1951

GENERAL SESSIONS

1951 National Safety Congress

(Index to Transactions of all Sessions)

Volume 1
Transactions
39th National Safety Congress

NATIONAL SAFETY COUNCIL
425 No. Michigan Avenue • Chicago 11, Ill.

New Ideas...

If safety is to keep pace with today's rapidly advancing technology, we must continually have "new ideas."

Each year, at the National Safety Congress, the ideas and experiences of many of the nation's top safety men are presented in the various sessions. Many of these ideas, devices and methods, first presented at a Congress session, later become generally accepted within their fields.

In order to present this information conveniently and at small cost, the Congress Transactions are published in volumes, one for each Section or Division, along with a General Sessions and Detailed Index to all volumes. The 34 volumes of the 1951 Congress Transactions are listed on the last page of this volume.

Safety directors everywhere have found the Congress Transactions a useful aid in their accident prevention programs. In industry, for example, their judicious distribution to key personnel in management and supervision has proved to be of invaluable service.

In preparing these Transactions, the proceedings of the Congress have been condensed and edited for reference purposes. Complete original manuscripts, with any charts or illustrations which were used, are available in National Safety Council files. Views expressed at the Congress or in this record are those of the Congress participants and are not necessarily those of the National Safety Council.

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Annual Council Meeting

Minutes

The 1951 Annual Council Meeting of the National Safety Council was held in the Grand Ballroom of the Stevens Hotel, on October 8, with Mr. Ned H. Dearborn, President, presiding.

Following the singing of the National Anthem, the invocation was offered by the Reverend Kenneth N. Hildebrand, Minister of the Central Church of Chicago.

After appropriate opening remarks, President Dearborn turned over the chairmanship of the meeting to Mr. Charles R. Cox, President of the Kennecott Copper Corporation, and Chairman of the Board of Directors of the National Safety Council.

After a brief but sincere expression of his fundamental interest in the Council and the safety movement, Mr. Cox 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 role; also to dispense with the reading of the minutes of the previous Annual Meeting, the minutes having been printed and circulated to the membership.

Mr. Cox called for the report of the Nominating Committee, which consisted of the following members: George A. Jacoby, Chairman; Lawrence E. Dickson; Walter G. Legge; Miss Marion E. Martin; Guy L. Noble; Robert T. Ross; and W. A. Stewart.

Mr. Jacoby reported in behalf of the Nominating Committee, pointing out that the Constitution authorizes the committee to name candidates for election to the Trustees, to the Board of Directors, and to all Offices except the office of Executive Vice-President. The selections of the committee, Mr. Jacoby stated, were reported to the Secretary of the Council more than 75 days before this meeting, and were announced to all members of the Council on August 24, 1951.

Mr. Jacoby then presented as nominees for Trustees of the Council, to be elected for a three-year term: Melvin H. Baker, Cason J. Callaway, Cleo F. Craig, Frederick C. Crawford, Richard R. Deupree, Gustav Metzman, Benjamin O'Shea, Thomas L. Parkinson, Dr. John F. Thompson, C. E. Wilson, and Charles Deere Wiman. (Secretary's Note: A complete list of the Trustees, including those nominated and elected at this meeting, as well as those continuing in office from previous elections, is given on pages 6 and 7 of this volume.)

Mr. Jacoby presented nominations for Directors, to be elected for a term of one-year. (Secretary's Note: A list of the new Board of Directors, as nominated and elected at this meeting, will be found on pages 8, 9 and 10 of this volume.)

Mr. Jacoby presented nominations for Officers of the Council. In doing so, he stressed the Council's appreciation to four men who are retiring from their offices this year, namely, Dr. D. B. Armstrong, Vice-President for Homes; Kenneth B. Colman, Vice-President for Local Safety Organizations; E. W. Kempton, Vice-President for Membership; and Dr. John W. Studebaker, Vice-President for Schools and Colleges. (Secretary's Note: A list of the Officers nominated and elected at this meeting will be found on page 5 of this volume.)

There were no nominations except those presented by Mr. Jacoby, and Mr. Cox announced that the entire proxy vote, numbering 10,781, was cast in favor of the nominees proposed by the Nominating Committee. Those attending the meeting also voted without dissent in favor of the nominations presented.

Mr. Cox referred to the booklet "The Fight for Life," which had been distributed to those attending the meeting. The booklet contained a summary of Council activities during the past year. Announcement was also made that the 1952 National Safety Congress would be held in Chicago October 20-24.

The remainder of the program consisted of an address entitled "Sportsmanship in Safety" by Helen Hull Jacobs, Lieutenant Commander, United States Navy, Washington, D. C.; an address by Millard Caldwell, Administrator, Federal Civil Defense Administration, Washington, D. C.; and an address by President Ned H. Dearborn, entitled "Six Steps Ahead."

These addresses are included as a part of these Transactions, immediately following.

R. L. Forney
Secretary

Sportsmanship in Safety

By HELEN HULL JACOBS
Lieutenant Commander, United States Navy, Washington, D. C.

It has seemed to me, for a long time, that the work the National Safety Council has been doing is such an important job that it ought to have the whole-hearted support of every citizen in this country, particularly those who get behind the wheel of an automobile.

I hesitate to confess when I first learned to drive a car, I might start an investigation! However, I'll take a chance. I was thirteen, and I hasten to add that I had a responsible person at my side. I've always liked cars, and I've always liked driving them. My favorite treat, when I was a little girl, was sitting on my uncle's lap, steering the first Stanley Steamer delivered in Arizona, where I was born. Of course, it was a very old car by then!

I've driven many thousands of miles since then. I've coped with the hazards of English country roads, the sudden turns obscured by hedgerows; and in Egypt, with the small boys rushing out in the path of the car to sell tangerines, frightening me out of a year's growth as they skidded to a stop within a hair's breadth of the front tires.

But these hazards were understandable. Cars don't travel the country roads in England, nor the road from Port Said to Cairo in anything like the numbers that cars travel the same sort of roads in this country.

There are more automobiles in the United States, per capita, than in any other country in the world. This would make it seem that the drivers of these cars know that it is smart to be careful, smart to be a good driver, sportsmanlike to obey the rules and courtesy of the road.

We Americans have always prided ourselves on our sportsmanship, which is after all, just good manners and consideration for the other fellow. In the game that I played for more than twenty years, I almost invariably found sportsmanship at its highest quality among the competitors of all nations. It is a game, as all of them are, that breeds sportsmanship among the right people, and most of them are right.

I particularly remember one example of this. In 1937, at Wimbledon, England, Gottfried Von Cramm and Henner Henkel, representing Germany in the Inter-Zone Davis Cup Final, and Donald Budge and Gene Mako, representing the United States, were playing one of the most exciting tennis matches I have ever seen. In the fifth set of this deciding doubles match, when it seemed as if the Germans were bound to win, and at a point which could have clinched the match for them, Don Budge tried a daring placement to pass Von Cramm at the net.

All of us, watching the match, saw Von Cramm make a perfect, winning volley for match point against the American team. But as the umpire started to call the score, Von Cramm held up his hand and said that his racket had touched the net as he made his volley. That is a fault in tennis. The point went to the American team. After Don Budge had asked Von Cramm if he was *sure* that he had touched the net, they finally won the match and eventually defeated the British team in the final.

No one who was sitting with me saw Von Cramm touch the net. But only the player, in a case like that, knows that he has done it. The winning of the Davis Cup for his country was less important to this German champion than the fair rules of the game.

I remember another instance of fine sportsmanship on the tennis court. This time, it was sportsmanship in the interests of safety. In the quarter-final of the 1934 National Championship Singles I was playing a California opponent and friend, Josephine Cruickshank. She had been a member of the Wightman Cup team that I had captained earlier that summer in England. I was making every effort to win the championship for the third time, and I knew that I faced a formidable opponent on my hopeful way to the final round.

It had rained most of the morning, and the court was very slippery that afternoon. I had fallen several times during the first

set of our match in going for wide shots and drop shots, and because I found it so difficult to keep my footing, I requested permission to wear spikes. Most players don't like to wear them, and they particularly dislike playing some one who does, because spikes are apt to make divots and grooves on the court.

The request was referred by the umpire to the referee who came out on the court, walked over part of it, said he didn't think it was slippery enough to justify the use of spikes and refused permission.

I again appealed to the umpire. A serious fall could put me out of the tournament and I didn't want to play against the mental hazard of that possibility. But there was little he could do. The decision was up to the referee. I asked Jo what she thought of the court.

Although she was one of the players who didn't like spikes, she told me and the umpire that she thought the condition of the court did justify their use. That settled the matter. The referee agreed, I wore them, and, able to get set for my shots, pulled through the match and finally won my championship.

Two years later, when I was practicing outside the stadium on one of the courts where spikes are never permitted because, reasonably, if it's too slippery, players practicing are expected to stop rather than damage the courts, I really came a cropper, landed on my right thumb and dislocated it. The New York Time's eminent tennis writer, Allison Danzig, got the New York Giant's trainer to come to Forest Hills and put my thumb and most of my hand in an adhesive plaster cast. I was trying for my fifth consecutive National Singles championship and couldn't bear the thought of being unable to continue play.

After a day's grace, I got through to the final. Then, ably assisted by Alice Marble, I lost a long match and my title to one of the greatest players and best sports that ever lived.

Most of you have seen impressive examples of sportsmanship in various games. Doesn't it seem incredible that the same sort of people who will concede points not rightfully theirs on the sporting field, will frequently forget sportsmanship when they are driving a car? Normally, they are law-abiding citizens who would condemn a killer to death, but will take a chance on themselves being killers for the sake of getting to their destinations a few minutes sooner.

It is hardly necessary to point out the close alliance between the safety program and our national defense. When our government is calling upon every able-bodied person in the United States to take his place in whatever capacity he can best serve his country, it is sickening to read the toll of lives, the maimings that are the result of highway accidents, so many of which were undoubtedly avoidable.

Anyone is willing to agree that in winter time, in most parts of the country, driving conditions become so hazardous that accidents are often unavoidable. It is not these that we can hope to write off the books, for the best of precautions can fail, and a slippery road can be more than human skill in driving can cope with.

It is the accident that is the result of stupidity, carelessness or wanton bad sportsmanship; passing on hills and curves, trusting to luck rather than judgment, driving a car that is mechanically deficient. It is the accident that is the result of drivers who persist, in travelling the fine highways that lace this country, in going at a pace that forces the driver who is observing the speed laws onto the soft shoulder of a road, then into a ditch; of the drivers who proceed at maddeningly slow pace in the left lane that is meant for fast traffic and for passing, and who take the "get-by-me-if-you-can" attitude, and tempt the motorist who will. These are the accidents that should be written off the books!

I'll give you an example of what I consider one of the worst violations of sportsmanship and good manners that I have encountered in a long time on the road. Returning from Fredericksburg, Virginia to Washington on the Shirley Highway, a splendid four-lane road, I had the misfortune to get behind a driver who was going about twenty-five miles an hour (the speed limit is fifty-five). I passed him and got back in the right hand lane. He passed me at about sixty-five, then promptly reduced his speed to twenty-five. This little game of highway horseplay went on for miles until another irate motorist got in front of this driver and held him to twenty miles an hour. I hung back long enough to see what happened. More blowing of horn and shaking of fists you've never seen. That kind of driver ought to be hauled into court as a highway menace just as much as the speeder.

I also have almost homicidal reactions to the truck driver who races like mad, passing you down every hill, then, because of the weight of his truck, is forced to proceed about ten miles an hour up the next hill, holding you and all traffic behind you to his pace, tempting the impatient motorist to pass at any cost.

The unavoidable hazards of driving, these days, make the problems of the National Safety Council tough enough without the added problem of coping with drivers who think it's smart to be stupid and who regard sportsmanship on the road as a virtue to be practiced only when they spot the highway patrol officer in the rear-view mirror; or when they become scared enough, after passing the tangled evidence of a wreck, and ambulances being loaded with the victims, to observe the rules of the road.

I have the good fortune to be on duty at the Naval Gun Factory in Washington. This is the largest naval armament plant in the world, and you can be sure that there is a safety problem there, too, although of a different sort.

When I first reported for duty at the Gun Factory. I was immediately aware of the extreme seriousness with which an industry, if it is to progress, must approach the business of accident prevention. The Navy, as you have done, has left no stone unturned in order to reduce the unnecessary waste of man and material power by accidents.

It's efforts have been so successful that it is outstanding among Naval shore establishments, and has been five times, within as many years, commended by the Secretary of the Navy for its safety records, four times honored by you, the National Safety Council, one of these honors being the coveted "Award of Honor for Distinguished Service to Safety."

Because you are all so interested in industrial safety in relation to the conservation of manpower, particularly for defense, I would like to read to you the Secretary of the Navy's commendation to the Gun Factory:

1 August 1951

"From: Secretary of the Navy

To: Superintendent, U. S. Naval Gun Factory, Washington, D. C.

Subj: Secretary of the Navy Award for Achievement in Safety

"1. The Naval Gun Factory achieved a four per cent reduction in its lost-time accident frequency rate and a sixty-nine per cent reduction in severity rate for the year 1950 as compared with the rates of the previous year. This improvement over 1949's less than 5.0 frequency rate is commendable and merits the Secretary of the Navy award for Achievement in Safety.

"2. This excellent accident record indicates that personnel of the Gun Factory are giving their wholehearted support and earnest effort to carrying out the safety program. The fact that the Gun Factory has earned this award for five consecutive years is evidence of the effectiveness of your safety organization. These years of low accident experience have contributed immeasurably to the saving of lives, the conservation of the nation's resources, and increased production.

"3. The Secretary's Award in official recognition of, and praise for, the untiring effort and constant vigilance of all personnel in accomplishing the improvement of an already outstanding performance in accident prevention.

"4. I congratulate all hands of the Naval Gun Factory on this noteworthy accomplishment.

Dan A. Kimball"

None of these awards has been merited without the full cooperation of every employee of the plant and the diligent work of the safety engineer and his staff.

Such programs as 100 per cent eye protection for all the employees of the Gun Factory, with eye correction included in their protective goggles, a system for the reporting and analyzing of every accident, with follow-up procedures to assure correction of the undesirable conditions; a safety indoctrination period for each new employee; safety instructions for supervisors; the review of all production projects to insure that safety engineering principles are incorporated in each operation; a program of shop safety committees and the enforcement of safety rules—all these things have been

responsible for the Gun Factory's record in holding accidents to a minimum, thereby insuring maximum defense production.

I hope you will forgive me for bragging about my present duty station, but I have been so close to it, have so admired the sportsmanship of everyone concerned in keeping this tremendous defense plant at top efficiency to serve the needs of the hour and to be prepared to meet the possible emergency of the future that I thought you would like to share with me my pride in the Gun Factory.

I believe, having spent most of my life in the field of sports, that I can say this to you with all sincerity. No one has ever won a championship without years of hard practice, heart-breaking disappointments and such a profound determination to reach the goal he has set for himself, that there can be no obstacle too great to overcome. The same is true of a champion in the field you have chosen. Hard work, enthusiasm, determination and, above all, an indomitable will to win, will, in the long run make each one of you a champion to the men and women and their families to whose safety and well-being you have dedicated your services.

Address

By MILLARD CALDWELL
Administrator, Federal Civil Defense Administration, Washington, D. C.

I am delighted to be here with you this morning because your objective and ours are the same. I am reminded a little bit of when I was appointed Federal Defense Administrator. One distinguished public officer said he did not believe I could accomplish that job. Upon being asked why, he said, "Well, if he had sense enough to do that job, he would have had too much sense to accept it." I think he probably has something.

The difference between your organization and Federal Civil Defense is the difference between the retailer and the wholesaler. We are very interested in safety, whether it be on the road, in the home, in the schools or on the farm. The accidents that disturb you and disturb the rest of us and are most frustrating, are the accidents that come in ones, twos and threes. The accidents which worry the Federal Civil Defense Administration are the accidents which come in the hundreds of thousands.

There are many clear reasons why the National Safety Council should be concerned about civil defense. Federal Civil Defense in the cities and in the states, is safety. It is the same kind of safety that you are interested in, the protection of American men, women and children. Accidents that can happen, whether on the home or on the farm or in the city, arising out of traffic or other means are involved.

Safety is no accident as your slogan has so long made the public know. It doesn't just happen. It is something you have to work for. It is something you have to keep working for, and there again we have a similarity. In civil defense, we are not interested in a momentary burst of enthusiasm. We want the calm acceptance with the facts on the part of the people in this country that civil defense is now as much a part of your everyday life as the fire department and the police department, public school system or your churches. It is true until the Utopian dream of peace on earth is realized, civil defense is a part of your everyday living.

The thing that we probably have failed to recognize in the last few years since 1945 is that the character of warfare has changed for the first time in the history of the world. Up to 1945, the wars were won or lost by the armies and navies in the field. Beginning with the dropping of the first atom bomb, the wars of the future will be won and lost by the people at home, and those people who are best informed, best organized, best trained, are the people who will win the next war, while the people who are least informed, least well organized, least well-trained, are the ones who are going to lose the war.

You may just as well accept the fact now, instead of when it is too late, that it makes not one particle of difference how big your air force is, how great your navy may be or what your ground forces may be. The military cannot win the next major war unless it is supported by an informed public dedicated to the business of maintaining production and life in the cities, the congested areas, the industrial centers of this country.

I think you may be interested in knowing what the best-informed people in this country, the best informed as to our military necessities have said about civil defense. I won't go into any detail.

Even the most skeptical of you now know that Russia does possess the atom bomb. Most of you know that Russia has been for some time producing the atom bomb in increasing numbers, and it has enough to blast all the major cities in this country any time it wishes to do so, and that the dropping of one atom bomb on a congested city such as Chicago, will produce more accidents, more casualties in the one accident, than all of the accidents from all of the causes in this country in one year. It will be very difficult for one atom bomb dropped on one of the cities in this country to produce as few as 90,000 deaths. The Joint Chiefs of Staff, speaking through General Bradley on September 4, just a month ago, had this to say: "While the Joint Chiefs of Staff feel that civil defense itself is not a military, but rather a civil responsibility, the armed forces in the past supported and will continue to support the very important mission of civil

defense. If the worst should come, the entire military effort will be concentrated upon the primary mission of defeating the hostile armed forces. In the event of an attack upon the United States by enemy aircraft, our military forces will do everything in their power to shoot down the enemy planes."

The air force itself has said that under optimum conditions with the maximum of radar protection devices provided, installed and manned (which will take another two years), and after all the thousands of air spotters have been enlisted and trained and put in their places of observation, after we have acquired the maximum of aircraft production, and those aircraft have been put into operation, the most we can hope to do is to stop three out of ten attacking planes. Without going into detail there, I might add that probably none of those three out of the ten will have the atomic bombs in them.

Continuing with General Bradley's statement:

"However, it is the opinion of the air force that should an attack come, a large percentage of enemy aircraft would probably be able to penetrate our defenses. Therefore, a competent, federal defense agency must be able to function in order to return our workers and our factories to maximum production and restore communications in the shortest possible time."

What happens to the federal civil defense agency is not important. It is what happens to your state, your city, and your local civil defense agency that will make the difference between winning and losing because all operating responsibility rests at the state, the city and the local level.

Again continuing with General Bradley's statement:

"There exists then, a requirement for an organization planned and set up beforehand to take over in the event of an emergency of this nature. If civil defense does not function effectively our defense efforts will be very adversely affected."

That language, "If civil defense does not function effectively, our defense efforts will be very severely, adversely affected," was by the Joint Chiefs of Staff, and it has put the issue squarely up to us. General Bradley said, "An urgent and continuing necessity is civil defense." It is a point of view that has been emphasized and should be emphasized by Secretary Acheson who recently succeeded General Marshall as Secretary of Defense. He justified that civil defense "is a partner, a co-equal partner in national defense."

If another war breaks out, Russia knows that to win it must stop production. Second, it must demoralize the people in this country. And Russia knows that unless we have trained civil defense organization throughout this country that the bombing of the half dozen or a dozen or 25 major production centers will stop production and it will panic the public. And it knows, of course, that if the public is uninformed and untrained, that more people will die in the panic than will have been killed by the bomb. If the war starts, it will start with that sort of an attack.

Secretary Finletter, testifying before the Senate Preparedness Committee not long ago, said, "Possible enemies of this country, according to our best information, now have a substantial number of atomic weapons and also have the planes to carry these weapons in an attack on this country."

We know Russia does have the atomic bomb and we do know they have over 500 tremendously big and powerful and well-manned planes that can drop an A-bomb anywhere in the United States any time they want to.

But, continuing, "Whether or not such an attack will be made can only be guessed at. But, for the purpose of our planning, we must assume that it will be made and must make our plans accordingly. It seems to me we should ready our civil defense as we are readying our radar interceptor and aircraft defenses. Our policy as to civil defense, I believe, should follow that policy and this should be based on the sound, subject, namely, that an attack may come and that whatever the proper measures are to provide for the civil defense of the nation in the event of such an attack should be put into effect as soon as possible."

I don't know whether General Marshall or Secretary Lovett or Secretary Finletter or General Bradley are talking through their hats or not. It is the best source of information I know. They are great men, all of them. They are not given to crying wolf. They tell you that this country is in danger at this time and they tell you that civil defense is necessary, and I say to you that for myself, I am convinced that they are right, and the sooner we start moving, the more likely we are to avoid such accidents.

The President said not long ago, as long as there is a chance of any kind that atomic bombs may fall on our cities, we cannot gamble. We cannot be caught unprepared. This matter of civil defense is a sort of casualty policy that does more than to protect you from the effects of an accident. This is the only policy I know that will have a tendency to prevent the happening of the accident. You insure your automobile and you collect if you have the accident. You insure this country with civil defense and it may be that you collect extra dividends by preventing the accident.

I say that because as we stand now, we are uninformed, we are unorganized, we are untrained, and Russia knows this morning that it can blast this country and the morale of the people of this country with great benefit. Russia also knows that when we inform the 150 million American citizens of what can happen and what to do if it does happen, and when we organize some 15 to 17 million American citizens in the volunteer forces of civil defense and train them to take care of the immediate problems of the rescue, problems of the police and fire and all other phases of the work, that they cannot by any such attack either stop the industry or upset the morale of this nation. And therefore, the faster we can move in our information program in the enlistment of intelligence and brawn in the civil defense organization, in the training of those people to do their job and do it effectively, the more rapidly do we reach that point where Russia will stop and think twice before it attempts to destroy this country by an atomic attack.

Six Steps Ahead

By NED H. DEARBORN
President, National Safety Council, Chicago

It is time for plain talk. You and your fellow Americans have been warned over and over, time and again, against accidents. You have been politely advised what to do to prevent them. Hundreds of organizations have waged a persistent program of action to help you help yourselves.

Thousands of news stories, special feature articles, editorials, and cartoons have for several years told the stark tragedy of human waste and economic loss that come through needless accidents. Millions have heard the safety doctrine by way of radio, television, and motion pictures. All other media of public education are contributing generously of their space and time to your welfare.

The best that can be said is that the over-all accident *rate* has been reduced and that the results would be too horrible to contemplate if these widespread and continuing efforts had not been made. We still kill and maim young and old until any decent-minded and thoughtful person must be sickened and shocked beyond words. I'm sickened and shocked but not yet beyond words.

You have been advised that cooperation must be the basic method used in this important area of human, economic, and national welfare. Oh yes, I can truthfully compliment many of you on the gains made in cooperation during recent years. Gratifying as the gains are, we are capable of much greater gains. But this is not a report of progress. That kind of a report has been made so often by so many that it has currently the effect of a bromide. This is a report on the *gaps* in our program of cooperation. Those who believe in and strive for cooperation will not take offense at what I shall say. Those whose personal or institutional selfishness keeps them from cooperation may not *enjoy* this report. They may even resent it. Those unfortunate people are more concerned with their own narrow and selfish purposes, prides, and prejudices, than in saving human beings from death and injury. But really I care not a whit what they think. I'm tired of being polite to those within and without the Council family who impede cooperation and thus contribute to our ghastly and disgraceful national accident record.

So I will spell out in my simplest English the six steps in cooperation. And I shall draw heavily upon my own experience to point out the gaps in our program to date. The six steps are: (1) the establishment of the *machinery* for cooperation, (2) the start of the machinery, (3) proper use of the machinery, (4) belief in each other, (5) support for one another—financial and moral, and (6) constant hard work toward full cooperation.

Last year I tried to explain the nature of man as we in America see it. I gave you a thumbnail sketch of the history of thought which resulted in the American concept of the *individual man*. In so doing I actually stated the fundamental concept, the nature of man as held in the United States and in all free countries, on which safety is based. I shall omit in this oral presentation the basic reasons for cooperation. In the record the explanation of why cooperation is a "must" will be printed as a postscript.

And now on with my very unpleasant duty of being *mildly* unpleasant in the face of a *tragically* unpleasant situation.

Step One—The Machinery for Cooperation

In 1947 we voted to revise our Constitution and By-Laws enabling us to set up Conferences in the several fields of accident prevention. Choice of membership in a conference is your own prerogative. After the initial letters of invitation, your advice on Conference membership has always been honored, even though the invitations still bear my signature. Each Conference is composed of representatives from leading public and private agencies. Each Conference has it in its power to be *the* National Safety Council in its special field—to be a COUNCIL in the best and truest sense of the word. The Conference is the mechanism through which cooperation can be realized.

The first step was to obtain Conference members. We were elated by the response. Only two agencies declined among the scores invited. These two agencies were afraid they would lose their identity, their prerogatives. They were afraid that this octopus, the National Safety Council, would *swallow them*. The irony is *that Conference* membership is a chance to cooperate with sister agencies in safety to their mutual advantage.

The Conference system precludes the possibility that the National Safety Council staff may "run the show." Only the secretary of the Conference is a staff member, and if he does more than advise at times and tend to the chores, it can be charged to the Conference members. The Conference takes the National Safety Council out of competition and makes it only one of many cooperating agencies. Thus, the machinery is established and ready for the mutual benefit of all agencies.

Step Two—Starting the Machinery

After the Conference is established, a Conference meeting is scheduled. The day arrives, and so do most of the Conference members. It is a cause for wonder at times why some of them ever agreed to join the group. The net effect so far is discouraging. One gets the impression that some people, a *few, are quite skeptical* of the motives of the National Safety Council in calling them together. What are these dubious characters on the staff up to? Are they fencing us in? Or, to change the figure of speech, are they building a tent over all other agencies? Are they reaching out for more power? Are they trying to control safety in this free country of ours? More irony. Each Conference member is, with few exceptions, already a member of the National Safety Council. So these skeptics in reality are doubting themselves—unless they entertain the *paradoxical* notion that their own hired hands are either incompetent or untrustworthy. Then their attitude toward each other is also perplexing. It seems they not only are skeptical about the motives of the National Safety Council, but *suspicious* of each others' motives. This would be amusing were it not for the devastating results on the main job of the Conference—namely, to bring about cooperative action. Lack of trust and base *suspicions* are unworthy factors in this great cause.

The next Conference phenomenon is really something to watch. Each member reports what his agency is doing in accident prevention. With no intention, I'm sure, of being untruthful, the tale loses nothing in the telling. After one such meeting a member who had been silent said to me, "We might as well go home and quit worrying. These folks are doing everything that can be done! There just can't be anything more to do!" Sardonic humor and more irony. All that is being done is not enough. The aggregate effort may sound impressive when well told. But separate efforts without unity, without cooperation, are wasteful of time, money, and effort, and can even be downright harmful. We must rise above ourselves, if necessary, in this great humanitarian effort.

Step Three—Proper Use of the Machinery

We have appeared before each Conference and tried to explain our policy of cooperation and what cooperation in action programs actually means. We have said each organization's opportunity's and privileges are *threefold in character*. First, the Conference should determine the size and seriousness of its problem. Secondly, through further discussion, it should reach the best decisions possible as to the several practical solutions to its problem. And lastly, the Conference members should agree among themselves what should be done, and what agency or agencies can best do what.

We further stated that our staff would *no longer decide by itself what activities or* publications the staff would perform or produce. Each Conference would do that. We said that we hoped our staff members would present worthwhile, practical ideas, but that the Conference would decide whether our staff members conducted their own suggested programs or whether some other agency or agencies could conduct them more effectively, or even whether the suggested programs should be postponed or dropped. So far as the National Safety Council is concerned, there are only two limitations on this procedure: (1) Our available funds to do what each Conference decides the staff should do, and (2) our general policy entitled "Safety In Action," formulated and made official by our Board of Directors, on which each *Conference has three* members of its own choice.

This doctrine must have been really revolutionary. It's quite clear some Conference

members haven't believed what they heard or they haven't understood what is meant by cooperation.

It would seem simple enough that if our staff members cooperate with other members of the Conference that other members should cooperate with them. And equally important, should cooperate with each other. Has this happened? Not nearly to the extent desirable or possible. Has each member brought his projected plans or those of his organization to the discussion group, the Conference? Those who have are the exceptions and they have been so conspicuous as to be unique. Most of them have kept right on peddling their own papers on their own paper routes. More irony. No person has a corner on good ideas, and I've never heard a proposed program that couldn't be improved by free and understanding discussion. Besides, the agency would leave the Conference meeting with the blessing and good will of all the other agencies represented. Let's try more and more teamwork and win more and better ball games. We can if we will.

Step Four—Belief in Each Other

The next and urgent need is to strengthen our faith in each other. One of the basic tenets of democracy is that each of us has in him more good than bad. I believe that, implicity. Let's look for the good in our fellow Conference members. It's there to see, and if the good needs encouragement, let's not make believe it doesn't exist.

We could make a good start in Council action and nationally if we worked harder than we do at the following and similar things. In industry let's stir top management to an active interest in safety—in the factory or business and outside of it. There is clear cut evidence that this is necessary. When achieved it is effective. To cite a single example among many: this summer I presented a Distinguished Service to Safety Award to a certain railroad. Its improved accident record began about five years ago with the advent of a new president and a new board chairman. That was more than coincidence.

Let's encourage management and labor more than we do to work together in accident prevention. There is no moral justification for either side carrying over into safety the differences, the distrust, the fear that has been too often engendered by questions of collective bargaining methods, wages, hours, pensions, and other working conditions. In safety management and labor surely have common interests. The Council's policy on this matter is crystal clear, and I have heard no dissent to it. We ourselves in the Council ranks might provide a good example.

Let's sell safety to our schools and colleges. This is a field where we are extremely vulnerable. To most school people we are still an "outside" agency. They still consider us in the same category as commercial agencies. And so we are suspect. But a good school program across the nation would be the greatest single force in the safety movement. And a single school generation would prove it.

In traffic safety, let's do two things. First, let's quite molly-coddling the incompetent or disinterested public official. And (2) let's build public support groups in every village, city, county, and state in our land. They should be comprised of our most influential men and women. They will give support to conscientious and able public officers.

In this connection, let's quit being diplomatic with a certain section of the public. I refer to the crazy traffic fools who drive and walk on our streets and highways. This group, I'm convinced, is a minority. But it is a menace to all decent-minded and intelligently careful drivers and pedestrians. These "crazy fools" don't keep their cars in good condition. They disobey the signs, signals, and regulations of the road. They speed. They zoom from one traffic lane to another, and back again. They pass cars on curves and hills where it is impossible to see what is ahead. They take chances at rail-highway crossings. They drink and drive. They drive when they are tired or sleepy. They start late and hurry in desperation to reach their destination to save a few minutes for nothing. They are the chronic ticket fixers. They show off. They are smart-alecky. And they disregard the fundamental rules of courtesy. I say these people are "crazy traffic fools" and they should be made to feel the displeasure and disapproval of all the rest of us. But the rest of us must shed our cloak of apathy and show more civic courage than we do. We can, and one day we will.

Let's take a good look at ourselves. It's not very important who originated the slogan "Be careful—the life you save may be your own." Or is it? Here is a supplementary slogan for traffic safety: "Watch out for the crazy traffic fool—the life he takes may be your own!" You are welcome to claim it as yours, just so it helps to prevent accidents. It's not overly important who made the best speech, who wrote the best feature article, the best editorial, or the best news story, or who drew the best cartoon. Everybody's talent is what counts. There is enough talent in this audience to work wonders if only we willed it so. We can and we must.

And finally in this fourth step, the attention of the professional safety leaders is earnestly sought. We warn them that any group in any area of human activity faces a very real danger of an infirmity. It may be called hyper-institutionalism. This is a *big* word for a *common* weakness among human beings. It means that a group lives with an occupation so long and so closely that it feels a prior claim to the field and a lessening compulsion to explain its program and purposes to those whom the group is designed to serve. Just look in any direction and note the "closed corporations," the "select clubs," the "professional sanctity," and the "smugness of group self-satisfaction." The preventive medicine or the antidote is humility, faith in others, new blood, and a determination to continue to serve humanity.

We may not like the way your hair is parted. We may think you wear just too, too awful hats. We may wish you wore less noisy socks or neckties. We may disapprove of your language or your stories. But we would be disloyal to the safety movement if we permitted such prejudices to undermine our faith in you. Faith will lead to cooperation. Faith will, it is said on respectable authority (!), remove mountains. We haven't any mountains to remove. We merely have to make our Conferences work. We are simply trying to cooperate. Let's try harder, beginning today.

There is a certain major league baseball team with more .300 hitters on it than any other team in the league. It didn't win the pennant. The reason most frequently given was "too many stars who didn't play well together as a team." We are engaged in an enterprise where not a pennant, but human lives, human suffering, economic health, and national security are at stake. Let's build team work through cooperation, through faith in each other. We can do no less, and remain true to our trust.

Step Five—Support for One Another —Financial and Moral

This deals with the "sordid" question of adequate financial support. The National Safety Council at the moment depends on corporation support to a very high degree. But that needs an explanatory note. Contributions from corporations account for only one-sixth of our annual income and one-third of that comes indirectly through Foundations. The rest of our income is from dues and sale of materials, bought and delivered as any other service useful to business and industry. Why the resistance to our appeal for corporate giving? Well, it's a new movement and there are many demands upon corporations. The state and local safety councils will tell the same story. But let's all increase and improve our requests.

In 1942 and 1943 the War Production Fund to Conserve Manpower was actually opposed by some industrial safety supervisors on the ground that it would result in smaller budgets for their own business and industrial safety departments. Of course the exact opposite happened. When top executives became aware of the safety problem, they gave more attention and financial support to their own safety programs.

Business executives properly insist that the base of support for accident prevention must be broadened. Well, it's being done, but it is a slow job. How many of *you* have dipped into your pocketbooks to make a personal donation to your local or state safety council? I won't ask how many of you have done that for your National Safety Council. I'll tell you. We have exactly 583 individual memberships—and their dues are payments for service—not contributions. Our individual contributors should be numbered in the thousands, and those of state and local councils in the millions. Other causes, no more worthy, have such support. Our cause can too.

Funds are necessary to organized effort. Organization is necessary on a modest scale, at least, to secure cooperation on a national, state or local level. Let's get adequate financial support and at the same time get

other agencies to spend their own funds on their parts of the total accident prevention program. The two goals are thoroughly consistent with each other. Cooperation is a two-way street.

We have discussed the first five steps: (1) establishing the machinery for cooperation, (2) starting the machinery, (3) use of the machinery, (4) belief in each other, and (5) support for each other—financial and moral. Steps Four and Five are still largely in the theoretical but potentially practical state. But for a consideration of Step Six let's regard them as realities.

Step Six—Constant Determination and Hard Work Toward Full Cooperation

So now we have the cooperative groups. They have accepted cooperation as the ideal method in accident prevention. Distrust is replaced by whole-hearted, unified action. They have faith in each other because they have faith in a job worth doing. They have adequate financial and moral support.

Each step—all five of them—will be of little avail unless the last one is taken. It is a constant rededication, a renewed consecration to the reduction of human suffering first of all, and, next, renewed consecration to the reduction of economic and national losses.

No one can view with equanimity the bruised, broken, bleeding and *lifeless victim* of an accident. I employ a yard man at home. He lost both feet and a finger in a steel mill accident. He still works in the steel mill and he does the work of two ordinary laborers in our yard. He is cheerful and willing and takes great pride in his workmanship. The latter point is priceless to our economy and to progress. What would that man have accomplished had he retained all his physical powers!

I know a young woman who was facially disfigured for life in a home accident. She is embittered, unhappy, and a psychopathic case. Her life is, in any comparative sense, almost useless.

Recently in New York a mother telephoned me. She said she fully agreed with what I say about accident prevention, but that I had consistently omitted one point. She said that her son was killed in a traffic accident and that she was "killed" too. She meant, of course, that her zest for life went with her beloved son.

These examples point to the useless tragedy of it all. And because of countless incidents like these, we must *never, never* lose sight of our purposes. They are high and noble purposes, and they deserve our unlasting best. No littleness of any kind whatsoever must alter our determination to win the big struggle against accidents.

There is a quotation I like from Booker T. Washington. It is this: "I will allow no man to drag me down so low as to make me hate him." Here is another way to say it: "I shall ever strive to rise to that plane where love for my fellow man governs my every thought and act." With such ideals, we should one day know the glories of cooperation. Then thine and mine shall be an eternal reward—the divine blessing, "Well done, thou good and faithful servant . . ."

Postscript

There was one paragraph in my report a year ago which is so basic to safety work that it bears constant recollection. I shall quote it without philosophical history.

"Our concept of an individual human being is an interesting composite. He has sense perceptions, related to each other, and to things about him. He is a knowing creature and so indulges in abstract and creative thought. He has a will and so exercises considerable control, especially over the inanimate aspects of his environment. He is a rationalist, and so he is importantly influenced by invention and discovery. He takes progress for granted. He has a soul and so is guided by a deep and strong faith in a metaphysical life. He is not a superman, is not a super leader, and does not believe in a super state. His powers to think rationally, to create, and to control do not take an assertive, aggressive form. He is moral, beneficent, tolerant, independent, free, peaceful, and industrious. The American ideal, in short, is the good man."

You and your loved ones, your friends and neighbors, your fellow countrymen, your fellow men, so defined are eminently worth saving. Each one should be protected against accidents, disease, disaster, and any other misfortune that endangers or impairs his maximum effectiveness as a responsible member of society. Our strength as a nation and our usefulness among the peoples of the world are directly proportionate to the strength and usefulness of each of us as

individual human beings. Hence, the importance of our work in the several fields of accident prevention.

I want at this time to stress with all the emphasis at my command the principal general method by which work in safety can be made most effective. I refer, as I have repeatedly for nearly a decade, to the principle of cooperation.

Webster says that "cooperate" means "to act or operate jointly with another or others; to concur in action, effort or effect." It would seem that the idea of working together is so simple as to be universally acceptable. On the contrary, the application of this simple principle is complex and difficult.

Primitive tribes exemplify cooperation within rather severe limits. Their individual members cooperated among themselves for day-by-day living, for protection against hostile tribes, and for making war against other tribes. Sometimes two or more tribes cooperated for the second and third reasons.

As population increased and, in consequence, tribes grew in size, for example, into city-states in Ancient Greece and Egypt —cooperation continued with notable variations. Captives from conquered tribes or states cooperated with their captors, but from fear and necessity rather than from any sense of loyalty to their new governing groups. Variations of this character are traceable in history to the modern nations.

Expediency in economic affairs leads to cooperation on a limited scale but throughout human record cooperation gave way to violence when economic greed and selfish ambitions for power impelled states or nations to forsake the paths of peaceful cooperation.

Political alliances and trade agreements of our day are a form of cooperation which in highest terms are maintained for the best interests of humanity; in lesser terms, for mutual benefits to groups of states or nations; in realistic terms, sometimes regrettable, for protection against opposing states or nations; and in basest terms, for unjustifiable and selfish aggression.

Nature produces examples of limited cooperation. Ants work together, and bees, for example, but the social organization of each is hardly a model for human beings even though both may be credited with what is for them good results. An ant or a bee falls considerably short of our description of an individual human being. It may even be held that nature enables plant life to cooperate in propagation.

Family life, as we know it, is a better example of cooperation than we can find elsewhere for our purposes. Devotion to an ill or crippled member of the family, sacrifice for the future welfare of our children, labor to provide food, clothing and shelter for our beloved, and efforts to protect the family name are typical of family cooperation. This is based on the keenest form of group loyalty. The elders and the youth of a family plan and work together for the welfare of each not only because of "blood" ties, but because each member is important as an individual and consequently as one of the family group.

In varying degrees these values find expression in neighborhood, community, state, and national action. In religious, political, and economic areas. And, in nationality background, racial and other cultural interests. So in many areas of American life, we have social cohesion or cooperation as an actuality.

It seems quite consistent in a free society to find cooperation in some aspects of group life and competition in others. They are both traceable to the original nature of man but for good or evil they depend on man's reasoning. His instincts to live, i.e., for food, clothing, shelter, other possessions, protection against foes of any kind, are good only so far as motives and methods are good. His instincts and impulses which lead to aggression and combativeness are good so long as they do not harm others. It is obvious that man by nature finds cooperation and competition consistent in group life if defensible values are sought in a logical way.

Cooperation in accident prevention is organized effort on a grand scale for protection against death, injury, economic loss, and national weakness. We have seen the results of competition among agencies, where each was clamoring for public credit, where each representative was ruthlessly striving for the center of the stage and the spotlight. It wasn't a pretty picture. Only a sadist or someone with a sardonic sense of humor could be amused by the continuous destruction of life and property which competition in safety failed to reduce.

We have also seen enough examples of cooperations to know that results are extremely gratifying. And when cooperation is at its best, we know that accidents are markedly reduced.

There is indeed some room for competition in safety. The motives and methods can never differ, however, from our central purposes. We might compete ethically, of course, for competent personnel. We might compete for ingenuity, excellency, and efficacy of action programs. For efficient and effective discharge of our assignments in the fields of accident prevention. For superior achievement within comparable groups. And especially, we might compete with our own records to the end that the accident curve ever tended downward and sharply so.

These illustrations merely indicate some healthy forms of competition. Reason guiding our natural instincts and impulses makes cooperation the overwhelming favorite as the governing principle of action in safety work. "In union there is strength." "We must hang together or we shall surely hang separately." "United we stand; divided we fall." These quotations seem happily pertinent to our own future efforts in accident prevention.

This principle of cooperation was made official National Safety Council policy on October 19, 1948 when the Board of Directors formally approved "Safety in Action," in which are embodied these words: "We are a council in the true sense of the word—a cooperative association of groups and individuals working together for the conduct of safety activities, both separately and jointly."

The difficult and complex task of applying our cardinal principle lies in large measure ahead of us. This can be, must be, and will be done.

Banquet

Address

By ROBERT YOUNG

Motion picture actor; Star of network radio program "Father Knows Best"; Recipient of the Sloan Award and the National Safety Council's Public Interest Award for exceptional service to safety in 1950.

The magnificent record of the National Safety Council and its member organizations is something we can all be proud of. The constant reduction in the accidental death rate since the Council was organized back in 1913 is, in itself, a tremendous accomplishment, and with nearly 8,000 member groups throughout the world working ceaselessly to extend that record even farther, the day may not be too far distant when the frustrating, wasteful loss of human life through accidental death will be reduced to a figure that is an encouraging indication of general vigilance rather than a staggering shock to the layman. To be a part of that job is a privilege that all of you people share, and I am grateful for the very small role I have been able to play.

Everyone, of course, knows the Safety Council by record and reputation. The Green Cross is a familiar symbol in homes, offices, factories and streets all over the country. But it is unfortunate that more people don't take the time to look behind that emblem—to see the huge, ever-growing shadow it casts as its stands between our citizens and disaster.

