safety leaders as well as production chiefs. Hopefully, safety then becomes a factor in their performance appraisal. To sell safety to foremen, we utilize regular monthly safety meetings of department heads and shift foremen during which motivation, safety hazards, and serious injury indexes are discussed. We also issue a weekly management memo, called "Update," in which safety is often a featured topic.

We often tell foremen that they are the important link in our safety program, but telling them is not enough. To show them, we recognize the department head or shift foremen whose groups have continuously worked the safest over a period of time. The recognition consists simply in posting on a special bulletin board the pictures and names of foremen whose groups have worked without a lost-time accident for a certain number of hundreds or thousands of man hours. We hope to expand this program by issuing "thousand day" or "five thousand day" lapel pins to all employees in a group which reaches such a level. Recognition, then, especially of the foremen, is highly important.

Finally, and certainly not least important, we must sell safety to top management. Fortunately, we have a general manager who is, by nature, safety conscious. He has often said that an unsafe plant cannot be a productive plant; and, our performance has supported this philosophy. Others of our management group are also genuine humanists, and show great concern about avoiding needless suffering by the employee and his family. For others who may be more dollars and cents oriented, it is an easy matter to demonstrate how much the company can save by having six lost-time accidents, as in 1967, instead of 51, as in 1947.

These, then, are some of the areas in which we at Anchor Hocking are working to fight accidents. Good communications, we feel, is literally the twin of a good safety program. These communications must originate either from the top (letters, showcases, public address, etc.) or from the grass roots (suggestions, slogans, poster contests).

I suppose it is a universal human characteristic to ask of any program, safety or otherwise, "How does this affect me?" Our only answer to that is that it is also a universal human characteristic to want the sight of both eyes, to have ten fingers and ten toes, and to be able to lead a normal, healthy life. Such is the aim of our entire communications safety effort: to avoid a lifetime of misery and suffering. We have a long way to go. But we won't be satisfied until all of our employees are as safety conscious, both in the plant and at home, as the passengers in an airliner with a novice at the controls — and that's pretty safety conscious.

EMERGENCY BRIGADE — PLANNING

By RICHARD D. ECKERT
Maintenance Supervisor, Ball Brothers Co., Inc., Mundelein, Ill.

A few years ago a new and modern ceramics plant was totally destroyed by fire. Losses ran into hundreds of thousands of dollars.

Even though the plant had two shifts in it at the time of the holocaust, there was no loss of lives, and only a few minor injuries, and this was only because management had the foresight to plan an emergency evacuation procedure.

If they had an emergency fire brigade, I am sure their loss would have been considerably less.

This one incident points up the need for proper training of people today in emergency plant procedures.

A well-trained group of people is by far the cheapest insurance a company can provide.

The plan by which our plant brigade is

set up, is one of the best for our needs. Each plant, of course, would have to change it to meet their own needs. The following is no more than a guide.

I—Purpose: The in-plant emergency brigade is an orgahized approach to utilize adequately trained, responsible personnel to cope with an emergency efficiently, before professionally trained fire, police and medical services are available. Such groups can be expected to prevent or greatly minimize the extent of loss to employees, buildings and equipment usually expected as a result of an emergency as defined hereinafter.

The purpose of organizing a brigade is to train a group of physically able employees, on each shift, to the extent that management will know that this group can be relied upon to handle emergency situations that could come up during their shift. Their training is to be extended in scope to cover accident emergencies, severe storms, power failure, as well as to extinguish small fires, and keep major fires under control until the local fire department arrives on the scene.

II—Organization: A well organized brigade should have a chief officer who will be responsible for all functions of the emergency brigade and report directly to the plant manager as to their functions, which would include the selection of brigade personnel, equipment, training, etc. Shift teams should be established along the following lines:

1. *Emergency brigade captain* — highest level line supervisor on each shift. Each captain is directly responsible for emergency brigade functions on his shift and reports to the designated chief officer.

2. *Emergency brigade lieutenants*—line supervisors on each shift who will direct the functions of the various teams on the shift and report directly to the shift brigade captain.

3. *Emergency brigade messengers*—one for each officer to carry out communications as deemed necessary in the emergency situation.

4. *Shift teams*—made up of two or more employees per team which will function, depending on the emergency, with specific instructions in the following categories:

   a. Fire extinguishers.
   b. Fire hose and pumps (where we have this equipment).
   c. Sprinkler systems.
   d. First aid.
   e. Evacuation and shutdown.
   f. Salvage.

All employees participating as team members should be under the supervision of the above officers according to function. All other employees remain under the supervision of their regular foreman or his designate.

III—Training: Those employees participating in the emergency brigade and all supervision should be required to receive complete training in all categories of emergency brigade functions. This complete training of all brigade members and supervision will permit reassignment of any member to meet the specific needs of any emergency.

The training of brigades shall consist of (1) lecture sessions, (2) actual practice, (3) scheduled follow-up on new training methods and emergency equipment, and (4) periodic drills and review of training. The outline of brigade training shall cover the following categories:

I. *Fire Fighting Emergency*

A. *Communications*

1. Fire Alarm.
   a. Where each is located.
   b. How to send in alarm.
   c. Messenger instructions.
   d. Use of P.A. System or brigade alarm.
   e. Use of signs and lights for direction.

B. *Hand Extinguishers Teams*

1. Select at least two men working together as a team.

2. Number of two-man teams needed will depend on the plant size, plant layout, materials used, and number of shifts working.