You people are experts in your field—safety and safety education are an integral part of your careers. You may wonder, and I wouldn't blame you, just why an actor is taking it upon himself to talk to you regarding a subject on which you are the qualified experts.

First of all, let's get a few things straight. I'm a pretty ordinary fellow, except that I happen to be in a business where I confront the public, or vice versa, from behind a radio microphone, from in front of a movie camera or from under a spotlight. I'm ordinary in the fact that I like kids and believe in them. I have a family that I love very much. That's pretty ordinary, too. And I spend a great deal of time thinking about my family and its future—just as you do. I want my youngsters to have fun and to grow up happily, without major problems. But I also want to instill in them a sense of responsibility toward their own welfare and the welfare of others, so that they will survive the many dangers of everyday existence and stay well and sound to enjoy the kind of life I dream of for them.

So, as an ordinary guy I have the same ordinary reasons for being concerned with the problems of traffic safety that everybody else has.

I don't *pretend* to be an expert on the subject of highway safety. But I have had the opportunity during the past two years of working in close cooperation with men and women who are experts. And, like them, I have come to believe that traffic accidents create the most serious, useless waste of our modern-day living.

As an actor, I have had an unusual advantage when it comes to doing something about this problem. That's where the unordinary side of my life comes in. This advantage stems from the very nature of my work, which is to gain the listening ears of as many people as possible, in the widest area possible, and from among as many age groups as possible. Both my radio and my motion picture work bring me in touch with millions of people.

That is why the Inter-Industry Highway Safety Committee approached me a couple of years ago with the suggestion that the network show, "Father Knows Best," might be an excellent vehicle to help put across to the people of the country, both youngsters and their parents, the challenge of improving that appalling record of deaths on the highways, which last year alone involved

11,700 drivers between fifteen and twenty-four.

I'll admit that I was skeptical at first. I couldn't readily see how statistics on traffic accidents could become a useful part of a straight entertainment program. Especially one with a light comedy format. I was assured that statistics, as such, were not a part of the plan, that the Committee believed that a program spotlighting the fortunes and misfortunes of an average American family could, with effectiveness and without preaching, remind other average American families of the urgency of the traffic-toll situation.

This, *they* felt, could be done as an integrated part of our "Father Knows Best" stories, wherein the members of the easy-to-*believe family could* discuss safe driving in a natural, interesting manner. The Committee also asked us to tell the public about its Man-to-Man and Dad-to-Daughter agreements, which, as you know, are pledges between parents and youngsters to abide by eight basic driving rules.

Since the inception of this nation-wide drive to help teen-agers help themselves to greater safety on the road, we have had inquiries, letters and requests for Man-to-Man agreements from well over three million people!

Some of the letters contain helpful comments on the development of the campaign; some of them are from parents who report successful local campaigns among young drivers in their communities, and many of them are from civic leaders and organizations who are using the IIHSC pattern for intensive safety drives in their cities and towns.

Some of them are from irate young drivers themselves.

Let me say right here that I do not believe (and neither do the experts) that *young* drivers are *bad* drivers. Dozens of youngsters wrote me, with pardonable indignation, that they had been driving for several years without a single accident or traffic violation. One young correspondent asked: "Why do you group all teen-agers together and make us all to blame for the bad record? Some of us are better drivers than our elders!"

It is absolutely true that most of our kids are potentially good, competent drivers. But *ironically enough*, that very fact is partly responsible for their misfortunes on the road. They are such good drivers that they take chances and try road tricks that the older drivers would never *dare attempt*. A car is still something of a plaything to a lot of youngsters. Because of their youth, they rely on quick reflexes, superior coordination and trustful optimism. But the driver of the car next in line, or the one coming down the road ahead, may not be possessed of all these advantages.

Every year more automobiles bid for space on our crowded streets and highways. The highway engineers are doing a remarkable job, but they can't possibly keep up with the astounding growth of the country's motoring population.

Believe me, I see this every day in my home town of Los Angeles, which claims more automobiles per capita than any other city in the country. We are very proud of the fact that Los Angeles has twice won first place in the Safety Council's traffic inventory for cities of one million inhabitants and over. We are proud of the record of our engineers, of increased public support of safety programs, of the fact that our accident rate is on a slow but steady decline. But we also know that the hazards are increasing every year and, therefore, the problem becomes harder to keep up with. Every year, too, two million youngsters come of driving age in the United States. All of these natural results of growth increase the problems of safeguarding lives on our highways. Driving, in this mechanical age, has become, like everything else, a mass undertaking.

Speed is exciting. There's no doubt about it. I can remember when I was a youngster and just as cracked on the subject of getting the fastest mile out of a Model T as teen-agers are today. It goes naturally with the enthusiasm and ingenuity of youth. They want to do everything fast, and that includes growing up. They're curious, they're impatient, they're smart, they're creative.

These kids of ours are wonderful, you know. I realize this is neither an original nor an unusual thought—but I think it should be said out loud, often and proudly, not just taken for granted. My enthusiasm for youth is partly due to the fact that mine is long past—partly due to my interest and pride in my own daughters, and partly to the never-ending surprises that come from just observing kids in general.

American youth is our greatest natural resource . . . our most natural resource. And what a treasure it is!

You know, last year I spent several weeks touring the country and talking with high school youngsters about the problem of reducing the appalling toll of highway accidents involving that age group. Except for my eldest daughter and her friends, my personal contact with teen-agers had been rather limited up to that time—limited almost entirely to the bobby-sox, autograph-seeking kind. And, believe me, they're something to cope with. I don't mind telling you I was plenty scared when I learned that I was to face whole assembly halls full of high school youngsters. I don't think I have ever had worse stage fright.

I went on this tour with a message—something I was pretty upset about, and the seriousness of it was the only thing that gave me courage to overcome my quaking knees. I expected to be received as a kind of spoil-sport, an old gaffer with a lecture to deliver. I wouldn't have been the least bit surprised, in those first few seconds, if the spit-balls had begun to fly and the cat-calls to echo.

I underestimated them, those youngsters. I won't make that mistake again, and I shall do everything in my power to see that *other* adults don't make it. The kids welcomed me with flattering hospitality, and they listened with interest and courtesy to what I had to say. They were anxious to find some practical solution to this accident problem. Their ideas were excellent, their attitude constructive and their sincerity impressive. They taught me right there that just *talking* is not enough. They sent me home with something of their own determination to get with it and do something, or at least find some plan for action.

I wanted to teach them something, and I remained to learn a great deal. I confirmed my opinion that most kids are pretty reliable citizens and that, given half a chance, they will solve their own problems and solve them intelligently.

I learned that our youngsters are not unmindful of their faults and excesses and those of their companions. Naturally, there are some kids who don't seem to care about improving their lot, who seem to take pride in their escapades. But they are in the minority.

American kids have a lot of pride. They are born to it, and this great country nurtures the kind of proudness that makes them want to walk with their heads high. It's a good kind of pride when properly used. This, I believe, is our best weapon against teen-age tragedy—the pride and enthusiasm of the kids themselves.

I don't think we are using it to greatest advantage. There are many ways to improve that use.

I think sometimes we adults make a mistake in assuming that we must solve our youngsters' problems for them, or, at least, tell them how to do it. There is a difference between guidance and interference. The first is appreciated by young people. The latter is resented. It ruffles that special pride.

There are many instances on record where groups of young people have taken a youth problem into their own hands and, with a minimum of aid from their elders but a maximum of encouragement, have solved it with dispatch and courage.

Reckless driving among youngsters is not just a safety hazard. It is a youth problem. And it can be treated, I believe, in the same manner that other youth problems are handled.

Naturally, we can't just stand and let our teen-agers become entangled in the complexities of growing up and not offer a helping hand. But we can keep that helping hand open, not tighten it into the fist of discipline and threat.

Sometimes it gets pretty discouraging. Sometimes it seems that all the efforts of parents and educators to instill high standards and appreciation of the right way have failed. Youthful hunger for excitement, the lure of the new and seemingly exotic, the yen to be a hero would seem to outweigh the mundane existence of being a good kid.

But not for long. I learned, during these safety discussions with high school students, that they don't really admire the flashy, reckless driver. They may admire his nerve for the moment, but, at heart, they think he's pretty un-smart.

When they realize that this same kind of nerve can be put to constructive work, that the same kind of creative energy can be used to build a better community, a more progressive school, a safer kind of life, they

look upon it with increased respect and set about harnessing it to their own use.

The accident rate among our young drivers is now steadily on the decline. It is still far, far too high. It would be too high if one youngster was killed or crippled. But at least, progress is being made.

This has been done partly through the efforts of adults in charting campaigns aimed directly at reducing the toll of that age group, by safety experts and educators. But largely it has been accomplished by the kids themselves. Once the problem was pointed out to them in realistic terms and they were asked to do something about it, they pitched in.

In many communities, clubs have been formed where youngsters learn how to maintain cars in the best mechanical shape and how to drive them at the peak of safety and efficiency. For boys and girls who are addicted to incurable "speed-dropbobis," racing associations have been formed, supervised by safety officials and located in areas like the Mojave Desert of California where traffic hazards do not exist and the terrain is suitable to speed driving.

Officials' clocks and professional racing regulations are rigorously enforced, and the kids can satisfy their zest for speed with a minimum of danger. This is an example of putting that youthful pride to work in a constructive way. How much better it is to encourage a lad to stand out above the crowd because he has the best car and drives it most efficiently rather than because he can pass all other cars on the road and scare the daylights out of doddering pilots like you and me!

Driver-training courses in the schools are becoming a growing part of the curriculum, and they, to my mind, are the most effective weapon we have.

I have visited several of these classes in the Los Angeles area, and I came away with a feeling almost of dedication to the idea that all schools should have them. Our California law states that all students of high school age must have a course in driver education. It's a good law.

Unfortunately, it is not always possible to combine the classroom work with actual behind-the-wheel instruction, because of financial restrictions, lack of personnel and other problems. In a great many communities, automobile dealers have stepped in and offered the use of cars for this training. In other towns, local organizations whose project is the promotion of safety have made it their duty to supply automobiles for school use.

If it is possible to do it, this program of education should be increased. Nothing is quite as effective in the training of a good driver as proper instruction at the very beginning. It isn't enough that parents and friends are always willing to act as teachers, because sometimes those parents and friends are not very good drivers themselves, and they transmit their faults to the beginner. Then it's up to the traffic experts to break those habits and instill new ones—a waste of time and money.

We must make safety attractive. We must make the safe way the appealing way, and we've got lots of competition. But of course, the prize that is the natural reward for caution is a big one—longer life and the ability to enjoy it.

The smartest people aren't necessarily the ones who get there first, but the ones who get there. And our youngsters have lots of places to go.

Traffic court judges and officials can be of immeasurable aid in this campaign against youthful traffic toll. A few extra minutes, a little special attention, some thought-provoking words, and the young traffic violator goes home with a sense of renewed responsibility, a healthy respect for the law and an understanding that its purpose is to protect him, not to punish him. He doesn't just plunk down Dad's five or ten bucks and go out to outsmart the cops. The traffic officers in our communities, by their attitude, can teach and encourage as well as discipline.

It's a personal challenge to all ages, this business of saving our youth. And it's a personal responsibility. It can't be charged off to the safety experts alone, to the parents, to the schools, or to the kids alone.

Like everything else in our way of life, this is a team job, a common challenge. And the reward is the future, waiting to be built with hope and happiness and peaceful attainment by this most natural resource—our American youth.

Safety Exposition Exhibitors

EXHIBITION HALL—STEVENS HOTEL
CASINO ROOM—CONGRESS HOTEL

Alphabetical List of Exhibitors of Industrial and Public Safety Equipment

Acme Protection Equipment Co., Chicago, Ill.
Gas Masks Exclusively.

Advance Glove Mfg. Co., Detroit, Mich.
All Types of Work Gloves, Safety Gloves and Leather Safety Clothing.

Aetna Life Affiliated Companies, Hartford, Conn.
Safety and Health Services for Employees, Both On and Off the Job.

Alan Wood Steel Co., Conshohocken, Pa
Abrasive Rolled Steel Floor Plate.

All American Safety Equipment Co., Chicago, Ill.
Power Press Guards; Safety Engineering Surveys; Consultants.

American Abrasive Metals Co., Irvington, N. J.
Abrasive Metals, Paints, Coatings, Non-Skid Grating for Safe Walkways.

American Chain & Cable Co., Inc., Bridgeport, Conn.
Chains, Cable and Wire Rope of Various Kinds and Sizes; Steel and Malleable Castings; Brakes and Brake Controls; Cranes, Hoists, Valves and Fittings.

American-LaFrance-Foamite Corp., Elmira, N. Y.
Fire Protection and Fire Fighting Equipment.

American Optical Co., Southbridge, Mass.
Head, Eye and Respiratory Protective Devices, Safety Clothing and Safety Specialty Products.

Ampco Metal, Inc., Milwaukee, Wis.
Safety Tools Fabricated from Ampco Metal, Ampco Beryllium-Copper and Monel.

Ansul Chemical Co., Fire Extinguisher Divn., Marinette, Wis.
Ansul Dry Chemical Fire Extinguishing Equipment.

Arcadia Mfg. Co., Birmingham, Mich.
Plastic Coated Gloves and Aprons for Industry.

Bashlin, W. M., Co., Grove City, Pa.
Linemen's Safety Equipment.

Bausch & Lomb Optical Co., Rochester, N. Y.
Safety Glasses and Safety Eyewear for Every Occupational Requirement.

Best, Alfred M., Co., Inc., New York, N. Y.
Safety Maintenance and Production; Best's Safety and Maintenance Directory.

Bradley Washfountain Co., Milwaukee, Wis.
Group Washing Equipment.

Brady, W. H., Co., Chippewa Falls, Wis.
Self-Sticking Safety Signs, Pipe Markers and Special Markers and Signs.

Breck, John H., Inc., Springfield, Mass.
Industrial Hand Cleaner; Hair and Scalp Preparations.

Browne, Stewart R., Mfg. Co., New York, N. Y.
Electrical Safety Equipment, Flashlights, Explosive-Proof and Vapor-Proof Extension Lights.

Buhrke, R. H., Co., Chicago, Ill.
Safety Equipment for Construction and Maintenance.

Bullard, E. D., Co., San Francisco, Calif.
Personal Safety Devices for Industry.

Canfield Oil Company, Cleveland, Ohio.
Oil Absorbents.

Chance, A. B., Co., Centralia, Mo.
Transmission and Distribution Equipment.

Chemical Service of Baltimore, Baltimore, Md.
Waxes, Soaps, Cleaners, Disinfectants and Chemical Specialties.

Chemical Specialties, Inc., Springfield, Mass.
Industrial Hand Creams and Cleansers.

Chicago Eye Shield Co., Chicago, Ill.
Head and Eye Protective Equipment.

Columbus Glove Mfg. Co., Columbus, Ohio.
Coated Gloves and Aprons.

Columbus McKinnon Chain Corp., Tonawanda, N. Y.
Herc-Alloy Sling Chains.

C-O-Two Fire Equipment Co., Newark, N. J.
Carbon Dioxide and Dry Chemical Extinguishers, Systems, Smoke Detectors.

Cunningham, M. E., Co., Pittsburgh, Pa.
Safety Marking Tools.

Davis Emergency Equipment Co., Inc., Newark, N. J.
Respiratory Protection, Combustible Gas Indicators, General Safety and First Aid Equipment.

Detex Watchclock Corp., New York, N. Y.
Watchmen's Clocks and Accessories.

Diamond Match Co., Springfield, Mass.
Book Matches for Safety Advertising and Sales Promotion Campaigns.

Diversey Corp., Chicago, Ill.
Industrial Maintenance and Cleaning Chemicals.

Dockson Corp., Detroit, Mich.
Goggles Face Shields, Welders, Helmets, Respirators.

Dow Corning Corp., Midland, Mich.
Cleaning Stations for Dispensing Silicone Treated Sight Saver Tissues.

Dunn Products, Chicago, Ill.
Protective Clothing for Industrial Workers Made from Asbestos, Leather, Rubber, Neoprene and Fire-Proofed Duck.

Duo-Safety Ladder Corp., Oshkosh, Wis.
Safety Ladders, Fire Ladders, Ladder Shoes.

Eagle-Picher Sales Co., Cincinnati, Ohio.
Eagle-Picher Industrial Floor Dry #85. A heavy duty, anti-skid, light reflecting absorbent for plant safety and maintenance.

Edmont Mfg. Co., Coshocton, Ohio.
Coated Fabric Work Gloves.

Elliott Service Co., Inc., Mt. Vernon, N. Y.
Accident Prevention Displays; Safety Conference Programs; Supervisor's Bulletin; Bulletin Boards.

Embosograf Corp. of America, New York, N. Y.
Sign Making Equipment, Safety Posters, Displays, Directory Signs.

Emerson, J. H., Co., Cambridge, Mass.
Resuscitators and Other Emergency Breathing Equipment.

Fairfield Glove Co., Fairfield, Iowa.
Industrial Gloves and Mittens.

Fendall Co., Chicago, Ill.
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Finnell System, Inc., Elkhart, Ind.
Floor Maintenance Machines.

Franklin Research Co., Philadelphia, Pa.
Anti-Slip Floor Maintenance Materials.

Gro-Cord Rubber Co., Lima, Ohio.
Gro-Cord, Raw-Cord and Neo-Cord Soles, Heels and Taps.

Hild Floor Machine Co., Chicago, Ill.
Floor Cleaning and Maintenance Equipment and Supplies.

Hillyard Chemical Co., St. Joseph, Mo.
Floor Treatments, Building Maintenance, Sanitation Products, Equipment and Materials.

Horner & Robertson, Inc., Denver, Colo.
Rolon Tire Chains.

Hy-Test Div., International Shoe Co., St. Louis, Mo.
Hy-Test Anchor Flange Steel Toe Safety Shoes.

Industrial Gloves Co., Danville, Ill.
Finger Guards, Supergards, Wovengards, Handgards, Gloves, Mittens, Arm Protectors, Protective Apparel, Leggings.

Insto-Gas Corp., Detroit, Mich.
Underwriters' and Factory Mutual Approved Torches and Furnaces.

Intoximeter Assn., Niagara Falls, N. Y.
Sales and Service of Equipment to Determine Degree of Alcoholic Influence.

Iron Age Div., H. Childs & Co., Inc., Pittsburgh, Pa.
Complete Line Leather and Rubber Industrial Safety Footwear for Men and Women.

Jenkin Safety Appliance Co., Louisville, Ky.
Junkin Interlocking Barrier Guard; Swinging Die Closure; Electro-Lock Shield and Splint Type Stretcher.

Justrite Mfg. Co., Chicago, Ill.
Safety Cans, Oily Waste Cans, Safety Electric Lanterns, Flashlights and Fire Extinguishers.

Karel First Aid Supply Co., Chicago, Ill.
Industrial Hospital Supplies and Equipment, Drugs, Dressings, Furniture, Instruments.

Kearney, James R., Corp., St. Louis, Mo.
Line Tools for Linemen in Handling Energized Wires.

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Original Binocular Visual Screening Tests for Industry.

Kidde, Walter & Co., Inc., Belleville, N. J.
Fire Protection and Extinguishing Equipment.

Kimball Safety Products Co., Cleveland, Ohio.
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Klein, Mathias & Sons, Chicago, Ill.
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Legge, Walter G., Co., Inc., New York, N. Y.
Safety Floor Polishes, Conductive Floor Coating, Static Grounding Device for Personnel.

Lehigh Safety Shoe Co., Allentown, Pa.
Leather Safety Box Toe Shoes and Rubber Boots.

Lightfoot Schultz Co., New York, N. Y.
Granulated Skin Cleansers, Lotion, Bar Soap and Dispensers.

Lincoln-Schlueter Floor Machinery Co., Chicago, Ill.
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Logan Mfg. Co., Glendale, Calif.
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Magnaflux Equipment for Maintenance, Safety and General *Inspection.*

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McAn, Thom, Safety Shoe Divn., Melville Shoe Corp., New York, N. Y.
Thom McAn Safety Shoes.

McDermott, Julian A., Corp., Corona, L. I., N. Y.
Warning, Work, Safety Lighting for Industrial, Utility Aviation Use.

McDonald, B. F., Co., Los Angeles, Calif.
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Medical Supply Co., Rockford, Ill.
MSCo Flexible Unit First Aid.

Metropolitan Life Insurance Co., New York, N. Y.
Educational Publications and Materials Dealing With Safety.

Milburn Co., Detroit, Mich.
Ply Protective Creams, Ply Garb Plastic Clothing, Ply Gloves, Plastic Work Gloves.

Miller Equipment Co., Inc., Franklin, Pa.
Linemen's and Industrial Safety Belts.

Mine Safety Appliances Co., Pittsburgh, Pa.
Safety Equipment for Every Industry.

Multi-Clean Products, Inc., St. Paul, Minn.
Floor Maintenance Equipment and Materials.

National Safety Council, Chicago, Ill.

Occupational Hazards, Inc., Cleveland, Ohio.
Publishers.

Oil-Dri Corp. of America, Chicago, Ill.
Oil and Grease Absorbents.

Onox, Inc., San Francisco, Calif.
Onox Skin Toughener for Athlete's Foot Prevention.

Osborn Mfg. Corp., Warsaw, Ind.
Safety Pliers and Tongs for Feeding Punch Presses.

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First Aid Equipment.

Packwood, G. H., Mfg. Co., St. Louis, Mo.
PAX Safety Industrial Skin Cleansers and Dispensers.

Patent Scaffolding Co., Inc., Chicago, Ill.
Gold Medal Wood and Magnesium Safety Ladders, Suspended, Sectional Tubular Steel and Aluminum Scaffolding, Sidewalk Protection Canopies, Steel Grandstands.

Positive Safety Mfg. Co., Cleveland, Ohio.

Protectoseal Co., Chicago, Ill.
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Scaffolding Towers, Saf-T-Swings, Special Products.

Salisbury, W. H., & Co., Chicago, Ill.
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Schrader's, A., Son, Brooklyn, N. Y.
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Scott Aviation Corp., Lancaster, N. Y.
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Rubber Gloves and Linemen's Equipment.

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Taylor, S. G., Chain Co., Hammond, Ind.
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Mechanized Equipment for Maintenance of Industrial Floors.

Trinal, Inc., Chicago, Ill.
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Union Wire Rope Corp., Kansas City, Mo.
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United States Dept. of Labor, Bureau of Labor Standards, Washington, D. C.

United States Safety Service Co., Kansas City, Mo.
Eye Protection, Impregnated and Enteric-Coated Salt Tablets, CO Indicators.

Wallace Optical Co., Inc., Detroit, Mich.
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Disinfectants, Deodorants—Products for the Promotion of Safety.

Western Coca-Cola Bottling Co., New York, N. Y.
Coca-Cola.

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Industrial Safety Clothing made from Asbestos, Flame-Proofed Duck and Jean Cloth, Leather and Wool.

Wilkins Co., Inc., Cortland, N. Y.
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Absorbents.

1951

Current Safety Topics in the

AERONAUTICAL INDUSTRIES

As presented in the Sessions of the Aeronautical Industries Section at the 1951 National Safety Congress

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Transactions
39th National Safety Congress

NATIONAL SAFETY COUNCIL
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New Ideas...

If safety is to keep pace with today's rapidly advancing technology, we must continually have "new ideas."

Each year, at the National Safety Congress, the ideas and experiences of many of the nation's top safety men are presented in the various sessions. Many of these ideas, devices and methods, first presented at a Congress session, later become generally accepted within their fields.

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Safety directors everywhere have found the Congress Transactions a useful aid in their accident prevention programs. In industry, for example, their judicious distribution to key personnel in management and supervision has proved to be of invaluable service.

In preparing these Transactions, the proceedings of the Congress have been condensed and edited for reference purposes. Complete original manuscripts, with any charts or illustrations which were used, are available in National Safety Council files. Views expressed at the Congress or in this record are those of the Congress participants and are not necessarily those of the National Safety Council.

AERONAUTICAL INDUSTRIES SECTION

This volume is a record of the sessions held at the 1951 National Safety Congress by the Aeronautical Industries Section. The conduct of these Congress sessions each year is only one of the many cooperative activities which the Aeronautical Industries Section carries on in behalf of its members, and for the benefit of accident prevention work in the aircraft manufacturing industry generally. The Section gives guidance in the preparation of a great variety of technical and educational material useful in the day-to-day safety programs of aircraft manufacturing plants. The activities of the Section are under the direction of its Executive Committee, the members of which are listed at the close of this volume.

Aviation Must Have Safety

By A. T. BURTON
Vice President, North American Aviation, Inc., Los Angeles, Calif.

When thinking of aviation and flying, one of the first thoughts which arise in the mind of the average person concerns safety, whether it be his own safety or that of a loved one boarding an airliner, or that of a military jet pilot being helped into the cockpit of a modern fighter with all his auxiliary equipment, or that of people on the ground over whose homes these aircraft fly. The thought of safety is probably associated with that instinctive fear of falling with which each of us is born; therefore, such thoughts are only natural.

If the layman had knowledge of all that goes into making for "safety in aviation" I believe that this instinctive fear of flying would be quickly dispelled and supplanted with a feeling of confidence and safety. I will endeavor to outline for you some of the salient points which tend to merit such confidence.

In this era of increased speeds and higher performance in both military and commercial airplanes, safety continues as always to be a factor of vital concern to the aviation industry.

Safety is a continuing process. Safety in flying starts on the ground in the aircraft manufacturing plants where the planes are designed, developed, and produced, long before the airplane even gets to the ground crew. Safety in the aircraft industry starts at the design board. From the first line drawn on the designer's clean white paper, through the production operations to the finished product, heavy emphasis is placed on safety.

In the past few years alone progress in the field of aeronautical engineering has been little short of revolutionary. This progress is measured by the high performance of today's aircraft with their vastly increased speed, altitude, and size, particularly in the field of military aviation.

We are now entering an age of flight as challenging as that which confronted the Wrights two generations ago. We have hurdled the so-called sonic barrier and are venturing further into new and unknown territory.

With each progressive step, our responsibility for the safety of the human beings in our aerial vehicles also increases. Human frailities become more apparent as aircraft performances go higher, and the means of overcoming these human limitations must be found on the design board. That is where safety starts.

This wasn't always the case. Safety was not built into the early airplanes, and their pilots were mostly a daring crowd who flew by the seat of their pants. As a rule, their love for flying greatly overshadowed any thoughts of how their flights might end. That day is completely gone. Safety is engineered into airplanes now, and today's pilot has a keen desire to live to a ripe old age. He is a well trained operator, and carefully groomed to routine safety habits. Scientific devices in the plane and on the ground have been developed to assist him in making flying itself a safe routine.

The habit of safety by enforced routines is of vital importance, whether it is the pilot running through his check list before takeoff, or the operator of a machine or lathe in the shop.

In the development of a new type aircraft those design engineers charged with design responsibility carefully consider every element of the proposed airplane. Through the years design criteria has been gathered and cataloged and put in usable form so that the designers have available the accumulated experience of many successful as well as unsuccessful aircraft.

When an aircraft company starts the development of a new type plane for the armed services, the normal procedure prescribes the procurement of three aircraft. Two of these airplanes will be built and thoroughly instrumented so that the forces experienced in flight will be recorded and evaluated by competent engineers and scientists who are as much specialists in their chosen professions as obstetricians and toxicologists are in the field of medicine.

These flight tests check not only the structural integrity of the airplane, but the characteristics such as stability and controllability, vibration and flutter, and the general performance of the airframe and the power plants. The flight test program is an exhaustive procedure covering all phases of the aircraft's operation.

The means and procedures for flight testing have increased and expanded with the increased performance of the airplane itself. In the late 30's, when the experimental model of the B-25 Mitchell medium bomber was test flown at North American, the flight engineer climbed aboard with his instruments packed in a fair sized box tucked under his arm. Contrast this with the extensive equipment used ten years later to flight test the first experimental model of the XB-45 Tornado four-jet light bomber.

Because the XB-45 was the first airplane of its type flown in this country, it was extensively instrumented for exhaustive testing which extended over nearly two years. The automatic recording instruments installed in the airplane included five photo-recorders to automatically record readings of 120 separate instruments, a pyrometer potentiometer which recorded temperatures at 140 different locations, three 14-channel oscillographs recording structural strains at various selected locations in the airplane.

All the instrumentation in an airplane is seldom operated at one time, but the quantity of recorded data which all the instrumentation operating simultaneously is capable of turning out is amazing. Just one minute of continuous operation provides 37 separate temperature recordings, 400 inches of oscillograph records and 1,200 separate pictures of instruments showing nearly 2,000 individual instrument readings.

Besides these automatic recordings which are made by the pilot while he is actually flying the airplane, there are the observations of the pilot himself on the handling characteristics, etc., of the aircraft. This mass of data turned over to the engineers and scientists for analysis is a far cry from the test pilot's later just before the last war.

The test pilot is just about as busy as the instruments with which he is surrounded. Only the pilot can report accurately on the airplane's handling qualities both on the ground and in flight, and the spinning and recovery characteristics in the air. It is also a matter of close personal concern to him for canopy and seat ejection systems to work efficiently and safely.

The flight testing must also check the cooling of all power components and accessories, radio and electronic noises, the antenna output patterns, potential fire hazards and fire extinguishing systems, fuel jettisoning, temperature ranges, heat and vent, and pressurization, to name only a few.

In today's high speed airplanes, the hydraulic power system is of increasing importance to the operation of the airplane and in turn to the pilot's safety. This system must be tested to make certain of its efficient operation to the extent of such a critical low temperature as minus 65 degrees F.

In the military airplane, testing must go beyond those matters of simply flying the aircraft under extreme conditions of speed, altitude, and temperature. The main purpose of a fighter, for example, is to fire guns, rockets, and sometimes drop bombs under these same conditions, so armament tests are a vital factor in the flight testing of the military aircraft.

The great effort expended in the flight testing necessary to make sure that the airplane is as efficient and safe as it is humanly possible to make it, is reflected in the cost figures for this part of the development of a new type military aircraft under the normal procedure of procuring three planes. For instance, eight per cent of the cost of developing a recent three-engine military airplane was expended for the flight test program.

We have considered the rigors to which the two experimental flying airplanes are put in flight testing. Now take the third airplane under the normal development program. It is subjected to a tortuous race in the static test laboratory before the flight models are permitted to fly.

Having drawn upon the information accumulated through experience with many previous aircraft, combining it with new ideas and theories, the design engineers achieve the design of the moment. It is this third airplane in which their ideas for a new military type are put to the first acid test. This static model of their design is

subjected to gruelling tests equivalent to and greater than the extreme conditions under which their final effort may be expected to operate safely.

The static tests subject the plane to load forces encountered in all types of landings, from normal to crash landings, and extreme pull outs and dives. These tests reach such critical points as a seat pull of 40 times the force of gravity under crash conditions.

The static test laboratory not only establishes the structural integrity of the main body of the aircraft, but also subjects the components to the same forces, for they too encounter these forces imposed in flight. If the design engineers' creation passes these tests successfully, it then is sent into the air for the flight testing we have just decribed.

I have dwelt upon the development phase of military aircraft, for we concentrate at North American on the design, development, and production of military planes. However, I also want to stress the fact that the manufacturers of transports subject the prototypes of those models to exhaustive testing in the interests of safety.

That American manufacturers have maintained a high standard of safety in commercial planes is shown by the all-time safety record established last year by this country's airlines. There were only 1.3 fatalities per 100 million passenger miles flown, which was better than the rate of every overland carrier except the railroads. Safety engineered into the airplane and development of sound safety habits for flight crews have converted flying from the romantic adventure of old to a safe routine.

At present the aircraft industry is in a state of partial mobilization, and our primary responsibility is for the quality of military aircraft. Quality and safety are closely related factors in the development and production of military planes, for quality can be the clear cut difference between survival and disaster for the pilot. The superior performance of our combat airplane over the enemy is the best assurance of safety for our flying personnel.

The loss ratios of the U. S. Air Force and Navy during World War II reveal the safety factor involved in superior quality. Official figures show that the Air Force destroyed three enemy planes for each Air Force plane lost, and in some cases the ratio was as high as eight to one. In the Pacific, the Navy and Marine Corps achieved the astounding ratio of about ten to one in air combat.

These figures not only show that quantity cannot beat quality, but definitely point up a safety factor. Quality which was triumphant enabled our pilots and air crews to complete their missions successfully and return safely to base.

The aircraft industry and the armed services place great emphasis on the safety of military personnel, as is exhibited by the use of armor plate, seat ejection, and other devices. While every consideration is given to safety, there are times when the tactical use for which the plane is intended must be given primary consideration.

The aircraft industry and the armed services have worked toward production aircraft designed to provide our pilots with equipment which will enable them to fight successfully and return home safely. Quality and safety are almost synonomous.

It is interesting to note that despite the great increase in speeds and general performance of the modern military aircraft, the military safety record has continued to improve. This is the direct result of two factors. The constant efforts of design engineers in basic design to preclude design and functional errors that lead to accidents, and the vigorous accident-prevention effort of the Flying Safety divisions of the armed services.

Analysis of aircraft accident history of the last war showed that huge expenditures of our war potential were incurred in non-combat aviation when compared to aviation losses due to enemy action. Experience has shown that aircraft used in operational training are subjected to higher stresses and aerodynamic loading than in actual combat. This is due to unfamiliarity of the pilot with the aircraft as a type and lack of almost inherent knowledge of the cockpit layout. The aircraft loss to the enemy was a small fraction of the total losses. The pattern is the same today with our forces in Korea.

The need for vigorous safety action in military aviation is apparent today when you consider the present accelerated program, the greater complexity and higher performance of new equipment, and the induction of re-

serve personnel who have been out of action for many months.

The armed services and the aircraft industry have made accident prevention a matter of common concern. Much preventive work is accomplished through data accumulated in the field by the agencies which use the aircraft. Evaluation of this information results in pertinent recommendations to be accomplished on aircraft in the design stage, aircraft in production and aircraft in the field. Our hopes for greater safety lie in this preventive effort.

Close cooperation between the industry and the services also is achieved through operational suitability testing by the flight test groups. This frequently uncovers deficiencies which result in corrective action being taken to retrofit planes in the field and on the production lines.

Every effort is made by the industry to carry out adequate and proper operational suitability testing in order to hold retrofits to a minimum. Excessive retrofits can be costly and can threaten the combat potential of the aircraft. That is one of many reasons why we stress safety engineering. Airplanes are the product of engineering, and in engineering lies the solution to the problems. Prevention of accidents can be greatly enhanced through improved design. The effort to achieve this must start with the preliminary design of a new aircraft and be carried through all phases of engineering, manufacturing, and testing.

Great stress is laid on performance in the military aircraft, and it is necessary that this be done. However, high performance is closely related to the safety factor. Recommendations to improve the safety of the airplane also increase the proficiency and effectiveness of the airplane to perform its mission, and coordinate the pilot's ability to *perform* his mission with the machine.

The cooperative effort between the services and the aircraft industry has served to make each more familiar with the problems of the other. Free exchange of essential information serves to eliminate many future design and procurement *problems.*

As you can see, the safety factor is taken into consideration by the manufacturer and the armed services right at the design board and the mockup stage of development. To better illustrate the need for this emphasis on pilot safety, let's consider the pilot's lot in the cockpit of an F-86E Sabre jet fighter.

Our pilot is in about 50 cubic feet of pressurized space in a seven-ton machine hurtling through space at almost 1,000 feet per second. Packed into this machine in every available space are about three tons of fuel and high explosives, large turbines spinning at 10,000 rpm and a lot of other complicated moving parts.

His job requires him to operate about 100 regular controls, switches, and buttons, and nine emergency controls. He must observe 24 instruments while keeping an eye on 12 indicators or warning lights installed for his safety. Besides doing all these things, he must keep a lookout through his transparent canopy and occasionally check a flight chart.

His operations may take him to 40,000 feet, so for his comfort and safety, our pilot must depend upon a highly complex arrangement for the simple matter of atmosphere. His breathing requirements are taken care of by bottled oxygen and a pressurized atmosphere within the cockpit. There is a powerful air conditioning system to protect him from the temperature conditions outside the cockpit, but even when this is working perfectly he may experience a temperature range of 50 degrees during a normal flight on a hot summer day. One of the most important parts of the air conditioning system is a small refrigerating unit about the size of a softball, yet having the capacity of 20 average home size refrigerators.

Our pilot is perched upon a seat which has a 37 *millimeter* shell under it. Because man is powerless to move against the pressure of winds at high speeds, this system is necessary to get him out of the plane in an emergency with enough speed to clear the tail surfaces.

Since it's entirely possible that he might have to bail out at the minus 65 degree temperature found at 40,000 feet, our pilot must wear enough clothes to survive under those conditions but not so much that he would be unable to perform his job in the cockpit. The compromise outfit consists of about 40 pounds of clothing, protective equipment, and gear.

The same winds which would pin our pilot helplessly to his seat without an ejection system, exert tremendous forces upon the control surfaces of his plane. Obviously, he needs help to overcome these forces, so there is a booster system which enables him to move his controls against those forces which could not be overcome by human effort alone.

You can see the human frailities which have become apparent in the operation of today's high speed aircraft. Performance is going to go higher and higher, and the human equation will become an even greater question mark.

While airplane design and performance have progressed, the human pilot who must fly the airplane, has not progressed in the *same manner* that engineers have improved the machine. The pilot weighs as much as he ever did and takes up just as much precious space. Man has not improved the way the airplane has, and it doesn't appear likely that he will do so.

Aviation medicine has accomplished a great deal for the safety and comfort of the pilot through studies which have produced some amazing facts as to the human's limitations and how to get the most out of his capabilities. But the hard fact remains that he still falls short of what the aircraft designer would like to get from him.

The human designer must start on his drafting board to help the human pilot keep pace with his responsibilities and duties in the regions of high speed, high altitude, and all-weather flying over longer distances and for longer periods. This help, which is after all a matter of safety, cannot start out in the wild blue yonder. It does, and must, start on the design board. It is most vital to the team of the airplane and the man if they are to perform their missions safely and effectively.

I have placed great stress on the engineering phase of safety in aviation, but there is a further element in the accident prevention program carried on throughout our organization.

Naturally, we at North American Aviation are deeply concerned with the prevention of accidents in our plants. Safety is an important factor in enabling us to carry out efficiently our primary responsibility of producing quality aircraft for our armed services. High quality work cannot be produced efficiently in an unsafe plant. Employees cannot have great enthusiasm for their work if they are fearful for their personal safety. An adequate safety program is essential to employee morale and quality production.

Our accident prevention program is organized on the committee basis with an executive committee, an employees committee, and a safety department as a staff coordinating function.

The executive safety committee, composed of the heads of nine interested divisions, meets once each month to set or discuss plant policy regarding accident prevention, any major problems which may have arisen or which will arise, and so on.

The safety department, headed by the chief safety engineer, conducts periodic plant inspections, special inspections, and accident investigations; designs machine guards; interprets all state safety orders in their relation to our plant; maintains adequate records of accidents and injuries; holds safety meetings for members of supervision; maintains safety bulletin boards; handles the sale of safety shoes and safety glasses to our employees; and numerous other functions. The safety department is a department of our industrial relations section, and reports *directly to the* assistant director of industrial relations.

The plant safety committee is composed of one or more members from each shop department in the plant. These men are selected by their departmental supervision and by the union, and serve for a six-month term. The members of this committee make periodic safety inspections of their assigned areas, instruct each new employee in plant safety policies, make safety recommendations, and assist where needed in accident investigations. This committee is vitally responsible for the success of our safety program.

The three groups mentioned above work closely and harmoniously together toward *one end*—the prevention of accidents in our plant. We feel that our program and our present organization is sound, basing this feeling on our low frequency record over the past seven years.

Management is solidly behind this accident prevention program, *which has made its success* possible. Responsibility for safety rests squarely upon management whose wholehearted support is essential to the success of a safety program in any line of endeavor.

Health Precautions in Handling Radioactive Electronic Tubes

By MAJOR ALVIN F. MEYER, JR.
Chief, Sanitary Engineering Section, Office of the Air Surgeon,
Air Materiel Command, Dayton, Ohio

Among the ever increasing utilizations of nuclear energy in our technology is its application in electronic tubes. Radioactive emanations have as one of their characteristics the production of ion pairs in matter. This ionization, or separating into component positive and negative parts, is the basic cause of physiological damage. It is also the reason for the inclusion of certain radioactive materials in electronic tubes.

The problem of a radioactive tube was first brought to the attention of preventive medical personnel in the early part of 1950. At that time, studies were made by the Department of the Navy as to the extent of the hazard and technical information was published. The Air Force Medical Service also made studies on the problem of determining the exact degree of hazard involved.

Information has been disseminated to medical service personnel through the *Medical Service Digest*, and a technical order covering the subject is in the process of publication at the present time. In addition, the forthcoming reviston to AMC Manual 160-2, "Precautionary Measures against Radiological Health Hazards," contains technical data on storage, handling, and disposition of the tubes, as well as detailed information on medical and environmental precautions in the general radiological health field.

The question might well be asked as to what a radioactive electronic tube looks like and why the need for inclusion of radioactive materials. They are little different from the standard spark gap, cold cathode, or TR tubes. The basic utilization of these tubes is in various types of communication equipment, including radio, radar, and telephone circuits.

The problem of the radioactive component which is generally applied as a coating to the dome of the tube or to other convenient locations within the tube component is to serve as a constant source of ions. This partial ionization of the tubes under constant conditions insure more speedy response of the tube to input signals. In the case of the TR tubes, this phenomena serves to give protection from the high energy pulses at the radar antennae. The source speeds up ionization of the gas in the tube when the energy impulse is received.

In order to understand the nature of the hazard, some appreciation of basic nuclear physics is required. Radioactive emissions in general, consist of either alpha particles, beta particles, or gamma rays. There are other emissions, such as neutrons, which are not, pertinent to this discussion. Alpha particles, which are positively charged, have poor penetrating power. These particles by their nature, however, are highly ionizing. Beta particles are capable of penetrating thin foils of aluminum and into the superficial layers of the skin, while gamma rays have the capacity for deep penetration passing through varying thicknesses of lead and other shielding depending upon the energy of the ray.

Alpha and beta particle-emitting radioactive substances are of primary danger if ingested or if they enter the body through a cut or wound. Gamma emitting materials, on the other hand, are more dangerous from the external exposure viewpoint. The material utilized in the TR tubes is Cobalt 60, which is primarily a beta-gamma emitter. Spark gap, glow lamp, and cold cathode tubes contain radium bromide, which emits alpha and gamma radiation.

In the tubes containing radium bromide, there also will exist a certain amount of radon gas which is a product of the disintegration of radium. Various types may contain from .01 to 2.0 micrograms of equivalent radium per tube.

The external radiation hazard from these tubes, as determined by experiments conducted both by the Department of the Navy and the Department of the Air Force, can be considered to be minimal. If all of the radioactivity in a large number of tubes were concentrated into a single point source, levels of radiation could be created which would exceed the daily permissible exposure levels. However, under normal conditions of packing and storing, intensities of radiation will be below the 300 milliroentgens per week which has been established as the maximum permissible exposure level.

Surveys made of tube storage areas at air materiel command installations have indicated that in no case were levels even approximating the permissible exposure level encountered. This confirms experimental data obtained at the San Francisco Naval Shipyard as reported in *Department of the Navy Electronics Information Bulletin No. 271.*

Although external radiation hazards to personnel do not exist if this type tube is properly stored in cartons, concentrated storage of large quantities of tubes should be avoided. In the case of the two tubes with maximum amounts of radioactivity, 1B22 and 1B29, piling together of over 100 tubes without cartons could produce an external radiation hazard.

To obtain a comparison of the degree of external radiation produced by these tubes with that of the normal radioactive painted watch and an aircraft instrument dial which has been stripped of its radioactive paint should be of value.

The type 1B24 tube at a distance of three inches from the detector gives a count rate of approximately 500 pc. minute. The 721A tube produces 30 counts per minute, and the 1B27 produces 20 counts per minute. My wrist watch, as seen, produces 400 counts per minute, and a stripped dial with retained radioactivity 300 counts per minute.

From this comparison, it is seen that the ionization produced by the intact tube is relatively slight. This is a qualitative indication of the differences in the amount of radiation produced by the tubes, and bears no direct relation to previously quoted permissible exposure levels.

The breaking of a tube envelope can present a serious radiation hazard. Tubes containing radium bromide will liberate a small amount of radon gas which, as previously mentioned, is highly ionizing. The accidental inhalation or ingestion of particles from the tubes can seriously affect personnel so exposed. Similarly, radioactive materials carried into wounds on particles or slivers of glass may be concentrated in the body and present long term internal exposure problems. In this connection, the lifetime body retention permissible for radium has been established at .1 of a microgram.

It is obvious that some of the tubes contain more than the lifetime permissible concentration. While it is considered remote that the entire radioactivity contained in the tube would be taken into the body on a single exposure, repeated careless handling of broken tubes might allow the accumulation of this concentration.

Half life of radium is 1560 years, and its biological half life is aproximately the life of the individual in view of its concentration in the bone marrow and slow excretion. All personnel who handle these tubes should be cautioned as to the procedures to be followed when tubes have been accidentally broken. Of primary consideration is the education of storage and electronics repair personnel to prevent such breakage.

The tubes themselves are sturdy, and with proper care breakage should be kept at a minimum. In the event tubes are broken, common sense routine precautions should be followed. Care should be taken to avoid inhalation of dust or gas from a tube. Fragments and debris should be handled in such a manner as to prevent cuts through which radioactive material may be carried into the body. Protective gloves—either rubber or heavy work gloves—should be worn when handling broken parts or other radioactive wastes.

Experience in the Air Materiel Command has indicated that unless several tubes are broken, monitoring of the area with ordinary GM survey equipment is not of practicable value. Illumination with ultraviolet light may assist in the location of radium bearing particles. In general, however, the area of contamination may be determined by visual inspection.

There are two general methods for cleaning an area in which tubes have been broken. In the wet method, large fragments should be first picked up with forceps. A large sheet of cellulose acetate or similar plastic material with a hole cut in it larger than the contaminated area should be laid over the site and the edges taped to the floor. Then, using a wet cloth, single swipes across the area should be made folding the cloth each time. If the cloth becomes too small,

it should be discarded into a suitable container, such as a plastic bag, ice cream carton, or glass jar. Care should be exercised not to rub the radioactive material into the surface, but to use a back-and-forth method with pressure.

The dry method involves the collection of large pieces of glass and debris with forceps and disposition into a container as in the wet method. The area should then be carefully cleaned with a vacuum cleaner. The collecting bag should be disposed of as contaminated and the cleaner itself should be considered as being contaminated.

All material utilized in the cleaning operations should be considered as having been contaminated until examined and proven otherwise. No such material and equipment should be allowed to come in contact with the body at any time. Equipment such as forceps and vacuum cleaners which are found to be contaminated may be decontaminated using approved procedures. Where the services of technical personnel are not available to provide advice on this problem, disposal is indicated.

Absolutely no food, drink, or smoking tobacco should be allowed in an area which has been contaminated. All personnel handling radioactive material should be carefully monitored with a GM type instrument before leaving the contaminated area. They should thoroughly wash their hands and arms before eating, drinking or smoking.

Debris from broken tubes and contaminated equipment must be disposed of under suitable precautions to prevent further spreading of the radioactive material. Similarly, unbroken tubes which are no longer usable must be disposed of in such a manner as to prevent their breaking and creating a hazard.

Burial in suitably encased containers is a satisfactory method of disposition. It is recommended that an inner container such as a used aircraft instrument can be utilized. After the container is sealed, it should be encased in concrete and then buried to a depth of not less than five feet in an isolated area which is in the possession of and will be maintained by the disposing agency.

In some cases radioactive wastes of low level contamination may be stored until radioactivity has decayed to below permissible exposure levels. In the case of radium compounds of extremely long half life, combined with the fact that the material offers such a serious internal hazard, even small quantities must be disposed of under rigid precautions.

The selection of burial sites should give consideration to the composition of the soil, the presence of ground water, and the possibility of erosion exposing the buried material. Limestone soils should be avoided with preference to soils in which there is little or no leaching or fissuring. Activities located near the sea may find it more expeditious to accomplish disposition by burial of concrete encased cylinders at sea. Clearance for such operations should be obtained from the Public Health Service and the Coast Guard. Such burial sites should be marked with conspicuous warning and their location should be entered in permanent records of the particular plant so that in case of future construction appropriate safeguards enforced to preclude inadvertant exposure to workers.

In the event that the breaking of a tube results in a wound, first aid measures should be administered immediately following such an accident. The wound should be irrigated with copious amounts of clean water immediately and the affected individual should report to the nearest medical facility as soon as possible. Definitive care of suspected contaminated wounds should follow the usual surgical procedures for heavily contaminated injuries. Plant physicians should be familiar with the follow-up examinations required so as to be able to detect the earliest evidences of acute radiation injury.

In summary, although a potential health hazard does exist in the handling and disposition of radioactive tubes, this hazard may be considered to be on a par with many of the commonly accepted risks of industrial operations, including the utilization of toxic chemicals in certain processes. Although the immediate reaction to any radioactive hazard is a desire to institute elaborate precautions, the fundamental health precautionary measures required in handling of radioactive electronic tubes revolve around common sense application of basic principles. As in all industrial health problems, a combination of engineering and medical controls is indicated. Education of workers to the hazards without generation of fear is essential.

Discuss Your Problem

(A discussion on pertinent problems developed from the floor and led by three safety engineers representing the East Coast, the Middle West and the West Coast industrial areas.)

Discussion Leaders:

J. C. SEWELL, Safety Engineering Supvr., Wright - Aeronautical Corp., Wood-Ridge, N. J.

LT. COL. R. T. HOLLYWOOD, USAF, Safety Director, Air Materiel Command, Dayton, Ohio.

R. WILKINS, Chief Safety Eng., North American Aviation Inc., Los Angeles, Calif.

(Summary of Discussion)

DELEGATE: What success have you people found in building in guards on power press dies, the relative cost, and the management repercussions, if any?

MR. SEWELL: In some states we have no choice. We must by law in New Jersey either enclose the operation or build a guard on the die.

DELEGATE: We have many short runs. It will help if you keep track of the cost of dies and accidents. We found a 1 to 5 per cent increase in cost through the use of barrier guards.

ANOTHER DELEGATE: Sometimes there will likely be less cost.

MR. WILKINS: Do any of the men present incorporate guards in their original die making? (Two delegates raise their hands.)

MR. ANDREWS: At Santa Monica, if two-hand controls can be used, built-in guards are not needed. Sometimes they can't be. We have found the set-up time high on enclosure type of guards.

MR. GIBBONS (Bell Aircraft): We took off all two-hand controls and substituted air guards. The guard operates the machine. A plastic window comes between the hands and the die. If anything blocks the drop of this window, it prevents the die from striking. This also protects against die breaks. We've found the set-up time lower, since the guard has to be installed only once. It takes care of most jobs, even large sheets. This provides only a frontal enclosure, and side-guarding must be adjusted.

DELEGATE: We have found the electric eye useful on presses.

MR. TEMPLE (Convair): We don't enclose any except strip stock dies. We use two-hand controls and have no trouble with tampering. We do check for tampering with each shift.

MR. LEE JOHNSON (Northrup): In using methyl bromide extinguishers, I argued for the addition of a warning odor and did succeed in getting one put in. This odor saved two of our employees. First we used wintergreen, but the employees liked that, which presented a hazard, and the odor was also easily absorbed. Medical officers at Wright Field gave us an odor made of acetic acid and something to make it smell like a barnyard. In California the state insists on the use of a warning odor. I think this Section might follow up this problem as a project.

MR. BUCK (NACA): I want to make a plea for standardization in the proper identification of line carrying gases and fluid. You are familiar with military regulations, but we also need standardization for commercial planes and at present there is no such standardization in practice. We recently had a serious accident and one near miss. In one case a pilot grabbed the wrong bottle of gas at 40,000 feet, and in the second case a bottle of nitrogen exploded in a wind tunnel. It had been filled with oxygen by mistake. Is any standardization planned?

DELEGATE: In Los Angeles we used a color coding of bottles, but in Ohio these were completely reversed. I'm not sure we need a standard.

MR. BUCK: I think this problem goes beyond the problem of air transport. And there are even inconsistencies in Air Force standards. We need standardization identification on both bottles and lines.

MILITARY DELEGATE: All the color codes stop short of the mark.

DELEGATE: Has anyone had trouble with high frequency noise? What can we do to protect against it?

MR. CHAPMAN: There are some good English ear defenders.

MR. WILKINS: Dr. Wheeler, of the American Academy of Ophthalmology and Otolaryngology, has done research in three California plants and has developed a modification of the ear defender. We hope to have a report soon, and I will send it to the National Safety Council. The new type gives about 38 decibels of attenuation. We had the problem of four engine jet bombers producing about 145 decibels, which is very uncomfortable. We are not too worried. Periodic audio tests can tell who has hearing loss, and persons with hearing loss can be transferred. In six months their hearing comes back to normal. Our people wear defenders of the internal type. We can reinstate them in the same department after the hearing recovered.

DELEGATE: The Navy has a doctor working on the same problem. I wish we could get all the studies together.

DELEGATE: I know a type of defender which cuts down high frequency noises, does well in protecting comfort and still allows a person to hear.

DELEGATE: Is it permissible for an engine test crew to enter a cell when the engine is idling?

ANOTHER DELEGATE: I don't know of any regulation, but I feel the answer is "No."

DELEGATE: I don't believe it is any more hazardous than when we are testing a reciprocal engine. They can't make adjustments without doing it. Safety depends on the construction of the cell. In ours a man can't get to the rear of the jet.

DELEGATE: In some engines, you can get in the ram jet even at idling speed.

Officers of the

AERONAUTICAL INDUSTRIES SECTION

NATIONAL SAFETY COUNCIL 1951-52

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1951

Current Safety Topics in the

AIR TRANSPORT INDUSTRY

As presented in the Sessions of the Air Transport Section at the 1951 National Safety Congress

Volume 3
Transactions
39th National Safety Congress

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425 No. Michigan Avenue • Chicago 11, Ill.

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Radioisotope Shipments in Aircraft Accidents

By EDWARD J. KEHOE
Chief, Fire and Accident Branch, New York Operations Office, U. S. Atomic Energy Commission, New York City

The most popular use of radioactive material in industry and in medical diagnosis and treatment is in the form of radioactive isotopes, which are simply radioactive varieties of substances we are already familiar with, such as carbon, sulphur and iodine. The radioactive form of a material cannot be distinguished chemically from its non-radioactive form; consequently, the radioisotope can be used to "tag" a material and to follow its routine chemical reactions. Radiation detection is much more sensitive than chemical detection.

As of June 30, 1951, the Isotope Division of the Atomic Energy Commission at Oak Ridge had made 12,905 shipments of radioisotopes to U. S. users outside Commission facilities. In addition, 1,135 shipments of radioisotopes had been made to foreign users. Approximately 80 per cent of these shipments have been sent by either air express or air freight; the highly perishable character of many short-lived radioisotopes requires that they be transported by air if they are to be successfully used at any distance from their point of manufacture. In addition to air transport, the shipments have been made approximately 19 per cent by Railway Express and 1 per cent by motor freight.

Radioisotopes are used in very small quantities; they do not of themselves contribute to the cause of fire nor do they tend to increase the intensity of combustion. The fact that a material is radioactive does not alter its combustion characteristics; radio-carbon burns in precisely the same manner as carbon which is not radioactive.

The industrial uses of radioactive materials are quite interesting. Radioisotopes are used in mapping sewers and locating pipeline obstructions. They serve as boundary markers for successive shipments of oil in pipe lines. Radiocobalt is utilized to radiograph thick castings and costs only a fraction of the radium formerly used; it can also function as a level gage to indicate the height of a liquid without the necessity of a mechanical connection.

General Aniline and Film is using radiocalcium to study synthetic detergents. Metal wear inside of motors can be studied without tearing down the engine, when bearing surfaces contain radioactive iron. The Bell Telephone Laboratories employ radiostrontium in searching for better preservatives for telephone poles and better methods for using such preservatives. A very sensitive and accurate type of thickness gage which does not damage materials is actuated by a radioactive source.

The medical applications are equally as intriguing. For example, saline solutions can be tagged and used to trace the flow of various fluids throughout the human body.

Prior to evaluating the hazard of radioisotopes in aircraft accidents, it is necessary to determine precisely what radiation is, and how we package and handle radioisotopes safely under routine conditions.

The radiation we are concerned with is an effect produced by the disintegration of atoms, a mechanism used by nature to achieve a nuclear balance. A somewhat similar phenomenon is that of water seeking its own level to accomplish a mechanical balance. The physiological effect of the radiation is that it attacks the living cells in the human body. A cell ordinarily recovers from light damage but severe injury may cause it to die. If sufficient cells are destroyed or badly damaged, the person is severely injured or dies; however, the important point is that an extremely severe exposure to radiation is necessary to actually cause death.

To say simply that something is radioactive does not mean that it is necessarily lethal or that it is to be feared; to say that something is "radioactively contaminated" is not being sufficiently definitive, unless the base for the maximum permissible level is indicated, and does not necessarily mean that we cannot have any contact with it. As a matter of fact, we have all been living with radiation for a long time. Even before man existed, the radiation of cosmic rays was striking down upon the earth from the

skies. The average radiation received by all workers at the Hanford and Oak Ridge plants is less than half the amount which residents of Rocky Mountain cities receive from cosmic rays.

Radioactive elements, like radium in the earth itself, give off radiation. Many of the most popular mineral waters drunk by people in the United States are naturally radioactive. Your face gets more radiation when you get your teeth X-rayed than it would receive over a period of a year if you worked in one of the plants operated for the Atomic Energy Commission.

Radioactive materials emit three types of radiation, namely, alpha, beta, and gamma rays. Alpha is the least penetrating of the three and is completely absorbed by the first fraction of a millimeter of skin surface. Consequently, external alpha exposure can be disregarded. However, alpha-emitting materials do present a hazard if ingested or inhaled since they then come in contact with internal body tissue.

While beta is more penetrating than alpha, it actually does not penetrate very deeply and the principal danger is that of exposing the entire body to radiation from a relatively strong beta source.

Gamma radiation is the most penetrating of these three types and must be guarded against because in sufficient dosage it may affect the skin and the internal blood-producing and reproductive organs. Personnel protection from radiation may be achieved variously: by shielding, by control of distance from the source of radiation, and by control of the time of exposure.

As a radioactive substance gives off its radiation, it disintegrates and becomes less powerful. The time required for half of a radioactive material to decay, or for the material to lose half of its strength, is known as its half-life. This half-life is a constant value and varies with each particular isotope. It remains the same regardless of the amount of the material sample under consideration. After six half-lives the material is 1.6 per cent of the original strength. Various isotopes have half-lives which range from a fraction of a second to thousands of years.

The half-life and type of radiation given off by five common radioactive materials are as follows:

Element	Half-Life	Radiation
Carbon—14	5100 years	Beta
Cobalt—60	5.3 years	Beta and Gamma
Phosphorous—32	14.3 days	Beta
Iodine—131	8 days	Beta and Gamma
Sodium—24	15 hours	Beta and Gamma

Alpha radiation is generally emitted only by the heavier and naturally radioactive materials, such as uranium, radium and thorium, which also give off beta and gamma radiation in their process of disintegration.

The unit for measuring the quantity of radioactivity in the source material is the curie; also the millicurie (one one-thousandth curie) and the microcurie (one one-millionth curie). The unit of measure of the radiation dosage on the exposed substance or object is the roentgen or the milliroentgen. The maximum permissible dose for personnel routinely exposed to gamma radiation over the entire body is recommended by the National Committee of Radiation Protection and the International Congress of Radiology as 300 milliroentgens, or 0.3 r in any week.

The average isotope shipment has been approximately 50 to 60 millicuries of activity; most of these have been in liquid form, generally less than 20 cc. in volume and not exceeding 30 cc. Approximately 85 per cent of AEC isotope shipments have been of materials having a half-life of less than 15 days. The total amount of radioactivity included in these shipments is about 850 curies, equivalent to about two lbs. of pure radium. Only about three lbs. of radium are under human control in the entire world.

Two standardized types of shipping containers are used by the Atomic Energy Commission:

1. The first type for low millicurie quantities of beta-emitting radioisotopes is made up of an inner glass bottle holding the radioactive material, a sealed concrete cylinder with one-inch to two-inch walls holding the glass bottle, and a sealed tin can filled with absorber.

2. The second type for larger quantities of beta-emitting and all gamma-emitting materials is made up of an inner glass container for liquids or a sealed aluminum capsule for solids, a cylindrical lead shield composed of from one-half inch to two and one-half inches of lead, depending upon the radiation present, a cylindrical stainless steel jacket encasing the lead shield, with a gasket between the top and lower part of the steel cylinder, and a wooden box encasing the entire container assembly.

Consideration is being given to replacement of the wooden box with a steel drum because the drum will not be as heavy, slightly cheaper, probably longer wearing, and more fire resistant.

To the captain of a commercial airliner, the safety of his ships, passengers and cargo resides to a large degree in navigation instruments. It is natural that the question of the possible effects of radiation on instruments should therefore be raised. This is actually an imaginary problem.

The principle of operation of no known navigation instrument depends in any way on ionization and these instruments are completely inert to gamma rays at available intensities. There is no known flight instrument, navigation instrument, radio, radar, or television apparatus which is responsive to the gamma ray intensity levels encountered in the shipment of isotopes.

The Civil Aeronautics Board in Civil Air Regulations 49 has promulgated regulations for the packing, marking and labeling of radioisotope shipments via passenger aircraft. The regulations are essentially the same as the Interstate Commerce Commission regulations. However, a number of air carriers have indicated their own individual restrictions to the general articles, all of which is published as a part of the "Official Air Transport Restricted Articles Tariff No. 1," issued October 15, 1950.

When the tariff first became effective there was a rather limited acceptance of the regulations covering air transport of radioacture materials. As of June 15, 1951, however, of the twenty-seven participating carriers, nineteen accepted the provisions of the tariff applying to radioactive materials, as published. The additional restrictions of individual airlines are relatively minor in nature; for example, the C.A.B. like the I.C.C. permits up to 200 milliroentgens per hour radiation at the surface of the shipping container. Nineteen of the airlines accept this figure; four others limit this figure to 15 milliroentgens. Naturally, it will be to the advantage of all concerned if these differences can be resolved.

In addition to the articles acceptable for transportation on passenger aircraft, any article accepted for and packed, marked and labeled in accordance with the instructions for transportation by Railway Express may be carried in cargo aircraft. The C.A.B. regulations contain a table of minimum distances of separation between a container or group of containers of radioactive materials and crew members and passengers. It is obviously somewhat more difficult to comply with this regulation for passenger craft than it is for cargo craft. The label now used meets all requirements for air transport and also for shipment by mail or truck in the event the shipment is "grounded" en route to destination or for movement to or from an airport.

Concerning the subject of accidents involving air shipments of radioisotopes, there risk to health and property is extremely slight. While this paper is particularly concerned with accidents involving such shipments, I have reviewed the subjects of radiation, shipping containers and shipping regulations in some detail in order to indicate the very careful and conservative approach to the problem. The air shipments are so safe that even in the event of an accident the problem is slight.

Relative to accidental damage or breakage of radioisotope shipping containers, C.A.B. Civil Air Regulation 49 specifies action as follows:

"Whenever any shipment of radioactive material is damaged or appears to be damaged, it should be removed from transportation and segregated as far as possible from human contact. The shipper should immediately be contacted for disposal instructions and the Administrator of the C.A.B. should also be notified."

Whenever there is any actual spillage of radioactive materials to the extent that the materials are no longer contained within their inner containers, no attempt should be made to remove or clean up the materials until instructions are received from the shipper or other qualified persons are present to supervise the handling."

These two requirements may seem somewhat stringent. However, they relate to accidents which are not serious and which afford plenty of time for care. In such incidents there is far more danger of damaging shipments of photographic equipment than there is of injuring human beings.

Considering radioisotope shipments which may be involved in serious aircraft accidents, the most important factor is the difference in the radiation "maximum permissible level" which may be accepted under emergency conditions as compared to that which is used in routine operation conditions, as in a laboratory. There is no contradiction because the one involves a "one shot" exposure, the other a continual exposure. The maximum permissible level used for the employee in our plants is extremely low because the man may be exposed day after day, year after year, for his entire working life. An individual who is exposed to radiation only on rare occasions—as, for example, in the emergency situation of fire fighting—can take as many as 500 times the daily maximum permissible level without any serious after-effects. You might be subjected to 50 times the daily maximum permissible dose during certain types of fluoroscopic X-ray examinations.

In the event of an aircraft crash, the additional risk presented to passengers or crew or to crash rescue and fire fighting personnel, by possible breakage of radioisotope containers or burning of the isotopes is just about nil as compared to the other risks persons are confronted with at such a time. I have done a considerable amount of flying and have had an opportunity to do some training and operational work with crash rescue and fire fighting units; I can assure you that if I am ever in a plane which is about to crash, or if I am ever involved in attempting to rescue personnel from a burning plane, I will be very badly scared. But the last thing in the world I will be worrying about is whether or not the plane is carrying radioisotopes!

In my opinion, the airline safety directors have a training job to do with shipping clerks, fire fighters, flight personnel, etc. They probably have a much greater fear of radiation than they should have. It is logical that the risk presented by radioisotopes should be evaluated correctly; it should not be exaggerated. We should be *willing* to assume the same degree of risk in radioisotope shipments as we do with other shipments.

Since 1946, over 20,000 shipments of radioisotopes have been made from Oak Ridge to off-project users in all parts of this country and in 27 foreign countries. In conclusion, I would like to point out that these radioisotopes have been produced, shipped and put to use by hundreds of workers in the isotope production and processing facilities at Oak Ridge, have been handled on railroads, motor-freight lines and air lines, in laboratories and in private institutions and industries—in safety and without a single reported radiation injury.

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2. The second type for larger quantities of beta-emitting and all gamma-emitting materials is made up of an inner glass container for liquids or a sealed aluminum capsule for solids, a cylindrical lead shield composed of from one-half inch to two and one-half inches of lead, depending upon the radiation present, a cylindrical stainless steel jacket encasing the lead shield, with a gasket between the top and lower part of the steel cylinder, and a wooden box encasing the entire container assembly.

Consideration is being given to replacement of the wooden box with a steel drum because the drum will not be as heavy, slightly cheaper, probably longer wearing, and more fire resistant.

To the captain of a commercial airliner, the safety of his ships, passengers and cargo resides to a large degree in navigation instruments. It is natural that the question of the possible effects of radiation on instruments should therefore be raised. This is actually an imaginary problem.

The principle of operation of no known navigation instrument depends in any way on ionization and these instruments are completely inert to gamma rays at available intensities. There is no known flight instrument, navigation instrument, radio, radar, or television apparatus which is responsive to the gamma ray intensity levels encountered in the shipment of isotopes.

The Civil Aeronautics Board in Civil Air Regulations 49 has promulgated regulations for the packing, marking and labeling of radioisotope shipments via passenger aircraft. The regulations are essentially the same as the Interstate Commerce Commission regulations. However, a number of air carriers have indicated their own individual restrictions to the general articles, all of which is published as a part of the "Official Air Transport Restricted Articles Tariff No. 1," issued October 15, 1950.

When the tariff first became effective there was a rather limited acceptance of the regulations covering air transport of radioactive materials. As of June 15, 1951, however, of the twenty-seven participating carriers, nineteen accepted the provisions of the tariff applying to radioactive materials, as published. The additional restrictions of individual airlines are relatively minor in nature; for example, the C.A.B. like the I.C.C. permits up to 200 milliroentgens per hour radiation at the surface of the shipping container. Nineteen of the airlines accept this figure; four others limit this figure to 15 milliroentgens. Naturally, it will be to the advantage of all concerned if these differences can be resolved.

In addition to the articles acceptable for transportation on passenger aircraft, any article accepted for and packed, marked and labeled in accordance with the instructions for transportation by Railway Express may be carried in cargo aircraft. The C.A.B. regulations contain a table of minimum distances of separation between a container or group of containers of radioactive materials and crew members and passengers. It is obviously somewhat more difficult to comply with this regulation for passenger craft than it is for cargo craft. The label now used meets all requirements for air transport and also for shipment by mail or truck in the event the shipment is "grounded" en route to destination or for movement to or from an airport.

Concerning the subject of accidents involving air shipments of radioisotopes, there risk to health and property is extremely slight. While this paper is particularly concerned with accidents involving such shipments, I have reviewed the subjects of radiation, shipping containers and shipping regulations in some detail in order to indicate the very careful and conservative approach to the problem. The air shipments are so safe that even in the event of an accident the problem is slight.

Relative to accidental damage or breakage of radioisotope shipping containers, C.A.B. Civil Air Regulation 49 specifies action as follows:

"Whenever any shipment of radioactive material is damaged or appears to be damaged, it should be removed from transportation and segregated as far as possible from human contact. The shipper should immediately be contacted for disposal instructions and the Administrator of the C.A.B. should also be notified.

Whenever there is any actual spillage of radioactive materials to the extent that the materials are no longer contained within their inner containers, no attempt should be made to remove or clean up the materials until instructions are received from the shipper or other qualified persons are present to supervise the handling."

These two requirements may seem somewhat stringent. However, they relate to accidents which are not serious and which afford plenty of time for care. In such incidents there is far more danger of damaging shipments of photographic equipment than there is of injuring human beings.

skies. The average radiation received by all workers at the Hanford and Oak Ridge plants is less than half the amount which residents of Rocky Mountain cities receive from cosmic rays.

Radioactive elements, like radium in the earth itself, give off radiation. Many of the most popular mineral waters drunk by people in the United States are naturally radioactive. Your face gets
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tance from the source of radiation, and by control of the time of exposure.

As a radioactive substance gives off its radiation, it disintegrates and becomes less powerful. The time required for half of a radioactive material to decay, or for the material to lose half of its strength, is known as its half-life. This half-life is a constant value and varies with each particular isotope. It remains the same regardless of the amount of the material sample under consideration. After six half-lives the material is 1.6 per cent of the original strength. Various isotopes have half-lives which range from a fraction of a second to thousands of years.

The half-life and type of radiation given off by five common radioactive materials are as follows:

Element	Half-Life	Radiation
Carbon—14	5100 years	Beta
Cobalt—60	5.3 years	Beta and Gamma
Phosphorous—32	14.3 days	Beta
Iodine—131	8 days	Beta and Gamma
Sodium—24	15 hours	Beta and Gamma

Alpha radiation is generally emitted only by the heavier and naturally radioactive materials, such as uranium, radium and thorium, which also give off beta and gamma
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, equivalent to about two lbs. of pure radium. Only about three lbs. of radium are under human control in the entire world.

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These two requirements may seem somewhat stringent. However, they relate to accidents which are not serious and which afford plenty of time for care. In such incidents there is far more danger of damaging shipments of photographic equipment than there is of injuring human beings.

Considering radioisotope shipments which may be involved in serious aircraft accidents, the most important factor is the difference in the radiation "maximum permissible level" which may be accepted under emergency conditions as compared to that which is used in routine operation conditions, as in a laboratory. There is no contradiction because the one involves a "one shot" exposure, the other a continual exposure. The maximum permissible level used for the employee in our plants is extremely low because *the man may be exposed day after* day, year after year, for his entire working life. An individual who is exposed to radiation only on rare occasions—as, for example, in the emergency situation of fire fighting—can take as many as 500 times the daily maximum permissible level without any serious after-effects. You might be subjected to 50 times the daily maximum permissible dose during certain types of fluoroscopic X-ray examinations.

In the event of an aircraft crash, the additional risk presented to passengers or crew or to crash rescue and fire fighting personnel, by possible breakage of radioisotope containers or burning of the isotopes is just about nil as compared to the other risks persons are confronted with at such a time. I have done a considerable amount of flying and have had an opportunity to do some training and operational work with crash rescue and fire fighting units; I can assure you that if I am ever in a plane which is about to crash, or if I am ever involved in attempting to rescue personnel from a burning plane, I will be very badly scared. But the last thing in the world I will be worrying about is whether or not the plane is carrying radioisotopes!

In my opinion, the airline safety director have a training job to do with shipping clerks, fire fighters, flight personnel, etc. They probably have a much greater fear of radiation than they should have. It is logical that the risk presented by radioisotopes should be evaluated correctly; it should not be exaggerated. We should be willing to assume the same degree of risk in radioisotope shipments as we do with other shipments.

Since 1946, over 20,000 shipments of radioisotopes have been made from Oak Ridge to off-project users in all parts of this country and in 27 foreign countries. In conclusion, I would like to point out that these radioisotopes have been produced, shipped and put to use by hundreds of workers in the isotope production and processing facilities at Oak Ridge, have been handled on railroads, motor-freight lines and air lines, in laboratories and in private institutions and industries—in safety and without a single reported radiation injury.

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1951

Current Safety Topics in the

AUTOMOTIVE AND MACHINE SHOP INDUSTRIES

As presented in the Sessions of the Automotive and Machine Shop Section at the 1951 National Safety Congress

Volume 4
Transactions
39th National Safety Congress

NATIONAL SAFETY COUNCIL
425 No. Michigan Avenue • Chicago 11, Ill.

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THE AUTOMOTIVE AND MACHINE SHOP SECTION

This volume is a record of the sessions held at the 1951 National Safety Congress by the Automotive and Machine Shop Section. The conduct of these Congress sessions each year is only one of the many cooperative activities which the Automotive and Machine Shop Section carries on in behalf of its members, and for the benefit of accident prevention work in the automotive and machine shop industries generally. The Section gives guidance in the preparation of a great variety of technical and educational material useful in the day-to-day plant safety programs. The activities of the Section are under the direction of its Executive Committee, the members of which are listed at the close of this volume.

Some Elements of Job and Employee Control for Accident Prevention

(A Symposium)

Time Study and Motion Time Analysis and its Influence on Every Day Shop Accidents

By RALPH KERWIN
Chief Industrial Eng., Bulldog Electric Co., Detroit, Mich.

About fifteen years after the close of the Civil War, this country entered a period of rapid industrial expansion and growth. This expansion was stimulated by the arrival on our shores of thousands of skilled craftsmen who fled to the new world from Europe to escape the oppression of personal freedom, the wars which swept back and forth across the continent, and persecution because of religious affiliation. The new world was rich in natural resources, which lay awaiting the hand and energy of anyone willing to develop them for a better way of life. Removal of restraint and new world challenge combined to stimulate development and new ideas. The vastness of this new country, in comparison with the old world countries of Western Europe, hastened transition from small enterprises to larger units. The abundance of raw material contributed to and encouraged the development of manufacturing units for its conversion to meet the increasing demands of a growing population.

As manufacturing units increased in size, there gradually arose a distinction between those upon whose shoulders rested the responsibility of planning and supervising and those responsible for performing the work. Naturally, as a result of this separation, a question arose, the answer to which has been the source of many errors and much disagreement of opinion. I have in mind the question, "What is a fair day's work for which a fair day's pay is exchanged?"

Human nature being what it is, neither party has been satisfied with their share of their combined efforts. Briefly, this describes the economic climate which prevailed when Fredrick W. Taylor began to develop his theory and technique of scientific management.

In the development of this management technique, two major elements were evolved. At the outset, the best way to perform a given operation was a matter of experiment, in which data was recorded giving the facts pertinent to the operation, such as machine used, material, tools, etc., together with the time taken to complete the operation element by element. By this means, data was collected, classified and indexed for reference with future orders.

Secondly, there gradually arose a new division of labor between management and labor. This new assignment of management's responsibility involved the planning of operations, such as determining the best way to perform, together with the proper time, place, materials, instructions, facilities, etc. The great gains in productivity which this accrued were not the result of increased exertion on the part of workers, but were, on the contrary, the result of waste eliminations—waste of workers and machine time through delay of misapplied effort, of failure in proper coordination and planning.

Arising out of this new assignment of management responsibility has been a job now defined as time study technician in its very broadest application. Much clarification of job description and content has taken place in the years that have elapsed until the present time. Volumes have been written, which can be perused at your leisure, describing in detail all the mental, technical and moral aspects. It is not our intention to add anything to what has been written on this subject, but rather to draw out the salient and important points surrounding this job.

There is one outstanding aspect of this job which is worthy of note, namely: the common denominator which is emphasized throughout all the data gathered by a time study man is the element of time. The extent to which this data can be sub-divided

into smaller elements is controlled solely by the ability of the time study man to observe, time and record his observations.

Coupled with this limitation of recording the small increments of time for his elemental breakdown of the operation being studied is the necessity of rating the operator's performance in terms of skill and effort or her pace. "Rating the performance," is nothing more than the time study observer's experienced judgment of how well the operator was performing in terms of the observer's conception of normal or average.

We all recognize that as individuals our performance even at golf is not always consistent, much less on work operations which do not contain an element of pleasure. Carrying the same analogy a step further to observing and judging someone else's performance in a golf game, we have doubled the possibility of error in our judgment. This is equally true in the case of making a time study of an operation.

As an observer, I must at all times be conscious of my own human limitations but, in addition, I must appraise the operator's performance as another human being into terms of my conception of normal or average. To the extent that we fail to do an average job of rating, just so much do we misjudge the operator we have observed. The result of this is either a standard of performance which is either too tight or too loose.

The problem is all the more complicated if, for instance, the job being studied is being performed by a group of operators. Add to this condition an incentive wage payment plan with its reward to the worker who puts forth better than average effort and the problem for a time study man is greatly aggravated. It is no wonder that workers have sought a counter balance or check upon the time study observer's judgment in the person of their Union time study stewards. This is good for it prevents any undue advantage of either party at the expense of the other one.

It is quite logical to stop and ask ourselves one question, "Is there a better way?" After all an engineer continually asks that sort of a question about any project before him if he is worthy of the name.

One answer to the foregoing question is motion study. Motion study, as we have it now, has evolved out of the desire of many time study men for a handbook of classified motions that could be used on any industrial operation. At first thought a catalog of industrial motions appeared to be the answer to a time study man's need for a more accurate method of setting task values, but after reflection upon the problem coupled with experience in using standard data, the much desired objective has not been achieved, at least as originally planned.

However, the desire has stimulated thought and research for a more scientific basis for determination of standard time values. In the forefront of this development work stand two individuals to whom belongs the credit of leadership. I have reference to Lillian M. Gilbreth and the late Frank B. Gilbreth, both of whom have been featured in "Cheaper By The Dozen." The foundation upon which the motion study technique rests is the concept of *therbligs*, or basic divisions of accomplishment. These are the basic motions which may be used in varying sequences and combinations to perform any industrial operation. A clear understanding of these is essential to anyone applying motion study.

One must be able to recognize the basic motions whenever an operation is reviewed with an eye for motion economy. Motion economy as applied to any industrial operation clearly implies that some motion patterns may not be as effective as others in so, or as accomplishing a deserved objective. Therefore, successful motion economy application imposes not only an understanding of basic human motions, but also training and experience in their use from an ever widening practical standpoint.

Purely Physical Basic Divisions

Transport Empty	TE
Transport Loaded	TL
Change Direction	CD
Grasp	G
Hold	H
Release Hold	R
Pre-position	PP

Semi-Mental Basic Divisions

Position	P
Search	S
Select	SE

Mental Basic Divisions

Plan	PL
Inspect	I

Objective Basic Divisions

Use	U
Assemble	A

Delay Basic Divisions

Avoidable Delay	AD
Unavoidable Delay	UD
Rest to Overcome Fatigue	F
Balancing Delay	BD

The use of motion pictures has greatly facilitated the development and applicability of motion analysis data. The film record of how the operation was performed in terms of basic motions used has been an invaluable aid. It has permitted review of the operation as a whole, but also made it possible to examine individual motions as to extent and sequence under varying degrees of applied skill and effort. Nor is this the only advantage arising from the use of motion picture film. As I previously indicated, there is a practical limit to the smallest work element which may be recorded by stop watch. This practical limit rules out any analysis insofar as basic motions are concerned. Thus the use of motion picture film makes possible an accurate record of motions performed, which are more minute than can be recorded by stop watch.

Human reaction time of the observer is no longer a limiting factor. The camera running at a closely controlled speed will by virtue of the number of frames used record not only the complete motion pattern of the operation, but will within the mechanical limits of its governor establish the time taken for basic motions and the entire job. Obviously, to use a camera to set the allowed time to perform any job is far from practical or economical.

Through the efforts of more than one group of men, the time to perform a basic motion such as reach, move or grasp has been determined from motion picture film analyses on hundreds of operations so as to give effect to all factors which may affect the time or extent of the motion. These basic motions and their limiting factors have been cataloged and classified so that having had the necessary training and experience, an engineer or observer can apply the recorded time values to an innumerable variety of operations with complete assurance that the task time thus set is basically sound and equitable from a human relations viewpoint.

Task times thus set have another very important advantage over those established by time study methods to the extent that time values for these basic motions have been determined and verified by exact observation and correct thinking, so to that extent these values will be correct on a scientific basis.

Laws of Motion Economy

1. When both hands begin and complete their motions simultaneously and are not idle except during rest periods, maximum performance is approached.

2. When motions of the arms are made simultaneously in opposite directions over symmetrical paths, rhythm and automaticity develop most naturally.

3. The motion sequence which employs the fewest basic divisions of accomplishment is the best for performing a given task.

4. When motions are confined to the lowest practical classifications, maximum performance and minimum fatigue are approached.

5. When conditions are the same, the time required to perform all basic divisions of accomplishment is constant for any given degree of skill and effort.

Corollaries to Laws of Motion Economy

1. Hesitation, or the temporary and often minute cessation from motion, should be analyzed, studied, and its cause accounted for and, if possible, eliminated. When various parts of the body do not begin or complete their motions simultaneously, the resulting balancing delay should be recognized and recorded as being necessary.

2. The shortest time taken for each motion during the course of the study made on an expert operator should be considered the desired standard; all variations of time from this standard should be analyzed for each motion and the causes determined and recorded.

3. The best sequence of motions for any one class of work is useful for suggesting the best sequence for other kinds of work.

4. Where delay occurs, consideration should be given to the advisability of providing additional work which will permit utilizing the time of delay, if study indicates that the delay is unnecessary for overcoming fatigue.

5. All material and tools should be located

within, or as near as possible to, the normal grasp area.

6. Tools and materials should be located so as to permit the following of the proper sequence of motions. The part required at the beginning of the cycle should be next to the point of release of the finished piece of the preceding cycle.

7. Tools and materials should be pre-positioned in order to eliminate the search and select basic operations.

8. Hands should be relieved of all work that can be done with the feet or other parts of the body, provided there is other work which the hands can do at the same time.

Up to this point we have considered fundamental characteristics of time study as such and in addition the characteristics of motion study techniques. You may perhaps ask the question, "What has all this to do with the *relationship between motion study* and the prevention of everyday job accidents?"

As you are all well aware, fatigue enters into productive capacity as the day wears on, particularly when an employee is engaged in highly responsive work. Not only does fatigue play a part but the monotony of the job plays an important part in the employee's interest in his or her job. It is at this point that the relationship between time and motion study with the prevention of shop accidents plays a very important part. If a particular operation is set up so that an employee, in order to complete this operation, is required to work either in an unnatural, awkward or poorly organized method, fatigue and monotony inevitably have a bearing on the employee's output. Referring back to law No. 4 of the 5 laws of motion economy previously quoted, I would like to re-quote law No. 4.

"Law No. 4 is when motions are confined to the lowest practical classification, maximum performance and minimum fatigue are approached."

From this law it will be readily apparent that either a time study or motion study application bears a very definite responsibility insofar as reducing everyday job accidents to the lowest possible minimum. This responsibility is assumed upon the basis that these five laws of motion economy are constantly observed and applied whenever a job is set up, a standard applied or an employee is trained in the method of performing a given operation.

As safety men I should like to submit for your consideration that although it is the responsibility of time study and methods engineers to see to it that each operation is set up in conformance with these laws, yet we cannot overlook the fact that you men in checking the safety surrounding factory jobs can offer a very definite assistance in regard to safety.

This assistance which you can offer is not through a complete understanding of motion study techniques but rather in the recognition that motion study strives to set the job up from an economic as well as fatigue elimination standpoint. Whenever you men become aware that a job is unduly fatiguing to the operator, this should become a clue that the job is not properly organized from a motion economy standpoint. This fact, if communicated to your standards department, can aid them in checking a job where undue fatigue exists with the viewpoint of reducing this hazardous element to the minimum and by the same token reducing the possibility of an accident before it occurs.

In conclusion I should like to re-emphasize the point which I have made, namely, that time and motion study application to everyday factory operations have a direct responsibility to assure the operator that his or her operation is being performed in the simplest and most economic manner. In the discharge of this responsibility to both management and employees, they are contributing to the reduction of everyday job accidents.

Prerequisites of Employment in Forecasting Employees' Safety Responsiveness

By A. L. McCOLLUM
Dir. of Employment, Delco-Remy Div., General Motors Corp., Anderson, Ind.

Perhaps many of you are wondering, and justifiably so, what an employment man is doing speaking to a safety conference. I feel just a little like the illegitimate son at the family reunion. I shouldn't feel that way though and I hope you don't look upon me in that light because there should be a very close and real relationship between employment people and safety engineers.

Our jobs have a common responsibility, namely: "Assisting the management of our companies in maintaining a safe, healthy, contented, and efficient working force." Of course you may get most of the blame if your accident rate is high but I know as well as you do that a great many accidents in your plant started in your employment office. Therefore, accident prevention by forecasting employee safety responsiveness is our common challenge in meeting our common responsibility.

What can we do about meeting that challenge? Just how can employment people and safety people get their collective teeth into this problem and attack it as a team? Lets look at the various elements of the problem and then fit them together.

First our problem is the individual differences in people—the people we hire and you try to keep from getting hurt. It's such a well known fact that people differ that it is frequently overlooked or accepted as something we can't do anything about. Worse still, the standards set by employment departments all too frequently include only a few of the more obvious differences and overlook the harder to determine but much more important differences in ability, aptitude, attitude, etc.

There are many important differences in people that we should consider. Improper size or inadequate physical strength and stamina may frequently mean the difference between an employee on the job or in the hospital. Physical qualifications don't stop with size and strength alone though. Physical reaction time, dexterity and general muscular coordination are also important factors. So are the physical senses, vision, feeling, smell, hearing, and even in some cases taste. Physical qualities may all be important to safety and efficiency and hardly any two people are exactly alike in these qualities.

Mental qualities are important too. People differ in their ability to learn to remember or understand the written and spoken word. This is vitally important to the safety of our employees. Few, if any, applicants who come to an employment department are ready and able to go out to a job in an industrial plant before they receive some instruction and training on how to perform that job efficiently and safely.

If the man fails to understand and remember his instructions or training, the chances are great that he will fall victim to an accident or fail to be a satisfactory employee on the job. We are very careful to see that people we hire for jobs have been exposed to a training period but we are likely to overlook their ability to absorb and retain the training needed. This is particularly true on unskilled or semi-skilled jobs.