3. Special training for these teams shall be:
   a. Complete review of different classes of fires. (A-B-C-D)
   b. Location of all extinguishers in the plant.
   c. Different types of extinguishers.
   d. When to use each type as to classification of fire.
   e. How to operate each type of extinguisher.

f. Where to direct the flow of discharge in relation to fire.

C. *Sprinkler Systems Teams*

1. Select two-man teams for each shift with special training on:

a. Location of each system and the area each covers.

b. Where each system control valve and drain valves are located.

c. Where division valves are located.

d. How to shut down and drain a system.

2. In the event of a damaged sprinkler system, the total area of coverage must be thoroughly checked to be sure there is no fire before shutting down system.

3. In the event of a fire, a system shall not be shut off until fire is under control, and then ordered to do so by brigade fire officer or local fire department officer on the scene.

4. To keep water damage down to a minimum, use sprinkler head wedge on all damaged heads.

II. *First Aid*

A. *Red Cross Basic Training or Equivalent*

1. All plant supervisory personnel should have this training.

2. Have at least three well-trained employees on each shift.

3. Facilities where we have Industrial Nurse on duty, should have two trained employees per shift.

4. First aid supplies on hand as recommended for facilities with a nurse on duty or without a nurse.

III. *Emergency Planning*

A. *Auxiliary Emergency Lighting in Event of Power Failure*

1. Each facility should have a sufficient number of units to:

a. Light aisleways to all exit doors.

b. Emergency equipment, including first aid supply, should be lighted.

c. Light boilers and compressor area.

B. *Orderly Shut Down Procedures*

1. Instruct all employees on their individual machine shut down.

2. Train a sufficient number of employees on the location of, and how to:

a. Shut off main electric power.

b. Closing natural gas supply valves.

c. Closing of supply valves for oil, propane, gasoline, or any other liquified gas.

d. Check boilers and compressor controls.

C. *Evacuation Procedures*

1. Select at least three guides per shift trained to carry out the evacuation plans approved by the committee and management.

2. Draw up plans for orderly evacuation of all employees such as:

a. Divide employees into groups or areas.

b. Assign each group or area to use designated exit.

c. This assignment will have to be flexible, depending on the nature of the emergency and the plant area.

d. Instruct all employees as to the evacuation plans.

e. After all plans are complete and employees have been fully instructed, arrange for a mock drill.

f. This mock drill should be repeated as often as necessary to carry out all evacuation plans in orderly manner.

D. *Shelter Areas*

1. Make plant survey as to a possible area that could be used for shelter in event of a severe storm warning.

2. If such area is available, instruct all employees as to where this area is located and the plans for using.

IV. *Public Relations*

A. Plant manager or his designate shall have the responsibility of immediate communications with the corporate offices:

1. Division vice president.

2. Director public relations.

3. Director accident prevention services.

4. Manager insurance and pensions.

B. Notify families of employees on duty.

C. Notify those employees that are scheduled to come on duty.

D. Meet the press or news media giving them information pertaining to the situation as directed by our Corporate Public Relations Director.

SAFETY IN THE SMALL PLASTICS PLANT

By R. D. DOMBACH
Assistant Plant Manager, Lancaster Closure, Armstrong Cork Co., Lancaster, Pa.

A really effective production team knows the value of organization. No objective can be obtained, whether it be for production, training, selling, or accident prevention without good management organization. I am convinced that an organized effort must be maintained for the prevention of industrial injuries. And, beyond our primary objective of safety for our personnel, accident prevention is sound economics. Lost man hours, compensation for injured employees, replacement of skilled help, and higher insurance rates mean dollars.

By comparison, the cost of equipping machinery with suitable safety devices, educating personnel to follow common sense safety habits, and instituting strict regulations for good housekeeping is sound business. Our facilities are located in an old plant. Some of the buildings are 100 years old. They are laid out in such a way that they do not lend themselves to straight line production operations, as would be the case with new plant construction today. Some of the buildings date back to 1865, with most of them having been built in the early 1900's when Armstrong's major product was cork stoppers.

In our plant, we have an organized effort for the prevention of industrial injuries. Safety of hourly employees is the responsibility of line or production supervisors. Each foreman is liable for safety in his own department. We rely on our foremen to continually police their areas and to search out any hazards that might develop as a result of the many changes taking place in their operation.

Another important element in this program is our safety administrator. Almost any time of day at the Closure Plant you might see him cruising the factory area, poking into corners, giving suspicious-looking cans what he calls the "sniff test" to determine if they contain flammable fluids. Any hazard encountered on this patrol is pursued until corrected. This surveillance work is carried forward at night by supervisors and others who have become highly safety-conscious through the years.

As a part of our safety program, regularly scheduled meetings are conducted each week with small groups of production people. The safety administrator plans the content of these meetings and sees to it that they come off smoothly. Always on hand for these weekly gatherings are either our plant manager or me. Here we tell our employees, face to face, that we are concerned for their safety, that management does everything in its power to provide safe working conditions, and that they are to notify us personally if they detect any risky conditions.

We point out that safety is a two-way street. It is also part of their job to work safely. They were hired by the company with the understanding that they would work safely, and they should want to for their own sake. The plant manager tells them that the most important thing about their job is to keep their mind on it. Before the meeting breaks up, a safety film is shown on an appropriate subject. The safety administrator will then ask the employees to be frank about any comments, suggestions, or complaints they have about working conditions. Our next job is to follow up on any tips with an on site inspection and to talk to the supervisor of any employee who has made a comment or suggestion, to assure that the supervisor is aware of the hazardous condition in his area. If the employee has described the situation accurately, results are forthcoming immediately without extensive delays. Should any injury occur in spite of these precautions, the employee is instructed to report it immediately. First aid is available at the plant dispensary from a registered nurse, and a doctor is in attendance each day.