I recall a boy we have on our payroll in one of our Anderson plants who became quite a problem some time back. He was originally hired for a labor job but was promoted from a labor gang to a job of driving a fork truck as one of the materials handling men. He had been very satisfactory on the labor job, had requested a better job and the foreman thought he deserved one. He was given very careful instructions by his foreman on how to operate this new job safely. In addition he was given a written copy of these instructions to study over so that he would not forget them.

It wasn't long, however, until he violated one of his instructions and an accident occurred, minor in results, but it easily could have been serious. His foreman reinstructed and cautioned him to re-read the instruction sheet. It was only a few days later, however, that he was again involved in an accident that was caused by an obvious violation of his instructions. A similar thing happened a third time before it was discovered

that this boy was a near illiterate, with such a low mental ability level that he could neither understand his written instructions nor remember the verbal ones clearly for more than a few hours.

That boy's accidents started in the employment office where those very important factors had not been determined so that his subsequent job assignments could be commensurate with his ability. Differences in mental ability do occur and may be extremely important to job success.

Temperament or emotional stability are important factors from both the standpoint of productivity and safety. An emotionally upset person is obviously more susceptible to accident and serious injury than a calm, clear-thinking individual. Yet temperament is a factor of individual difference that is somewhat difficult to determine and understand and is, therefore, frequently overlooked.

This is particularly true once we get to know a person well. We are prone to think "He must have gotten up on the wrong side of bed today"—but we seldom look at him as a serious accident hazard while he is in that "grouch" mood. Nevertheless statistical research has proved that a great many accidents occur at times when the person or persons involved are in an undesirable emotional state or are emotionally immature persons. Temperaments differ from one individual to another and these differences too are mighty important to us.

There are many more specific physiological and psychological differences between human beings but I believe they are beyond the scope of this discussion. I believe we've touched them all in a general sort of way when we call them physical, mental, and temperamental or emotional differences. How do they relate to safety, and what can we do about them in predicting safety responsiveness?

The safe and efficient operation of a punch press doesn't have exactly the same requirements as the safe and efficient operation of an automatic screw machine, or the operation of a drill press, or a paint spray, or a plating tank, or a simple repetitive assembly opertion.

We know that there are many differences between these jobs. We pay people different rates of pay to perform these operations. They require differences in training. Some are considered more highly skilled than others and some are considerably more complex in nature.

Therefore, among people with differences in mental ability some are going to be successfully trained for the high skills and others are not. Some of these jobs may require more muscular coordination, or more dexterity, better vision, greater strength, or more height than others. The highest degree of emotional stability may be vital in one and not too important to another.

The answer to "What can we do about it?" is obvious. Match the characteristics of the man as nearly as possible to the requirements of the job. But proper job placement has been a keynote in industry for a long time. The real problem is getting it done with the assurance that it's done correctly. It takes the combined efforts of lots of people in any organization to accomplish it.

It's human nature to work with opinions. We all do it every day in some situation or other. It's easier to form an opinion than to dig out all the facts before arriving at a logical conclusion. Prove that to yourself the next time you investigate an accident. Keep track of the opinions that are expressed to you and the number of facts that are given to you about the employee, the job, what happened, how it happened, etc. The opinions will far outnumber the facts and a good many of the opinions will be directly contrary to the facts.

What [illegible] that to do with our common responsibility [illegible] maintaining a safe, healthy, contented and efficient working force for our management? Remember my example of the boy who was a near illiterate who got into so much trouble? He was one of those that people are all too prone to write off as just "no good" when he got into trouble.

Why? Because everyone responsible for his job assignment was working on opinions—he had been doing satisfactory work and seemed to be a good boy, he was just careless with a fork truck—no one took the time to determine the facts till it was almost too late.

Once the facts were determined and a proper job placement was made, he again proved satisfactory. If that had been done in the employment office, or by the foreman, or by the safety engineer who investigated his first accident, all the later trouble would have been avoided.

It was no one person's fault, it was the fault of all who dealt with the boy from the time he was hired till the matter was finally straightened out. That sort of thing can easily be avoided if, starting in the employment process, everyone responsible makes every effort to get facts upon which to pass judgment and render decisions.

There are several ways to get these facts. For example you can investigate the background of every job applicant that you are interested in hiring. Such investigation would include prior work history, school records, home and family background, hobbies and other spare time activities, etc.

The investigation can be made by trained investigators making personal contacts, or phone calls and reference blanks sent through the mail. They can also be obtained by hiring the services of professional investigation organizations such as credit bureaus, etc. They can never be too complete but they can be misleading if done haphazardly.

You can add to that information by giving tests to the applicants to determine as accurately as possible their mental ability, mechanical knowledge, manual dexterity, emotional stability, interests, physical characteristics, and many other areas that may be of interest to you as their prospective employer. Tests too can be misleading if not properly evaluated.

A well-planned interview with the applicant by a skilled interviewer will further uncover some of the facts needed. Facts that seem to conflict from these different explorations may need to be rechecked to determine the most nearly right answer.

Once the decision to hire or not to hire is made on the basis of all the facts obtained, the job is only half done. All these procedures together will not produce a perfect result. A man picking apples in the dark has about a fifty-fifty chance of getting a good apple. The same is true of hiring people purely by chance. The best you can hope to do with the facts obtained from all the investigation, test, and interview procedure is to improve that chance relationship until you approach perfection.

No matter how good a job you do in the selection and original placement process, however, some of the apples are going to go sour once they get on the job. The real proof of your selection comes on the job and over a period of time, depending upon the complexity of the job itself. Therefore, the second part of this job of ours, and frequently the harder portion to get accomplished, is the follow-up phase.

The follow-up starts with the indoctrination or introduction of the job to the employee and the various types of training given to him on the job. It continues with the daily observance of his performance on the job; and it never stops as long as he remains an employee. This follow-up, to be of any value, must also be based on facts. A foreman's statement, "He's no good," doesn't give you a thing to use in making a constructive adjustment in either his assignment or your employment and placement standards or procedures.

On the other hand, there are facts, such as, "This man's hand coordination is so slow that he seems to be all thumbs," or, "This person is not able to see the difference between two similar parts," or, "He has mixed them several times and is unable to sort them easily," or, "This man did an outstanding job today because when he found an error in a blueprint he corrected it and changed the set-up before the job was run. If he had let it go, considerable waste and scrap would have resulted."

Those statements are facts that indicate some trait or ability that vary from one person to another. They also show how well or how poorly the employee is adapted to the requirements of his particular job assignment. They also serve as spotters to the employment department, showing whether their spots are hitting the target. They may help them make adjustments in their investigation, testing or interviewing procedures so that similar mistakes can be prevented in the future.

What is the source of these follow-up facts and how should they be handled? The foreman, the safety engineer, and any other member of supervision or any other employee who is in a position to observe the things that actually happen is the source.

Some method should, therefore, be devised to facilitate the easy recording of the facts on an individual record for the employee involved. The information thus assembled should be readily available for the employment people, safety engineers, supervision, etc.

Facts placed on paper are permanent and as meaningful ten years after the fact as the day they are recorded. Facts retained in the human memory deteriorate into opinions or are lost altogether. Facts are only valuable when they are available and used —they may be needed anytime in the future and the more of them that are available, the more reliable they become and the more sound the decisions that are made from them.

This is an expensive program; it does take time. So are accidents expensive and time consuming. The loss of one eye costs far more in dollars and cents alone than need normally be spent on testing 5,000 job applicants. The loss or permanent disability to one hand or one foot costs more than thoroughly investigating the past history of hundreds of people seeking employment.

Several thousand applicants can be interviewed and closely followed up for less than the cost of one fatality. All this without regard to the increase in efficiency of operations brought about by proper job placement.

Can we actually forecast safety responsiveness in our employees? Can we prevent accidents by stopping them in the employment office? Can we actually meet our responsibility of maintaining a safe, healthy, contented, and efficient working force? Yes, we can if we search for the facts about people and determine their individual differences, determine if their abilities fit the requirements of the job. If they do, train them to use these abilities properly. Realize that you may have overlooked something and be ever ready to change your decision if the subsequent facts show that an error of selection or placement has been made. Get the facts and you will discover the cause.

Moving Death—Material Handling

(A Panel Discussion)

(A review and analysis of materials handling accidents in automotive and machine shop industrial operations.)

Discussion Leader: E. O. Prange, Safety Director, Bendix Products Div., Bendix Aviation Corp., South Bend, Ind.

Narrator: C. C. Drake, Dir. of Plant Protection & Safety, The Oliver Corp., South Bend, Ind.

Participants:

Walter Haag, Safety Supvr., Servel, Inc., Evansville, Ind.

T. R. Leadbeater, Safety Eng., Ford Instrument Co., Div. of Sperry Corp., Long Island City, New York.

H. M. Huntington, Works Safety Supvr., International Harvester Co., Chicago.

Gil Snyder, Supvr., Safety & Sanitation, Allis-Chalmers Mfg. Co., La Porte, Ind.

(A Summary)

Case 1

Victim was pinned between an electric platform lift truck and a standard gauge gondola car resulting in his suffering fractures to two ribs and a collapse of one lobe of the left lung.

Truck was parked on a concrete apron awaiting repairs. The fact that the speed control lever spring was broken was plainly marked in chalk at the controls of the truck. This truck was equipped with the "Tiller" arm type of steering device. This device struck victim in chest and pinned him to the gondola car.

Investigation disclosed that since the spring on the speed control lever was broken, gravity caused the lever to be in a full "on" position. This permitted victim to move the truck by use of the "Forward-Reverse" lever rather than by the speed control lever.

In driving the truck, victim was not facing the direction he was going.

If victim had been in proper driving position the "Tiller" arm would have struck the gondola car instead of the victim. The brakes on the truck were found in good operating condition when inspected after the accident.

Conclusions

Mr. Leadbeater stated that there were a variety of causes of this accident. The operating of a defective truck was, of course, a primary cause. Other causes were divided into two groups: Contradictory and underlying.

The contradictory causes numbered: No identification of the damaged truck, not taking the truck out of operation, and the fact that the truck was operated improperly.

The underlying causes included: Unsafe design of the speed control lever, ignorance of supervisor, and ignorance of top management of the accident prevention program.

Mr. Leadbeater emphasized that for an accident prevention program to succeed, management must find out its responsibilities. In a plant where top management takes an indifferent attitude there is little chance that foremen and other supervising personnel will effectively enforce and take an interest in such a program.

Mr. Leadbeater concluded that top management needs training as much as any other group in the plant.

Case 2

This accident occurred in a sheet metal storage bay. Two ten ton cranes operate in this bay unloading sheet metal from gondolas and trucks, placing the steel on material handling equipment, and distributing it to various fabricating machines. A sheet metal lifter with angle iron jaws which are adjustable and clamp over the lift of metal with an ice tong effect is used to handle this metal with the cranes.

A floor man and a helper were instructed to restack a lift of sheet metal by hand on 2 x 4 cross skids and move it to another location. This restacking was done by them on a truck built and used for transporting steel to the shears. The platform of this truck was 30 inches from the floor. This particular steel was 3/32 of an inch x 9 inches by 10 feet. The steel was restacked in three equal piles approximately 8 inches high. Nearby on one side of the truck there was a stack of steel about 3½ feet high and on the other end by a pile 6 feet high. On the other side close by also, was a stack 5 feet high.

After restacking was completed the floor man signaled the crane operator to move the lift of steel from the truck. The crane operator lowered the lifter over the lift of steel and the floor man proceeded to close the lifter on the steel supposedly under the 2 x 4's, and gave the crane operator the signal to hoist after receiving a nod from the helper that his side of the lift was okay. As the craneman began to hoist the lift, the metal suddenly began sliding off the truck onto the feet and legs of the helper pinning him against the stack of steel on his side of the truck.

The following points were brought out in the investigation:

The injured man was 19 years old and a new employee. It was the first time he had worked as a floor man's helper. He had received only meager instructions from his supervisor. The supervisor admitted that the instructions were incomplete and not properly enforced. The injured employee and the floor man admitted that they had used poor judgment and took a chance to save time. The metal was not strap-banded to the skids as it was not a regular practice to do so. The crane operator could not see whether the lifter jaws were in proper position from his location in the crane cab. He was a qualified and experienced operator.

Conclusions

Mr. Haag stated that since the injured man was a new employee the orientation and instruction procedures in the plant were not adequate.

Particular emphasis was placed by Mr. Haag on safe practices in the control of crane operators. He mentioned several rules which will greatly aid in securing safe crane operation.

Safe operating procedures should be listed and tailored to fit the needs of the particular situation.

Personnel should be mature and level headed. The operators should be only experienced or learners under qualified supervision.

Only authorized personnel should be allowed in the cab at any time.

All operators should be required to pass a test and all should be given periodical physical examinations—with special attention being payed to eyesight and reflexes. Hearing is important and nobody with heart or epileptic ailments should be hired.

Operators should be required to be fa-

miliar with the signal code. This code could be included in the test given to the operators.

Case 3

Three maintenance employees loaded an eight spindle tapping machine onto a flat steel truck which was 16 inches high with a platform 39 inches wide, and 66 inches long, and equipped with caster type wheels. The base of the machine was 3½ feet by 4 feet and was 8 feet tall.

As the machine was being pulled down an aisle by a tractor, it was unattended except for the tractor driver, the left front caster of the steel truck hit a gauge in the floor and broke loose. The machine toppled over, striking an employee working at a bench 5 feet off the aisle a glancing blow. This employee was paying no attention to the moving activity in the aisle.

This glancing blow was so severe that the crushing injury to his lower chest abdomen and right thigh, coupled with severe shock, resulted in his death two hours later.

Conclusions

Following are four corrective measures which could have been taken to prevent this type of accident, according to Mr. Snyder.

1. A fork truck could have been used.

2. The load could have been carried horizontally.

3. The center of gravity should have been lower (a smaller truck could have been used, with possibly two inch rollers).

4. One man could have accompanied the truck along the route, clearing the aisle, etc.

The accident indicates a lack of supervision.

Case 4

For the past ten or more years motorized transporters, transstackers, and jack-stackers have rapidly replaced cumbersome, inefficient methods for rapid transfer and stacking of materials. Instructions, rules, and regulations are definitely needed for their operation. Probably first on the list should be that the number of employees given permission to operate the equipment should be held to a minimum. Definitely, this equipment does not come under the classification of a toy, incidentally, some employees regard it as such. No provision is made for riding on this equipment and reasonable rules prohibit riding at all times. User experience has proven that careless operation of this equipment will lead to accidents and injuries. Fortunately, most of the accidents and injuries are not too serious. The following four examples are quite common unless adequate control measures are taken:

1. An employee was preparing to move a skid of armatures. He accidentally touched the control button and the transporter moved forward catching his foot between the transporter and another skid of armatures. A bone was chipped in his ankle.

2. An employee was taking an empty rail to the dock and allowed the transporter to run over his foot, which was severely bruised.

3. An employee was moving an empty transporter and stopped to get some instructions. His attention was drawn away from the transporter and he presumed that it had stopped. It had not, and his foot was run over with a severe injury resulting.

4. An operator of a transporter in making a turn into an aisle accidentally struck the heel of an employee's foot, causing him to lose his balance and fall backwards. He sustained a fracture to his right hip.

Conclusions

Following are some of the points brought out by Mr. Huntington in connection with the foregoing accident:

1. Authorization to operate equipment should be mandatory.

2. Special controls should be set up to control riding on equipment.

3. The importance of proper training should be stressed, with plenty of follow-up on the safe use of equipment.

Mr. Haag added that more consideration should be given to the hiring of truck operators. The personnel office has a definite responsibility.

Case 5

A load of pipe brackets measuring 15 to 18 feet in length loaded on a "pull" type of material truck was being moved to a box car for loading. Enroute, it had to travel up a concrete ramp. This was accomplished by an electric truck pushing the material truck.

The material truck wheels were equipped with solid rubber tires. Part of the tread off one of the front tires was either worn or torn causing it to be difficult to maneuver the handle of the material truck to guide it.

Going up the ramp, the truck became slightly out of line. It was necessary for an employee to exert considerable pressure to straighten the tongue of the truck. Another employee pulled on the front stake of the truck and the stake socket broke loose causing the man to fall backward some 3 feet over the ramp embankment. He landed on a pallet loaded with steel floor plate sections causing a severe sprain to his spine in the lumbar region.

Conclusions

Mr. Snyder said that he felt there should have been better maintenance and constant checking. In this case the puller should have had some control over the pusher, with the reverse also holding true. A guard rail or ramp should have helped to prevent this accident.

Mr. Leadbeater stated that there was a definite need for job analysis in this instance. He suggested that an abrasive could have been used on the runway.

Case 6

An employee was in the process of moving a large part weighing 1800 lbs. from a cooling unit to be placed in a jig fixture where the operation on the part could be completed. The part was in a vertical position while the blower cooled it so that it could be handled in the next operation.

The employee was using a jib crane to remove the part from the cooler and place it in the jig fixture in a horizontal position. He had placed an eye bolt in the end of the shaft and hooked the crane cable into the eye bolt. He raised the part, and placed the end of it on the jig fixture. He then inserted a bar through the eye bolt to support the part while he lowered the crane cable so that the part could be lowered into a horizontal position in the fixture.

Apparently the part became balanced on the pivot point on the eye bolt. The employee did not notice that it was in balance and continued to press the control button lowering the cable to the extent that the hook became disengaged from the eye bolt, thus leaving the part without any support.

The part fell over, striking the employee on the head, fracturing his skull and causing a brain concussion. He also suffered a fractured knee cap and ankle.

Conclusions

Mr. Haag suggested a safety latch on the hoist hook. Mr. Leadbeater suggested that there should have been a helper on the job.

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1951

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As presented in the Sessions of the Cement and Quarry Section at the 1951 National Safety Congress

Volume 5
Transactions
39th National Safety Congress

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What's New in Explosives' Safety

By F. D. BICKEL

Technical Service Section, Explosives Dept., E. I. du Pont de Nemours & Co., Inc. Wilmington, Del.

Tremendous strides have been made during recent years in making dynamite safer to handle on the job. Most of this accomplishment concerns the formulation or make-up of the explosive itself, and many of you are familiar with these developments. Also, we have learned more about safe methods of loading in the bore holes—what can be done with safety and what practices are dangerous.

The fact remains, however, that even the quarry grades of dynamite with which you are familiar are made to explode. As such, they are relatively dangerous. I refer now to the ammonia and ammonia gelatin types that are most widely used in quarry work and in general are safer than the old type dynamite that contained high percentages of nitroglycerin. However, they are far from foolproof and for safe and successful use require strict adherence to certain fundamental practices based on the characteristics of the explosives.

For example, you all know they will burn and later explode, so we keep fire away. They may go off from too much friction, so when we tamp them in a bore hole, we do it carefully and without too much force. Also, they can be fired by a rifle bullet as small as a .22.

The explosion of a half-pound 1¼ x 8 inch cartridge will set off other dynamite as far as one to three feet away in open air. Fifty pounds will do the same thing ten feet away. This sensitivity trait of high explosives has been the cause of a great many fatal accidents over the years. Several of major proportion occurred during the past year.

As most of you know, a very common practice in loading churn drill blasts in quarries is to pile the individual loads at each hole. The distances between holes may be said to range from 10 to 35 feet. The dynamite charges per hole vary according to spacing and height of face but may be considered as ranging from 50 pounds to 5,000 pounds.

With explosives distributed over the top of a shot area in this manner, it can be readily seen that if a premature occurs in any portion of the area, the entire amount lying on the surface is bound to detonate, taking everything with it, both men and equipment. And this is just what happened in a number of cases, including one several years ago that amounted literally to a catastrophe.

In my opinion, every operator is vulnerable unless he has done one of two things: First, unless he has seen the light and is handling his explosives on the top in accordance with the best available advice and in such a manner that the detonation will be very unlikely to propagate from pile to pile; or second, unless he is using a cap-insensitive blasting agent such as our "Nitramon," with which such propagation is practically impossible even though the charges are placed at the holes in the usual manner.

Undoubtedly, everybody in the industry has recognized the hazards of propagation on the surface for many years, but the Du Pont Company decided to do something about it. The problem was first submitted to our explosives chemists, who told us that it was possible to calculate the distances at which various quantities of dynamite would propagate or jump. This was done. Then in order to corroborate their findings, actual tests were made in a remote section of Canada in which amounts ranging up to several hundred pounds were exploded on the ground.

All of the standard quarry grades were used, and these were placed on both solid rock surfaces and on soft ground in order to fully evaluate all conceivable factors. As a result, we were able to determine the maximum distance at which a given amount of explosives would fire another pile by influence or propagation.

From this information, a tabulation was made up showing two classes of data: First, these maximum distances at which different quantities will cause a detonation every

time; and second, the distances at which the same quantities would fail every time to detonate another pile.

Each quarry operation presents a different problem in safe distribution, but we believe all of these problems can be solved insofar as the layout is concerned by using the table. We have prepared a plan based on a typical drilling pattern, using 18-foot spacings and loads of 2,000 pounds per hole.

We learn from the table that 500 pounds will propagate 28½ feet, so we know that with this layout a premature in hole No. 1 will fire every pound of explosive on top of the quarry. However, from the table, we can see that by grouping four charges in one pile we can get a safe spacing and still maintain uniform distribution. Four spaces between holes total 72 feet, and the 2,000 pounds containing the charges for these four holes will fail to propagate 70 feet, which we are sure you will agree makes a much safer layout than the first one.

These piles are kept a minimum distance of 25 feet from the line of holes, preferably to the rear. However, if this is not possible, modifications of this scheme can be devised so as to accomplish the same objective. This 25-foot separation is important; in fact, it is one of the principal factors comprising the whole plan of increased safety.

Experience indicates that prematures are most likely to occur in or near the particular hole being loaded. If there is no dynamite closer than 25 feet from the hole collar, then no propagation can occur.

Another scheme is to have 100 pounds piled at each alternate hole. This is for convenience in loading and making up primers. According to the table, these 100-pound quantities cannot propagate each other, nor can they propagate the main piles located 25 feet away. However, one precaution is recommended for these 100-pound piles at alternate holes. They should be kept at least six feet from the hole collar.

Actual tests were made as a basis for this recommendation. These tests showed that the firing of heavy charges in churn drill holes, both stemmed and unstemmed, would not detonate dynamite lying on the surface at distances considerably less than six feet from the collar of the hole. This was done to be certain that under normal conditions a premature occurring down within the hole itself would not set off the dynamite on top, a few feet to one side.

It is of utmost importance, however, that the "Primacord" branch line in the hole should be cut from the spool as soon as the line is in place in the hole. The spool should then be moved several feet away. Failure to do this has been responsible for a number of accidents that would not have occurred otherwise, so this precaution cannot be emphasized too strongly.

The spool may still contain several pounds of PETN core, a very powerful explosive which can set off dynamite several feet away. Of course, if a premature occurs in the hole and the spool is still attached to the down line, it will be fired with the explosive in the hole. If it is cut off, the force of the explosion being directed upward will normally not shoot any dynamite if it is at least six feet away on top of the ground.

The objection has been raised that the distribution scheme we have just described is too laborious. It is alleged that the blast will take longer to load, and therefore the men will be exposed longer than if the individual charges are distributed at each hole. It seems to us that this type of reasoning is entirely false, since the increase in safety provided by the recommended plan is many times greater than the increased time of exposure of the men loading the blast.

Actually, with a properly organized crew containing the minimum number of men required to do the job, we believe the exposure need not be any greater than with the conventional method. In the last analysis, it is up to each operator to make his own choice.

But in making this choice, he should keep in mind one very pertinent factor. Each time a serious explosives accident occurs, the particular state officials concerned, and the lay public in general, immediately become imbued with the idea of more regulation. These bodies are seldom concerned with the practical aspects of the situation; as a general rule, they are simply interested in satisfying public clamor, regardless of the cost to the operator.

I could quote several examples to illustrate my point, but one will serve the purpose just as well. Several years ago, a serious explosives accident occurred on a quarry

blast involving propagation on the surface and resulting in a number of fatalities.

As a result, the state authorities were insistent on promulgating a code requiring dynamite charges to be piled 400 feet back of the holes. Obviously such a rule would work a terrific hardship on the operators, but it was only by citing to the State the results of our research work just described that they agreed to drop this requirement.

Legislation regulating the use of explosives is pending in several states at this moment, and with each and every accident, these regulations tend to become more restrictive. Our function as explosives manufacturers has been twofold: First, to try to guide the lawmakers along safe but practical lines; and second, to try to advise and educate the operators in sound practices. Neither of these is an easy task, but we are sure you will all agree that if the second job is properly done, the first may not be necessary.

Unfortunately, there are a number of complacent operators who make this a difficult undertaking. Too many believe, "It can't happen here"—especially if they have never had a serious accident; but I repeat to you men here today the old adage, "A word to the wise is sufficient."

The story of explosives distribution for a quarry blast is incomplete without some mention of blasting agents, of which our "Nitramon" is an example. Our principal interest at the moment is to see how it compares with dynamite from the standpoint of distribution on the shot. When propagation tests were made on dynamite to develop a dynamite table, parallel experiments were carried on with "Nitramon." This work produced the tabulation we have here, and from it we can check the propagating distance for the 500-pound load used a moment ago in the hypothetical dynamite blast. We have 100 per cent failures to detonate "Nitramon" at ten feet, so for this shot we can place all the charges at the individual holes 18 feet apart with entire safety.

The special primer used with our blasting agent is somewhat more sensitive and is classed as an explosive. It is kept several feet away from the "Nitramon" pile and from the hole, but otherwise no special precautions are needed.

Again referring to the table, we find that our individual charges of blasting agent can go as high as 2,500 pounds per hole without danger of propagation at 18 feet. With only three feet more spacing at 21 feet, we can load 5,000 pounds per hole and still distribute the charges at each hole in the usual manner. Such a blasting agent, then, offers by far the best solution to the operators' safety problem, eliminating all distribution hazards without any special handling, such as described with dynamite.

Experience has shown that with the grades now available, "Nitramon" blasting agent is applicable to almost every conceivable quarry problem. In addition, it provides the ultimate in over-all blasting safety, generally with no additional cost.

By way of summary, then, we have at hand two methods of virtually eliminating the distribution hazard: First, a blasting agent with its attendant safety benefits; and second, a relatively safe, if somewhat more laborious, method of handling dynamite on the quarry top.

There are a number of other subjects which we believe fall within the scope of "What's New in Explosives Safety," and the first of these deals with short-interval delay blasting. All of you are doubtless familiar with the general procedure and the very beneficial results that are being accomplished, especially with respect to vibration and general primary breakage.

Up until late last year, there were two methods available for short-interval firing, and these are still in use. The first consists of short-interval or millisecond delay electric caps. The second is the electrically-driven timer, which energizes a number of circuits in sequence.

When using the timer, instantaneous caps are attached to "Primacord" down lines at the collars of the holes at the last minute before firing. This involves the minimum duration of exposure time to any hazards there might be arising from stray currents or lightning.

A safer method, even, than this and one that is growing in popularity is to first attach the cap to a short "Primacord" tail. This is kept away from the down lines in the holes until the blast is ready. At the last moment, after all personnel and equipment are in the clear, the tails are tied to the down lines with a square knot, thus providing the very minimum exposure to electrical hazards before firing the blast.

Short-interval delays are attached to the "Primacord" down lines on surface in a similar manner. A more hazardous procedure, of course, is to use them for direct priming of the charge in the hole. This is the universal method when firing wagon drill and other small-diameter holes at short intervals. It is used to a much lesser extent in large-diameter churn drill holes, because in such cases the spacings are generally large enough to allow short-interval firing from the surface of the ground without risk of cut-offs.

You can readily understand, of course, that with electric caps of any type placed down in a bore hole in a charge of high explosives, the hole is subject to the potential hazard of premature firing during the entire period from the moment it is loaded until the blast is finally made. This premature may be caused by lightning and to a much lesser degree by stray currents. Also, with a cap in the charge, accidental detonation is more likely to take place if a misfired charge is being dug out by the shovel.

Recognizing the need for greater safety in short-interval delay firing, we have developed the "Primacord" MS Connector. This device provides an interval averaging 17 milliseconds without the use of any electrical element whatever. As you can see, it is equipped with a short "Primacord" tail at either end, by means of which it can be tied into the trunk line wherever desired. This is not done until the blast is to be fired, and even during the short period of normal exposure, the hazard of a premature from an electrical source is practically nil.

The demand for these connectors by the quarry industry in general has been tremendous, which indicates that they are fulfilling a definite need. Of course, the short-interval delay caps will always be in demand for small-diameter holes for reasons of cost and because the close spacings require direct priming of explosive charges to minimize cut-offs from ground movement.

Also, the timer will still be in the picture to some extent where a more accurately controlled shorter interval is felt to be necessary and where surface noise from "Primacord" is considered a nuisance factor.

On the whole, however, we expect that eventually the MS Connectors will be adopted on practically all large-hole blasting in quarries, strippings, and open pits. As you can see, they offer the tremendous advantages of both safety and convenience as compared with the other two procedures.

A safety talk on explosives would not be complete without a discussion of the various hazards incident to electric firing and what is being done about them. In this category I want to mention briefly prematures or accidental detonations from static, lightning, and short wave radio.

We have known for a long time that static is quite a serious hazard in dry climates, such as are found in the Southwest. Low humidity promotes the accumulation of a static charge, which is further aggravated during a sandstorm. The result has been a history of prematures from this source, especially in seismograph exploration for oil. The incidence of prematures from static is on the decrease.

A similar situation can develop if electric caps are being used during a cold, driving snowstorm. Apparently the particles of snow under such conditions carry small charges of static that can accumulate until enough potential is built up to fire a cap. We know, too, that in the case of an airplane flying through a snowstorm sufficient static can collect on the wings to give off a corona discharge having a sort of luminous appearance around the edge of the wings.

Judging from the number of caps used successfully in cold climates, we believe the danger is slight, but it is a possibility, nevertheless. The remedy is—don't use electric caps during a driving snowstorm in a dry, cold climate. For years we have advised against throwing out long cap leg wires on quarries.

Several prematures have occurred while doing this, and we suspect that the static-charged steam particles from a steam shovel exhaust had something to do with it. There aren't many steam shovels around any more, but it's still not a good practice to uncoil long cap wires by throwing them out. If you insist on doing it, don't hold the cap in your hand.

Lightning is by far the most serious and widespread source of trouble in electric firing. This is not especially new, but nevertheless each year we receive many reports of new instances of prematures from this source.

In spite of the fact that lightning is known to be a bad actor in connection with

electrical blasting, many operators still insist on using cap firing of churn drill blast holes because of the idea that they get better results, especially in pulling bottom. This may be true in some cases; however, we know that in a 100-foot churn drill hole, the detonation travels down the "Primacord" from top to bottom in only five thousandths of a second or five milliseconds where in most cases the burden of the hole does not move appreciably for anywhere from 30 to 50 milliseconds. On the basis of this reasoning, we seriously doubt that the improved bottom performance of caps over "Primacord" (if any) justifies the greatly increased risk of prematures.

A statistical record of the number of such occurrences per year bears testimony to the fact that many people have still not learned this lesson of safety. Everything by way of study and development is being done that can be done to make caps more lightning-resistant. However, at the moment, we see but little prospect of anything on the order of a major improvement. Unfortunately, in many of these instances involving lightning, the men were allowed to stay on the blast until the storm broke, and, of course, fatalities were the result. We can't give you a safe electric cap to meet this hazard, but we can give you some advice.

First, use "Primacord" wherever possible. There is not a single case on record wherein "Primacord" was ever fired by lightning, and we seriously doubt that this can occur. If you insist on bottom detonation, as promoted by the advocates of electric firing, we can give it to you with "Primacord" and "Nitramon" (not with standard explosives).

Second, if you must use electric firing, as in wagon drill or jackhammer shooting, use a radio or some other detection device to warn of the approach of a thunderstorm and get the men off the job in time.

No protection, such as a shunt, burying the ends of the wires or hooking them in series, is effective in the presence of lightning. A direct hit is not necessary to set off caps; a strike anywhere in the vicinity will do the job.

By far the newest hazard to electric firing is short wave radio. At least one serious accident occurred from this source about three years ago when a 50-watt sending station on a seismograph boat fired a charge on board. Since that time, a tremendous amount of interest has arisen regarding the possible danger of blasting near broadcasting stations. Of course, this has been due principally to the amazing increase in the use of portable short wave equipment in all sorts of vehicles.

The radio hazard problem in electric blasting may be divided into three parts: First, transporting electric blasting caps in vehicles equipped with two way radio; second, transmitting with mobile equipment in the vicinity of electric blasting operations; and third, carrying out such operations near broadcasting stations, either commercial or the central transmitter in a mobile set-up.

Our conclusions and recommendations are based on tests that we have made ourselves, data supplied by Motorola, Inc., and RCA, and information submitted by certain of our customers who have used the lamp test we recommend. This lamp test, incidentally, has been approved by both Motorola and RCA.

We believe there is no hazard in transporting electric blasting caps in their original cases or cartons in vehicles equipped with two-way radio. This is principally for the reason that the wire coil lengths are far shorter than one-half the radio wave length. Nevertheless, we recommend that the caps be carried in a metal container lined with wood, rubber, or similar material. The metal, of course, effectively shields the caps against radio-induced currents. We also advise that no transmitting be done while the caps are either being put into or taken out of the container.

In the tests that have been made to date, even the highest powered mobile transmitters have failed to produce enough current to fire a cap at a distance greater than ten feet. These tests were made under the worst conceivable conditions; for example, with wire lengths exactly equal to one-half the radio wave length and held parallel to the antenna. In our opinion, however, there should be a large margin of safety. Consequently, we are recommending that no transmitting with a portable set be permitted within 100 feet of an electric blasting operation.

Central broadcasting stations might conceivably represent a hazard at distances so great as one mile. This depends, of course, on the power, frequency, height of antenna, directional effects, and other factors. Our suggestion in this case is that no electric

blasting be done in the vicinity of a fixed station until it has been established by a suitable test that no hazard exists.

Our recommended test is this: Place a No. 47 radio pilot lamp in the center of a straight piece of wire of a length in feet exactly equal to one-half the radio wave length. This length can be determined by dividing the figure 500,000 by the frequency in kilocycles. For example, if the set has a frequency of 30 megacycles, which is 30,000 kilocycles, the half-wave length would be 500,000 divided by 30,000, or 16-2/3 feet.

Next, hold this assembly two or three feet above the ground in a position parellel to the antenna. The lamp will light to full brilliancy with a current of 0.15 ampere, which is about half the minimum firing current for any electric blasting cap manufactured in this country. However, we strongly advise against electric blasting, if any glow at all is observed.

You doubtless realize that we do not pretend to be radio experts. However, the demand for information on this problem has been so widespread that we found it necessary to investigate the situation from the standpoint of blasting safety. All of the evidence we have accumulated thus far indicates that if the precautions just outlined are strictly followed, there will be no chance of a premature due to radio-induced current.

In electric firing, as in all other kinds of firing, our main concern for over-all safety should be to fire the blast in a safe, dependable manner. In other words, we want to fire the blast at the intended moment, not before, and in a manner that will insure complete detonation of all holes. We know that none of you relishes the prospect of digging into misfired holes containing dynamite, with or without a cap in it.

Here are what we consider the three prime essentials for such a system:

First, we have Unit No. 1, the power entrance switch. Any good double-throw safety switch will do. The pertinent features are the positive break provided by this jumper cord between the switch and the blast and, also, the grounding of the switch box, which is the only ground used on the entire system.

Unit No. 2 consists mainly of our specially constructed blasting switch with the other accessories, including the jumper cord, pilot light on both the hot and cold side, etc. The main feature of this switch is that it is a quick make-quick break, spring actuated, oil-immersed type, providing an automatic short on the blasting lines when it is in the "off" position.

This switch is not especially new, as it was designed several years ago mainly for underground work. However, it is equally adapted to electric firing anywhere, and in the interest of safe blasting in quarries, we are recommending this system.

Unit No. 3 represents one or more auxiliary switches installed between the blast area and the firing switch for safety or to tie in several separate sections of a blast being fired at the same time. This is primarily a regular double pole, double throw Square "D" type with a shorting bar in the down position. A number of operators, however, are adopting our regular blasting switch for this purpose also, with a slight modification of the handle which permits locking it in both the "off" and "on" positions instead of in the "off" position only.

It is frequently desirable to fire large electrical blasts in quarries or on construction jobs that are beyond the capacity of a regular push-down battery. Shots containing over 250 caps are in this category, which means that they must be fired with a power line or by means of a portable power or lighting plant.

It happens quite often that neither of these is readily available, and to meet this need we have devised a new type condenser-discharge blasting machine. This battery is still under development, but we have a model which will fire well over 1,000 caps in parallel series. We believe we have still not fully exploited this principle to the limit of its capacities. You may wonder what all this had to do with safety. But you will remember we mentioned earlier that safety and economy are inseparably linked together, and the best way of putting over a safe practice is to make it also the most economical practice, if it is possible to do so.

By providing a high-capacity, portable machine at reasonable cost for firing shots containing several hundred holes, we eliminate the necessity for slip-shod methods and the resultant hazards. We also eliminate the human element that is such an important factor in the performance of most of the common types of blasting batteries.

There are only two more points that should properly be included in this talk. The first deals with a hazard that has just come to our attention relatively recently.

On a Pennsylvania Turnpike job, the dynamite in a 6-foot wagon drill hole exploded just as the shooter had finished loading and stemming and was bending over the hole coiling the cap wires. Lightning, stray currents, and static were ruled out of the picture because of local conditions.

However, subsequent investigation developed that the material being drilled was very hard and drilling speed was slow, even with the carbide insert bits being used on the job. Steel breakage was high, especially in the threads at the bit end, and we have found that general experience indicates this might be expected under such conditions.

Evidence points to the fact that the bit broke off in this hole shortly before it was down to depth. The driller allowed the machine to run for several minutes with the broken steel pounding on the bit, which raised the bit temperature to several hundred degrees, far above the ignition point of dynamite.

We know that the shooter loaded the hole only a few minutes after the driller moved off and presumably before the bit had a chance to cool. As a result, the dynamite was set on fire, and since it was under confinement and contained a cap, it was bound to explode a short time later.

The use of carbide insert bits has evidently introduced a new problem in steel breakage. The same conclusion was reached as a result of tests described at the AIMME meeting in St. Louis. Under the circumstances, it behooves us all to use every precaution to avoid loading dynamite on top of a hot bit left in a bore hole from drilling operations.

An old hazard that is still with us on all kinds of blasting is the danger from flying material. Every year records injuries and fatalities from this source. All of them are due to faulty judgment or carelessness by allowing observers to watch a blast from in front of the face or within the danger area.

There is, perhaps, no simpler means of savings lives than to keep people out of the way. Always allow for the unexpected—even though the blast is planned and loaded perfectly, unseen weaknesses in the rock structure can and do cause wild spurts of flying material that are still taking their annual toll.

Locking Out Machinery as a Means of Controlling Severest Hazards

By O. A. LAWRENCE
Plant Mgr., Universal Atlas Cement Co., Buffington, Ind.

The human body is frail indeed when compared to the forces exerted by the machinery we operate. For this reason accidents caused by moving machinery carry such a high severity rate in our industry that the need for guarding moving parts has for a good many years been accepted as an absolute necessity in reducing accidents.

This guarding of moving machinery, which we now consider basic to any good safety program, required a great deal of selling by the pioneer safety engineer. To those who fought for the guarding of machinery, full credit must be given for the reduction of severe injuries in industry today. We soon found, however, that the guarding of moving parts alone did not fully eliminate moving machinery accidents. We found that men would reach through guards to feel the tension on a moving V-belt. We found that men would reach behind guards to oil and grease machinery. We found that men would clean pulleys and conveyor rolls while in motion. We found through bitter experience that our guards did not give 100 per cent protection from injury, and so we gradually adopted another practice which has been accepted throughout the industry, that of shutting down all moving machinery when repairs or adjustments are necessary.

It does seem that adequate machinery guards along with the practice of shutting down operating units for adjustments and repairs would once and for all end accidents caused by moving machinery. Through sad experience, however, we found that the human element again prevented absolute control of machinery accidents.

Thirty-six accidents last year were reported to the Portland Cement Association which were the direct result of failure to properly lock out machinery until repairs were completed and all workmen were in the clear.

These 36 accidents included two deaths, one permanent total disability and 14 permanently crippling injuries. This year to-date the story is very near the same; two deaths reported from this cause in the first seven months.

Since this problem of locking out machinery is of such major importance in controlling severest hazards, I would like to relate our experience in dealing with this problem.

Unfortunately, it sometimes takes an injury or a close call to stir us to positive action in this safety work of ours and we confess that our plant safety lock program, as it exists today, is the result of our being badly scared. An electrician working on a motor just missed being seriously, if not fatally, injured, when his safety lock was removed from the switch of the motor on which he was working and the switch put into the closed position.

After our scare we were indignant. We had a locking out program. We had furnished employees with safety locks. We had discussed their use in safety meetings. Why then should we have narrow escapes such as this?. Well, a closer look at our program revealed that several keys were available for each lock permitting easy removal by anyone securing a key. Locks sometimes were left on uncompleted jobs by off-going employees, necessitating removal by other employees when the job was completed. And we found different departments administering the program differently. Obviously, unless we were content to risk another near serious accident, we had to tighten up our locking out program.

The more we considered what was necessary to a good locking out program the more we realized that a completely revamped program was necessary at our plant; a program wherein we must set forth certain basic fundamentals about safety locks that all must follow. We must answer such questions as what happens when the worker reaches the end of his turn and the job is not completed, does he remove his lock or does it remain to protect the equipment? Certainly the equipment must be protected, yet, what if the job is completed while the employee is at home, who removes the lock and how?

How many keys should there be to a lock, etc.? There were many angles to consider and during the discussions preliminary to preparing our rules we had many and varied opinions.

A subcommittee was selected for the purpose of preparing a proposed set of rules for consideration by the plant general safety committee which must pass on all rules before they can become effective at our plant. This committee reviewed rules for locking out machinery used by other industries. These rules were found to vary among plants and few of them were considered to be satisfactory in our situation.

The subcommittee first decided that safety locks are designed for the protection of the employee and, therefore, the lock must be with him at all times so that it always is available to perform its duty of protecting its holder while he is working on plant equipment. This came into being a basic fundamental at the plant concerning safety locks, namely, that the safety lock is a personal tool to protect the employee. Well now, a repairman working on a piece of equipment goes home, or is called to another job and takes along his safety lock. To all intents and purposes this would indicate to a casual observer that the equipment is ready for operation. Starting equipment in such condition could have serious results, so job number two was to provide a lock program also for protecting the equipment.

Other questions were considered by the subcommittee such as, who was to hang the locks, when, who was to remove them, when?

"Effective March 16, 1949, the following rules concerning the use of safety locks shall prevail:

1. "A standard type of lock shall be issued to each individual, who has need for a personal safety lock, as determined by the department head;

2. "The personal safety lock shall be considered to be exclusively for the protection of the individual and shall be placed on the switch in such a manner as to lock the switch in an off position on any piece of equipment to be worked on. The lock shall be removed only by the holder of the lock;

3. "Whenever an individual leaves the job (that is, assigned to another task, end of turn, etc.) he shall remove his personal safety lock and take it with him;

4. "In the event that an employee is reassigned to another task or reaches the end of the turn before the job is completed he shall secure from an authorized person in his own department a machinery lock which he shall place on the locked out switch before removing his personal safety lock.

5. "Different colored personal safety locks shall be issued to the employees of the various departments. This color coding will aid in determining the department working on the equipment.

6. "Machinery locks for the various departments will be of the same color as the personal safety lock and will be further identified by addition of a yellow stripe on the lock. Such locks will be in the possession of an authorized person in each department whose responsibility it will be to dispense machinery locks at the request of the workmen and to remove such locks upon completion of the job;

7. "When a group of workmen are engaged on a job the leader of each group will be responsible for placing his personal safety lock on the switch of the equipment being worked on and any individual workman may, as he desires, also attach his personal safety lock. The leader shall be responsible for seeing that all employees are in the clear before removing his personal safety lock."

Now, we had what we considered to be a good set of rules governing the use of safety locks at our plant. We concluded that we shouldn't have any more close calls to anyone working on machinery, through failure to lock out the machinery or through promiscuous removal of locks, that is if the men abide by the rules. There was the bug, "if the men lived up to the rules." We decided that the program could be a success and that the men would live up to the rules if properly trained. The rules were made known to our union officers, they were published on the safety bulletin boards, they were discussed in safety meetings and a copy of the rules was issued with each lock. In addition, we provided for dealing with the occasional offender who cannot abide by rules as follows:

"Management desires to provide to the greatest degree possible a safe working procedure and to that end the following shall prevail;

"Any employee starting or attempting to start a machine while a safety lock is on the switch or who removes a safety lock, other than his own 'personal safety lock' without proper authority from his supervisor, shall be subject to disciplinary action. Such discipline may extend to suspension preliminary to discharge."

I wish to add that to date we have not had to discipline anyone for violation of this rule nor have we had any injury or near accident through misuse of safety locks since the effective date of these rules.

It is not my intention to infer that our safety lock program works perfectly. We from time to time find a safety lock on the employee's locker. We immediately check the number, find the employee who is the offender and have him remove the lock and at the same time explain to him again its purpose.

It is also necessary to call in locks from time to time and have them repainted in order to identify the department or to identify the machinery lock. In other words the program requires constant policing.

We believe it is another step toward absolute control of machinery accidents to see that the safety lock program works.

Controlling Severest Hazards

By H. RIEFENSTAHL
Safety Dir., Alpha Portland Cement Co., Easton, Pa.

Through the extensive studies of the Portland Cement Association's Accident Prevention Bureau during the last decade, the cement industry has come to regard moving machinery, electricity, railroads, and high places, as *our severest hazards*. These four accident causes account for a large portion of *all* severity charges each year. For example, during 1950, in the cement industry, these hazards accounted for nearly 90 per cent of all time charged; 100 per cent of all deaths and permanent total disabilities; and 70 per cent of all permanent injuries; yet these same accidents during the year accounted for only 40 per cent of the total.

There is little doubt that when attention is concentrated on severe hazards, amicable relations exist between employees and management. Consequently, severity control should not be neglected. But neither should it be segregated from the general accident prevention work since severity is reduced only through general control of all accident causes. I am reminded of a phrase that the difference between a serious lost-time injury and a minor wound or insignificant accident is merely the matter of inches of space or seconds of time. Possibly the near serious accidents in your own personal experience will bear out this statement.

The three "E's" of safety—Engineering, Education, and Enforcement, the basic safety principles applicable to controlling all accident causes, also apply to the control of severest hazards. However, the modern approach to industrial safety indicates a strong trend to substitute for *Enforcement more* and broader educational features, including visual aids and demonstrations.

The basic fact behind this educational approach is that accidents constitute a serious preventable loss to management and workers alike and through mutual understanding, both can *jointly* practice accident elimination. Mutual understanding can be achieved by the cooperative efforts of management and workers in a planned program designed for action and sparked by a two-way, uninterrupted communication line.

Although man-failure accident causes are predominant, it is generally agreed that mechanical guarding and correction of mechanical and physical hazards is the fundamental and first requirement of a complete safety program.

Despite adequate mechanical safeguards, it is often necessary to analyze reasons leading to the unsafe acts committed by workers. Job training and safety education play an important part in safety psychology.

Obviously, the surest control method of any hazard is through its elimination. Elimination or reduction of hazard sometimes may be possible through engineering revision. When this is not practicable, then education of the worker is a necessary control measure.

Selective analyses and inspections, with supervisory and worker participation, appear to be safety educational tools. For example, in 1946, we were plagued with a number of electrical accidents, apparently caused by lack of proper operating knowledge. Several oil switches exploded and serious injuries were suffered by our employees. Contact points on both oil and safety switches were continually being burned by "teasing" or "itching" the switch. This was a poor operating practice and caused additional maintenance and repair work for the plant electrical department.

We interested our supervisory group in the problem and they developed a practical, educational, visual demonstration in a miniature glass-enclosed oil switch.

At plants where this demonstration was performed, workmen responsible for operating switches remarked that they never realized what "teasing" a switch could do and that in the future their switch operations would be performed correctly. Incidentally, and perhaps luckily, we have not had any electrical injuries since the institution of this program. However, the demonstration is revived from time to time as a *means of job-instructing* and safety-educating newer employees.

Engineering revision or better design may help to reduce severe accidents. Let us consider, for example, some case histories under moving machinery: In January, 1929, one of our raw millers removed a screw conveyor cover. He later stepped into the opening and was killed, leaving a wife and four children. Prior to that time it was not unusual to have an occasional screw conveyor death due to the failure of the cover plate or unsafe act on the part of a workman.

However, following the above accident, an engineering-management policy was established requiring full-length installation of grating under cover plates on all new screw conveyor installations. Instructions were issued that this same policy should be followed on all replacements. The full-length grating installations beneath cover plates facilitated clean-up routine; materials could be safely returned to conveyors at any point; and they eliminated the necessity of specially-constructed clean-up openings on all doors.

Although the above tragic occurrence 21 years ago was our last screw conveyor *fatality*, we continued to have a few screw conveyor accidents, but not such serious ones as in the past. For example, in 1930, a packer pulling cement into a screw conveyor with a pole stepped on a bent grating bar and his foot slipped into the opening. The conveyor flight caught his toes, necessitating their amputation.

In 1947, a coal choke-up shifted an unbolted section of grating, allowing a laborer to step into the hole. Fortunately, only a bruise and cut foot resulted.

Our most recent accident of this particular type occurred in 1948, when a coal passer's shoe tip slipped between the grating bars of a running screw conveyor. The flight caught his shoe tip, causing a lacerated and bruised right foot.

Many accidents in our industry are caused by the existence of an unsafe condition due to improper or inadequate guarding. The unsafe practice or position of the employee can be considered as an auxiliary cause. The above accidents are no exceptions and could have been prevented if:

1. The grating had been bolted or permanently fastened.

2. The grating bars had been stronger so that constant beating with shovels or bars could not have spread them.

Through selective inspections and analyses, other innovations, designs and educational programs may be developed for controlling severe hazards. For example, a number of bad falls caused by defective wood ladders were responsible for an extensive ladder inspection program. The result of this inspection was an aluminum ladder replacement program, requiring ladder safety shoes and spikes, wall and pole grips, a program which not only minimized ladder-slipping accidents but pleased employees as well because of easier handling.

Likewise, a latching tool was designed for fastening the hatch cover on railroad bulk cars after years of using an ordinary bar for this purpose. Frequently, the bar would slip, but it was not until a 14-foot fall from a bulk car, resulting in several fractured ribs, and an accident report, that attention was centered on this hazard with the subsequent development of the tool.

Analyses of welding accidents and eye injuries resulted, respectively, in a welding clinic program and safety prescription glasses program, both well received by employees and local plant management. Coincidental with these programs, lost-time injuries in these fields were greatly reduced. Often, specialized equipment manufacturers offer programs designed to job-train and safety-educate employee-operators in the proper handling of their particular equipment. We have found such programs collectively beneficial and generally educative.

Speaking of education, we have heard that a good definition of modern education consists of information passing from notebook of teacher to notebook of student without passing through the heads of either. Safety education is probably no exception to this definition. However, with practical demonstrations, visual aids, and group participation, employees become informed. They may evaluate what they see, hear, and do in relation to their jobs.

Time and space will not permit further outlining of specific methods and other programs used to control severest hazards. Suffice it to say that supervisory and employee education, human psychology and engineering design play most important parts. Perhaps the greatest of these is visual education.

On the Job Safety

By R. M. COX
Treasurer and General Auditor, Ash Grove Lime & Portland Cement Co.
Kansas City, Mo.

The basic on-the-job safety problem is always the same—How to keep workers from being the victims of unnecessary accidents. We have made splendid progress in the prevention of industrial accidents but because of this very progress and changes in labor relations it is essential we now approach this problem from a different viewpoint. Our efforts of yesterday centered around the writing of rules and practices, providing mechanical guards, protective equipment, building safety organizations, and the evangelistic spirit of the early safety leaders. This basic safety problem will be solved if we learn to control the human element. We have now reached the point in our program where mechanical and environmental causes have decreased in importance while the human element has become the major factor.

The psychological reactions found in our early safety work are somewhat similar to those existing in the job of pulling weeds in our front yard. At first, we are prone to believe the job is utterly hopeless but since there is unlimited opportunity for useful effort, we go ahead. As the work continues, the visible evidence of what is being accomplished is so outstanding our spirit receives a tremendous boost and the job is carried on.

As it becomes more difficult to find weeds to pull, the resulting stimulation grows weaker and weaker. After reaching this stage, unless we have a strong conviction that the final goal justifies the work, a weed-free lawn will never be attained.

Right now, many industrial plants, after energetically digging at safety hazards for years, have reached the point where they see little tangible progress from their continuous safety activities. With the stimulation of visible improvement lacking, a great many of us lose part of our determination that all accidents can be prevented. Consequently, more and more individuals are taking unnecessary chances in the performance of their daily jobs in spite of safety training and knowledge.

Almost any analysis of current day industrial accidents will demonstrate that injuries are mainly due to lack of proper safety attitude rather than lack of safety knowledge. To continue our advancement in safety, will require a compelling urge to eliminate all industrial accidents. This urge must be supported by an unwavering belief the goal can be reached, and the rededication of our talents toward accomplishing it.

This problem of individual safety attitude is not a condition which has just come to our attention. It has always been present but our talents have been largely directed toward the task of developing safety knowledge and equipment. There comes a time when, because the level of knowledge and equipment has advanced faster than the ability to make effective use of them, it is essential to give top priority to the job of improving the safety attitudes of all individuals. With the improvement of this safety attitude, the knowledge and equipment already developed will become more and more valuable to our efforts.

In the last twenty years, major industrial and political changes have taken place in the status of labor. Today, the worker is exerting direct influences on the conduct of local and national governments as well as on the actual operation of many industrial plants. This means his actions are no longer entirely controlled by being told what to do or by the fact it has always been done a certain way in the past. Instead he is honestly attempting to arrive at his own personal conviction as to what is right, particularly for himself.

To obtain the best cooperation in present day labor relations, every contact with employees must reflect an honest consideration for their personal rights. No longer can safety be promoted by passing out rules and regulations prepared by leaders who have little interest in the personal welfare of the worker. The proper safety attitude must include a true and vital concern for the health and happiness of our fellow workers as well as an active conviction that accidents can be prevented.

The more I see of the workings of any endeavor where the human element is involved, the more I realize the importance of that word attitude. Our most pressing safety problem therefore must be—How can we produce the proper safety attitude in the employees of our industrial plants?

To improve the attitude of others, we must first be concerned with our own. The spirit behind any endeavor or activity increases or decreases from the top downward. Therefore, it is obvious, to develop the proper safety attitude in the individuals working under our supervision, demands that first we give consideration to our own. We must resolve to transmit this proper attitude to others through the medium of teaching and living.

Our on-the-job safety problem has narrowed down to—How can we produce the proper safety attitude in the supervisors and other leaders in our industrial plants?

Several months ago, the minister at my church preached on the subject "How to Become a Vital Christian." He described the following steps to accomplish this:

1. To learn about religion.
2. To believe and live the knowledge received.
3. To teach or pass on the convictions and beliefs thus attained.

These three steps likewise outline the way to create the proper safety attitude in ourselves. Thus, we must learn about safety, live it every day in every way, and teach it constantly to our friends and fellow workers. Such an attitude cannot be produced over night but rather the process will take continued effort over many years, if not for the rest of our lives. Attitude refers to a state of mind and its relation to human beings, neither of which is ever static. A continuity of influence can only be maintained if we are able to adjust promptly to the constant changes of life and conditions as they exist in our sphere.

Learning

The proper safety attitude will have to be built on a foundation of safety knowledge. There are many books, magazines, and publications readily available from which the fundamental facts of safe operation can be learned. From a study of these sources, we will learn the different types of plant safety organizations, kinds of mechanical guards and various types of protective equipment being manufactured, the innumerable schemes for stimulating the interest of the worker, procedure to follow for job safety analyses, and many other phases of accident prevention.

We will all quickly admit the need for this knowledge in carrying out our assigned responsibilities, but too many of us are prone to let up on our learning. There are millions of words written or spoken on this subject each year, all for the primary purpose of helping us to do our jobs better. It behooves us to make full use of this help by continuing our studies and constantly looking for new ideas.

Frequently, the thought which a writer or speaker is developing will not click with us but from the knowledge thus gained we can work out another approach which may prove extremely valuable. Certainly, a supervisor, who tries daily to improve his safety knowledge, will gain more confidence from his men than if he assumes a know-it-all attitude.

No man can actually supervise unless he himself knows what is expected of his department. This gives need for a thorough knowledge of all policies and production schedules of his company. The policies and schedules must be interpreted and applied to the one department. A supervisor is expected to be informed on the operation of the department for which he is responsible. This does not mean a mere speaking acquaintance but rather an intimate and detailed concept of everything which his workers are required to do.

The day when you could order a worker to do what you want has passed. The supervisor must learn how to control the activities of the men working under him so as to obtain the best cooperation and the desired results. The subject of human relations may appear to be too complicated for most of us to obtain much help from our studies.

Our needs in this field of thought do not require us to be students of psychology. They are primarily concerned with the recognition that each of our workers are personalities with likes, dislikes, and the ability to think. The help we need will come from a study of the Golden Rule and from the effort to apply it in our supervisory duties. We must learn how to gain the respect and admiration of our workers and continually

guard against doing anything which will destroy or reduce this feeling.

To keep abreast of the times, every supervisor must continue his learning in all phases of his responsibility. Unless we keep up with the constant changes in conditions and human qualities, we may find ourselves behind the times.

Living

The most effective way to convince others we are sincere in our safety convictions is to live them every day. If we do not believe in safety sufficiently to make it a part of our daily lives, both at work and at home, how can we teach it to anyone else?

Fundamentally, the principles of accident prevention outline a way of life. Someone has said that our safety effort is worthwhile because it offers one of the best opportunities for people to apply, in a very practical manner, the Christian principles of living. Safety means to protect ourselves from injury but the real vital force behind its success comes when each of us recognize our responsibility for keeping our fellow workers from being injured. They will be encouraged to follow safe practices if we live our safety beliefs. The Golden Rule could very easily be used as the primary safety rule.

Since we have been designated as supervisors or, in other words, leaders of men, it is extremely important to be aware of our actions and how they may effect others. Because of the position of leadership which has been assigned us, we will create impressions every day on the men working under us through our words and actions. These influences will never be dormant. They will either be good or bad. The kind we produce will depend to a large extent on the persistence with which we pursue our learning.

Each of us should take time every day to analyze impressions created by contacts. In my opinion, too much importance cannot be given to this part of our responsibility. The safety, contentment, and efficiency of any worker depends upon the type of influence which his supervisor exerts on him. If we truly want to improve the safety attitude of our workers and thus prevent injuries, the most powerful force we can use is to show this desire by the way we live and associate with our fellow workers and not merely by lip service.

Teaching

The challenge to industrial supervision and leaders is the same as the challenge to other teachers. Gradually, we are coming to understand that the paramount responsibility of any supervisor is to teach. This teaching must include satisfaction and contentment as well as safety and job performance if we hope to be successful in our efforts.

A most important factor in our effort to teach safety is the degree of importance we give it, as related to our production responsibility. Present day industrial techniques gives equal importance to the three elements of production—quality, quantity and safe operation. It is highly improbable that satisfactory results can be maintained in any of the three unless all are developed on the same level of efficiency.

If we will be honest we must admit when an employee does not carry out an assigned job as instructed, the fault lies entirely in the teaching. This condition may be the result of insufficient knowledge, lack of experience, or an indifference to the fulfillment of the responsibilities which have been assigned to us.

Teaching involves human beings, and since each of us is different, it requires a varied approach to accomplish the desired job of instruction. It seems to me it would be well to remember the advice a school superintendent gave to his teachers each year—"When you get the most exasperated with your students, stop and remember they are in your class because they were assigned there and not because they chose you for a teacher." This is also true of the workers under our supervision for while they may have asked for a job at the plant or office they certainly did not request one under our supervision.

To teach effectively, a supervisor must have a better knowledge of safety and job performance than the worker. This knowledge is of little value if he has failed to gain the respect of his fellow employees. Our teaching requirements are not fulfilled by specific job instruction but must include every contact we have with a worker. Teaching by influence is as important as giving factual information.

The paramount desire of each of us is to learn how to operate our plants so as to eliminate injuries. This desire can be attained if we are willing to work for it and concentrate our efforts in the right direction. Certainly, everything which is now being done must be continued and further developed. In addition, a crusade must be started to develop a proper attitude in the hearts and minds of every worker.

This attitude must be made to grow out of a full job satisfaction, a confidence in the sincerity of the supervisory and management organization as well as strong safety convictions and beliefs. It cannot be produced unless all phases of his industrial life are developed on the proper basis.

Supervisory employees are the designated leaders and there can never be a proper attitude on the part of a workman unless the supervisors and foremen lead the way by developing such an attitude themselves.

Most workmen want to be led. But they want leaders whose sincerity of purpose commands their respect and trust; leaders whose own activity sets the pattern they are to follow.

There is conclusive proof that accidents do happen because instructions have not been followed. It is easy to say the cause is improper safety attitude or not following instructions. These are merely alibis because the responsibility for the accident rests entirely on the shoulders of the assigned supervisor. His job is to instruct and he should be expected to use the necessary teaching technique to sell the employee on how to do his work safely.

Do you remember your emotional reactions the last time you had a disabling injury in your department or company? That deep feeling of sympathy, the worry as to what you had not done to prevent its occurrence, the resolution you would do all possible not to let it happen again—these are the reactions which, if made a permanent part of our personality, will produce the proper safety attitude in ourselves and our fellow workers.

Therefore, we come back to the same premise that, if we really want to eliminate all accidents, we must provide continual guidance and inspiration; we must set an example of safety consciousness from the highest executive down. In the famous words of Thomas Burke, "Example is the school of mankind, and they will learn at no other."

C. F. & L Off the Job Safety

By A. H. ZEILINGER
Superintendent of Safety, The Colorado Fuel and Iron Corp., Pueblo, Colo.

For several years we at Pueblo realized that more of our employees were losing their lives and limbs in off-the-job accidents than in accidents while on the job. We also realized that we were doing nothing about that bad situation. So we came to the conclusion that we would do something about it.

We began making safety talks to the schools and P. T. A.'s. In this endeavor we were happy with the fine cooperation we received. We felt the youngsters and their mothers would carry some of the safety we presented into the homes, and dads would absorb some additional accident prevention matter to take with them on the highway, on hunting and fishing trips and elsewhere while not on the job. We feel that it does some good.

Next, we began a plan where the wife of the worker is brought to the worker's job to see him work, view the hazards of his job and become more safety minded so she would discuss safety more with him while he was off the job. In this feature a picture of husband and wife is taken on the job and she is asked for her comment on safety, what it means to her, to the home and to the children. The picture and comments are published in our house organ for the benefit of other employees.

We find additional opportunity for off-the-job safety work when our safety men are giving first aid and fire precaution instructions out in the community. This has other values in addition to accident prevention. Better employee morale, better community spirit and better understanding are some of those values.

We also take advantage of opportunities to talk safety to employees about ready to go on vacation. One of our activities was distributing safety sheets about poison ivy. This sheet contained a sketch of the leaf of the plant for identification, how to avoid the plant and first aid remedy in case of contact with this plant. The theme was avoid the plant and you avoid the poison.

Book matches with safety messages is another off-the-job feature. They are given to all our employees so they may take them along and use them at home, on the street, on the vacation trips or wherever they go. The wife also uses these matches, so we feel that the husband and wife will discuss the safety messages displayed and benefit from them. To increase the interest we are offering prizes for completing the word "Safety" with covers containing the letters.

Much additional safety material is printed in our plant paper which finds its way in, the homes of all our employees. Last year it won a safety award, is looking for another this year.

One of our field safety supervisors is fire captain in a nearby rural district. He injects much safety in his fire prevention and fire control work. This is important because the employee's home is foremost in the picture and since home is where the heart is we know much of this safety work registers and finds outlet in action.

Recently we entered off-the-job safety from another angle. We made a wire recording of a panel discussion on safety. This recording was made in connection with a program which was put on for the crippled children's organization. The recording is being used before groups of children and adults as well. Many adults were present. Some were relatives of the panel members.

The panel was made up of one child injured in a home accident, one injured in a play accident, a youth injured in a sports accident, a woman injured in a traffic accident and a man injured in an industrial accident. These were all questioned in turn by the moderator, the C. F. & I. safety director.

Each explained what injuries he received, what losses he suffered, what caused the accident and how the injured thought such accidents could be prevented. The moderator summed up the cases and made further comments on accident prevention and what could be done to prevent accidents in the homes, on the highway, in athletics and on the playground.

Another safety activity in our program is that of conducting groups of school children through our plant at Pueblo and emphasizing safety, all along the route of their visit. These youngsters talk a lot of safety to dad and mother when they get back home. Their teachers go with them on these visits and are placed in positions which enable them to speak in behalf of safety.

We get whole packs of complimentary and thank you letters from the youngsters and their teachers. Rarely do they fail to mention something about safety.

We feel that many of these young folks will become our future employees. That is another advantage point for they already have some knowledge of safety and some realization of the need for it. This feature has been extremely popular with youngsters, teachers and parents alike. I might add we like it too.

Another opportunity for off-the-job safety is taken advantage of by one of our staff who is a counsellor for the Boy Scouts. The main activity under his leadership is first-aid. Safety is emphasized in this work and the boys retain much of their safety instruction. Again this activity is not directly off-the-job safety for our employees but it is for our future employees.

We use our local newspapers to promulgate safety to our employees and to the whole community. In this work we are happy with the fine cooperation we receive from the management of the papers.

From the twelve activities explainkd above, we feel that a lot of good safety work is carried on for our employees who are off the job and for the community as well and we are happy indeed to have these opportunities for greater safety service.

Practical Safety Training for Small Organizations

By CHAS. R. ZESKEY, JR.
Chief Eng., T. H. Martin & Co., Kansas City, Mo.

Whether or not a training program is practical depends entirely on the particular conditions which exist in the plant where the program is to be put into effect. What may seem practical for one plant may be quite impractical for another. In spite of this, however, it seems to me that there are three main elements of any training program which are important whether the educational work is at the college level or if it is to be carried on within an industrial plant. These elements are good instruction; good subject material; and a suitable place for the instruction to be given.

Good instruction requires thorough preparation. A safety training program is going to be no better than the quality of its instruction. The safety engineer or the foreman who appears before a group of employees to instruct them even on such an elementary subject as the wearing of goggles, and who fails to prepare his talk in advance is bound to lose the confidence and respect of his audience sooner or later.

The job of the plant safety engineer in the training program, it seems to me, should be something like this: He must first sell the chief operating executive on the idea. This is a training job in itself for if this executive has been untrained or poorly trained in accident prevention work, the safety engineer must be very carefully and thoroughly prepared on his subject material before he tackles the job. Then, with the help of the safety engineer the big boss is responsible for training his superintendent.

How much responsibility rests with the safety director or with the person who is in charge of safety, depends entirely on whether he is a staff or line executive. In a small plant he may be a foreman, and his job of training the superintendent will require the wholehearted help and backing of the chief executive. The superintendent should then be responsible for training his foremen, again with the help of the safety director or the safety engineer.

The final job, helping the foreman train the line employees, is where most training programs start and where a great many of them fail. Unless the foreman and superintendent, and the big boss himself, have been well trained and instructed, the time spent in training the employees is bound to be largely wasted.

In my opinion, it is impossible to overstress the importance of thorough preparation in each step of the training process. A good instructor must be interested in his subject and must know it thoroughly. He does not have to be a good public speaker, but he must be able to get the idea across to his audience that he knows what he is talking about and has the authority to pass his knowledge on to them.

The second element of any training program is certainly good subject material. Just exactly what subjects are to be covered in a training program is again a question which can be answered only with reference to one particular plant. In any case, the man in charge of the training should develop his curriculum logically so that the training will be progressive and remain interesting to the employees who will remain on the payroll from year to year, but he must also foresee the need for preparing a cycle of training which will apply to those employees who come and go, and who are, in general, responsible for much of the bad accident experience in industry.

It hardly seems necessary to go into any great detail on where this instructional material can be obtained. Even aside from the many pamphlets, sound slide films and other information issued by the National Safety Council, each National Safety Congress provides a gold mine of first class instructional material. In addition to this, of course, there are casualty insurance companies, Federal and State Departments of Labor, and Trade Associations.

As in the case of the first two elements of a good training program, no definite specifications or recommendations can be made in connection with a proper meeting place. In some cases, this may be the tail gate of a truck or the superintendent's office. It might be the tool room or even

under the shade of a convenient elm tree. In any event, it should be appropriate, and due consideration should be given to the type of instruction which is to be given and the comfort of the employees.

As I mentioned a few minutes ago, some thought should certainly be given to the question of who needs training. A certain percentage of your employees can be depended upon to show up for work day after day and month after month. Perhaps this is 50 per cent and perhaps it is 90 per cent. The remaining 10 per cent or 50 per cent are the drifters down to a warmer climate when the wind starts getting cold. Any training program must be flexible enough to include both of these groups and to keep both of them interested. The job is not a simple one, but it is not impossible either.

Very little that is new can be said on the subject of training programs. The basic principles have existed for years, and the programs which have followed these principles have been successful. The failures have resulted when these principles were ignored. The safety engineer or safety director has available all the necessary tools and materials to solve this problem as well as nearly all the others which he may encounter. The wise safety man will avail himself of these tools which, if used properly, will assure him of success in his work.

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39th National Safety Congress

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Laboratory Safety

(A Symposium)

Training Laboratory Personnel

By A. H. CHRISTIAN
Safety Eng., Merck & Co., Inc., Rahway, N. J.

The usual staff of technical personnel includes eminent specialists, together with other personnel possessing varying degrees of experience, down to the newly employed recent graduate with a Bachelor's degree, but no practical industrial experience.

Now, a specialist may know all about his chosen field but can't be expected to know all of the facts that may be pertinent to his safety, particularly in view of the many revolutionary though often potentially hazardous new techniques that seem to develop almost overnight.

Doubtless, he has had little in the way of direct safety training during his formal education. In fact, it is generally true that most college graduates have had little formal safety training, although currently some universities are attempting to rectify this oversight. It is encouraging to know that several centers of higher education are now thinking actively of safety matters. In some cases, they are actually incorporating safety instruction in the courses, where it logically should be.

In addition, Alpha Chi Sigma, the national professional chemical fraternity, has an active National Safety Committee and is doing much to further safety, both at the collegiate level and in the industrial laboratory. Also, the *News Edition* of the American Chemical Society now includes a Safety Forum in most issues which contains pertinent safety information of interest to chemists. In at least one case a local section of the A.C.S. has formed a safety committee. However, all of these programs are, and always must be, merely supplements to the basic aim, which is the direct application of safety by the individual chemist.

Surely everyone will agree, however, that there is still much to be done, and we have a long way to go before our universities graduate fully safety-conscious personnel. It is still rather appalling to see the number of technically well educated chemists who don't fully realize the insidious toxicity of benzene, or that serious aniline poisoning can result from contact of aniline with the intact skin. They just seem to have little appreciation of the fact that many important common chemicals are quite deadly.

Along these lines some hazards seem to be overemphasized. I believe most graduate chemists, as well as laymen, fully realize that cyanide is bad for the system, that mineral acids will do considerable damage to your skin, and that sodium should not be promiscuously brought in contact with water.

Speaking in generalities, the average technical person does not need to be convinced of the necessity for working safely. Neither do I think we'd have to convince him that it is better to learn from the experience of others than from one's own bitter experience.

Assuming that we don't need to do a selling job on the fundamental need for safety, there is a vast amount of work to be done to make safety a natural, ever present, instinctive habit. We must tell the new person what he is likely to encounter, sell him on remembering what he's been told, sell him on being constantly on the lookout for other potential hazards, and taking the proper precautions.

Certainly, the experienced, recently hired technical person has some idea of the hazards he will encounter in a typical research laboratory, unless he is changing fields entirely; but we wonder if recently graduated technical personnel have a full comprehension or realization of exactly what is facing them, as they make the transition from an academic atmosphere to the pressure of the industrial research laboratory.

Let us take as an example a young chemist. In the average laboratory, in addition to the hazards encountered by most people, he should be fully cognizant of the fact that he can be exposed to highly flammable and explosive materials, toxic compounds, corrosives, and insidious sensitizers. True, the quantity, in most instances, is small,

but it takes less than 10 ml. of concentrated caustic to destroy an eye, and a like amount of certain peroxides can detonate and destroy a hand.

Moreover, he may be confronted with the unknown; new materials whose hazardous characteristics have not been fully explored; the danger of reactions that are not anticipated even as a result of a literature search; and, possibly the greatest hazard of all, the unsafe chemist across the bench.

As background information, our young chemists should know that the company has a sincere interest in the safety of its employees and has established specific safety policies for their protection. To support these policies, and to insure good morale, a safe working environment must be provided and maintained. Management must insure that, wherever possible, hazards are eliminated.

This will not be possible in all instances, for, obviously, in attaining the successful culmination of some research projects, hazardous work must be accomplished. When this is necessary, all concerned should be advised of the hazard, that it cannot be mitigated or eliminated, and carefully told how to safeguard themselves and others.

A new man's first day is usually difficult; there is much to remember, many people have been introduced, copious forms have been completed, and everything is just a little confused. In spite of all this a member of management should at least inform the new person of the existence of the company's safety program. In our own case this is augmented by something tangible; namely, a requisition for safety glasses to be procured before going to work in the laboratory. This should go far toward impressing the new man that the company is interested in him as a person, and in his safety.

Some time during the first week of work it is well to discuss safety as applied to the man's specific job in more detail. The importance of safety can be established by the department head's chatting with the new man for five minutes about safety, covering the general company safety policy and impressing him with the need for working safely.

His immediate superior can then take over and elaborate, for example, on the correct method of safely operating specialized equipment and facilities, warn him about any unusual hazards of materials in the area, indicate the location of emergency equipment and explain how to use it, review the correct procedure for turning in fire alarms, insure familiarization with personal protective equipment and how to obtain it, discuss the correct method of transporting, storing, handling, and disposing of solvents, stress the importance of good housekeeping, and other similar points of significance.

To insure compliance and uniformity, a check list showing the points to be covered will be helpful. It may be signed by the supervisor, indicating that he has explained the various points to the new man, and then be sent to the personnel files to become part of his permanent record.

To keep the safety program alive in the man's crowded mind, some representative of the management—either his immediate superior, or if a safety committee system is used, possibly the applicable representative, could present to him the laboratory safety manual during the second week.

The safety manual can reiterate the company's safety policy, present an explanation of the purpose and uses of personal protective equipment, and explain common types of laboratory fires, and fire hazard properties of flammable substances. The manual also should include recommended precautions for the safe handling of selected hazardous chemicals, and the operation of potentially dangerous laboratory equipment.

To insure that new men are at least introduced to the more common or anticipated hazards of our industry, all new technical personnel in our laboratories are given a two-hour indoctrination course, called a "Review" rather than an "Instruction" session, which touches generally on the usual hazards in the Merck Laboratories and is designed to explain more fully the reasons for the existing laboratory safety regulations.

In view of the diversification of our research, it is impossible to give specific safety instructions at this session. Instead, these instructions must be the responsibility of immediate supervision. This, incidentally, is an important point, for some supervising chemists, who may be top flight scientists, may be under such pressure that they do not have the opportunity to realize fully their safety responsibilities and adequately discharge them.

As part of this two-hour course, we show colored slides of typical situations which we are attempting to explain or clarify.

1. We explain our eye protection program and explain that for optimum protection, safety glasses still must be worn even though the hazard may appear no greater than that encountered in the normal kitchen.

By way of selling this point, it is mentioned that statistics show humans yet do not possess extra sensory powers that warn them that an accident is about to occur, so that proper personal protective equipment may be donned.

2. We explain the fire alarm system, showing a map and a close-up of the telephone dial, which bears instructions for reporting a fire.

3. We show typical locations of fire extinguishers which serve as a basis for explaining the various types of fire extinguishers to be found in the plant, and their use.

4. We note also the "NO SMOKING" sign affixed to the door jamb of a specially restricted laboratory.

5. Pictures serve as a basis for explaining the difference between explosion-proof equipment and vapor-proof equipment, and when each is used.

6. In the explanation of the hazards of compressed gases, we emphasize that cylinders must be adequately supported at all times. Hydrogen and other cylinders of flammable gases must be grounded to dissipate static electricity and proper reducing valves must be used.

7. The use of portable shields is discussed, and their uses under certain conditions emphasized. This applies equally to guards for vacuum desiccators.

8. The hazard of solvent handling, storage, and disposal is discussed. The design and use of the safety can is explained.

9. The hazard of storing solvents in refrigerators is explained, together with an explanation of the modifications of refrigerators necessary for safe storage.

10. There is a discussion of equipment safe for use in high solvent vapor concentrations. An air-motor stirrer is an example.

11. The hazards of mouth pipetting are explained and the uses of the rubber bulb for pipetting discussed.

12. The advantages of good housekeeping are mentioned.

One of the most important single aspects in the thorough indoctrination and training in safety of new laboratory personnel is the utilization of the knowledge of senior men. In my opinion, it is singularly important that they fully realize their safety responsibilities towards new personnel and discharge them fully.

Until the new person is fully acclimated, the senior man, in giving assignments, should include safety precautions together with any other general of specific instructions. He should tell the new person where he can get more information; for example, from a search of the literature or from staff agencies such as the safety department or fire department.

At this time in his training, the new man should be impressed that it is no disgrace to have a lack of knowledge on some point, but it is regrettable to have an accident because he didn't explore fully all potentialities.

No matter how well indoctrinated or well trained research personnel may be, constant follow-up is necessary to keep their safety consciousness alive. The promotional aspects may take many forms. For example, from time to time as the need arises, supplements to the laboratory manual may be issued. These can be either quite general in nature or have very specific instructions. They serve not only to keep the manual up to date, but in addition, often serve to remind the chemist that he has such a manual for ready reference.

A monthly report to supervisory personnel which discusses both general and specific safety problems, together with significant trends in recent accidents or near accidents, can be quite helpful.

If a literature abstracting service is available, chemical accidents or hazards of significance in other plants can be circulated. Any technical advances in properties or safe handling of chemicals of interest to the organization might also be included.

Moreover, if there is a safety committee, an occasional general announcement to all personnel from the committee is helpful to

remind the staff of the committee's existence. Problems of current interest can be included in this announcement, as, for example, a reminder of approved methods for the disposal of toxic chemicals or solvents.

In summation, I believe typical laboratory personnel will receive the optimum of safety training if we will insure that they are:

1. Fully advised of the company's safety policy;
2. Aware of the type of hazards they may meet and how to eliminate them or safeguard themselves and others;
3. Constantly reminded of safety by a well-organized promotional campaign;
4. Given a good example by all representatives of management.

Accident Prevention in Research and Development Programs

By JOHN H. WALDO
Dir. of Research, Eli Lilly and Co., Indianapolis, Ind.

One of the main jobs of research and development groups is to determine the complete requirements for manufacturing new products. These requirements, among other things, include safety. One of the responsibilities of a research or development group is to accumulate all safety information possible, and pass it on to the production department in whatever form is apropriate within the company involved.

Very often nothing is known of the safety requirements of a new product, and they cannot be predicted definitely. Therefore, it is essential that safe working facilities be provided for the worst hazard conditions which can be imagined. Such facilities must be incorporated in the design of the building housing this work and into the laboratory and pilot plant equipment which is used. In dealing with this subject, I am going to discuss both laboratory and pilot plant requirements.

The best way to provide protection against noxious and toxic vapors is through adequate ventilation. In the laboratory, this is done with hoods. Hoods are quite uniform in design, being constructed to provide reasonable variation in air removal. We prefer air velocities in hoods of not less than 75 *feet per minute*. Hood design should be such that closure of sliding doors will progressively increase this air velocity as needed.

Hood design should also permit, by damper regulation, a greater removal of air from the bottom of the hood if heavy vapors are involved. Facilities for this purpose are provided if the worker will take time to make such adjustments. Unfortunately, however, these adjustments are sufficiently difficult to make that they are seldom used, but air velocities, such as mentioned previously, will compensate for this lack of adjustment.

As a protection against explosion within a hood, the glass in the sliding door should be of a shatterproof type, or if doors are not a part of the hood construction, shatterproof shields should be provided. One problem of the safety-minded supervisor of laboratory personnel is to get such personnel to pull down hood doors routinely in order to protect their faces and bodies against breakage of laboratory glassware.

With such air velocities through hoods, it is obviously necessary to provide replacement air in sufficient amount that the rooms are not under reduced pressure. Such replacement assures not only the desired air velocity but also clean air in the rooms.

In the pilot plant, the standard laboratory hood will not be encountered, but means of ventilation for a greater degree of air movement must be provided, again with a comparable air replacement. In a pilot plant designed for the study of organic compounds, we have provided facilities which are working admirably. In a line with the pilot plant equipment, we have constructed under-the-floor ducts 18 inches in diameter. Opening from these at floor level, at 10-foot intervals, are smaller ducts, five and one-half inches in diameter, which are capped when not in use.

The fan on this system is large enough for each opening to pass 2,100 feet of air per minute when all duct caps are open.

Flexible five-inch hose is inserted into the door opening, and the other end is directed toward whatever piece of pilot plant equipment requires ventilation. If one hose is inadequate, two can easily be used, and in case of extremely bad conditions, small portable hoods with three vent outlets are provided. This arrangement has eliminated any need for enclosure of equipment setups in a wind tunnel.

I have discussed ventilation in considerable detail because *it is the safest way to* deal with toxic, noxious, or corrosive vapors. With adequate ventilation available, the need for gas mask use is much less frequent. Gas masks must be available, however, for use as demanded—generally, emergency use. Both canister type and positive air-pressure type gas masks should be available. Each has recognized advantages and disadvantages.

In most cases, and for more general use, I prefer the positive air-pressure type—largely because I have observed a greater readiness and willingness on the part of the *personnel to use it.* This stems *from* a greater personal comfort to the operator when gas mask use is required for extended periods of time and also because its length of use is not limited to the life of a cartridge, nor to the concentration of noxious gas in the air.

Dust respirators must be available. Since pilot plant manipulations involve working with relatively small quantities of product and with the ventilation available, as described above, *there is,* however, infrequent occasion for their use.

Eye protection has been indirectly referred to in discussing the use of hood doors. It is one of the most difficult safety measures to enforce and one of the most important. Safety glasses should be provided and worn during a large part of laboratory or pilot plant work. Goggles are specified for use in our organization when acids, alkalies, or other materials known to be harmful to the eyes are involved. If there seems the least probability that there can be flying particles, goggles should be worn.

Our general safety regulations specify that goggles or safety glasses, whichever type is appropriate, should be worn when the eyes are endangered by flying objects or particles, or by harmful chemicals or drugs. Because of the discomfort which results from constant wearing of goggles, the decision as to the proper eye protection is left up to the department head and the General Safety Committee. If possible, it is desired that there shall be no general dogmatic rule requiring constant use of goggles.

Other types of personal protective equipment supplied pilot plant personnel include gloves of various kinds. Although it is important on many occasions to require the use of rubber or rubber-like gloves, experience has shown that frequent skin irritations *can and do result from their use.* This is particularly true in hot weather.

Some creams provide adequate protection in certain cases, but the use of gloves is recommended only when the need for protection is known to be greater than the possible irritation which may be caused by their use.

All laboratory and pilot plant areas should be supplied with fire extinguishers and, of course, should have a sprinkler system. We locate a four-pound carbon dioxide extinguisher in each laboratory and have additional 10-pound carbon dioxide cylinders available nearby in each hallway. It is notable that only on infrequent occasions have the sprinkler heads been set off in our laboratories, and in every case so far, the fire department has been met with smiling faces because the fire was out before its arrival.

This means that all personnel are thoroughly instructed in the use of extinguishers and are not reluctant to use them. In the *pilot plant* area, there are several 10-pound carbon dioxide cylinders, one 50-pound carbon dioxide truck, and one 40-gallon foam truck. In keeping with generally accepted opinion, we feel that carbon dioxide and foam are preferable to carbon tetrachloride. Carbon tetrachloride has the distinct disadvantage of producing extremely toxic vapors when subjected to fire. It has been observed also that carbon tetrachloride produces corrosion which frequently plugs up extinguisher outlets and renders them useless at the time of the emergency.

Proper storage for the elimination of hazards is essential. The proper storage and handling of cylinders of compressed gases is one case in point. Nothing could be much more destructive than a well-filled cylinder which had been dropped so that the head or valve was broken. Storage areas for cylinders should be well ventilated, prefer-

ably with ducts at floor and ceiling levels, in order to assure removal of leaking gases. Large cylinders should be stored on end and chained against the wall. Small cylinders should be laid on their sides in bins on slightly inclined shelves.

Moving of large cylinders should be on cylinder trucks, which permits holding them securely. When in use, cylinders again should be securely supported with chains or rings or in cylinder trucks. It is a good practice to equip all hoods or appropriate lab benches with chains for this purpose.

In most laboratories and pilot plants, considerable volumes of many flammable solvents are used. If the gallonage is great enough, the safest storage is in underground tanks. Normally, however, gallonage of all solvents is not sufficient to justify this expense. Storage in drums is then necessary but must be under conditions which assure fire control.

An explosion-proof area should be provided, separated from other areas by fire walls, and ventilated to assure that an explosive concentration of vapors never occurs. All vent ducts to such an area should be equipped with fusible links to provide closure of the duct and stoppage of the fan in case of fire in order that flames will not be propagated through the vent system and will be confined to the storage area.

The room should be equipped with a sprinkler or fog system. All drums should be connected to a reliable ground. In turn, whenever flammable solvents are being run from drums into other containers, the two should be connected with a ground to assure no undue build-up of static electricity in the drum outlet. This connection should be made as close to the outlet orifice as possible since the major electrostatic charge build-up will be at that opening.

Containers to handle smaller than drum quantities of flammable solvents should be safety cans, and probably never more than one gallon of flammable solvent should be kept in glass bottles in laboratory or pilot plant areas. Metal safety cans are preferable for volumes between one gallon and 50 gallons.

The build-up of hazardous electrostatic charges is one of the most insidious dangers which exists. Although some precautions, such as the above, can be outlined to represent partial safeguards, no sure cure for all possibilities exists short of continued personal thoughtfulness.

It is helpful to locate grounded patches in the floor in front of all entrances to an explosion-proof area. This will tend to remove electrostatic charges built up in persons outside and coming into the area, but it cannot preclude the possibility of an individual creating electrostatic build-ups as he works. Only a continual awareness of this possibility by the personnel and a proper care to discharge oneself of such charges under safe conditions will guarantee the elimination of this hazard.