As you might suspect from our product line, we are a job shop. We are continually making setup changes which require the

movement of heavy injection frames, compression tools, or container molds to and from the molding machine area. In addition, most of our molding equipment is mechanized, so we must move considerable raw material to the molding machines, and nearly the same weight away from the molding machines, as finished goods. With this high level of material handling activity in the production areas, housekeeping is of major importance.

Good housekeeping logically accomplishes three important ends—high morale and increased productivity, with an improved safety record.

The tooling for any one of our product lines is very heavy and bulky. So as not to congest the production area with this heavy equipment, we have provided tool room storage areas remote from the production area. Racks are provided to facilitate orderly storage, and provision is made in the same area to accomplish tool maintenance. Many hoists and lifts are provided in production areas and in the tool maintenance and storage areas. Our employees use them to minimize back injuries. We have a considerable capital investment in our tooling, so by providing a storage area remote from the production operation, we can more easily protect this valuable tooling equipment from accidental damage.

Moving the raw material to the molding machine presents many safety hazards. Most of the plastic raw materials are shipped in 50 pound paper bags, stacked on a wood pallet. These bags are subject to damage from the time they are placed in the warehouse until they are finally fed into the hoppers. When a bag is torn, we can have a stream of plastic pellets leading from the point of damage to the final destination. Any plastic pellet on the floor is a serious hazard; they behave like small ball bearings. A partial answer to this problem is the use of corrugated containers for 1,000 pound lots of material. But here again, should this container be damaged in storage by a fork lift truck, a stream of plastic pellets can become a tripping or falling trap. Bags stacked on pallets are still in use in the plastic container and compression molding departments and for certain low-volume items in injection.

We have installed a bulk handling system which conveys the plastic material from the rail car to the production area in our injection molding operation. This has proven very successful and has improved our housekeeping tremendously. Not only does the bulk handling system remove the potential hazard of loose plastic pellets on the floor, but the system makes it no longer necessary for our employees to physically lift the 50 pound bag from near the floor and place the bagged material overhead into the machine hopper. Lastly, we are realizing a substantial cost saving in wasted raw material. To date, we have not been able to utilize a bulk handling system in our compression molding operation. However, we do have two very active engineering projects being studied in this area, and we are confident that in the next 12 to 24 months we will see a break-through.

Moving the finished product away from the production equipment as soon as possible is also very important to good housekeeping. In the Plastic Bottle Department, we convey the finished containers to a remote area for packing. In Injection Molding, we have installed a floor conveyor to carry the finished product in cartons to a weigh count station and then on to goods in process storage for subsequent operations. All of these items materially aid our housekeeping.

Machinery manufacturers have available, as standard equipment, certain fail-safe features and injury prevention devices. Although we may request, when ordering this equipment, that a given safety feature be modified to satisfy our particular needs, we always insist the safety device be included by the original equipment manufacturer. Our experience dictates that built-in features on any machine or equipment usually provide greater protection than safety devices which are added after the installation and use of the machine. Optional equipment is usually ordered with plastic processing machinery. This includes power take-off, mold wipers, and unscrewing mechanisms to ensure the greater safety protection for the operator. It is our responsibility, not that of the machinery manufacturer, to fully protect our operators and to be sure that machinery installed and operated in our plant is safe.

Briefly, I would like to touch on some of the more important mechanical safety features in our plastic operations. All of our injection and blow-molding presses are horizontal, and mold closing is a hazard. We use heavy duty tempered glass for safety gates both front and rear, interlocked into the con-

trol system through limit switches. When the gate is open, the electrical system is locked out, so the molds will not close by either the automatic or manual cycle. The only time the molds can close is when the gates are closed and the operator is protected.

The automatic relieving of extruder internal pressures in injection molding, which we call decompression, is normally considered an operational feature to minimize nozzle drill. While we do use it to good advantage in the automatic operation of the press, we have also found it can be used to good advantage as a safety device when bleeding a blocked injection nozzle. When a press is down for an extended period of time the plastic material freezes in the nozzle, and it is necessary that a heated probe (brass rod approximately 3/16 inches in diameter, eight inches long) be inserted into the nozzle to melt that material which is not in close proximity to the nozzle heaters. When the internal pressure is relieved by using the decompression feature, only vapors are ejected through the nozzle; however, if we did not use the decompression feature, hot plasticized material would be ejected along the probe with considerable force.

Unfortunately, we did experience an injury when one of our set-up men failed to use the decompression feature prior to inserting a probe to open a nozzle. He received severe burns of the left hand. Believe me it was an ugly looking hand. The general foreman of the Injection Molding Department used this situation to good advantage by scheduling a different set-up man to accompany the injured man to the dispensary every day to witness the dressing of the wound. There is no doubt that they all received the message. They now religiously use the decompression feature.

Electrical interlocks, such as limit and pressure switches, have to be designed in such a way that they cannot be stuck accidentally and that it is almost impossible that they be wedged or tied in the run position. Many times, two safety devices or two control elements are placed in series, so should one be accidentally stuck, the second continues to serve as protection. Mounting them on the machine so that one is depressed and the other released is another approach to prevent human or accidental failures.