It is interesting to note that the potentiality of electro-static build-up varies immensely between different people. A potentially fatal accident occurred to a chemical engineer who was reacting sodium with ethyl alcohol in the pilot plant. His working operations involved his going up and down a stairway several times in the course of a reaction.

Hydrogen evolved in the reaction was ignited apparently by an electrostatic discharge which, fortunately, did not result in serious burns or permanent injury, but which put him in the hospital for about a week. When he was measured at a later date for electrostatic charge potentialities, it was found that his skin possessed high resistance to passage of electrical current—in fact, as high as has ever been recorded in the literature.

Proper grounding of all vessels in which flammable solvents are being processed and in which friction possibilities exist should always be observed in order to assure draining away electrostatic charges before they can grow to a discharge potential.

Sparks from other sources must also be guarded against. All wheels on portable equipment, tools, and other metal objects should be sparkproof.

I never have been able to figure any way in which a laboratory could be equipped to meet explosion-proof requirements and still permit normal laboratory operations. But certainly, pilot plants can and should meet Class I, Group D requirements. This means that all motors, switches, lights, and electrical plugs and outlets must be explosion-proof. Air motors can be used advantageously on many operations and do permit some economy as compared with explosion-proof electric motor costs.

Safety cans for flammable solvents have been referred to above. Our safety committee has developed a safety can for bottles of acids and alkalies. This can has much merit and, I believe, has not been described publicly before.

It is designed to hold a one-gallon or similar sized bottle, such as is routinely used for concentrated acids. It can be used as a storage container, a carrying case, and for safe pouring of such liquids from the bottle, protecting at all times against the breaking of the bottle. These cans are preferably made of stainless steel.

There is a swiveled carrying handle, a handle toward the bottom to permit easy tilting for pouring, and a clamp that fits around the neck of the bottle and snugly against the top to hold the bottle in place. A rubber pad in the bottom of the can prevents breakage by jarring.

In recent years, increased interest in pressure reactions has developed. Pressure is extremely helpful in many organic reactions; therefore, much thought must be given to the adequate protection of people engaged in such work. A discussion covering this field of operations was given by A. B. Ritter of the Hercules Experiment Station in the 1950 Safety Congress, but a discussion must be included in this paper for purposes of completeness.

Pressures normally encountered will vary from five to 5,000 pounds. Many low pressure experiments, up to 50 pounds, can be studied in a laboratory way by using the standard "pop" bottle units available from certain equipment supply houses. It must be standard practice to enclose the "pop" bottle with expanded metal or similar guards.

For pressure above 50 pounds, special equipment made of metal alloys and designed and tested for higher pressures must be provided, and they should be located under special housing conditions which will assure safety to the operator. The safety designs must recognize the fact that in this type of reaction, flammable solvents and explosive hydrogen are going to be handled.

In the last two or three years, several descriptions of pressure vessel housing have appeared in the literature which showed adequate thought for personal safety. In most respects there seems to be agreement as to means of providing adequate protection.

The chief lines of variance are with regard to wall thickness of buildings. Obviously these would vary greatly in proportion to differences in working pressures in the pressure vessels. Certainly, specific wall thicknesses in all cases cannot be accurately defined because of the unknown conditions which can result from unpredictable explosion waves and because of flying fragments of ruptured vessels.

I have seen walls surrounding pressure vessels which have varied from one-quarter inch steel to one and one-half feet of reinforced concrete. Certainly the one-quarter inch steel is very inadequate. Many have used dirt embankments, and, where location and space permit, this protection is excellent; but it does not satisfactorily serve to separate the operator and instrument control room from the pressure equipment.

A safety enclosure would be obtained from eight-inch heavily reinforced concrete walls, or 12 inches or more of concrete alone. Frangible portions can be made by having one wall or the ceiling of wood construction, or one wall open, and this open or frangible surface covered on the inside with explosion matting made of five-eighths-inch woven wire cable. Such an arrangement will provide for possible explosion waves and confine any flying parts.

Entrance to the pressure area may be through an adjacent aisle when an open wall construction is used, or it should be a minimum size door at floor level. The door may be built of one-inch steel which can be hung in two or three manners to permit opening without undue effort.

All pressure vessels should be equipped with frangible discs or pop-off valves, and all electrical equipment should meet explosion-proof requirements if there is a possibility that explosive concentrations of flammable vapors will be reached. All pressure vessels should be tested at routine intervals to be sure that they will continue to withstand the working pressures involved.

The supplementing of open flames in laboratories by electric and steam heating is a safety blessing in disguise. Because of the hazards which open flames create, smoking in laboratories and pilot plants should be prohibited and limited to approved locations or rooms where no chemical processing is carried on. In many instances, the difference in insurance rates in cases in which smoking

restrictions are exercised will have dictated this policy to management.

J. J. Hoffmann, in the 1948 Safety Congress, has correctly remarked that supplying safety equipment may cause a sense of false safety, and that intelligent handling of safety matters through thorough training is most important. I am more and more convinced as time goes on that safety should become a subject in routine academic training. Very few colleges give any thought to this extremely important subject.

Safety can appropriately be incorporated into nearly any academic subject, but most assuredly should be routinely included in chemical and engineering training. Too many technically trained college graduates are going into industry with no school training along these lines and are inclined to believe, therefore, that such things are not important to them.

It is a noticeable fact that the noncollege worker accepts safety measures much more readily and follows them more willingly. Safety consciousness gives the best approach to experimental work.

Safe Handling of Corrosive Materials

By E. V. SISUL
Safety Inspector, General Chemical Div., Allied Chemical & Dye Corp., Chicago

Published information defines a corrosive as an agent which in contact with living tissue will cause more or less severe destruction of tissue by chemical action. In this section of the program I shall discuss only chemical corrosive action and refrain from discussing X-ray, radioactive substances, or occupational diseases that arise from corrosives.

Probably the first thing to do in considering how you shall handle corrosives in the laboratory is to find out what they are and how corrosive burns are to be treated. The National Safety Council and the Manufacturing Chemists' Association publish extensive pamphlets on handling of corrosives.

As a partial list, some of the corrosives encountered and used in industrial laboratories are acids; especially hydrofluoric, sulfuric, nitric, perchloric and glacial acetic; alkalies, especially sodium and potassium hydroxide, ammonia and sodium peroxide; bromine; phenol; phosphorus and phosphorous compounds; glass washing solutions; and, of course, dozens of other corrosives either tested or used as reagents depending on the type of laboratory you have.

As an example of the procedure to follow in handling corrosives, let's take a typical one, hydrofluoric acid. This is perhaps one of the most dangerous corrosives you use. Anhydrous HF produces immediately painful and severe burns. Weak aqueous HF is insidious in that it may produce burns that are not immediately felt so that the technician can go home and wake up in the middle of the night with unbearable pain from a splash that he got late in the afternoon. The vapors from anhydrous HF are extremely dangerous in concentrated form and with lesser exposures there is a serious hazard of lung edema.

Before receiving and using HF you should adopt the following procedure:

1. All personnel in the laboratory, including janitors and glass washers who might come into contact with it, should be advised what the hazards are and what the first aid treatment is.

2. You should obtain the antidotes suggested in the published material. In MCA Data Sheet No. 25 these consist of magnesium oxide paste, oxygen for inhalation, lime water, calcium gluconate, and alcohol. If your use of hydrofluoric acid is not large enough to warrant the purchase of some or all of these materials you should satisfy yourself that they will be immediately available in a nearby hospital or on an emergency ambulance.

3. A laboratory safety shower is essential.

The receipt of such corrosives as HF is a subject which should be studied diligently. If you are going to unload the truck or the shipping package, you must be on the alert for broken containers and know what you are going to do with them. Some containers require periodic venting in order to prevent build-up of hydrogen pressure and you should enforce a rigid schedule to do this.

Some corrosives should not be stored with certain other materials or chemicals because of the possibility of devious reactions, should the two substances come into contact.

The storage area for the corrosive should be chosen with care and immaculate housekeeping preserved. In general the stock containers out of which reagents are drawn should be kept at floor level, if possible, to prevent accidental overturn. Some corrosives must be stored in cool places; others, to prevent freezing, must be stored at room temperature.

Before a container for corrosives is opened the workman should equip himself with the necessary protective clothing. This will vary according to the corrosive being handled. For example, operations involving opening and transferral of HF should include full face shield and respirator, while with corrosives, such as sulfuric acid, which do not give off vapor, a respirator is unnecessary. Industry has devised and adopted a labeling procedure which should be studied, used and followed in the handling of all corrosive materials. Job safety analyses should be written for each of the routines involved.

Students or non-authorized personnel should not be permitted to have access to storage containers of corrosives. The transferral of corrosives from storage containers to reagent bottles should be done with care and preferably mechanized as far as possible. There are on the market some excellent commercial carboy tilters, pumps and siphons. Frequently one finds a laboratory attempting to transfer the contents of a carboy or glass container by the use of air pressure. This is a practice to be condemned as the carboy or container may fracture and its contents thus be sprayed all over the laboratory.

Safety for students and trainees is a subject in itself. Laboratory directors all too frequently forget that the student may not know the properties of even the simplest chemical, let alone know what to do if he is splashed with it. Some laboratories have adopted the procedure of devoting the first laboratory sessions to an explanation of chemical hazards and requiring the students to take written examinations on the subject.

If you have a plant physician, or a doctor on call, you should not assume that he knows how to treat burns caused by all the corrosives you use. As you know, some of these chemicals are quite special and it is asking too much of the doctor, who is not a chemist, to look at a burn and automatically know how to treat it. You should advise your physician exactly what corrosive you are handling and, by use of published information on these corrosives, help him in formulating his first aid procedure.

Another important item is to be sure that the people handling the substances know what they are. I am sure this sounds rather elemental to you but there are routine procedures in laboratories frequently handled by workmen or hourly paid technicians who do not know what they are handling. As a result they may show up in the doctor's office with a burn and yet be unable to *inform the doctor* what the burn had been caused by.

It is necessary to mention the hazards of over-treatment. Many laymen who are burned with corrosives enthusiastically "neutralize" the burn. That is if they have a caustic burn they douse it with vinegar; if they have an acid burn, they plaster it with sodium bicarbonate or even ammonia. This practice has two bad effects.

In the first place it prevents the rapid and full application of water, which in 99 per cent of the cases is the best first aid procedure following corrosive burns; and secondly, the neutralizing technique is likely to form a salt which becomes lodged in the tissues so that by the time the man gets to the doctor he has both the burn and the effect of the salt to treat. First aid procedure *should strictly follow* the published data and you will find that this data is based primarily on the copious application of water to the burned area.

We in industry have found that although corrosive burns are frequent to the point of being common, permanent damage from corrosive burns are almost nonexistent. This can be attributed to two sources. One, that the body, including the eyes, has an astonishing regenerative quality, and the other is that in industry in general great pains have been taken to install safety showers and adequate well-stored first aid rooms. The same technique should be used in laboratories.

The laboratory worker is actually engaged in more hazardous work than the chemical

process operator. For one thing he is likely to handle a wider variety of substances and in fragile containers. Most of his work is experimental and the outcome of his experiment is not always known. Furthermore, there is a feeling among technical personnel that their B.S., M.A. or Ph.D. grants them a certain immunity to chemical injuries and that they can handle reagents with an abandon that would get a plant process operator discharged.

In conclusion, let us review the essentials toward achieving safe handling of corrosive materials in the laboratory.

1. Prepare a list of all corrosives to be used in the laboratory.
2. List available data sheets relative to handling and precautionary measures associated with the materials.
3. Prepare a list of and have available necessary protective equipment.
4. Study the chemical characteristics of corrosives as regards to proper storage.
5. Establish procedures as to method of handling corrosives and review these frequently to insure sound practices.
6. Establish first aid measures and include that of acquainting doctor with all available information and possible exposures.

Such adoptions, if intelligently applied, will assure good results and remove the basic causes of most laboratory accidents.

Flammable Liquids in the Chemical Laboratory

By ALLEN L. COBB
Dir., Safety and Fire Prevention, Eastman Kodak Co., Rochester, N. Y.

Most of us in industry have been rather familiar with the handling of flammable liquids in our production operations and know that rather strict rules have been laid down regarding containers, allowable quantities, acceptable handling methods, and so on.

We may, however, sometimes forget that the reagent in a 500 cc. bottle on the laboratory shelf may be just as flammable as that in the red label drum in the yard or in the safety can in the operating part of the plant. In fact, with the variety of work done in the chemical laboratory it will not be at all unusual to find flammable liquids in the average laboratory far more volatile and more susceptible to ignition at low temperatures than those commonly used in manufacturing areas.

Accustomed as we are to the common use of open flames in laboratories it is not unusual to find very volatile flammable liquids used in laboratories under conditions which would be unthinkable in any manufacturing plant.

The fact that this is laboratory work and the man doing it may hold a degree of doctor of philosophy and be well acquainted with the family tree of the material he is handling is not in itself a guarantee of safety.

The newcomer in the plant, distrusting all chemicals as somewhat mysterious and probably dangerous compounds, is often a far better man from the safety point of view than the college trained chemist who has perhaps acquired an undue familiarity with some of these materials. In other words, *what's* good for the goose is good for the gander.

The use of these materials in relatively small quantities tends to give a feeling of security. Few people expect much of a fire from, let us say, 250 cc. of a flammable liquid. Yet such a liquid if fully volatilized and mixed with air might easily give up 400 or 500 cu. ft. of an explosive gas mixture quite capable of literally raising the roof in the laboratory. Further, if we will glance around, we will often find that the small quantity is often times repeated. Sometimes there may be hundreds of relatively small glass containers in one laboratory aggregating, however, to make a quite respectable bonfire.

Further, these materials are commonly in glass. Technical chemicals are usually shipped this way and to avoid contamination, glass is usually the best container. Often it is possible to handle larger quantities in safety cans, particularly in safety cans made of stainless steel or monel metal, but the use of glass containers for reagent containers is probably unavoidable.

Generally speaking, in ordinary laboratory usage the glass containers stand up pretty well. *They do*, in fact, have some merit as static sparks do not jump around when a flammable liquid is poured from one glass container into another. However, just drop a bottle or a flask and you knew what happens. Glass containers just don't bounce.

If we couple the use of glass containers with the familiar laboratory open flame, we build up a hazard of no mean proportions. It is unfortunately not rare to find an ether extraction being conducted over an open Bunsen flame.

Suppose we consider just a few subjects with which I am sure you are all very familiar. For example, the little brown jug technique is not an ideal way to fill a small graduate from a large container, especially with that handy little Bunsen burner in the background." You will, of course, say that this is kindergarten stuff, but I am quite sure if you will analyze some of the laboratory accidents and fires, you may conclude that some of our Ph.D.'s have not yet been to kindergarten.

How many of you have ever seen the ether bottle open on the shelf, or ether being heated in a beaker over an open flame? Fire, and lots of it, is only minutes or seconds away. You say no one would be stupid enough to do such a thing? A mantle around the flask is not rated as explosion proof but general experience with such mantles has indicated good fire experience. The cork back in the bottle, and a reflux column on the flask keep vapors from boiling out into the room.

These, of course, are just a few of the conditions and they really *are* of the kindergarten variety, but I am very much afraid that that is just where our teaching will have to begin.

Out in the plant we are careful to ground containers. We make sure that the containers are well bonded together before pouring from one to the other and so on, but I wonder if we do the same in the lab itself. Static electricity is no respector of persons, places, or of degrees. A static spark caused, for example, by pouring a dry liquid through a wool filter will ignite just as surely in the laboratory as in the plant.

One saving feature that I mentioned earlier was that in handling liquids in glass containers there is no conducting surface on which a bound charge may collect to jump off at a single point. However, the chemist himself can get charged, and the results when he reaches out to take hold of a beaker of flammable liquid may well be spectacular. Humidity and the habit of frequently touching grounded metal surfaces will prevent a lot of trouble. In the really hazardous situations, conductive pouring coupled with conductive shoes may well be in order.

One real trouble with the chemist is that he produces so much waste material. The disposal of waste materials from laboratories is a very serious problem. Dropped down the drain they may result in a manhole explosion later on and some distance away. Dumped in a container intended for an incinerator, they may cause plenty of trouble to the man who loads the incinerator. Remember, this fellow doesn't have a degree and isn't supposed to know much about the materials delivered to him.

Unstable materials sometimes find their way into the regular waste collection service and go off with pretty vigorous results. A review of the waste material handling program, setting up provisions for the handling of unstable materials, flammable liquids, various nitrated compounds, and so on should be one of the very first interests of the safety engineer in considering his laboratory hazards.

Finally, just a word on fire protection in case something does go wrong and a fire does result. Best of all, of course, is the old familiar automatic sprinkler. It may not directly put out a fire in some dry flammable liquids but it cools everything down and prevents the fire from spreading. I will admit that automatic sprinklers make somewhat of a mess of a laboratory. But even so, the messing up of a single laboratory is a lot better than burning down the whole building.

We shouldn't pass water protection without mentioning the man shower. Most medical people are agreed that there is nothing better for a fire in clothing than water and lots of it. Fortunately the same holds true for acids, caustics, and all the other chemical materials that can be splashed into a face or spilled on clothing. The safety shower is a must for the chemical laboratory.

Finally there are various types of first aid protection which may be used. Most chem-

ical laboratory people handling flammable liquids have become quite skilled in the use of carbon dioxide extinguishers and have been able to control the ordinary laboratory fire without damage to equipment. Somewhat more messy but with greater extinguishing power is the dry chemical extinguisher, very useful on spill fires of flammable liquids.

Generally speaking, water type extinguishers do not find much chemical laboratory use and the same also holds true of foam, which while suited to flammable liquid fires is limited to those which are not readily miscible with water.

Carbon tetrachloride has been used to a limited extent in laboratories, but it is in itself toxic, it gives off toxic vapors in contact with heated surfaces, and may react vigorously with some materials.

Obviously the first aid extinguisher is only as good as the man using it, so that a training program in the use of these extinguishers is in order. Both the carbon dioxide and dry chemical extinguisher require quite a degree of familiarity with the method of extinguishment, understanding of the general nature of fire, and the best method of attack.

The Importance of Proper Labeling in Preventing Accidents

By FRANK S. LOW

Research Consultant, Westvaco Chemical Div., Food Machinery & Chemical Corp., New York, N. Y.

The incentives for an adequate labeling program probably date back to the introduction in Congress of the Bingham Act in 1932. This act was prepared in response to the activities of the late *Dr.* Yandell Henderson of Yale University's Medical School and Dr. Alice Hamilton—at that time the head of the New York State Department of Labor.

The bill was introduced into Congress by Senator Bingham of Connecticut. The act called for the labeling of certain chemical products, particularly those evolving potentially injurious vapors, requiring as a warning the word *Poison* and the well-known skull and crossbones.

The act called for nothing in the way of specific warnings as to the nature of the hazard involved or preventive measures for overcoming such hazards. The introduction of this act, however, caused a vigorous awakening on the part of the chemical industry and a committee was organized by this industry to meet with a group representing the proponents of the bill in the office of the Surgeon General of Public Health, Dr. H. C. Cumming.

As a result of this meeting, a permanent committee was organized to work out with the Surgeon General a series of agreements between the manufacturers of some eight or ten chemical products and the Surgeon General's office whereby the manufacturers voluntarily agreed to affix a warning label on all shipments of these products from the manufacturers' plant.

The texts of the various labels were worked out by the committee and representatives of the Surgeon General's office. These agreements were entered into early in 1934 and have been lived up to faithfully by all of the manufacturers party to the agreements.

The next important incentive was found in a publication of the Manufacturing Chemists' Association mailed to the presidents of all member companies entitled *A Confidential Report on Adequate Labeling—Its Importance to the Chemical Manufacturer.* The report was prepared by Carl M. Anderson representing the legal department of Merck & Company.

Part One of this report dealt with the question of adequate labeling and Part Two was entitled "The Manufacturers Duty as Interpreted by the Courts" and comprised a very complete summary of court decisions involving the subject of precautionary labeling of chemical products. The report also carried a summary of court decisions awarding damages resulting from disability due to chemical exposures.

As a result of the interest and anxiety aroused by this report, a conference of representatives from all M.C.A. member companies was held on April 12, 1944. This conference was widely attended and as a result it was voted to organize a permanent committee to study the whole subject of labeling.

This committee was accordingly set up and adopted the name of "Labels and Precautionary Information Committee," promptly abbreviated to L.A.P.I. Committee. This Committee originally consisting of ten members held their first meeting on May 17, 1944. The Committee was made up of members of the legal, medical, research, operating, and sales representatives of the participating companies.

The Committee arrived at the decision that the following subject matter should be considered for inclusion on a warning label:

A. Name of Product—The accepted chemical name in addition to any trade name.

B. Signal word designating degree of hazard — DANGER!, WARNING!, or CAUTION!

C. Affirmative statement of hazards—such as, Flammable, Vapor hazardous, Harmful dust, etc.

D. Precautionary measures covering actions to be followed or avoided—such as, Keep away from heat and flame, Do not breathe vapor, Avoid contact with skin, etc.

E. Instructions in case of contact or exposure, where advisable. Under some laws antidotes are required when the word "POISON" is used.

F. Instructions for the safe handling and storage of containers should also be considered for inclusion on the label.

I will not elaborate on the evolution of the labels now in common use under the terms of the above described system, but will refer any interested parties to pages 7 to 17 of the M.C.A. publication entitled *Warning Labels—Manual L-1—A Guide for the Preparation of Warning Labels for Hazardous Chemicals.*

This manual also contains typical labels for over 200 commonly used chemical products. The first edition of the manual was published early in 1945 and met with almost universal acceptance, especially on the part of various federal and state regulatory bodies.

At the time our committee was preparing this manual the State of California was also busily engaged in the preparation of labeling regulations covering the use of a large number of potentially hazardous chemicals within the State of California. As a result of close and cordial cooperation between the state authorities and our Committee the California regulations when enacted and published were practically identical with our LAPI system and representative labels.

The action of California was followed by Oregon, Hawaii, Illinois and similar regulations are now pending in Ohio, Rhode Island, New York and several other states. I think it is obvious that so much activity would not have been encountered if the state authorities had not become convinced of the desirability or perhaps necessity of promoting some form of adequate labeling.

Having reached this point in their activities, the LAPI Committee then undertook to study the question of the best means of obtaining observance and enforcement of the labeling laws or regulations they had recommended. The weakest point in the old Surgeon General's Agreements lay in the fact that they carried no adequate enforcement provisions. The chemical manufacturers who signed the agreements lived up to their obligations concerning labeling in every respect; but having sold their product, there was no means of compelling the purchaser to apply a warning label similar in text to the one used on the initial shipment by the manufacturer, to any shipment of repackaged material.

After a careful study of the situation extending over more than three years, the LAPI Committee came to the conclusion that the best way to handle the label problem was through enactment on the part of the various states of legislation empowering a suitable state agency, such as the Department of Health, Department of Safety or Department of Labor, to issue regulations specifying the safety provisions that should be made in connection with adequate labeling, safeguards in handling, fire prevention, and so forth.

Authority should be granted to such authorized agency providing for the enforcement and imposition of penalties for ignoring the regulations on the part of sellers or users.

After careful study of this situation from all angles the LAPI Committee recom-

mended the approach by means of regulations rather than the writing of the label control measures into the organic law of the states. It is much easier and quicker to change such regulations, after public hearings before the designated state regulatory agency, than to bring about such changes by amendment of law, which requires favorable action of both houses of the state legislature and approval of the governor.

One highly important requirement for these regulations is covered by the word "uniformity." Obviously, it increases the difficulty, almost if not quite to the point of impossibility, of compliance on the part of the manufacturer and distributor if these various state regulations call for the adoption of different label tests.

For example, a manufacturer may ship his product to a warehouse in Chicago from which it may be sold in any one of the states of Illinois, Indiana, Michigan, Wisconsin or Iowa. Unless the label requirements of these states are uniform, there is no assurance that a label complying with all the requirements of the State of Illinois may not end up in Michigan or Wisconsin where quite different label tests are enforced.

The "reductio ad absurdum" in this situation may be found in the State of California. The State Board of Pharmacy and the State Industrial Safety Commission require the affixing of two different labels on the same product. The poor manufacturer or distributor in order to escape all hazard of fine or imprisonment will be required to use two different label tests on his shipments in California.

Our committee recognizes, however, that this whole labeling question is a relatively new problem placed before the regulatory bodies and that, furthermore, in almost every case these regulatory bodies have been found to be very cooperative and sympathetic with the problems and difficulties involved, and are almost universally disposed to correct any anomalies, such as the one just cited in the case of California.

I might state at this point that the manufacturers of chemical products are just as actively interested in the advancement of safety through adequate labeling as are any of the state or federal authorities having these matters in charge. The manufacturers will be greatly relieved if and when adequate regulations are widely adopted accompanied by suitable enforcement provisions.

In our opinion the greatest offenders today against labeling regulations and usages are the small formulators and distributors of potentially hazardous chemicals in the form of household or farm products, such as cleaning fluids, detergents, insecticides, fungicides, rodenticides, and so forth.

The initial bulk shipment of any of these products is usually covered by an adequate warning label, but when it reaches the hand of the repackager or formulator, he frequently neglects or refuses to make use of a similar precautionary text and the only recourse the manufacturer has is the dubious one of refusing to accept his orders after it has been clearly demonstrated that he is not complying with modern label requirements.

I cannot close these remarks without referring to the importance of reading the label. This statement is emphasized by the fact that the Federal Government has recently published a pamphlet prepared under the auspices of the U. S. Food & Drug Administration and obtainable from the Government Printing Office in Washington. The title of this pamphlet is *Read the Label*.

If I may be permitted to make a suggestion to an organization as well-known and widely respected as the National Safety Council, it would be that they make an effort to inform the public on the vital necessity of reading the labels found on any label-bearing package purchased or used, whether in the factory, in the laboratory or in the home.

This afternoon's symposium, according to the program, deals with the subject of laboratory safety. Since many of the employees in a laboratory have had technical training and practically all of them are more or less familiar with chemicals, the necessity for using warning labels on products used in the chemical laboratory might appear to be less than the requirements for use on materials employed in the factory or home.

Moreover, most laboratories are equipped with adequate facilities in the way of general exhaust ventilation and well-designed fume hoods so that the opportunity for the more commonly encountered types of chemical exposure occurs much less frequently in the laboratory than in other locations.

We believe, however, that with the advent of many new chemical products, the characteristics of which are not so well-known, that the use of these warning labels is thoroughly justified even on packages of reagent chemicals for use in the laboratory.

The situation is somewhat complicated by the fact that laboratory reagents are frequently encountered in relatively small packages which naturally limits the size of the label and the space available on it for warning text.

The LAPI Committee has this problem at present under review by a subcommittee comprised of members of three of the principal manufacturers and distributors of reagent chemicals and we feel quite sure that some satisfactory method can be found for condensing the minimum warning text within the maximum space available on small labels.

One other point that will contribute materially to laboratory safety is strict observance of the rule to apply a warning label to any refill containers of reagent materials. Original packages containing such materials are frequently placed in the laboratory or plant stock room and used to refill smaller bottles or containers for use on the laboratory bench.

In any case where the original package carries a warning label a copy of the chemical name of the product and the warning text found on the original label should be printed on a gummed label and affixed to the container actually being used in the laboratory.

A quick drying varnish or lacquer brushed over the label will serve to protect it and maintain its legibility and also assist in retaining the gummed label on the glass surface of the bottle.

I have frequently observed in laboratories refilled bottles with such illegible markings (or perhaps no markings at all) as to render identification of the contents difficult or impossible.

This not only results in a hazard, but requently in a waste of material since in many cases the only safe thing to do with chemicals of unknown composition is to empty them into the waste disposal can and even such disposition may involve some hazard through possible reaction with some other chemical in the waste can.

I again urge upon the managerial staff of all laboratories as well as all of the personnel employed in them that they carefully follow all precautionary measures set forth on reagent labels.

Discussion of Fires and Explosions Which Have Occurred in the Chemical Industry and Their Causes and Corrective Measures

By W. H. DOYLE
Chemical Engineer, Factory Insurance Assn., Hartford, Conn.

I find that everyone outside of the industry thinks of chemical plant fires as resulting from weird combinations of exotic chemicals, when the truth of the matter is that fires in this industry mostly come from just the same causes that they do in a cotton mill or a machine shop.

Most of the fires still occur because someone gets careless with a welder's torch—the only difference is that when a man is careless in a chemical plant he can usually do much more damage than elsewhere because chemical plants usually have sizeable quantities of flammable materials. I want to talk chiefly about the more unusual fires, but I will say one careless welder recently caused a chemical plant loss estimated at two million dollars, a case of a spark on tar coated cork insulation.

In another instance a welder connected the ground on an electric welding machine to a rail on a siding where a flammable liquid tank car was being unloaded. The man who disconnected the car was fatally burned by the flash fire set off by the spark made when the connection was broken.

On the other side of the picture—a thirty million dollar expansion by Dow in Texas involved a multitude of outside welders but was completed without a single fire from welding. It does not mean no fires that resulted in losses, it actually means no fire. Naturally, I went all out to get the trade secret involved, and like most trade secrets, it didn't turn out to be so much after all. The procedure was to have a meeting of all prime and subcontractors about once a week, at which the law was laid down and to hire a crew of clean-up men who worked so fast that when a man dropped a wrench from a scaffold, he had to go to the waste dump to find it.

The next greatest loss cause in our experience is the misuse of electricity. Industry would save a great many dollars annually if people could only remember that 14 wire means 15 amps. There is one electrical problem, however, that presents no easy solution and that is the repair of explosion-proof equipment. If a fitting is put back with a cross thread, if the wax seal is broken and not repoured, if a lamp cover is put back only two turns instead of the required five or seven, the equipment is no longer explosion-proof, but the defect is practically invisible. A periodic check on how thoroughly your chief electrical maintenance man supervises his employees is well worth while.

A typical example of an electrical loss is one which cost fourteen thousand dollars a few years ago. A solid product was being extracted with isopropyl alcohol but the machine was not running smoothly. So, the operator took off the man-hole cover and looked inside with a strictly explosion-proof extension light; he then pushed the starter button to give the apparatus a quarter turn, the heavy cord caught in the gears with a shower of sparks and the resulting fire.

Here are a few odd items that can happen anywhere, but did occur actually in chemical plants. In the first case, a fire department came roaring in to put out a fire in some asphalt-coated metal and were told that the hydrant was over yonder painted red. So—they hitched on to a red painted outlet on a fuel oil line and really burned the building down. It doesn't matter whether fire equipment is painted red, green, or aquamarine, but that color should be reserved for use on fire equipment only.

In another case, a sulfuric acid line was not identified as such and a pipe fitter was seriously burned because the line was not purged as it should have been and hydrogen inside exploded when he broke a stubborn joint.

Another man went to replace a cylinder of nitrogen for use in blowing out a kettle containing a flammable liquid, but the light bulb was out and he connected a cylinder of oxygen instead.

Turning now to losses that are a little more apt to occur in the chemical plant than elsewhere, there is the ever present question of gauge glasses. When I started getting together data I was very much surprised to find that there was only one case where fire was said to have been caused by the breakage of a gauge glass and resulting contact of the spilled liquid with a source of ignition. I will get to that a little later. I did find, however, plenty of cases where once a fire started ordinary gauge glasses were broken from heat or hose stream impact and added fuel to the fire.

To find a really bad case of a broken gauge glass, I had to go out of the chemical industry to the aircraft engine test cell explosion which was in the papers a couple of months ago. That was not strictly a gauge glass, but the breaking of a glass rotameter which spilled gasoline and where the loss estimates vary from one million dollars to five million dollars for the resulting damage.

The other case I mentioned previously occurred where benzene was being used to purify a chemical and there was about a one hundred and fifty thousand dollar fire. The operator said that he saw a gauge glass break, got out of the room and the fire started as soon as he left. Plant safety people were not entirely satisfied, however, and when the explosion-proof electrical wiring was taken down from the concrete ceiling they examined it very carefully and found that the wire inside the conduit was melted at one point, and that this point was pretty remote from the broken gauge glass. A little further questioning disclosed that the operator had been filling a tank and had disobeyed orders by leaving the room without shutting off the flow of benzene. Actually, the tank had overflowed while he was away and the fire originated at the point of overflow.

However, the gauge glass did break and did add fuel to the fire, and the damage would have undoubtedly been less, as in many other cases, with a better system of gauging. Incidentally, it is obvious that if this tank had been equipped with an overflow pipe back to the the storage tank, there could never have been a benzene spill.

In a great many instances, gauge glasses can be completely done away with by the use of pipe line meters which can be set so that they will be shut off after a predetermined volume has been passed; by the use of weigh tanks or by the use of measuring tanks with a heavy glass "bull's eye" at the proper level. Where gauge glasses must be used, they can be of the type originally built for heavy pressure steam, or if the liquid is clean the "Shomatic" gauge made by the Hartford Machine Screw Company can be used. This is a simple device with a spring loaded valve at each end and with the valves held open by filling the glass with ball bearings. Break the glass and the ball bearings roll all over the floor and the valves shut.

It used to be fashionable for insurance inspectors to recommend ball check valves in gauge glass connections, or gauge glasses connected to weighted or spring loaded valves, so the operator had to hold them open while taking the reading. But ball check valves are apt to gum up and they don't work very reliably at low pressures and operators always seem to develop the obnoxious habit of propping up the weight on weight loaded valves or tying up the handles on spring loaded ones, so something less subject to tampering is more desirable.

A further thought on the previously mentioned overflowing of the benzene tank is that it is always good practice to provide good overflow drainage at any place where a flammable liquid spill may occur. For obvious reasons it is better to have this emergency drain independent of all other sewer lines but, if this cannot be done, discharging through a good sized trap into a storm sewer can be considered. The trouble with storm sewers is that you can't tell who will throw a cigarette into a man hole half a mile away and blow up the sewer.

Not too long ago such an explosion did occur where carbon disulfide in a sewer was ignited, presumably at a man hole in a burning city dump located out of sight of the plant involved. Furthermore, with control of stream pollution becoming increasingly important, this may involve a decision as to whether you would prefer to risk burning a plant down, or spend the rest of your life in jail for killing the fish.

I mentioned a while back the case of the operator who inadvertently used oxygen instead of nitrogen to transfer a flammable liquid. I purposely did not mention what happened, but all of you must have guessed correctly that the vessel blew up violently. Fortunately the operator escaped by reason of being behind a steel column at the time. Everyone realizes instantly how dangerous it would be to use oxygen to transfer a flammable liquid, but quite a few plants still insist on using a 20 per cent oxygen mixture called air. Periodically a fire or explosion results and another convert is made to the cause of safety.

The worst loss of this nature that I recall occurred when crude benzene was being agitated with air to prevent stratification. Somehow a spark occurred and this one tank ruptured, spreading fire throughout a sizeable storage area and resulting in a claim for $1,090,000.

Flipping the coin over to the other side, if it is dangerous to mix air with flammable vapors, it is likewise dangerous to mix flammable vapors with air in a confined space. The worst chemical plant losses have resulted from such accidental mixing. A sixty thousand dollar example of the first case occurred when benzene vapor was being transferred under a slight vacuum; a gasket failed and air was drawn into the vapor pipe.

Two million-dollar examples of the second case have occurred, one where alcohol vapor was discharged in large volume from a still vent that terminated inside the building and another when maintenance men removed piping between a rupture diaphragm and the outside of a building, so that when the rupture diaphragm failed, the building filled with butadiene vapor.

The latter case illustrates what can happen when there is a slip in cooperation between plant maintenance and plant safety. The first case is an example of what happens by reason of taking the first "No" for an answer when the alcohol tax unit was asked for permission to extend the vent outside.

The fires and explosions mentioned so far, with the possible exception of the one involving oxygen, are all examples of a mild explosion, a mild explosion being one where the roof lets a few inches and drops back in place and the windows and parts of the walls fall out.

Plants can be designed, however, to withstand mild explosions by the use of top-hinged windows with frames latched, or the use of light siding, such as asbestos, or corrugated iron, or a light roof, or something of that nature. It is the same idea as designing a building to withstand a heavy wind. If you are down south in the hurricane country, you design to withstand winds of up to 125 miles per hour; if there is a remote chance of a mild explosion, you provide explosion relief venting in the ratio of one square foot of relief area to each 30 to 50 cubic feet of room volume.

However, just as there is no economically justifiable design to withstand the 400-odd-mile per hour wind in the eye of a tornado, there is no reasonable way to design a plant to withstand a flammable vapor detonation. All you can do is make extremely sure that the detonation never takes place and carry insurance in case you guess wrong.

The difference between an "explosion" and a "detonation," as I am using the words, is rather difficult to define. Professor Tenney L. Davis of M.I.T. wrote a book on "Powders and Explosives" and defines an explosion as "a loud noise accompanied by the rapid departure of things from the place where they have been." A detonation is more of the same (this is no longer Professor Davis) except that the gas expands so fast in a detonation that a vacuum is momentarily created where it took place. Therefore, any wall nearby that is not pushed out by the shock of the detonation falls in toward it as the air rushes back to break the vacuum.

The simplest illustration of the difference occurs when you drive a car with a high compression engine using low test gasoline. As long as you are going on the level, the engine runs smoothly because of the explosions in the cylinders. But when you start up a hill, part of the mixture explodes and the rest detonates, giving you a knock. This occurs because your foot is down on the accelerator, so the mixture is richer and the engine is running slower; the compression stroke heats the mixture to a point where it is just about ready to burn without a spark; the spark plug ignites a small portion and the rest of it goes all at once.

Theoretically, there are two different sets of circumstances under which a detonation can take place and, unfortunately, I am able to cite very expensive examples of each kind. In both cases the vapor and air mixture must be right in the middle of the explosive range. Then, just as in an automobile engine, this mixture must be heated almost to the temperature at which it would ignite spontaneously so that the addition of just a little more heat from what starts out to be a mild explosion will heat the rest of the mixture so that it all burns at once. It is pretty hard to produce both of these conditions simultaneously except in a laboratory where a deliberate attempt is made to do it. That is why flammable vapor detonations are are so rare in industry.

However, let us get down to specific cases. In one plant a flammable liquid was being treated with a very finely divided catalyst. If the liquid was bone dry and the catalyst likewise dry, and if several other special conditions were met, the relatively cheap raw stock was changed to a more valuable product which could be distilled off. The chemical reaction produced considerable heat so the reaction vessel was equipped with a rupture diaphragm of adequate size; it had cooling coils for temperature control; and the agitator and the liquid supply line were interlocked so that the flammable liquid could not be run into the kettle unless the agitator was running.

In case these precautions were not enough and the temperature continued to rise, there was a pressure tank of a neutralizing solution that could be dumped into the kettle to stop the reaction by opening one valve. The vapor space above the kettle was filled with inert gas. All this adds up to the fact that the reaction was protected against every conceivable accident that the designer could foresee.

At this point I would like to interject the thought that a good modern chemical plant design such as this is so far ahead of normal insurance requirements that insurance inspection and underwriting is inevitably a good many years behind. Having outlined the exceptional precautions and if I now tell you that no human failure was involved, I would be willing to risk a small bet that no one can tell me how a detonation could occur.

When the reaction was started up after a shut-down, the usual procedure was followed but no reaction took place. Such a situation was not abnormal because moisture could collect inside the kettle, on the catalyst or in the raw stock during the shut-down. Accordingly, the unreacted kettle contents were pumped to the still, the catalyst was allowed to settle out, the raw stock distilled off and the process started again. For a second time, no reaction took place and the mixture was again pumped to the still. Then, unexpectedly, the reaction started to take place in the still which had no cooling coils, no rupture diaphragm, no inert atmosphere, no agitator, and no pressure tank to put in the inhibitor. The very hot liquid in the still, hot because of the reaction, foamed out and filled the building with vapor so that the conditions of high temperature and perfect mixture were reached and a detonation took place.

The building was of the best possible construction for the occupancy, with steel frame, with small floor area, and with corrugated asbestos sides and roof, so there was explosion relief in the ratio of about one to thirty, but the building was completely wrecked and walls and windows in adjacent buildings were pulled out toward the detonation. All three people in the building at the time were killed. While it is hoped that this loss will amount to less than one and one-half million dollars, it does not seem likely that it will be less than one million dollars. After the loss, it is easy to see that a filter should have been installed between the reaction kettle and the still. The rebuilt plant will incorporate that feature.

It is somewhat easier to produce a detonation in a pipe line. If a pipe contains a mixture in the middle of the explosive range and ignition takes place at an open end, the flame will start to travel back up the pipe at the normal speed of flame at sea level and normal temperature—which is about seven feet per second or about 45 seconds for the 100-yard dash. Most of us here are probably over-age and overweight for some athletic events, but it would be easy to outrun a flame.

Unfortunately since we started the flame in a pipe, this slow speed doesn't stay slow very long. The products of combustion are hot and have a much greater volume than the unburned gases, so the pressure in the pipe increases as the flame travels to furnish the energy needed to push the burned gas out to the open air. By the time the flame has traveled about 15 to 20 pipe diameters the gas pressure in front of the flame has been increased enough so the temperature has been raised and conditions are ideal for a detonation. In the book, *Safety in Petroleum Refining and Related Industries*, by George Armistead, Jr., there is a picture showing what happened when a Texas oil pipe line was being cleaned by an air-powered "go devil" and a detonation took place. Twenty-six miles of ten-inch pipe line detonated.

A somewhat similar accident occurred in a chemical plant where flammable vapors were being drawn through a duct over the roof to a solvent recovery system. For a long time the master mechanic had a work order on his desk to cut another inlet into the duct to remove vapors from some new machinery that was going to be installed. Naturally he would not do the work while the plant was operating, even though the vapor concentration in the pipe was supposed to be automatically maintained well below the lower explosive limit. There was never any indication that this safe condition was not complied with, but he had a healthy respect for flammable vapors and would not take chances.

Accordingly, when an electrical power failure occurred during a thunderstorm, causing a plant shut-down, he got the plant electrical people to give him an estimate of the time required to restore the outage, found it was long enough, told them not to start solvent recovery even after power was restored until he gave them the word, and sent a man with a torch upon the roof to cut a hole in the duct.

What everyone lost sight of was that there was a certain amount of residual solvent vapors even though it was technically not running. About the time the welder started work, the duct was filled with vapors in the middle of the range and an explosion took place. Theory was on the side of the welder because the flame in the duct traveled away from him in both directions for a far enough distance before

detonation took place, so that all he got was a bad scare. When the pipe detonated it broke the concrete roof immediately below it, showering fragments down into the operating area, again without hurting anyone, and coping tile on the parapet was sucked in toward the pipe. This loss amounted to six hundred thousand dollars.

Before leaving the subject of detonations, I do want to mention the possibilities inherent in acetylene, and acetylene to which one molecule of water has been added, under which situation it is known as ethylene oxide. The materials can be detonated if they are in the vapor or gas phase, even though no air or oxygen is present.

The industry cross-section I am familiar with does not show any explosions of these chemicals other than an infrequent acetylene generator explosion which may or may not be attributable to the property of these gases of being susceptible to detonation in the absence of air. This record is partly a result of the fact that use of these chemicals has so far been limited and on a relatively small scale, but mostly to the extreme precautions taken by design and maintenance personnel in chemical plants where they are used.

In the case of ethylene oxide, Carbon & Carbide, Dow, and Jefferson Chemical all do their utmost individually through the medium of engineering booklets, trade magazine advertisements, salesmen education, and jointly through the Manufacturing Chemists' Association to see that consumers are fully aware of the hazards involved and this educational program will undoubtedly keep the number of losses to a minimum. Now that all the easy chemicals have been made and the research departments are continually working on the hard ones, I believe that such action in the public interest will become increasingly common.

A while back I mentioned the problem of getting rid of accidental spills of flammable liquids, and I also mentioned a sewer explosion in that connection. Another type of loss occurred in connection with waste disposal in a plant where all the liquid waste from a fermentation process was being brought down to a neutral Ph before discharging it into a city sewer. The system involved putting the waste into an agitated kettle and neutralizing it with caustic, and it worked to the full satisfaction of the municipal authorities. So when a new fermentation process was put in, the same system was followed.

Unfortunately, the waste from the new process contained a material which polymerized, giving off a great amount of heat when treated with caustic. No one suspected it until the treating kettle exploded. The operator heard the kettle hissing and sent everyone else out of the building but he was killed when the explosion took place.

While on the subject of waste disposal, I might mention two other unusual cases. In one, a flammable waste was being burned intermittently on an experimental basis using a home-made burner rigged up with an acetylene pilot light for ignition. When the pilot light was turned on one morning, the main waste pipe exploded because, apparently, the valve on the acetylene cylinder leaked and the acetylene backed up into the main pipe.

In another case, excess chlorine gas from a chrolination process was intermittently absorbed in a tank of caustic soda. Eventually the caustic soda was all neutralized and when more chlorine was introduced the tank became a chlorine dioxide generator. This gas explodes spontaneously when it reaches about 10 per cent concentration, so the neutralizing tank blew up. Apparently the plant safety department now has another duty added, that of personally seeing that waste is escorted out of the plant in a reasonably safe manner. Right at the present time this will probably be something of a headache because most waste disposal plants are on pretty much of a pilot plant basis.

On the subject of pilot plants, these are undoubtedly good things even from an insurance company viewpoint, because while they do have a somewhat excessive number of losses, it is undoubtedly better to have these losses in a small plant than in a large one. On the other hand, perhaps if the pilot plants were omitted entirely, much more thought would go into the design of the large-scale plants and the accidents which show up in pilot plant operations might not occur at all. I am told that Oak Ridge has an extremely good safety and fire record, even though it started out with no pilot plant and is one of the world's largest chemical operations.

I would like to give a few examples of

pilot plant losses that could have been avoided by a little more thought to safe design. The first case involved a catalytic reaction where the hot vapors given off ran to a water-cooled condenser and returned to the reaction kettle to help keep the temperature under control. What was overlooked was that water poisoned the catalyst so when a condenser tube leaked the reaction stopped and a flow of flammable gas continued through the kettle, resulting in escape of gas into the building and a subsequent explosion. Installing a small automatic decanting tank in the return line from the condenser would have eliminated this loss.

In another case, a chemical had to be reacted with a boiling flammable liquid under conditions that required the use of a Haveg vessel. This reaction, also, was cooled by the condensate from a water condenser and the condenser was made of Haveg. Cooling water to the condenser failed, so the temperature went up and the resultant violent boiling caused bumping and the Haveg kettle broke, releasing the hot liquid.

Fortunately, in this case the liquid was benzene and benzene has an extremely high ignition temperature, 1,000 degrees F., so the resulting explosion was a simple explosion, and not a detonation. A water flow alarm on the cooling water line to the condenser, or a thermostatic alarm on the condenser would have prevented this loss.

In another case, lithium hydride was being added to a brand new pilot plant unit and the addition was being made through a system of double gate valves so the top one could be opened, the hydride poured in, then the top one closed and the bottom valve opened to admit the hydride to the reaction kettle. Before starting the reaction the vessel had been very thoroughly dried, including a final interior wiping with dry cloth. This was necessary because lithium hydride reacts violently with water.

However, an explosion took place when the bottom valve was opened, because it had been forgotten that the manufacturer tested all the valves hydrostatically and because this test left a little pocket of water in the body of the valve which was forced out when the valve was opened.

My first experience with an industrial accident was along somewhat similar lines. I used to work in a brass mill during summer vacations and one summer the job was to dip the ends of tubing into a molten salt bath, and one day I dipped in a tube bundle that had been hydrostatically tested but from which the water had not been blown out.

Another pilot plant loss occurred when an organic material was being oxidized to an acid with nitric acid. The reaction worked fine in laboratory glassware, but blew up the stainless steel kettle in the pilot plant. Apparently there was enough material dissolved from the pilot plant vessel, probably manganese, so that it catalyzed the formation of an explosive agent, peroxide, instead of the desired acid.

Along similar lines, at another plant a vessel exploded because a stainless steel kettle was made of steel containing molybdenum instead of one which was free of this material, and it was later found that traces of molybdenum catalyzed an explosive decomposition of the chemical involved.

The question of how far to go in designing for safety is always a troublesome one. Every added safety feature usually means an added expense and it is poor economics to spend so much on safety equipment that the product cost goes up and sales go down. On the other hand, if the remote contingency does come to pass and someone is killed, or customers are lost because there's nothing to sell, then it always seems possible when rebuilding to devise some means to avoid a repetition of the accident.

A few examples of trouble along these lines include the accident at a plant which is one of several under the same ownership. There was an extensive flammable liquid recovery operation at each plant and at the plant in question the recovery equipment was producing a recovered solvent of about 97 per cent purity. The assistant operator had previously worked at another plant of the company and had heard from a friend employed at that plant that the recovery equipment there was producing 98.5 per cent purity.

He had worked with that equipment and figured that if it could be done at the other plant, it could be done here. So, one day when the chief operator was sick, he started changing reflux ratios and employing similar tricks so that he could show improved results. What his friend had not told him was that the equipment at the other plant had been modified, so that when the

increased reflux ratio was used there was adequate venting, which did not exist here where he was trying it.

With inadequate venting the room filled with flammable vapor and an explosion occurred when an outside contractor came in and started to light a cigarette, in defiance of all common sense, posted signs, and previous verbal instructions.

After the loss, all vents were gone over and over-designed, but prior to the loss this was not a condition which could have been foreseen by an insurance inspector or the plant safety department and, even if it had been foreseen, it is doubtful if the expense would have been approved when it would have served only to provide protection against such a remote chance. Incidentally, this loss cost the insurance companies about three hundred thousand dollars.

Another similar case occurred when two nonhazardous chemicals were reacted to form another nonhazardous chemical. No flammables were involved, water solutions were used, and the vessel was heated only by low pressure steam in order to hurry up the reaction. Naturally, under such conditions there was no rupture diaphragm on the kettle and yet it exploded after some eleven years of operation. The only conceivable explanation is that somehow a wrong chemical got in this one batch. Inreconstructing the plant, a rupture diaphragm is being provided on the kettle, but this is another case where anticipation of the accident would have been practically impossible.

I have a set of cards on which I have noted some typical accidents. Here are a few losses picked at random:

Alcohol was being evaporated from a solid product in a 24 by 30 by 18 inch laboratory dryer. Ignition took place and the damage was seventy-two thousand dollars.

A night watchman was walking along a laboratory corridor and saw a refrigerator body appear through the tile wall corridor and stop in front of him. The door of the refrigerator was found in the plant yard. This was an automatic electric refrigerator and someone had put in a flask containing some material dissolved in ether. Apparently the ether vapor got up into the refrigerator switch by following along the thermostat tube, so when the switch operated the box exploded.

A laboratory helper went to get a sample from a methyl-ethyl ketone still and dropped the five-gallon glass sample bottle. Thinking quickly, he fetched a broom and started to sweep the liquid out of the building, but unfortunately a welder was working overhead just outside the door. That one cost twelve thousand dollars.

In a somewhat similar case, a benzol spill was being swept into a drainage trench into which some steam traps also discharged. If you will look back through the literature, you will find that the Dutchman who invented the Leyden Jar corresponded with Benjamin Franklin and mentioned that one of the easiest ways to generate static electricity was to discharge steam from a nozzle, whereupon the nozzle picked up a heavy charge of static. A steam trap discharged just as the benzol reached the trench and the fire followed.

There is another type of loss which gives everyone red faces; that is when the first, or the second, or the third loss occur from the same cause, all with nominal damage but the next one is a big one. The first time the residue from a still in one plant caught fire, a little painting had to be done, but there was no insurance claim. The next time the loss was one hundred and fifty thousand dollars. Now a safe method of waste disposal has been worked out.

At a synthetic ammonia plant, synthesis gas escaped and caught fire in a valve packing and the plant people spent about two hundred dollars to make repairs. The next time it leaked along a piston rod and caught fire, and the plant people spent about three hundred dollars. The property I am speaking about was government-owned, so the tax payer paid the bill. The tax payer also paid the three million dollar loss resulting from the third leakage.

Treatment of Tank Car Wash Water Wastes

By G. GUTZEIT
Director, Research & Testing Laboratory, General American Transportation Corp., East Chicago, In

Shipping of liquids in tank cars, from a very modest beginning initiated by the petroleum industry, has today grown to gigantic proportions.

In recent years, the trend has been towards increased bulk transportation of manufactured chemicals and intermediates, which, in turn, has involved the development of specialized conveyances.[1, 2] The following data show the shift:

	Jan., 1948	April, 1930
Chemicals & Intermediates	17.5%	28.5%
Sulfuric Acid	4.1%	4.5%
Petroleum Products	51.5%	46.2%

These figures should not be misinterpreted. They do *not* mean that the shipment of petroleum products (which utilizes today a carrier capacity of about 700 million gallons) has decreased in the least, but that the proportion has changed in favor of the chemicals.

The General American Transportation Corporation (G.A.T.C.) owns and operates a fleet of over 42,000 tank cars, which are used to ship more than 700 different commodities.

In order to perform the necessary repair and maintenance work, about 40 "General American" shops are strategically located throughout the country.

One of their important functions is the cleaning of the empty tanks. This operation generally involves draining, steaming with or without atomization of a solvent, and rinsing.[3, 4] The wash waters, including condensate, represent the waste of these plants. It is quite obvious that the latter is not only complex, but also highly variable in composition. The only favorable factor is its relatively low volume (from 5,000 to 70,000 gals/day).

In terms of the corresponding treatment installation, this involves a relatively complicated system, but allows a compact design comprising small units. Of course, local conditions—topographical and geological features, State pollution laws, population, existing industries, etc.—may change the picture for better or for worse. Under certain favorable circumstances, such as, for instance, a large river to dilute considerably the effluent, a sparse population with a separate unpolluted drinking water supply (deep wells), a high evaporation rate, etc., relatively simplified treatment systems might be acceptable. On the other hand, there are areas where practically total purification is required.

Functionally, the basic complete flow-sheet involves the following steps (not necessarily in the indicated sequence): Separation and removal of free oils and greases.—Destruction of emlusions and removal of the organic phase.—Separation of solid suspensoids.—Clarification.—Removal or destruction of phenols and other water soluble taste and odor producing compounds.—Reduction of B.O.D. (specifically O.C.) value to an acceptable figure.—Sterilization.

Tank Car Wastes

The nature of the wastes produced by tank car cleaning operations changes from day to day—even from hour to hour. The distribution of commodities shipped also changes to a certain extent as a function of geographic location, i.e. of area industry, although this factor tends to level off as time goes on.

By comparing the following data from a six-month survey of commodities shipped in California (GATC Los Angeles shop) in 1948 with a similar survey made in East Chicago, Indiana (Plant No. 2), during the same general period, the difference in commodity distribution will be noticed.[4, 7]

Class of Commodity	California Per cent	Indiana Per cent
Acids	3.3	3.32
Alkalies & Alk. Salts	5.5	5.97
Petroleum Products	27.3	31.29
Vegetable Oils, Fats, etc.	11.5	12.75
Wine	21.0	0.1

Before the cleaning operation proper, tank cars are drained to remove as much as possible of the commodity residual. In the case of greases, asphalt, pitch, etc., this involves heating by means of the steam coils

or even treatment with hot air, or superheated steam.

Tank car cleaning methods, of course, have to be adapted to the last load carried. But, generally speaking, they can be classified into six techniques; namely[6, 8]:

1. Removal of solid residues by mechanical means.
2. Simple washing with hot or cold water.
3. Washing with a solvent, reagent or detergent solution, by fillage or by spray.
4. Steaming.
5. Steaming with simultaneous atomizing of a solvent such as kerosene, a reagent such as caustic soda or a detergent.
6. Wiping.

Ordinarily, several of these methods may be combined to achieve the desired results.[6, 9]

For the purpose of waste treatment, it is best to segregate the tank cars to be cleaned according to the nature of their last load. This segregation also depends upon local conditions and requirements. The most general case calls for three or four cleaning stations.

In certain cases, segregation is impossible or impractical, and therefore has to be foregone. This of couse places an additional burden on the waste treatment installation.

As to the volume of the wastes, it is a function of the number of cars cleaned per day and of their last loading; in other words of the cleaning method applied. For a cleaning rack able to handle 20 cars in eight hours, the maximum quantity of wash water and condensate is about 50,000 gallons/eight-hour day. A good average figure is around 25,000 gallons/eight-hour day.

In order to reduce as much as possible the variation in composition of the waste, it is important to collect each category of waste, or the total, if segregation is impossible, in large holding basins or lagoons, prior to each phase of treatment. A large reservoir is particularly important ahead of the final biological oxidation step, as the organisms have to be accustomed to certain concentrations of toxic compounds, such as phenols, and are highly sensitive to variations in either direction.

The separation of free oil and grease is a preliminary requirement. In the case of segregation, it is only carried out on the effluent of the cleaning station for water insoluble liquids, etc. Note that the waste of this category also contains acids, which enhance the hydrophobic character of this type of compounds, and thus facilitate coalescence of the droplets. Any proven design involving gentle, slow agitation, such as the A.P.I. or the Gale interceptor, are suitable for achieving the purpose of forming a surface oil layer that can be collected as an overflow.

Destruction of emulsions and removal of suspensoids, including most of the coloring components, can be obtained by different means, of which at least two have been found practical and efficient.

One of them is based on the process known as "chemical precipitation" or "chemical coagulation," and involves the formation of an absorbent, colloidal, inorganic gel in the waste. This is done by feeding small amounts of a non-toxic, inexpensive metal salt able to yield a gelatinous precipitate when the pH value is properly adjusted. In practice, ferrous sulfate, aluminum sulfate or magnesium sulfate are exclusively used.

Regulation of the pH is generally achieved by addition of sulfuric acid or of lime, preferrably as by-products such as cement plant dust or by-product carbonate-lime slurry, and should be automatically controlled.

The other method combines the destruction of emulsions with the removal of the major amount of phenols and similar organic compounds of acidic character, such as creosote, mercaptans, fatty acids, etc. It is based on the fact that certain types of hydrophobic solids, such as bituminous coals, have a remarkable tendency to absorb on their surface polar-nonpolar compounds as described above.

To take full advantage of this fact, coal or another suitable hydrophobic solid is finely ground in order to increase its surface, and suspended in the waste, after the pH has been brought to the proper value by addition of acid, and allowing for sufficient contact time to utilize the full adsorption capacity of the reagent. The latter is then separated, which can be done by flotation, filtration, centrifuging, etc.

Flotation is preferred for at least two reasons: by the adsorption of the organic constituents of the waste, the solid reagent is "activated" sufficiently to attach to the air-bubbles, without any further need for a collector; furthermore, the additional aeration required for flotation oxydizes unstable compounds, and removes such gases as hydrocyanic acid, liberated by the previous acidification.

As can be seen, both methods achieve a double, but different result. If used successively, they will, after clarification by settling or filtration, yield an effluent that is highly purified.

If only the "chemical precipitation" process is applied, and if the waste has a phenol content over 80 ppm, it is advisable to further treat the clarified liquor. Chemical oxydation, as with chlorine dioxide or ozone, is effective, but quite expensive. Finally, biological treatment, eventually followed by chemical sterilization, will result in a product acceptable in any receiving stream.

It should be noted that the above outlined process is not only applicable to tank car wastes, but to many types of effluents from organic manufacturing or refining plants.

The California Works

In early March, 1948, the new "General American" repair and maintenance shop located in West Colton, St. Bernardino County, California, started operating, after its waste treatment installation had been completed and tested.[6]

The State Bureau of Sanitary Engineering, at that time the policing authority, replaced today in this function by the Regional Water Pollution Control Boards, restricted the types of commodities that could be contained in the treatment influent by prohibiting the cleaning of all cars having been last loaded with aromatic and toxic compounds, such as phenols, cresols, tar oils, cyanides, arsenates and arsenites, etc.; and, secondly, required that no sodium or potassium salts be discharged into the ground water supply, in view of their objectionable effect on the citrus cultures.

While the first ruling actually simplified the flow-sheet, but reduced seriously the over-all usefulness of the shop, the second point called for further segregation and an additional treatment step. Fortunately, local geological and climatic conditions are favorable, so that a relatively simple installation could be devised, despite the fact that no river is available for high dilution purposes, and that the effluent has to be fed into an underground basin which represents the main water supply of that area.

Advantage was taken of the high rate of solar evaporation (up to 72 in. per year) for the disposal of alkali compounds, and of the existence of a natural sand-filter, comprising a depth of 40 ft. of loose micaceous loom gravel strata and an impermeable clay bed, followed by sandstone and limestone formations, for clarification and oxidation purposes.

The waste treatment system can be summarized as follows: Tank cars having contained alkali-compounds such as caustic soda, brine, sodium silicate, potassium salts, etc., are cleaned on a separate rack. The resulting solution is discharged through a cement channel into a sump, and pumped from there, at a slow rate, into an impermeable, solar evaporation basin. The latter has a flat bottom 180 ft. by 45 ft. and sloping (1 ft. in 20 ft.) sides 20 ft. wide.

It is built of concrete, and coated with an asphaltic concrete mix. It is surrounded by a reinforced cement curb, 16 in. high (8 in. above ground), 9 in. wide at the bottom and 6 in. at the top, sealed with bituminous emulsion. These generous dimensions, combined with the high natural evaporation rate prevailing in that area, where the yearly rainfall averages only 3.04 in., will permit several years of use before the accumulated solids will have to be removed and dumped in the nearby desert.

Tank cars that require caustic soda treatment for cleaning, such as certain vegetable or animal oils and greases, are first drained and steamed on the "insoluble rack," then switched to the "alkali rack."

Cars having last been loaded with water insoluble solids, such as asphalt, pitch, Fuller's earth, clay slurry, etc., are cleaned mechanically on a side track. The residues are dumped and eventually burned.

Special tank cars having last contained liquified gases, such as chlorine, carbon dioxide, butane, etc., do not present any water pollution problem. They are simply vented, and can be rinsed on the "solubles" rack, if necessary.

Cars having been used for shipment of water-insoluble commodities, such as oils (whether of vegetable, animal or mineral origin), gasoline, ketones, ethers, etc. are cleaned over a separate flume by steaming

and washing. If they contain volatile chemicals, the bottom valve is kept closed until the product has evaporated, after which they are rinsed.

The resulting liquid waste flows first through two pre-settling basins, then alternately through one of two Gale oil separators (while the other can be cleaned). Most of the free non-miscible organic liquids rise to the surface, and are pumped to a storage tank, where, in conjunction with standard fuel oil, they are utilized to produce the steam needed for the cleaning operations. The underflow from the oil separators is collected in a large covered holding basin, for storage and equalizing purposes.

The wash water and steam condensate from cars having last contained water soluble commodities (with the exception of alkali compounds) is directly discharged into the same basin. This cement reservoir, capacity 58,000 gallons, has a sloping bottom (28 x 28 ft.) with a sump at the lower end, and is equipped with a 40 g.p.m. float valve controlled centrifugal pump. The collected mixed waste is pumped at the above rate to the chemical treatment installation, housed in a steel building.

The liquid is first dosed with a saturated ferrous sulfate solution, prepared and stored in a small turbo-mixer, by means of a 0 to 4 g.p.m. centrifugal pump. The amount fed varies from zero to a maximum of 9 lb./hr. The zero figure is used when acid cars supply enough iron ions through tank shell corrosion. The mixture is then fed to a turbo-aerator of 1,200 gallon capacity (15-20 min. retention time), acting both as a neutralizer-precipitator and as an oxidizer.

A Beckman pH flow cell, located in the overflow pipe, regulates, by means of an electronic control and an air-operated valve, the amount of 10-20 per cent lime slurry (up to 15 lb. CaO/hr.) necessary to maintain the pH between 7.2 and 8.0. The lime slurry is prepared and stored in a 540 gallon turbo-mixer, equipped with level control, and delivered by means of a 0 to 30 g.p.m. centrifugal pump with by-pass (recirculation) line.

Precipitation of gelatinous ferrous hydroxide occurs at pH values between 5.5 and 6.0. The aeration achieves transformation to the faster settling ferric compound, and induced oxidation of many organic substances. The suspension of ferric hydroxide flows into one of two large ponds (155 by 263 ft. each), separated by a 10 ft. dike. The water percolates through the mentioned 40 ft. deep natural sand bed, and finally reaches the underground basin, where it is diluted approximately in the proportion of 1:1500.

Plant operation is fully automatic, with lag timers, visual and audible signals, etc.

A specially constructed well, which provides the water for the plant, is located in such a manner as to allow testing of the effluent. Analyses have been performed regularly by the County Health authorities.

The plant has been running now for over three years, and results have been very adequate. As a matter of fact, the California State Department of Health has expressed their complete satisfaction.

The East Chicago Works

The repair and maintenance shop located in East Chicago has been in operation since June, 1937. Originally, the waste resulting from tatnk car cleaning was simply lagooned in a large pond, approximately 150 x 50 ft.

When the latter was filled, and until the waste treatment installation was completed, the aqueous phase, separated in the pond as a strata between a *floating top* layer of light oil and the settled heavy sludge, was sent through two baffled oil interceptors in series to the city sewer, by means of a pump mounted on a raft and equipped with a specially designed, vertical intake sleeve. This arrangement required constant supervision of the baffle height adjustment, in order to avoid transferring an excess of oil, and involved the risk of poisoning the municipal sewage treatment works (Guggenheim—biological system).

In 1949, it was decided to design and construct a new cleaning rack and a chemical treatment plant. After a few trial runs and subsequent modifications of the original flow diagram, regular operation was started in April, 1951.

The problem was somewhat more complicated than that of West Colton, California, because there was no limitation as to the waste composition, and no segregation whatsoever could be practiced, in view of the lack of available space. For the same reason, the treatment installation had to be very compact.

On the other hand, the effluent, which could be fed either to the municipal sewer (11,000,000 gallons/day) for secondary biological oxydation, or to the Calumet River, i.e. ultimately into Lake Michigan supplying a very high dilution, did not have to be purified to an extreme degree.

The system can be described as follows: The waste produced by the cleaning of all types of tank cars, with the exception of those having carried insoluble commodities, solid at ordinary temperatures, flows into the lagoon. This pond, which has been partly filled to provide the necessary area for new construction, will be leveled in the future, except for a small section with a capacity of about 100,000 gallons. It functions as a large equalizing and holding basin.

The liquid is presently pumped through the two baffled oil interceptors mentioned above, then, through a cement sludge settling basin, to one of two 300 gallons/minute Gale Oil Separators in parallel. The overflow (oil) is stored in a 10,000 gallon steel tank equipped with level indicator and signal. The underflow is collected in a sump, and fed to three horizontal, interconnected steel tanks having a total capacity of 30,000 gallons, and provided with automatic level controls and maximum level signals. These tanks act as additional equalizers and cushioning vessels.

The waste is then pumped into the "head box" of an Infilco Accelator at a maximum rate of 100 gpm, where its pH value is recorded. From this "head box" it flows by gravity to a mixing tank. A fixed amount of aluminum sulfate is added, according to a daily determination of optimum dosage for floc formation and clarification. The average amount of "alum" is about one pound per ton of waste.

Either sulfuric acid or a lime slurry are then fed to a predetermined, automatically controlled pH. The selected pH value depends on two factors, namely the original pH of the raw mixed waste (as measured at the "head box") and the results of the preliminary flocculation-settling test.

The liquid then runs by gravity into a pre-settling tank. The latter has a capacity of 15,000 gallons, and a surface area of 340 square feet. It was built from a half car tank, and is a rather original contraption. The flow is perpendicular to the length, at a rate of six feet/hour, both feed and overflow being through slit pipes. Retention time is over two hours. The thickened sludge is collected along the sloping bottom of the vessel, and its discharge is achieved through automatic timed valves.

The overflow is collected in a sump equipped with float control and pump, which elevates the liquid to the Infilco Accelator feed pipe. Again, a fixed amount of aluminum sulfate (averaging 0.25 pounds/ton) is added under the hood. Additional lime dosage for secondary flocculation is controlled by a pH system. Discharge of the sludge is through automatic timed valves. The combined sludge from the pre-settler and the Accelator are presently returned into the lagoon.

A pressure filter will be installed, and the cake will be incinerated, together with overflow oil and heavy sediment from the Gale Oil Separators, as well as the combustible solids (such as asphalt, naphthalene, creosote, etc.) from tank cleaning operations, in an existing Goder furnace. The pH value of the overflow is checked, and can be controlled to any desired value by automatic addition of the corresponding amount of sulfuric acid.

The clear effluent from the Infilco Accelator flows through a large pipe equipped with sight glass and sampling cocks to a manhole, thus insuring a minimum of 5-6 minutes total retention time before the outfall conduit is reached. Chlorine dioxide solution is directly injected into the stream, a few feet below the Accelator discharge. It is produced by reacting an aqueous mixture of high calcium hypochlorite and sodium chlorite with hydrochloric acid in an acrylic plastic chamber, according to the method developed by Mathieson Alkali Company.

Both reagents are dosed by means of a duplex proportioning pump, tygon plastic tubing being used for the transfer of the product. Chlorine dioxide is a strong oxidizing agent, with a selective action on phenols and some other odor-producing products. It does not lead to the formation of highly obnoxious chloro-phenols, as does chlorine. It is also a potent germicide.

Theoretically, two pounds of sodium chlorite (as ClO_2) are needed to destroy one pound of pure phenol. This figure was checked in the laboratory, and found to be correct. In practice, however, and in the presence of other organic and inorganic

waste, it does not hold true. Pilot plant work sponsored by the Ohio River Valley Sanitation Commission and performed at the Armco Steel Corporation in cooperation with Mathieson Chemical Corporation and others, showed that, in the case of phenolic ammonia still wastes, about 2500 ppm of ClO_2 was required to completely oxidize 140 ppm of phenols.

In the case of tank car wash water waste, about 10 to 12 pounds of chlorine dioxide are needed to destroy one pound of phenolic compounds. In other words, at the maximum flow rate of our East Chicago installation, namely 100 gpm, a phenol content of 20 ppm corresponds to one pound of phenols per hour, and will consume 12 pounds of sodium chlorite at 72c per pound, or $8.64 per hour! As can be seen, this method is very expensive, as a result of high reagent prices and high reagent demand.

In order to keep this cost as low as possible, it is necessary to closely control the chlorine dioxide consumption. This can best be done by automatic methods, because analysis by ordinary procedures would involve both a serious time lag and the salary for a full time chemist. A system has been developed which, by means of a photocolorimetric device and electronic instrumentation, allows continuous automatic control proportionally to the phenol content of the waste.

The East Chicago waste treatment installation has now operated satisfactorily for several months. Suspended solids have kept at about 0.01 per cent or below, and organic matters (as expressed by a dichromate O.C. test) have been reduced from 25 to 50 per cent. The effluent is free of oil (less than 8 ppm) and very clear.

The Saegertown Pennsylvania Works

The new shop in Saegertown, Crawford County, Pennsylvania, on French Creek, was completed early in 1951. The waste treatment installation started discharging its effluent by the end of April.

In view of the fact that the Pennsylvania State Laws require a high degree of purification, before industrial residue liquors can be fed into a "clean river," it was necessary to design a plant that could meet this requirement. Particularly, no phenols or other taste-producing compounds can be tolerated in "French Creek," which is used downstream as a source of drinking water supply by the town of Franklin.

Therefore, in addition to chemical treatment, as practiced in the Colton (California) and the East Chicago (Indiana) shops, a coal adsorption system and biological oxidation were installed. The former process was developed by the Research Laboratory of General American Transportation Corporation* particularly for the removal of the major part of phenols and other organic compounds with acidic polar groups (fatty acids mercaptans, etc.). Moreover, it results in destruction of emulsions, in decoloration, and in considerable reduction of B.O.D. (specifically O.C.).

The bio-filtration step is, to our knowledge, the first one treating mixed wastes. It uses the sanitary sewage of the working population as nutrient, and achieves oxidation of the phenols remaining after adsorption, as well as the usual stabilization of the effluent. A chlorine dioxide generator, with a maximum capacity of 12 pounds/hour is installed at the discharge end, both for final sterilization and for emergency oxidation of residual phenols, should biological treatment fail or be insufficient.

Except for a few detail modifications and one major change (addition of one conditioner), the flow sheet has remained as originally planned and described elsewhere.

The cars are first segregated into three categories, according to the nature of their last load, namely (1) products which are solid at ordinary temperature, or aqueous suspensions of such solids; (2) liquid commodities, immiscible with water, insoluble or only slightly soluble, and acids; (3) all other materials.

Category 1 (solids) in turn, is subdivided into (a) combustible products; (b) incombustible products. The first group (a) is incinerated, while the second group (b) can be simply dumped.

A particular problem was encountered with solid materials such as naphtalene, waxes, etc., that have a low melting point and therefore can be cleaned by steaming. Cars having shipped such commodities were placed on track (2), with the result that the products solidified in the channels, sludge basins and oil separators, clogging them and causing much trouble. Retention pools were

*Patent pending.

constructed to avoid this interference with normal operation, and have proven satisfactory.

The wash waters from category (2) are treated alternately (for periodic cleaning purposes) in one of two Gale Oil Separators, removing the largest part of free insolubles; such as liquid petroleum products, animal and vegetal oils, turpentine, ketones, etc., which are collected in a storage tank. The aqueous underflow is stored in an equalizing basin of 50,000 gallons capacity and pumped, at a maximum rate of 40 gallons/minute, to two turbo-conditioners in series, assuring a retention time of over 40 minutes.

Bituminous coal, ground to 100 per cent minus 35 mesh, is added in these conditioners, and the pH is automatically controlled to a value around 6.5. Under these conditions, the hydrophobic, solid particles adsorb nonpolar oils, phenols, fatty acids, mercaptans—generally most organic chemicals with an acidic functional group, and, thereby, also destroy emulsions. At the same time, they contribute to clarify the waste, and to reduce its O.C. load (respectively B.O.D.).

The coal, after adsorption, becomes floatable without addition of any extra collector. The slurry flows into a bank of three turbo cells, where a small amount of frothing agent is supplied, resulting in separation by flotation of the solids. The foam is scraped off by paddles, and filtered. The cake is dryed, and can be used as a fuel.

The flotation effluent, together with the wash water from category (3), pumped at the maximum rate of 20 gallons/minute, is treated in three turbo-aerators with enough ferrous sulfate and lime to form a good floc. Addition of the alkaline reagent is controlled automatically by a pH system. The gelatinous ferrous hydroxide, as well as organic matters, are oxidized. The effluent is clarified in a thickener (80,000 gallons capacity).

The thickener overflow, in view of biological treatment, runs into a large impermeable lagoon having a capacity of 150,000 gallons. This equalizes the character of the pretreated waste, avoids "slugs" of undiluted products toxic to biological life, and allows a storage of five days or better. The pretreated, clear waste is fed continuously, at a rate of 17 gallons/ minute to a pump well of 6,000-gallon capacity, where it is mixed with ground sanitary sewage from the working population, expected to reach soon 150-200 men, flowing at the rate of 0 to 50 gallons/minute.

A portion of trickling filter effluent is also recycled into the same well at a rate of 43 to 93 gallons/minute. The mixture is fed continuously to the trickling filter, 28 feet in diameter, with a media depth of six feet. Before discharge into the river, the filter effluent is settled in a clarifier, and sterilized by addition of chlorine dioxide.

It is interesting to note that the installation was designed for a waste containing 50 ppm of phenol, plus a 100 per cent safety factor (total: 100 ppm), i.e. a coal grinding capacity of about 50 pounds per ton of waste. During the initial operating period, through improper management of the car cleaning schedule, loads above 800 ppm were encountered, and had to be taken care of. Even so, less than two ppm of phenols were contained in the final clarifier overflow, and could be easily oxidized by ClO_2. For instance, on April 2nd, the influent waste contained 864.0 ppm of phenols. Adsorption treatment with coal reduced this figure to 304.0 ppm, i.e. a removal of 64.81 per cent. The lagoon had a phenol content of 111.0 ppm; while the clarifier overflow analyzed 1.76 ppm.

In this connection, it should be understood that the amount of phenols that can be removed by adsorption in a given time, per unit weight of coal, is a function of several factors, such as initial phenol concentration, particle size (or, more precisely, available surface) of the hydrophobic solid, its physical and chemical constitution, temperature of the slurry, presence of other adsorbable compounds, presence of foreign ions, etc. In a plant, designed to grind a fixed quantity of coal to a predetermined particle size (generally 100 per cent minus 35 mesh), the only independent variables are the temperature, and, to a certain extent (dictated by transportation economics) the quality of the adsorbant.

The Saegertown plant, prototype for complete treatment of complex industrial waste, has been operating adequately, despite temporary pollution loads amounting to 5-10 times the design figures. This has been possible thanks to the great flexibility of the combined adsorption — chemical — biological system.

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Safe Practices Through Visual Education

By T. J. WHALEN

Safety Eng., Solvay Process Div., Allied Chem. and Dye Corp., Solvay, N. Y.

In considering "Safe Practices Through Visual Education" it is important that we recognize the part the safety engineer plays in the overall training of the worker. Much as he would like to school each individual in the fundamentals of safety, the hazards of his individual job and the precautionary measures provided for his safety, time does not always allow for it. The safety engineer, therefore, relies on supervision to carry the major portion of the burden.

He must supply supervision with the newest and best material available and with the best means of presentation of this material. He will need educational aids to give them additional help to successfully carry out this program. Educational departments of the larger chemical companies do the planning and preparing of this helpful material to supply their supervision with the necessary aids to enable them to better carry out the actual, on the job, instruction of the individual. Since these departments are well organized and have at their disposal the most modern educational means available, it is not necessary to dwell upon them.

However, the safety engineer in the smaller plant also has a responsibility he cannot shirk. How can he best discharge this responsibility? Heinrich, in his book, *Industrial Accident Prevention*, tells us that one of the basic principles of scientific accident prevention is the creation and maintenance of an active interest in safety. What means or methods can he use that will be best suited to creating an interest among his own people?

Perhaps many among you recall the heavyweight championship match between Ezzard Charles and Joe Walcott? Sportscasters and advertisers alike gloried in the fact that the largest audience ever to view a fight resulted from televising this contest. This was voluntary attendance at the television sets.

For years we have been accustomed to broadcasts of championship sports events on the radio, but, if we can believe the sportscasters, never before was such an audience assembled for a sports event. What made the difference? It was the opportunity to see it as well as hear it.

Recognizing this, the intelligent safety engineer will make good use of the motion picture projector as an interest creator. If limited safety budgets are an objection to purchasing one, then rental may be the answer. There usually are several sources in the community where they can be readily rented. We did that and the results were so gratifying, that it was not difficult to sell management on the need for one of our own.

A word of caution here; be sure you have a competent operator available. If not, train one, as there is nothing quite so embarrassing as a poorly presented film. You can readily lose your group and what started out to be a good meeting develops into a comedy with comment from the group surplanting the safety message you had hoped to put across.

No doubt you have thought at some time or other how much you would like to have a motion picture film of some of the safety aspects of your own processes that you could show to your employees. Like many others, you no doubt have found the cost of making such a film prohibitive.

That is true in most instances, but don't let it upset your program. It is no problem to obtain good safety films. The National Safety Council has an excellent film library which is available to you. Safety films can be rented at a nominal cost. There are available through this source films dealing with the safety aspect of many subjects.

Insurance companies, chambers of commerce, manufacturers of various products, such as fire extinguishers, etc. are good sources to draw on. Since there are many calls on them for the use of their film, it is well to contact them far enough in advance to insure showing the film when you want it. Last minute arrangements are not good and usually backfire. So get your program planned well in advance.

You may not want to depend on borrowed or rented film because of your own special need for repeated showings. In that case you can set up your own film library. This can be an expensive item, but with a little shopping around and careful selection to get the films best suited to your needs, it can be done with a reasonable expenditure of funds. In this manner your film will always be available for use at your own convenience.

Film strips or slides, will effectively portray, at a nominal cost, those safety features you wish to put across. Good slide and film strip projectors are available for less than one hundred dollars. Their use as an aid to safety education is invaluable. Having attended the sessions here at the Congress, you have had an opportunity to observe the use of the motion picture, film strip and slide projectors and to note their effectiveness.

Those among you who attended last year's sessions here remember the fine talk and demonstration conducted by Mr. John Bollman. He and members of his staff at Procter and Gamble produced, in color, their own film strip. You who might be interested can get facts on the subject from John. It is not necessary, however, to produce your own film strip or slides since many and varied types are available for rental and sale.

Film strips of job contents have been used to good advantage to point out to new employees the hazards of their job and the protective measures instituted to guard against such hazards. It is possible through this medium to bring the discussion right to the employees door. He sees and recognizes *the thing* that he will deal with himself. He is not exposed to a portrayal of some hazards from far away places, but rather that which is within his own area. In fact, he and his work become the stars of the production.

He sees and is interested and being interested he gives more thought to safe operation. Here again, we require a competent operator. The success or failure of your program will depend to a great extent upon the presentation. Don't chance losing the interest of your group by a poorly planned and executed presentation.

The use of bulletin boards is recognized as a good advertising medium. However, it is not as simple as some would make us believe. I have found that careful planning of bulletin board displays is a must. They should not contain too many posters or messages. They must be constantly changed and kept up. Long messages or slogans should be avoided. The old adage of making messages fit the pattern of "so he who runs can read" is a good one to follow.

Your bulletin boards should be placed in prominent spots in your plant area. They should contain only information pertaining to safety. We have found that a glass front, locked board has aided materially to discourage those employees who would clutter them with other notices. Small boards for purposes other than safety notices should be erected and employees encouraged to use them. Only safety messages should be posted on the safety bulletin boards.

A study of types of accident most frequently occurring in areas of your plant should help you determine your choice of posters. We are rather fortunate in having a good artist working, as a fire marshal in our Syracuse Plant. We have used his talent to good advantage. Some of his poster creations dealing with subjects peculiar to our own plant were excellent interest creators.

Not all organizations are as fortunate as to have within their ranks a person possessing such talents. You can, however, obtain posters suited to your needs from many sources. Good use can be made of the poster service of the National Safety Council. They have a variety of posters to fit most any need and are constantly trying to im-

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prove their service. We, of the visual aid committee, are anxious to obtain any new ideas or suggestions you might have for better posters. Many manufacturing concerns have posters, viz. safety shoe manufacturers and they are only too glad to supply you with them.

We have attempted to cover here a few of the visual aids that you can use to further your plans for safety education among your employees. Much of this is old stuff to many of you. The fact that it is old stuff indicates that you, like so many other safety men, have recognized that after all your big job is the "man." Statistics have proven that the preponderance of accidents occur because of man failure.

No safety program could be complete without a thorough, well planned and regular program of inspections for unsafe conditions. It is necessary—it is important. But, it is more important to develop in the individual worker a safety consciousness. A consciousness that will make him a safer worker and thus a more efficient worker. It is possible for you through films, film strips, bulletin boards, special posters, etc. to carry the message of safety to the individual man. Constant repetition of recognized safe practices, repeated in an interesting manner will keep him interested.

Knowing well that every picture tells a story, use the visual aids available to you to tell the story of safety. Keep it constantly before your men. In this manner you will make great strides towards your goal.

We are not trying to prove that the use of visual aids is the complete answer to your workers educational program. They are what their name implies—aids. What we hope to do is to point out some of the valuable aids available to you at nominal cost. In our efforts to create and maintain interest in programs we must be ever vigilant to seek out the best means available. We have such means at our disposal in our visual aids. Let's use them.

Where are the Accidents in the Chemical Industry?

By E. R. WALLACE
Safety Engineer, Eastman Kodak Co., Rochester, N. Y.

Many of us feel that the accidents which occur and are reported in the chemical industry are those involving severe chemical burns caused by explosions, fires, major spills and the like. As a matter of fact, I was of the same opinion until we started on some statistical research in an attempt to get a better picture of our accident record.

We discovered that the accident picture in the chemical industry is not much different than it is in any other industry. Too many of us have been accepting this misconception for too long a period of time.

When this assignment was accepted, it was felt that in order to give a true picture of what is going on, a survey should be made from the records of other chemical industries to determine the type of accidents being reported. So on that basis, a questionnaire was prepared and sent to the safety directors of some thirty different chemical plants in an attempt to accumulate enough data to substantiate our findings.

It was found on reviewing the questionnaires which were returned that the experience of other industries in the chemical field is similar to ours. From the information received on the questionnaire a series of conclusions have been drawn which will illustrate where the accidents are occurring in the chemical industry.

I admit at this point that not all the information was used, the reason being that the numbers of accidents reported on the questionnaire would prove rather unwieldy for this sort of discussion. However, in checking over the total results, we found that omission of these figures did not change the ratios appreciably so that we are using approximately 1,000 accidents as our source which we feel will be a representative picture of where accidents occur in the chemical industry.

Nature of the injury. Here we see that ¼ of the total reported are lacerations; about 20 per cent are fractures; and approximately 18 per cent are bruises, contusions, and strains. However, looking at the chart, we see that the accident type one would normally expect to find, chemical burns, accounts for approximately four per cent while fume inhalations, asphyxiation and systemic toxic effects make up one per cent of the total.

Parts of the body injured. Nearly 25 per cent were smashed fingers; 15 per cent were damaged faces; strained backs, about seven percent; and head, hands, feet, legs, and toes account for about ½ of the balance.

Unsafe acts; Over 400 of the total accidents reported were caused by striking against or being struck by an object or being caught in, on, or between two objects while contact with chemicals or the inhalation, absorption, or ingestion of toxic materials accounts for less than ten per cent of the total.

These three conclusions show us definitely that on analyzing the experience of several plants within the industry throughout the country the results are much the same. On comparing these results with the results of other industries again we find that the experience is similar.

Where the fault lies. On our questionnaire we asked for a designation of responsibility and from the list sent us, we find that per cent of the accidents reported were caused by failure to exercise a reasonable amount of care on the part of the injured individual. Willful disregard of rules account for 6 per cent, where chance-taking caused 13 per cent. It is of interest to note that instruction, muscular weakness, judgment failure and lack of knowledge of the job account for a total of 25 per cent collectively.

The total percentage of employee failures is 84 per cent.

We find supervision failures, the total of which is 16 per cent; failure to instruct, five per cent of the 16 per cent; failure to establish safe practice, three per cent; and failure to provide proper equipment, six per cent. Now remember, this supervisory designation of responsibility is the report of all companies who answered the questionnaire.

What does this prove? It proves, in the first place, that our supervisors are doing a rather slipshod job of providing those things necessary to eliminate accidents.

Years ago we had a very simple way of analyzing accident responsibility. In reviewing some very old records, I find that over 99 per cent of the cases on the report stated that the injury was the result of employee carelessness.

Today we have expanded the definition of carelessness so that we now have many breakdowns which I feel are another way of saying the same thing. It looks as if we are still shoving the responsibility on the employee himself.