Power systems which include electric, air, or hydraulic supply are designed to fail safe. Should the power source be interrupted, the control relays are de-energized and the equipment remains in a safe position. It cannot be put back into service until the operator manually puts the equipment through the start-up cycle. This, obviously, is very important and is another reason equipment manufacturers should be consulted by the users before making any modifications to their equipment, regardless of how insignificant or small you may think the revision to be.

Our disabling-injury frequency rate over the last four years was 3.07 disabling injuries per million man-hours worked. This compares favorably with the frequency rate of 4.14 for the entire rubber and plastics industry over the same period.

Another way of measuring safety performance is in direct injury cost per 10,000 man-hours. We calculate our direct injury cost by relating it to the number of man-hours worked. For my plant, over the last four years this cost averaged $50 per 10,000 man-hours. Over the same period, the total company costs were $162 per 10,000 man-hours. So we are doing a good job, but disabling injuries are still costing our plant $50 per 10,000 man-hours. Our aim is to reduce this cost to zero.

We at the Closure Plant know, as you know, that a good safety record cannot be attributed to safety glasses, safety shoes, heavy gloves, tidy work areas, or sophisticated equipment, although these things, of course, do contribute. Most injuries are caused by carelessness—and safety results directly from individuals who are careful. This is a matter of employee attitude, and in this respect the meetings and our obvious concern for safety are paying off.

KEEPING ABREAST OF THE CHANGING TIMES

By E. H. WORCESTER
Factory Manager, Uniroyal, Inc., Indianapolis, Ind.

(Mr. Worcester spoke without a prepared paper. The following is a summary of the major points covered in his presentation.)

What the manager of today's plant expects from the people that work for him.

There are changes in people themselves; they're looking for improved safer working conditions, increased benefits, etc. These changes are a result of cause and effect.

Communications play a big part in changes; finding out what's going on; good lesson with those in the know; and an established contact and rapport.

Today's factory manager has a big job, and it is literally impossible for him to know everything without a good team. His staff members must investigate changes of production, engineering, personnel, etc. A good safety man will keep his factory manager aware of the accident-prone employee. Contact through the controller can keep the factory manager aware of the hidden and known costs which result from accidents. The plant engineer can show a reduction of costs thru good engineering practices. Also, safe engineering practices can result in a cost reduction of the final product.

We in safety must do a selling job on the boss — the factory manager. Sell him on safety. If we can sell him, we will then have his backing all the way, which will make our safety program easier to sell to the rest of our employees. Safety must be instilled into the organization by a safety minded safety man. Safety is defined as hard work, everyday.

Inspection and training are two other means of selling safety. Personal inspections by the safety man will show he is interested in the employee. Follow-up of inspections must be made. Training is a must, even though it can be costly. Today, we are in a workers market. Today's worker must be fitted into the work force. Training with new equipment in a new job is a must.

How do we motivate the new employee in safety? Supervision must set up working habits, with safety included. We must show the employee we are concerned with his safety off the job as well as on the job. Organized plants with union safety committees should use the dedicated union employee to advantage in safety.

To summarize, we must keep abreast of change. The manager's responsibility is managing accident prevention by working with his people.

ATMOSPHERIC SAMPLING

By W. T. McCORMICK
Asst. Director, Medical Dept., Inland Steel Co., East Chicago, Ill.

Through the ages, man has had to depend upon his five senses for self preservation and to warn him of the presence of a dangerous environment. These were sufficient if the contaminating substances were large enough in size so as to be readily visible to the naked eye; of a readily distinguishable color; or had an odor which was noticeable and repellant at levels significantly below the danger point.

With the advent of the industrial revolution and the concomitant release of many unusual contaminants into the work room air, man learned to his sorrow that even the five senses are not infallible as warning devices. Some of the exposures brought about a rapid fatigue of the nervous system involved. The olfactory nerve, for example, rapidly loses its ability to detect even high concentrations of hydrogen sulfide.

Many by-products of man's industrial environment, and even his activities during

leisure hours, result in exposures which cannot be recognized by the unaided senses or are not considered by him to constitute a hazard. He breathes carbon monoxide from the cigarette he smokes, from the exhaust of the car he drives and, in smaller amounts, from the cooking of his food as well as in the products of combustion in industry. Carbon monoxide, of course, is colorless, odorless, and tasteless.

Other materials, even though they may have a distinctive odor, can wreak damage upon the human organism at levels below their threshold of odor. Carbon tetrachloride has a discernable odor at about 75 parts per million; yet, a safe concentration of the vapors of this solvent for daily exposure has been pegged at 10 parts per million by the American Conference of Governmental Industrial Hygienists.

Since environmental contaminants can be hazardous in sizes and concentrations which may be far below the abilities of the senses to detect, the investigator is left with two courses only to pursue in the identification and measurement of abnormal conditions in the work place. In effect, he may take the environment to the laboratory, or take the laboratory to the job site or, in some cases, he may elect to do both.

Certain things which find their way into the worker's environment must be collected at the job site and then returned to the laboratory for analysis and measurement. The collection phase may be accomplished by electrostatic precipitation, by filter media, through impingement or trapping in a liquid, or by drawing a sample of the atmosphere into an impervious container. Once collected, the contaminants or the suspect atmosphere must then be studied chemically or physically, usually through involved and complicated procedures for identification and measurement. These are, of course, time-consuming procedures which frequently require highly sophisticated equipment.

There are, however, certain advantages which may be of great importance. The sample, since it is collected over a longer period of time, more or less accurately represents the average exposure of the worker. The accuracy of the results is limited only by the ability, training, and precision of the laboratory worker. The components of the sample are capable of full and complete identification.

While these methods are usually most desirable, certainly many of the smaller companies cannot employ the highly trained personnel who would be required, nor can they justify the cost of a laboratory and its necessary equipment. They must, therefore, seek assistance from the state, their insurance carrier, or independent consulting laboratories for appraisal and measurement. These greatly increase the waiting time between consideration of a potential hazard and reporting of results.

A rapid approximation of the concentration of undesirable atmospheric contaminants is frequently desirable. Certain vapors, gases, and mists can be identified and measured through the use of commercially available direct reading istrumentation which is readily carried to the job site. While it is true that the accuracy of the results is not as good as can be obtained by laboratory procedures, this is counter balanced to some extent by the speed with which results are obtained and the possibility of frequent retesting. Thus, fluctuations in concentrations of gases and vapors can be noted and, for this reason, it is possible that greater safety for the worker will result.

A century ago, the need for portable instrumentation was recognized, and the first of what is now a multitude of instruments was developed. This was the flame safety lamp designed for the mining industry and which, in the hands of a skilled operator, could detect the presence of explosive gases or a marked reduction in the oxygen content of the air.

Advances in technology have produced instruments which are more desirable for measuring flammable gases and vapors. Utilizing the Wheatstone bridge and more intricate design, these units may be used to measure not only percentages of the lower explosive limit, but also total concentration. These units do not, however, give selective readings of percentages of ingredients in a mixture.

Oxygen concentrations both above and below the norm can be measured by commercially available equipment of two general types. One utilizes the Orsot principle, in which oxygen is absorbed by liquid and the rise of the column of liquid in a graduated tube indicates the concentration. Another common type makes use of a chemical cell and electrical circuitry to deliver readings.

Other gases and vapors can be measured and to some extent identified through the use of glass tubes filled with chemicals. These chemicals are compounded so as to change color upon exposure to certain gases, vapors, or mists, and the concentration is determined either by the intensity of the color change or by the length of the color change within the tube.

These sampling units require that flow rate and total air sampled be rigidly controlled, and this is accomplished by means of pumps or aspirator bulbs. These tubes and their sampling accouterments are manufactured by several companies, but since accuracy depends upon a specific volume of air delivered through an orifice of controlled diameter, the interchanging of tubes of different manufacturers is usually not desirable.

It is not within the province of this paper to recommend the product of any manufacturer. Each potential user must make his own selection of the unit or units he would consider to be most desirable for his own operations. Criteria, which could reasonably be expected to influence such a decision would include accuracy or reproducibility of results, ease of maintenance of aspirators or pumps, ready availability of tubes and other equipment, and the variety of tubes available.

As with all equipment, there are advantages and disadvantages inherent in the design of these units. Each user must carefully balance these to determine whether such equipment fulfills his needs. A major advantage of these readily portable tools is that they are designed to be used by persons who have not had extensive training in chemical analysis. Air borne compounds will react only with the chemical constituents of certain tubes, thereby permitting not only their identification but an immediate measurement of their concentration. Because of the possibility of remote testing, the tester himself need not be placed in a hazardous position. With refinement of manufacturing techniques, the shelf life of the tubes has been markedly increased.

The disadvantages of this method of testing must also be considered. Among these would be the temperature range, which limits the accuracy of results. With some, the lowest desirable testing temperature is 50°F. With others, it may be as low as 0°F. Most are limited to ambient temperatures below a maximum of 100°F. The pump must be inspected frequently for flow rate characteristics and maintenance procedures must be followed regularly, since any variation adversely affects the results because of the small volume of the sample. The chemicals within the tubes may pack slightly in shipment or in storage, and in testing the air flow may channel rather than diffusing uniformly around each grain of the filler, hence altering the results. Also, occasionally it is important to measure the total amount of a contaminant present, and this is possible only up to the maximum capacity of any specific tube.

And so today, man's five senses have been augmented by the use of an untold number of devices and methods to study his environment. Certainly, the people who witnessed the introduction of the flame safety lamp in mining could not conceive of the diversity of equipment available and used today. We can only guess what new instruments and materials may be ushered in tomorrow?

SAFETY EDUCATION FOR THE SUPERVISOR

By O. E. GROSSMANN
Safety Specialist, Uniroyal Inc., Joliet Army Ammunition Plant, Joliet, Ill.

Repetition was the method used when we went to grade school. By constantly being told and shown how to conquer the mysteries of Mathematics, English, etc., we learned. The more we learned, the easier it became and, eventually, it was fun going to school. We weren't afraid of the subjects anymore, because we knew what to do — we understood. How many times we went thru the front door of the school with a big hollowness in the pit of our stomach because we didn't know our lesson? We were afraid — we didn't understand.

When the production, technical, and even administrative workers at our plants don't know — don't understand their job thoroughly — they fumble, they flounder, and they eventually get hurt or hurt others, or get killed or kill others.

Proper orientation must be given to all incoming people telling them the basics. What they can and can't do, when and where things can safely be done and, most of all, why they can't do certain things. Then make sure they understand — let them ask questions. During their job training period the same whats and what nots and wheres and whens must be explained and again we must make sure we tell them why.

All instructions should be safety centered and people must be told the seriousness of the powders and chemicals they work with and what can happen if they are mishandled and if SOP's are not followed. They must be told what to do if things go wrong.

Before supervision can do this, they must be properly educated. It is the responsibility of the safety department to prepare and assist in procuring materials for the presentation of the plant safety program to the supervisor. The supervisor then can dynamically sell his program to his people.

It's not always easy to get the safety message across to some people. "What's in it for me?" is the question we get sometimes; usually from an employee who hasn't personally experienced pain himself, or has not had some member of his family seriously injured. With these it's mostly a case of poor attitude which can be changed thru education.

Safety Responsibilities

We all hate to see people get hurt. Sympathy for the worker and for his family is one of the most important reasons for a good accident prevention program.

After feeling sorry for the man and his family, then we start getting angry. We begin thinking of names like careless, accident prone, and even stupid, because we recognize that 95 per cent of our accidents are a result of the unsafe act on the part of the employee. We will also feel a little angry at ourselves because we did not take steps to prevent the accident. The first reaction of some supervisors will be "I've got to get out production! I can't think of everything, and I can't be everywhere all the time!" In essence, the supervisor wants to prevent accidents, but he feels he does not have the time to do so.

Accidents, whether there is personal injury or not, destroy efficiency, but more important they are an indication that something is wrong! Lack of control over men, materials, and processes spells inefficient operations. We all like to operate on a schedule; this is necessary for efficiency. An accident is never scheduled, and generally happens at the most inconvenient time. When these occur, you will find that many people who never worried about safety before will do a lot of worrying about an accident or the consequences. A series of little accidents can keep a department in a state of inefficiency and uncertainty.

A high injury rate has a depressing effect on employees' morale. Unsafe plant conditions which contribute to accidents lead to dissatisfaction and poor job performance. A bad accident makes everybody jumpy and resentful. Repeated accidents make employees feel that the company doesn't care or that the foreman is not on top of his job and that things are out of control. On the other hand, real pride and enthusiasm for the job exists in companies that have outstanding safety records. Preventing acci-

dents pays off in good employee morale and in good public relations. A company can establish a good reputation in the community with a good safety record, and they can certainly establish a bad reputation with a bad safety record.

One thing a foreman or Supervisor cannot afford to do is to let someone else take over safety instruction and safety supervision in his department. If he does, he will weaken his own position as a production man and as a leader.

Attitudes

The supervisor's attitude is a most important factor toward safety. His attitude toward the safety of his employees has a direct effect on the frequency and experience rate of accidents within the department.

Webster tells us that attitude is: "A bodily posture showing or meant to show a mental state, emotion, or mood. It is also a manner of acting, feeling, or thinking that shows one's disposition or opinion."

Workers will pick up many of their supervisor's habits. This is fine if all of your work habits are good ones. Unfortunately, however, your men are going to pick up your bad habits too, if you have any.

If you give them the impression that you are not concerned with the production schedules, why should they be concerned? If you don't show any concern about the department and plant housekeeping, why should they be concerned? And, if you don't show sincere interest and concern in the safety rules and regulations of the plant and in their personal safety, is there any reason to believe that their attitude is going to be any different than yours?

What will their attitude be? Whatever you do or say, or how you act must be all right because you are the boss. Or, if they have enough sense to see through you, they'll wonder how you ever got to be the boss and will lose their respect for you. It's pretty hard to lead if you've got a bunch of men who don't have enough confidence in you to really want to follow.

Talk to your people daily as you walk through your areas. It doesn't have to be a lengthy visit. A brief "good morning, how's the family?" will do, and as you're speaking you have an excellent opportunity to check the person over to see if the proper protective clothing and equipment is being worn. Let the person who isn't wearing his safety glasses know that you are concerned about his eyes, and let the person who isn't wearing safety shoes know that you are concerned about his feet.

The concern must come from you. You must show each person under you that you are personally concerned about his or her safety, and not because "Those guys in the front office that wrote the rules said this is what we gotta do. I don't agree 100 per cent, but they're the boss." This is one way to get the people on your side, maybe but it's a real good way of convincing the people that you're not really their boss, but merely a messenger for the boss.

Remember, to the people under your supervision there is only one boss, you. As hazards develop or are found by you or one of your workers, take the necessary steps to get them corrected immediately. Hazards are easy to find after someone gets injured. Very easy to locate in most cases—just look for the red marker. When a hazard is found and corrected *before* someone has gotten injured, your accident frequency goes down, your production record goes up, because your people are all on the job.

Last, but certainly not least, the morale of your department will go up because through your efforts as a sincere supervisor you will have obtained the cooperation of your people to work safely themselves and to help each other work safely, thus eliminating much pain and suffering.

Nothing will wreck a safety program faster than a supervisor giving lip service—failing to wear protective clothing or performing an unsafe act because it is expedient. The supervisor must set the example. The supervisor must be totally familiar with every job under his jurisdiction and must know every possible hazard connected with each job. If he knows everything about the job except the hazards, people will get hurt and production will suffer.

Safety results from organization policy. It is expected and required just as production is required. You let workers know by work and by attitude that safe workmanship is required. We have established that we cannot force safety on people with a "get tough" approach. The first violation of safety

rules may not cause a worker to get hurt, but sooner or later, if he's permitted to continue violating safe practices, he will be hurt. If a supervisor observes an unsafe act but takes *no* action, the worker and others may assume that the supervisor approves, and it becomes an accepted practice.

Personal contact with an employee is important, or individual contact by talking informally with the employee in the course of his everyday job will integrate safety with the production process.

Accident Facts

What is an accident? What does the word mean? An accident is a happening that is not expected, foreseen, or intended, an unfortunate occurrence or mishap usually resulting in physical injury!

Knowing where, how, and why accidents occur is fundamental to an understanding of accident problems and their solution. Accidents don't just happen, they are caused. With very few exceptions, there are understandable reasons for all of them. When you determine the circumstances and causes of an accident, measures can be taken in most cases to prevent similar accidents from happening.

Each type of tool, machine, and material used in a department is a potential source of accident under certain circumstances. However, some of these accident sources figure in many more injuries than do others. To achieve a good safety record, sources of frequent injuries must be known and must be given special attention. Knowledge of the sources tells the supervisor where to direct his efforts to prevent bad accidents. A mechanic who understands how the parts of a machine work has the basic information for locating trouble and correcting it. Similarly, the supervisor who knows the elements of an accident and how they enter into the occurrence of an injury, has a guide for securing the right facts upon which to base his corrective action.

The Elements of an Accident

There is nothing complex or mysterious about the basic nature of an accident. It can be taken apart like a machine to find out what is wrong. An accident has five basic elements or parts. If each element is checked thoroughly, you have the essential information for preventing similar accidents:

1. The tool, machine, or material involved in the accident, such as a ladder, hammer, piece of pipe, taping machine, etc. You must know the part of the machine, tool, or other equipment involved in order to know exactly where to take corrective action.

2. The manner in which the employee was injured, or the "type" of accident. Examples of this are falls, struck by (a falling or flying object), getting caught in or between (the moving parts of a machine), burns, (acid, hot steam, etc.).

3. The unsafe conditions of the tool, material, or machine, such as a broken hammer handle, bad brakes on a vehicle, improper or insufficient guarding, etc.

4. The unsafe act or unsafe practice of the employee, such as working near the moving parts of a machine without first stopping it, lifting with the back muscles instead of the leg muscles, failure to wear protective equipment (safety glasses, acid goggles, helmet, acid suit, safety shoes, etc.)

5. The reason for the employee's unsafe action or practice, disregarding instructions or, possibly, a physical handicap.

Instructing for Safety

Lack of knowledge or skill is one of the most frequent personal causes of accidents. The man may never have learned to do the job the right way. He may have learned to do the job, but not well enough to establish safe work habits in doing it, or he may have learned to do the job under normal conditions but has never fully realized the danger of unsafe acts under unusual conditions.

Instruction is the supervisor's first job. He must be able to do it well, for whatever he accomplishes is done by the people who work according to his instructions. The new employee needs to be told about the company and department safety policies. Often, a safety department representative or a member of the personnel department talks to new employees about safety. The supervisor should know what the new employee has been told and should be prepared to give detailed safety instructions as applied to the job.

Every worker starting on a new job should be instructed how to do that job, even if he has done similar work before. Our safety requirements may be slightly different than he has been used to. Good instructions help

safety, even though the instruction is not specifically on safe practices. Good instruction promotes better workmanship, satisfaction, cooperation, and safe work habits. Sometimes other skilled workers make good instructors, but it remains the supervisor's responsibility.

Teaching ability is not necessarily a gift, but an acquired skill that can be learned. Instruction, like any other skill, must be learned by practice.

Some of the basic steps in proper job instruction are:

1. Preparation
2. Presentation
3. Application
4. Testing
5. Follow-up

Wherever jobs are being done, there is need for instruction. The foreman can check the results by observing performance of those he instructs. If the worker hasn't learned, the instructor hasn't taught. When planning to teach a job one must be able to do the job, but not all experts are able to teach adequately. A skilled worker does not think about every little part of a job and how it is to be done.

A most valuable source of information for use in job safety instruction will be obtained when you conduct your job hazard analysis. Check each operation in your department, area, or building very carefully for any existing hazards or potential hazards. Knowledge of what can possibly go wrong is most important and is the first step towards total safety.

Decide carefully on the proper corrective action necessary to prevent an accident from happening due to the hazard—use good, sound judgment, and make sure that what you recommend does not create another hazard. Then make sure it gets done.

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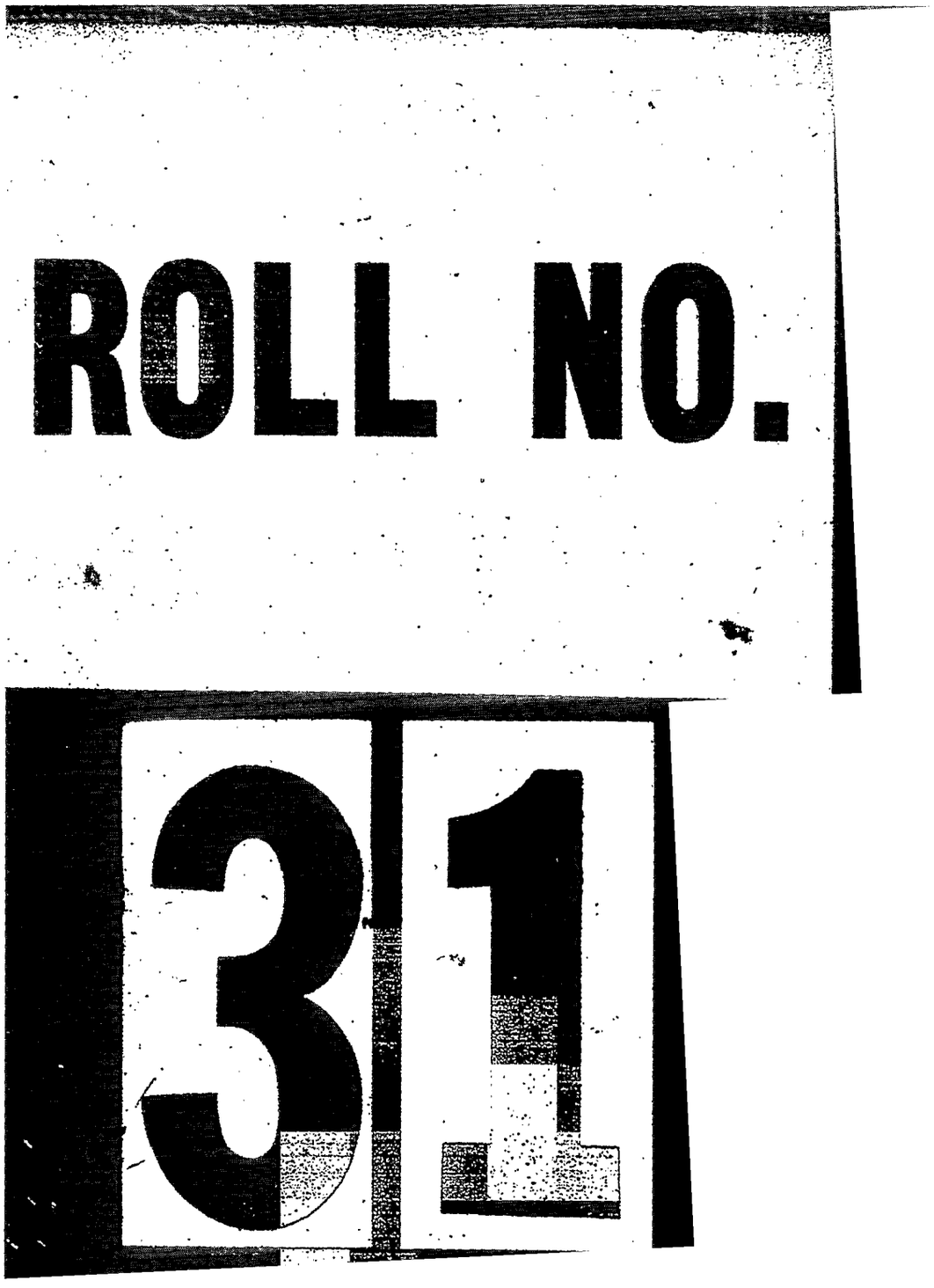
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ing reduced the accident potential for the brakeman, machine safeguarding has reduced the accident potential for the operator. Point-of-operation guarding, power transmission guarding, electrical hazard guarding, have all been covered in great detail by numerous authors and most engineering handbooks, and reputable manufacturers have designed their equipment to eliminate accident potentials in this category.

Growth of consumer acceptance of prepared foods has resulted in increased sales and production. This, in turn, has given the requisite economic justification of equipment with greater capacity and higher machine speeds. More continuous operations have been designed, and automation has removed the operator from the point-of-operation to the instrument console. All of these have reduced the number of operators, reduced the accident potential, and the end result is fewer accidents. All of this sounds like good news to the safety supervisor; but is it? Have we not introduced a new hazard with the equipment of greater capacity, higher operating speeds, more continuous operations and, finally, automation? My concern is that we have overlooked, in the design of machines, safeguarding of our cleaning and maintenance personnel.

Safer Machine Design for Cleaning Personnel

One of our senior engineers is the supposed author of several engineering laws in Campbell Soup Company. Melhorn's first law states, "If it doesn't move, paint it;" the second law is, "It doesn't have to work as long as you can clean it;" and the third law is, "If it can happen, it will happen, and at the most inopportune time." Those of us who work in the food industry are quite aware of the stringent requirements placed on the process design engineer for adequacy in design for cleaning equipment and processes; therefore, the emphasis on safety of cleaning personnel and maintenance craftsmen.

The degree of automation in existence in the food industry today requires a considerable amount of equipment interlocking so that downstream equipment is functioning prior to the start-up of upstream equipment. This requires remote and automatic starting of unattended equipment; this is reflected in rather complicated electrical control drawings.

Instrumentation in the early food industry consisted of the clock, the thermometer, and the pressure gauge. While these instruments have not been superseded, they have been supplemented by more sophisticated control equipment. The process computer has, in some instances, supplemented the clock; the temperature transmitter and recorder-controller, have supplemented the thermometer; the pressure transmitter and recorder-controller have supplemented the pressure gauge. This more sophisticated instrumentation has given the designer a great deal more latitude for automation in the food industry. For example, agitators can be stopped and started, depending on the liquid level in the tank, thereby improving product quality. This same type of control, however, constitutes an accident potential. To reduce this potential, all tanks containing agitators must have the manhole cover interlocked with the agitator driver motor so as to prevent the remote starting of this equipment while any employee is in the tank.

Now, what has all this to do with machine design for safeguarding our cleaning personnel? Like many design engineers in the food industry, I have had my experience as "chief cook and bottle washer" on experimental processes. In this capacity it has been necessary to train not only the operating personnel but the cleaning personnel as well. I have worked with our cleaning personnel, used a cleaning hose, disassembled equipment for cleaning, and reassembled it for start-up. Our cleaning operations take place on the third shift. The working hours are not attractive; supervision is spread thin; and the educational level of these cleaners is not high. They are not unintelligent, and oftentimes make excellent operators because of their intimate knowledge of the equipment and process gained while cleaning. The safety of these people needs to be considered when an engineer designs equipment.

The engineer should actually take apart the equipment he has designed, and clean it. I believe—as numerous cuts on my fingers would attest—that the sharp edges with which he would come in contact would lead him to question their desirability. I believe he would also find that, if a guard must be removed for cleaning the equipment, he would feel much more secure if that guard