Our charts show that it is not often that supervision is charged with the responsibility of the so-called accident. However, how many of us, deep down inside, realize that it is more likely our responsibility as safety people and the responsibility of the supervisors to provide the training, the additional supervision, the investigations, the job layouts, and the constant checks necessary to keep the employee safe and well.

How many of us have a definite formal program in our organization of on-the-job instruction and training for the employee? How many of us take the time to re-check a new employee to see that he has been fully instructed on the job and is aware of every detail on that job?

No doubt, we all have our indoctrination program fairly well established. How many of us call our employees back for a review at the end of six months or a year or longer? How many of us lose sight of the fact that the employee is the man who reflects the type of job we are doing?

You might think from what has been said already that I am saying that we should throw the responsibility for our accident records directly on the supervisor, and in a sense I am doing just that. I have said that, by and large, our record indicates the same trends that we have in other industries and yet we must remember that this is the chemical industry we are talking about and we have more to consider in our safety program than normal guarding of machines, setting up of programs, etc.

We must remember that while the majority of the accidents that occur in the chemical industry are due to the familiar causes, in all instances that the truly chemical accident occurs, it results in serious injuries—the kind we all wish to prevent.

As an example of that, I would like to review an accident which occurred in an organic laboratory recently. The picture was something like this:

A graduate chemist was running a vacuum distillation with phosphorous tri-bromide, using as a receiver a 13-liter boiling flask. In order to keep the reaction cool, a stream of water was played over the outside surface of the glass flask.

Now this laboratory was a part of a production department so that the chemist had more than one thing to watch at a time. As the first reaction was running smoothly he started to set up a second reaction using phosphorous oxy-chloride in the same hood. The hood was a walk-in type with a counter-balanced vertical door on the front. The ventilation in the hood was sufficient so that if the door was opened ample movement of air was available.

The chemist opened the vertical door of the hood and picked up a 13-liter flask of phosphorous oxy-chloride and stepped into the hood to place the flask on a ringstand. However, he then noticed that the ringstand would have to be moved before it could be used because it was directly in back of the distillation apparatus.

He grasped the top of the ringstand with his free hand and attempted to lift it around the side of the receiver and as he did so, the base struck the glass flask allowing water to be drawn into the receiver by vacuum through the crack that appeared in the side.

Fortunately for the chemist, he was a quick-thinking individual and he moved very rapidly. Dropping the flask of phosphorous oxy-chloride and grabbing the handles of the open door, he lifted himself upward as he pulled the door down.

The vacuum distillation equipment exploded throwing glass chips throughout the general laboratory area breaking all the glass inside the hood and driving particles of glass of high velocity considerable distances completely through empty glassware on the other side of the room.

The chemist sustained second-degree burns on the lower portion of the body and a very severe laceration of the vein on the inside of his leg. Fortunately, for the injured chemist, adequate first aid was applied and the medical department was readily available so while his injuries were rather severe, they were minimized considerably.

What can we learn from an accident of this type? First of all, is it necessarily an accident? Did the employee have full control over his laboratory and should the responsibility for the injuries he sustained be borne by him alone? Too frequently the supervisor or safety engineer say, "What can I do about it?"

In this case some advance thinking on the part of the employee, supervision and the safety engineer would have prevented the accident. For altogether too frequently our chemical laboratories become cluttered with apparatus not in use at the moment. Too frequently we allow chemists who, because of their familiarity with these high-hazard materials have no fear or respect for the danger, to run two reactions of high hazard in the same hood or alone in the same laboratory.

Of course, in this case as in most cases of this order we have locked the barn thoroughly, but have we gone far enough to determine where the next incident may occur? Would it not be wise to definitely place responsibility for safe working conditions all the way along the line with the employee taking his just share, the supervisor in the control capacity leaving the safety engineer time away from the smaller details to spend his efforts on a search for the reduction of the major chemical accident.

As another example of this sort of situation, we might mention briefly the numerous explosions that have occurred across country in chemical plants storing high-hazard flammable liquids. There is no need to review each case individually for we are all familiar with them.

However, I would like to point out that without question, had more time been spent by top supervision and safety supervisors on the investigation of possibilities of major disaster and had adequate thought been given to disaster plans, some of the loss of life and property could have been eliminated.

Investigations made by insurance companies such as the Factory Mutuals, the Factory Insurance Associations, or by other organizations such as the National Fire Protection Association after the serious fires that occurred in flammable liquid storage fields have shown us that had each individual in the organization been justly aware of his full responsibility in the prevention of accidents that many of the unsafe conditions could have been eliminated on the drawing board and much of the loss of life and property could have been prevented long before.

Recently, I visited the storage area of a large international chemical company and the first thing that was noticed was the fact that the immense storage tanks of flammable liquids were located so close together that it would be almost impossible for two men to walk side by side between them. No diking was in evidence and to top it all off, gas vents were burning 10 or 15 feet above the tops of the tanks and not too far away.

The first thought that occurred was that a great deal of distance should be put between me and the storage tanks. Perhaps you know the answer as to how such a condition could exist. Perhaps this plant like many others with which we are much more familiar grew like Topsy.

Whatever the answer, it is our hope that this organization is aware of the things that may occur and that the newer installations are laid out according to accepted standards.

We know that it is impossible for any safety man to be aware of what is going on in every corner of his operation at all times. We do know that each employee and each supervisor is aware of what is going on within his own sphere of responsibility and if they assumed that responsibility and do something about it, safety personnel can be assured of the opportunity to investigate in advance those areas where major difficulties can occur. I do not mean to say that we are even suggesting removal of any of the responsibility for overall safety program from the safety department because that responsibility should never be removed.

While the majority of accidents may be due to the old familiar causes, we still have the very real responsibility of doing everything we can to prevent the major type of accident whether chemical or otherwise and it is in this field that the trained safety engineer can be of great deal of service to his organization.

No doubt you are reviewing certain situations right now as you are sitting here on which you would like to spend more time and effort. Or you are wondering how such an idealistic program can be put into effect. I cannot tell you the answer for each plant, company, organization differs not only from the management standpoint but on a production basis as well.

This idea is a challenge to you as a safety man or a production supervisor or as a member of management to do something that is urgent when you return to your job. But something must be done and be done quickly.

If we have the aid of every employee with us, we can eliminate this 84 per cent of employee responsibility injuries. If we have every supervisor in our corner sharing his just portion of responsibility, we can no doubt reduce our rate, likewise, and if we give the safety department that additional time for research and advance investigation we no doubt would be able to prevent the major disturbing situations that cause us all so much difficulty even though they are infrequent.

I do not know what your job is or what company you represent or why you are here today, but I can assume that you are interested in knowing where the accidents are in the chemical industry. I trust that I have been able to point the way to determining where those accidents are and how to eliminate some of them.

I hope that I have stimulated your interest sufficiently so that you will accept the challenge to do something about re-organizing your thinking in terms of where responsibility lies. When we have all completely sold the personnel in our plant from management to employee on their share of responsibility, I think we will have started on an accident prevention program that will prove successful.

Safety Contests in the Chemical Industry

By M. A. SNELL
Supervising Engineer, Hartford Accident and Indemnity Co., Hartford, Conn.

In addition to competing in the annual contest conducted by the Chemical Section of the National Safety Council, many companies have their own safety contests either between plants, or between departments in a plant, or both. It was decided that information about such contests would be of considerable interest and assistance to all of the members of the Chemical Section. In order to obtain this information, questionnaires were distributed with the May, 1951, *Chemical Section Newsletter*, with a request that member companies fill them out and return them to the National Safety Council.

Unfortunately, there were only 33 replies received from the members of the Chemical Section. Of these, 19 reported no contest, and 14 reported contests of various types. Some of these contests had many features in common, but in other respects they differed radically from one another. Some of them had developed very interesting innovations that should be of considerable interest to all of us. These will be described in detail in this report.

Let us consider the replies to each of the six questions that were listed on the form.

1. *Do you operate your own safety contest?*

Nine companies reported that they operate contests between the departments in a plant. Seven companies stated that they operate contests between separate plants. In some cases a company operated not only interplant contests, but also interdepartmental ones within those plants. These contests were in addition to the one operated by the Chemical Section of the Council. In each case there was no connection between this contest and those operated by the companies.

2. *If you operate your own contest, what benefits have resulted from its operation?*

Most of the replies indicated that one of the principal benefits was the greater interest in safety and accident prevention that had been created among the employees, including supervision and even management. Two reported better housekeeping.

One plant reported a 66 per cent reduction in their accident frequency as a result of the operation of their contest.

3. *What particular features of your safety contest have been responsible for these benefits?*

The greater interest in safety among the employees resulted from a desire to win awards of various kinds. Apparently, in some cases employees were more interested in winning individual awards than in helping their department or their plant win an award.

Some reports indicated that employees are interested in any kind of a contest because people generally enjoy competition and if it is properly conducted, will take an active part in it. Apparently, many people are more apt to enjoy participation in a competition if it is operated on a team basis rather than among individuals. This is probably due to the pleasure derived from the feeling of belonging to a winning group, which in many cases, is much stronger than a similar feeling derived from winning as an individual.

From the material standpoint, there were many reasons for the benefits resulting from these contests. Frequently all of the members of a winning department were given individual merchandise awards, such as cigarette lighters, sets of plastic playing cards, automatic pencils and ball-point pens. In one case all the employees in accident-free departments participated in a drawing for two $25.00 U. S. Savings Bonds each month.

Cups, plaques or certificates were frequently awarded to winning departments or plants. In one case, the cup was personally presented to the winning plant by the president of the company, with a suitable ceremony attended by all plant employees. Apparently, there was keen competition and much greater interest in safety activities because of the desire to have the president of this large corporation attend a ceremony of this type.

In one case these plaques were made from expensive bronze rather than the usual

hard wood. In most contests the names of the winners were inscribed on the awards. In one contest the winners were allowed to keep the awards permanently, but in most cases they were allowed to keep them for only one year. However, if a plant or department won the award for three years, not necessarily consecutively, they were allowed to keep it permanently.

In order to impress employees with the importance of winning, many companies spent considerable sums of money and went to a great deal of trouble. Frequently, all winning employees were invited to a dinner or an evening of entertainment or sometimes both. Wives or even entire families of employees were frequently invited to these functions. One plant staged an annual dinner dance for the members of the winning department. In another plant all the members of the winning group with one guest for each were taken on Sunday morning by bus to the city zoo at company expense. After eating lunch there, all of them were taken to a major league ball game.

Apparently it was believed that greater interest was created in the contest if the wives or families were invited to participate in the events given by the company to the winners.

One company kept the departmental foremen on their toes by annually awarding very attractive statuettes to the foremen of winning departments. As a result, all the foremen in the plant spent considerable time in the elimination of unsafe conditions and unsafe acts, and in the enforcement of all safety rules.

One large company has purchased four electric clocks awarded annually to the four plants having the lowest frequency rates. One clock known as the "Master Trophy" is awarded as the first prize to the plant having the lowest frequency rate. Three clocks, all of similar design but not quite as attractive as the Master Clock, are given as second, third and fourth prizes to the plants with frequency rates in that order.

The first prize electric clock is attractively designed in a weather-proof case, mounted on a pedestal and installed in an appropriate outdoor location at the plant. The clock dial is electrically illuminated and the letters, SAFETY ALWAYS, are used around the dial in place of numerals to indicate the hours. The other clocks, although less expensive, are similar in design and are also weather-proof, mounted on pedestals and marked to indicate whether they are second, third or fourth place awards. These clocks are awarded on an annual basis and at the expiration of the contest, are transferred to the new winning plants.

In order to maintain interest in the contests from day to day and from month to month, records and standings of departments or plants were posted on bulletin boards or published in bulletins or magazines given monthly or weekly to all employees. Interesting articles and pictures were frequently included on various phases of the accident prevention activities. In one plant, flags were displayed each month in the department that was leading the contest.

Importance is frequently attached to the establishment of records for no lost time injuries. One plant has handled this by awarding an appropriate certificate at a suitable ceremony when a department has completed 100,000 man-hours with no lost time injuries. This recognition is repeated at the completion of every subsequent 100,000 man-hours. However, at 500,000 man-hours the company invites all employees with their wives or husbands to an evening program. At the completion of one million man-hours, employees and their wives or husbands participate in an excellent chicken dinner.

This same company has solved the problem of giving recognition to departments that are too small to qualify under the plan mentioned above. In such departments, at the end of a five-year period with no lost time injuries, each employee in the department is given a very attractive merchandise award. At the completion of ten years, or one million man-hours, whichever comes first, the employees and their wives or husbands are invited to a chicken dinner.

One large company has a plan which is used by all of their plants. It does not involve any actual competition between plants. Instead, each plant attempts to reach one or more of three established goals of number of days' operation without a lost-time accident. Whenever any plant reaches one of these goals, all the members participate in a worthwhile award determined by a committee.

4. *Will you send us a copy of your safety contest plan or program?*

Six replies included a copy of the contest plan. One other company agreed to send a copy as soon as it had been completed because apparently at the time it was in the formative stage.

5. *Do you object to the Chemical Section making a summary of the material in your program, together with that of other members of the section, and distributing it to all interested members?*

Apparently there were absolutely no objections to the use of the information supplied in the questionnaires.

6. *Do you wish to receive a copy of this safety contest summary?*

Thirty companies of the 33 that replied stated that they were very much interested in the results of this study. By means of this report, we are making it available to all the members of the Chemical Section.

It will probably be of interest to mention some of the interesting innovations that have been developed in these contests, although we do not have time to discuss them in detail. In some plans the different plants or departments competed with one another simply on the basis of their current cumulative frequency rate for the contest period. However, in many cases it is questionable if that is a fair basis for the competition because of the great differences in the operations and the accident possibilities involved.

To overcome this, one company had the departments compete with their own past accident record rather than with that of other departments. They were very positive in their belief that as a result of this change in their contest there is much greater interest in winning the contest and in accident prevention generally than before the change was made. Obviously, it is often times discouraging to a department with many serious accident exposures to attempt to match the frequency rates of another department that has comparatively few.

Up until a few years ago our own contest in the Chemical Section of the Council was operated by grouping the plants by types of industry without any thought to the accident-producing factors involved in the plants. Several years ago that was changed so that now the contestants are grouped on the basis of their own previous accident record. Although they are still competing with one another, they are nevertheless, grouped with other plants who have a past frequency rate similar to their own. We believe that the contest is much more interesting and has attracted many more participants due to this change.

Another problem in connection with the operation of safety contests involves the vast difference in the size of departments. This is usually handled by having departments or plants compete with others that develop approximately the same number of man-hours during the contest period. Our own sectional contest is operated on this basis.

One member reports that their contest includes 25 departments in the plant. These are combined into five groups of five departments each. This grouping is accomplished in such a manner that the resulting accident hazards or possibilities in each group are approximately the same. Two other plants have done exactly the same thing by combining the departments into teams, each made up of several similar departments in order to make the competition on a more even basis.

Within a single plant or among several plants in a company, it is often difficult to apply a proper method of grouping using man-hours alone. This problem has been expertly solved in one contest plan by developing a method of scoring that automatically includes the size of the department, so that grouping by size is unnecessary. At the beginning of the contest period each unit or department receives a credit consisting of a number of points equivalent to one-half its average number of employees multiplied by twelve months.

As an example, the base points of a department of 50 people would be 50 (No. of employees) x 0.5 (points per employee) x 12 (No. of months) or 300. At the end of the contest period if they receive no credits nor penalties, their score would be 300 divided by 300 or 100 per cent. However, it would be very unusual for a department to end up with a score of exactly 100, because of the credits and penalties used during the contest year.

For example, credit points are given to a department for any safety suggestions submitted by members of that department that are accepted and paid for by the suggestion committee. Also, during the year employees are selected at random and at

unspecified times throughout the plant. If such an employee at that time can accurately quote specific safety regulations that have been posted on the bulletin board, additional credits are given his department. However, inability to quote correctly results in no penalties.

This contest plan has also developed a very interesting system of penalty charges. For example, if an injured employee loses any time, or if he cannot do his regular work, or is temporarily or permanently disabled, and the accident is due to controllable causes or could have been prevented, the department is given an appropriate penalty charge according to a published table. If a fire occurs in a department and it is due to controllable causes, that department is penalized 20 points.

Monthly inspections are made of all departments and penalities are given for poor housekeeping or safety violations, using an extensive table that involves floors, a possible falling object, cabinets, equipment, materials, personal protective equipment and general factors.

The method of scoring at the end of the contest period starts with the department's base points calculated from the number of employees. To it are added the credits and from it are deducted the penalties. The score is expressed in a percentage of the net total points. Obviously, if a plant develops some credits, but has no penalties, they can have a score of over 100 per cent. This seems to be a very interesting approach to the safety contest problem because it attempts to take into consideration every important factor.

Another company uses a similar approach, but developed a system of demerits. However, it apparently is a fairly simple plan compared to the one mentioned above. Unfortunately, we did not receive any details on this plan and because the questionnaire was not signed, we were unable to write to them for additional information. The questionnaire did state that every lost-time accident is given three demerits with one more demerit for each day of lost-time.

Two of the plans give demerits for poor housekeeping. Another contest is based entirely on housekeeping, the quality of which is determined by monthly inspections of departments. Two other plans are also based on systems using demerits. In one of them, if an employee is injured and sent to a doctor, one demerit is charged. If the injury results in lost time, five additional demerits are given. If the accident occurred through the employee's failure to wear protective equipment or management's failure to provide such equipment, the result is an additional five demerits. The winners are those that have the lowest demerit frequency during the contest period. This frequency is the number of demerits per 100,000 man-hours worked.

In the other plan, each contest covers a six-month period. The score is based on the frequency rate and demerits for unsafe practices, non-reporting of injuries and poor housekeeping, determined by safety inspection tours by a committee.

In all of the contests, except two, the winners were picked either on the basis of the accident frequency or demerit frequency as explained above. You will note, however, that in the demerit frequency plans the severity of the lost-time accident was taken into consideration. One of the exceptions involved a plan that added the frequency and severity rates together in determining the winners. Both of these were the usual rates established by the American Standards Association. However, the severity rate is multiplied by ten before adding it to the frequency rate. If this factor of ten were not used, the severity rates would have very little effect on the frequency rates of the contestants.

The receipt of a greater number of replies to our questionnaire would probably have resulted in a more complete cross-section of the contests used by the chemical industry. However, I hope you will agree that even these few replies have contained some very interesting and helpful information. Perhaps it will help you and other people in the chemical industry in the development of a better plan or program for operating your own contest.

It may assist you not only in operating your contest on a more equitable basis, but it also may give you some ideas on how to create greater interest in the contest and the benefits that result from it. Actually, the only worthwhile benefit is an improvement in your own past accident experience.

Disaster Control in Chemical Plants

By REUEL C. STRATTON
Supervising Chemical Engineer, The Travelers Insurance Co., Hartford, Conn.

The modern safety campaign projects itself almost entirely toward the education or protection of the individual as an individual entity. It is true certain fundamentals underlying such a program bring into the picture the question of preventing loss of property, but in very few instances is or has there been any definite approach made toward the prevention of the so-called spectacular accident or disaster until the recent emergency through the Civil Defense Program attracted attention toward the need for such controls even in peace times.

What constitutes a disaster? I formerly considered for the purpose of discussion that the term "disaster" would be limited to the result of any accidental event which might take the lives of more than three persons or might cause substantial property loss. Webster defines a disaster as an unforeseen or ruinous mischance or misadventure which happens, often suddenly, either through culpable lack of foresight or through an adverse external agency. Personally, for this purpose, I prefer to consider a disaster "anything that provides a major disruption of production regardless of loss of life or property."

It is peculiar that under the circumstances of a disaster the first thought usually appears to be the initiation of an official investigation by civic or other interested agencies chiefly to fix the blame. By such investigation it is hoped to create a demand that something should be done about such things. However, such efforts generally diminish rapidly as time goes on and are lost sight of eventually. This diminution of effort clearly proves a point which I desire to emphasize; namely, that disaster control should be just as much a part of a plant safety program as any other and must be carried on day in and day out regardless of whether a disaster has ever occurred or whether one is expected to occur.

Examples of what may constitute a disaster are as follows: a. Those resulting from the military operation of an enemy such as; bomb bursts, incendiaries, bacteriological attack, chemical warfare agents, sabotage; b. Other agencies: cyclones, earthquakes, floods, fires, process explosions, building collapse.

It may be that this discussion will appear to be directed toward a large plant but there is a purpose in doing this because it is considerably easier to scale down a program to fit a small plant, while it must be remembered that a large plant is generally only a group of small plants banded together by transportation or other process equipment.

Obviously, *the responsibility for disaster control rests with top management.* In these days, failure to consider disaster control and to provide a means for meeting disaster and survive may be only a forerunner of industrial bankruptcy. It is human to avoid thinking about unpleasant episodes, such as going to the dentist, until that episode through pain or actual occurrence forces one to consider the need. The need for disaster control in chemical plants today is ever present.

Proper executive planning is necessary. The steps in the development of disaster control can follow easily the steps suggested by the Carnegie success formula and if followed will establish a smooth functioning organization. "Organize," "deputize," and "supervise" are the three basic fundamentals necessary. Each plant should hand-tailor a plan to fit the particular plant, but in the adaptation thereof a sufficient similarity should be maintained so that plant-to-plant liaison assistance may be made available.

Again for the purpose of this discussion I am going to assume that I have been detailed by top management to establish disaster control for a medium size chemical plant. I am going to go through the establishment of the disaster control program step by step as if I had to do the job. Consequently, if I use the first person it is solely for the purpose of clarity and not to attempt in any way to develop the point that this one particular plan is the beginning and the end of all disaster control plans. Such is not the case. Every plan developed must be fitted to the exposure which it is to protect or control. This is simply a pattern.

The first important step is to establish the office of plant emergency defense with one person entitled the "Defense Director" appointed to take charge of all protective requirements. The next step is to appoint a deputy to take complete charge when the primary person is absent or might have become a casualty. If a plant operates around the clock then a deputy and an assistant to that deputy should be appointed for each shift. Such appointments including the defense director need not be from executive personnel, but may be made from the plant staff with the choice being influenced by the person's experience, his attitude toward the problem, and his ability to secure cooperation from all others who may have to function with him. The selection of the defense director and his deputies and the assistants is most important and should be carefully considered.

The next step is to establish a safe headquarters for the office of plant emergency defense. Such a headquarters should be established in a relatively strong building away from hazardous areas, preferably in a basement. The headquarters should be equipped with telephones, emergency lighting, sanitary facilities, and at least one extra exit.

After the defense director and his deputies have established the headquarters, consideration of appointments for the staff functions should be entertained. There are three staff appointments. These are: 1. communications; 2. liaison to local civil defense and other plants; and 3. the investigation team.

Communications: Communications should be arranged under the direction of a chief messenger. In the event of a disaster it is probable that a portion of all normal means of communication services will be disrupted. Therefore, the chief messengers should arrange to appoint a staff of younger men who will under the direction of the chief messenger be located at a central point and be prepared to act as runners between defense emergency headquarters and the various service units.

The headquarters for the messenger service should be equipped with emergency lights, telephones, walky-talkies, and other items for the communication of messengers. Each messenger should be equipped with a flashlight, safety goggles, steel helmet, and gloves. Those appointed for messenger service should be thoroughly familiar with all parts of the plant.

Liaison with local civil defense and other plants: This function may be accomplished by one or more persons specifically selected because of their contact knowledge of surrounding plants and facilities. The duties are to establish liaison with local civil defense authorities as well as with other plants so that mutual aid and assistance can be received or given in the event of a disaster.

This liaison should create similarity of function between the primary plant and the other plant contacts so in the event that assistance is required or must be given the organization from one plant will blend into the functional operations of the others without confusion. This same thought applies to the relationship with any local civil defense program.

Investigation team: This team should be selected from persons proven as to their experience and ability to seek out the cause of any disaster. They should be provided with proper safety equipment and authorized to enter any disaster area immediately after any episode to obtain the earliest and most authentic information as to what occurred, how it occurred and what might be remedial measures for any future protective requirements.

Few persons really know how to investigate a disaster. It means long hours spent "picking up the pieces and fitting them together," "interviewing eye witnesses and injured," "putting together parts of stories," "discounting over-emphasis by the witnesses," etc. until the cause is actually determined.

Under and directly reporting to the office of plant emergency defense should be five important groups. These are: Fire chief, police chief, medical services chief, air raid warden, maintenance and salvage chief.

Naturally, if the plant involved is a large one these positions are already filled and the personnel will be available, but if such is not the case, then a chief and a deputy for each should be selected from plant personnel. When such is done, each person selected should either be completely familiar with the plant, or he should be trained so that he will know the plant completely, have complete knowledge of his own particular field and position in the disaster control

plan. Each should also be a leader by temperament with reasonable quantities of moral and physical courage, and last but not least, an ample supply of good common sense. The functions of each of the five divisions will be considered now. Again reference to the organization charges suggested.

Fire chief. The fire chief should establish and assume responsibility for: The selection and training of fire fighting brigades. Select and train rescue units, together in liaison with the medical department and supply with all necessary rescue equipment. Select and develop the personnel for inspection unit, whose duties will be to not only make regular inspections of plant properties, but also in the event of a disaster will move in and inspect the area completely as well as surrounding areas to determine the extent of the damage and its effect upon surrounding areas. Organize a training program so that each plant employee will become familiar with the emergency fire fighting equipment placed in his department and thus be prepared to assist in first aid fire fighting.

Air raid warden chief. The air raid warden chief should be held responsible for: The selection, organizing and training of personnel to serve as air raid wardens. Such people should be chosen because of their calmness in an emergency and their ability to set an example for others. Training toward the control of employees by themselves should be established. This is particularly necessary if panic is to be avoided. Supervise process shutdown. This unit should be selected from personnel familiar with plant procedures and production programs. Members of the unit should move into an affected area immediately and shut down electric, control, process, steam, and other lines so that the effect of the disaster will be minimized. An education and publicity unit should be appointed to maintain a continuous program whereby all employees will be continuously advised of techniques, procedures, and the fact the control plan is functioning and is a necessity for plant operation.

Police chief. The police chief should be appointed and held responsible for: The selection of personnel to act as plant guards and to direct all of their activities. A traffice control squad should be developed who will move in and assume charge of traffic when a disaster occurs. A demolition and missiles squad should be appointed. Such personnel should be familiar with the plant equipment, but also should be selected so that they can be trained to take care of unexploded missiles in the event of enemy attack. Their chief job will be to make structures safe by demolishing unsafe structures or equipment following a disaster. A group to supervise and be responsible for personnel identification, visitor controls and possible espionage, should be established. This is more or less self-explanatory.

Medical services chief. The chief medical officer should be appointed and held responsible for: The establishment of needed hospital services and the maintaining of such dispensary and medical units including the selecting and organization of first aid units. The number of these units should be determined upon the basis of the number of employees as suggested by or in accordance with local civil defense suggestions. Ambulance service either by the plant ambulance, if one is available, or emergency equipped trucks, or liaison with community available ambulances should be established. First aid training: develop first aid course for all employees.

Salvage and maintenance chief. A chief appointed preferably from the maintenance department should be held responsible for: An inspection and repair unit should be appointed. These appointments should be from plant staff familiar with plant operations, who will move into the area following the disaster and inspect and then establish emergency repairs to necessary lines of communication, water and process lines, fire hydrants and so forth. An equipment protection unit should be appointed. This unit will function somewhat similar to the salvage squad attached to local fire departments. They will by means of protective equipment attempt to hold down water damage, damage from falling structures, etc. A clean-up and maintenance squad should be appointed. The duties of this squad are to clean away debris and to assist in other maintenance functions in returning the plant to operating condition with as much speed as possible.

Investigations: While I have discussed the function of the investigation team previously, I must emphasize the importance of this team. Every plant catastrophe regardless of cause or size should be investigated completely and the story as to cause and effect spread to all personnel. Unfortunately few are qualified to conduct an investigation. The training is long and arduous, but pays dividends in the end.

It is essential that the team should know what to look for. They should know how to piece together the material and other evidence, they should know how to evaluate photographs taken before and after if it is possible to secure previous photographs and they should particularly school themselves in the way to reject the misleading data which may be wholly circumstantial when securing information from witnesses. However, the time taken to train upon this subject is well spent as the conclusions obtained might save the entire industry a second episode.

Panic: Panic must be avoided at all cost. Oftentimes panic is a greater threat to security and safety than even the threat of a bombing. Psychological defense plays a major roll in the development of a good plant defense program. It is necessary to build employee morale now so that it may be able to withstand possible shocking events later.

A program to prevent panic may be achieved in three major steps: 1. Preparation—this includes proper planning and personnel appointments. 2. Information—it is essential to keep all plant personnel advised continuously by some means so that they will know not only what the plant is doing for their protection in line with disaster control but what part they individually will play in the program. 3. Action—all plans require action. Training and conditioning of personnel is essential. This can be carried out by educational and inspiring talks and discussions. It may be done through public addresses or by means of plant notices or a plant publication. Actual demonstrations or "dry runs" are essential. This is particularly true if the plant is a large one, as such demonstrations made with representatives of other departments or other portions of the plant will give those who may have to assist outside of their own area in the event of a catastrophe, a realization of what they will have to do if they move into that section of the plant. It is important to watch for signs of interest breakdown with all personnel. The program must be excited continuously if it is to be successful.

In conclusion I would state most emphatically: 1. Plant disaster control plans are important to any chemical plant. 2. Your disaster control plans should have been completed and functioning the day before last year. Let us hope it is not too late to start now. 3. If you have not done so—start immediately to assign responsibility, to prepare your personnel, and then to train, train, train and to continue training. Only by accomplishing the above can you be prepared for any disaster great or small arising out of production or enemy action.

Top Management's Safety Responsibility and the Benefits the Industry Will Derive from Safe Operation

By W. N. WATMOUGH, JR.
Vice Pres., The Davison Chemical Corp., Baltimore, Md.

In order to do a better job of safety in the future we need to take a little jaunt into history, dig into the past. What was the business like 33 years ago when this young hopeful started out in the plant at 17, stenciling brand names and analyses on 200 pound burlaps bags by hand? The bag room was adjacent to the rock grinding department. The dust in the air so thick you literally could not see across the room. Ten hours per day, 6 days per week and in the heart of the shipping season much longer hours.

You can imagine what the conditions were out in the plant as to dust and fumes. Superphosphate was cut out of hot dens by pick and shovel an hour after the phosphate rock had been treated with sulphuric acid! Nitrogen materials were largely of organic origin, dusty, bad odors, in fact,

the mention of the word fertilizer caused noses to go up in the air with a derisive sniff!

Movement and processing of materials was by pick and shovels and the hand truck employing unskilled labor. Sixty per cent of the tonnage was moved in an eight week period in the south and during a 16 week period in the north; an industry as highly seasonal as you could imagine. Over 80 per cent of the personnel laid off during the slack season.

Tonnage consumed by the farmer amounted to eight million tons at that time. It dropped to five and one half million in 1933, the worst depression year. Seasonal operations, poor working conditions, unskilled labor, high turnover, all contributed to what seemed an almost insurmountable problem to obtain funds from management to implement safety.

Let's take a look at where we stand today. Our industry is largely a chemical one now, synthetic nitrogen from the air, sulphuric acid by catalytic conversion of sulphur dioxide to sulphur trioxide, superphosphate by mechanical means, mechanically excavated and stored. Gases and fumes are recovered as a by-product to produce silicofluorides for diversified industry.

We now produce 18 million tons compared to five and one half in 1933. And since fertilizers are much more concentrated, that 18 million is equivalent to 21 million tons when compared with the plant food content of 1933. Since most materials must be handled three times, received, manufactured to storage and shipped to the consumer, we move 63 million tons.

This major materials handling problem has been largely solved by the use of overhead bridge cranes moving four to five tons at one bite of the clam shell bucket, and in other type plants by every kind of modern mobile and conveying equipment you could possibly imagine. Dust conditions, while tremendously improved, still leave a great deal to be desired. Turnover is still high.

By manufacturing products of greatly improved storability we are able to move finished goods to the dealer and to the consumer well ahead of planting time, cutting down somewhat the extreme seasonal characteristics of the operations. We have, by improved efficiency in operating techniques, by progress through chemistry and by attracting skilled and technical personnel, effected economies that have improved the earnings picture of the industry.

A large part of this saving has been passed on to the farmer. The price he pays for a far superior fertilizer based on recent index figures published by the national fertilizer association stands at 152 as compared with 272 for the index covering all of the commodities he buys.

Have we made the same progress in safety? Probably so, if we had the statistics to prove it. But only because our record was so disgraceful. We have not gone forward at the rate of other heavy industry, for example, chemicals or steel. Our company, as I'm sure is true with many other individual organizations, has made progress at a rate we didn't believe to be possible a few years ago.

The chart shows the past four and one half years record of the fertilizer division of our company, entirely separated from the record of the corporation as a whole. As most of you know, the injury index figure is the product of frequency multiplied by severity. Starting in 1947, we stood at just slightly better than the average of those fertilizer plants covered by the rather sparse statistics available.

	Frequency	*Severity*	*Injury Index*
1947	.....39.76	0.56	22.27
1948	.....19.76	5.47	108.09
1949	.....10.54	10.01	105.51
1950	..... 5.49	0.13	.71
1951	.....10.14	0.29	2.94
(as of 6/30)			

Our medium sized fertilizer plant at Savannah, Georgia, passed the four year mark without a single lost time accident in September of this year. Naturally we are proud of this accomplishment. I wish I could say to you that we had discovered some startling, new, unheard of method or system to guide the industry and our own company in the future. But we haven't. There is no magic formula; our own record shows it. No, it's just the same old common sense formula:

1. A sound safety program. The man charged with this responsibility by the industrial relations section is a key member.

2. One hundred per cent implementation by line authority is due to the full backing and in fact the insistence of top management.

3. One hundred per cent interest and cooperation of every employee in the company is a selling job of line management, the union and the industrial relations staff.

In many companies the job of getting the wholehearted backing and enthusiasm of top management is a tough one, but the finest safety set up isn't worth a "tinker's dam" without it.

So I say to you safety men, get after your management. Keep hammering for the elimination of hazards in your plants. Organize your plant safety committee with rotating members from line authority and the rank and file. And if you do, there is no reason that a fertilizer plant can't be as safe a place to work as any other in a similar type industry.

Sure, you have to invest money for safety, a lot of it. But the return on that investment in the form of injuries eliminated, lower turnover, higher grade personnel needed for a modern industry, will repay us ten times over. Frequently those returns are not all indirect. We recently received from the insurance companies $75,000, retrospective return premium on a premium which had already reflected our good experience.

So there is proof that safety can pay off in cash. A safe plant, a plant with good housekeeping, is an efficient one. It puts out quality products. It makes for low costs. Those are benefits worth going after.

Achieving Safety in Fertilizer Plants

(A Symposium)

Handling Sulfuric Acid

By DAVID P. DELAVAN

Chemical Supt., Pasadena Fertilizer Plant, Mathieson Chemical Corp., Pasadena, Texas

In order to discuss "Handling of Sulfuric Acid" in an orderly manner, the subject will be developed from three viewpoints. The first is a discussion of the material itself. Sulfuric acid is outstanding in its peculiarities, such as its specific gravity, or Baumé as it is generally known in the fertilizer industry. It is the heaviest of all acids generally used. 60 per cent acid has a specific gravity of 1.50 and 98 per cent acid 1.84. Above this percentage the specific gravity decreases.

The weaker acids are more corrosive than 98 to 100 per cent acids. The most outstanding peculiarity is its freezing point. At 35 per cent, it has a freezing point of almost —130° F., yet at about 83 to 85 per cent and at 99 to 100 per cent it freezes about 48° F. 93 per cent acid freezes about —21° F. This shows how confusing it becomes to operate a fertilizer plant in the winter time. A word of caution, however, is mandatory.

If the acid is frozen, the first impulse is to add water in order to change the acid concentration and thereby decrease the freezing point. This is the worst thing you can do, as a considerable amount of heat is generated, enough to boil the sulfuric acid and splatter anybody in the area. In fact, extreme caution should be exercised when adding acid of one strength to an acid of another strength. From a safety angle, purchasers of sulfuric acid should buy only 93 per cent acid, or to be on the safe side, 72 per cent acid. These, of course, are more corrosive and other problems are presented that will be discussed later. Hot water or waste steam coils in the storage tanks are used frequently.

The second impulse with frozen acid is to melt it, using fire. This also is extremely dangerous, as sulfuric acid reacts with the iron to form iron sulfate and hydrogen. The latter forms an explosive mixture with the oxygen of the air. It is easy to visualize what would happen if a storage tank or tank car of sulfuric acid exploded. Incidentally, this reaction between sulfuric acid and iron goes on even without heat so that

the explosive mixture is always present in tanks, tank cars, pipe lines and other metal containers. This means that welding should never be attempted on sulfuric acid containers unless they have been thoroughly cleaned of acid and are well ventilated. It follows, of course, no smoking or open flames should be permitted in the immediate area where sulfuric acid is stored and handled.

From an equipment standpoint, the main problem is the corrosive action of this acid on materials of construction. Although this is not a corrosion forum, this subject is important in handling sulfuric acid safely. No metals are absolutely resistant to sulfuric acid but with proper inspection and maintenance leaks and spills can be reduced to almost nothing. If a steel pipe acid line has been in service for several years without a leak, serious thought should be given to changing the line completely, especially if there are numerous elbows, tees, valves, and other fittings in the line. Even from an operation's standpoint, let alone the safety angle, management will be dollars ahead to scrap the pipe. When one leak develops, I can assure you others are imminent, with the resultant hazards and down time.

The old standby of the sulfuric acid industry is lead. At room temperature strengths up to 93 per cent can be handled successfully. Up to a temperature of 425° the concentration should not exceed 85 per cent. High velocity or abrasion will remove the protective lead sulphate coating.

For concentrations greater than 93 per cent steel can be used at room temperatures, and cast iron up to about 190° F. Steel is commonly used when handling Oleum. Other materials such as glass, high silicon steel, carbon and allied products can be used but are fragile to thermal and mechanical shock. The high nickel molybdenum alloys are used successfully in the lower concentrations and temperatures, and the high chromium-nickel-copper steel in all concentrations at room temperature. These last four and other metals such as tantalum and nickel alloys are relatively high in cost and are used only in special applications.

Valves made of the chromium-nickel-copper alloys are very satisfactory, although the high silicon steels give good results. For the first one named at temperatures approaching 176° F., there is a critical range of between 70 to 90 per cent acid concentration where corrosion of these metals is relatively high. However, temperatures in this range usually aren't encountered in the fertilizer industry.

The most satisfactory metals for pumps are the nickel-chromium-copper alloys. Leaks at the pump's packing gland probably account for more acid burns than any other location. Therefore, it is of prime importance that the pump shaft and impeller are true, not corroded or pitted, yet sufficiently free to turn without friction power loss, and hence generation of heat to loosen the packing rings. Shields made of old rubber belting should be put around packing glands.

There is an art to tightening a pump packing gland that every operator must learn before he can be called a safe operator. Better yet, packless pumps are recommended or mechanical seal rings installed in place of the packing gland. There are several types of each offered, and I refer you to the manufacturers for their recommendations. Incidentally, all pumps, lines and tanks should be thoroughly grounded, especially when using two or more types of metals even when they are similar in chemical analysis. Each should be grounded separately to prevent electrolytic action, with the resultant rapid corrosion and leaks.

For packing on pumps the best material is asbestos rings. Usually these are specially prepared and combined with graphite. Plain asbestos makes very satisfactory gasket material for flanged pipe. Teflon can also be used for this as well as for valve stem packing.

Plain steel is satisfactory for storage tanks at room temperatures. A lining of acid proof brick, lead or certain thermoplastic should be added if the acid concentration is below 93 per cent.

For dilution pits, the standard lining is also acid proof bricks. For small mixing pots lead is very satisfactory.

Acid proof or carbon bricks should be used exclusively for flooring in the area of the pumps, where acid drips and spills are prevalent.

The last and most important consideration is the employee himself. If he does not know what kind of material he is dealing with and is not provided with the proper handling equipment, no amount of safety schools, posters, or talks are going to save him from accidents. On the other hand, if he is provided with the best equipment in the world and knows all there is to know about the acid, burns will still result, unless the employee protects himself.

It has been our experience, and other plants can confirm this, that the eyes are the most vulnerable for acid burns. Therefore, the use of goggles should be strictly enforced, and I don't mean just around one's neck either. Although I don't pretend to be an expert on the proper design of goggles, I will recommend any type that is well ventilated, tight fitting and with no blind areas to the sides. All of the goggles, of course, must be acid resistant and the eyepiece shatterproof. A face shield is also excellent, but fumes from the acid can still reach the eyes.

The next most vulnerable spot is the hands. Gloves, of course, will give ample protection. However, a word of caution. These gloves should be made of rubber or neoprene, either cloth dipped, or pure rubber. The latter, with proper care, will last indefinitely, and have the added advantage of being cleaner. Further, they can be quickly removed if acid gets inside of them. The cloth neoprene or rubber dipped gloves, however, can probably stand more rugged service and are not so cumbersome nor as slick as the pure rubber. The feet, legs and arms receive the lowest percentage of acid burns. For foot protection, numerous styles of rubber shoes are made that will provide satisfactory protection. These are a must in areas where acids are used.

For protection of the arms, legs and body, several types of clothing are available. In my opinion, some of them are not satisfactory and since they are not porous they are bulky and hot, especially in the hot, humid area of the Gulfcoast, or in the summer months elsewhere. In recent years, numerous plastic materials have been introduced, and clothing made of them. They are very promising, and should be investigated. The ones I have seen are of tight enough weave to prevent the acid from going through, yet loose enough to allow circulation of the air. They remain practically inert to sulfuric acid.

To complete the wardrobe of this employee some type of hat, preferably a hard hat must be included.

In spite of all the proper handling and precautions acid burns will still happen. If the acid is washed off promptly with liberal amounts of water, serious results will be prevented. Therefore, safety showers, that always work, must be in the general area, in strategic locations. For further treatment, the case must be immediately referred to the first aid attendant, or doctor. Delays may result in permanent injury, especially with eye burns.

The operator of the equipment should conduct himself in a safe and workmanlike manner at all times. The usual precautions of acid pumping such as opening valves slowly and carefully, not pumping against closed valves and standing away from pump packing [illegible] should be even more rigidly enforced in handling sulfuric acid.

Safe Handling of Anhydrous Ammonia and Ammoniating Solutions

By H. R. KRUEGER
Director of Technical Service, Phillips Chemical Co., Bartlesville, Okla.

Anhydrous ammonia, ammonia "B" liquor, ammonium nitrate-aqua ammonia, and urea-aqua ammonia solutions are now in common use in commercial fertilizer plants throughout the United States.

The merits of these materials as ammoniants of phosphate-carrying fertilizers are not to be denied since they provide an economical source of nitrogen while, at the same time, greatly improving the mechanical condition of the mixture; but it is sometimes alarming to note the laxity and carelessness with which these materials are handled at many plants.

Anhydrous ammonia, containing some 82 per cent nitrogen by weight, is the most concentrated source of available nitrogen used by the fertilizer industry. However, because it is stored and transported as a compressed gas, it does require pressure

equipment and a more specialized technique for handling. Its properties should be familiar to all of you, but it would be well to remind you again that its boiling point is —28°F., at 70°F. it exerts a vapor pressure of 114 psig, and at 90°F., a pressure of 166 psig.

It volatilizes immediately upon release to the atmosphere and up to 100 ppm are permissible for a worker to endure for an eight-hour period. Four hundred ppm cause throat irritation and 700 ppm cause eye irritation, with usually no serious after effects, providing exposure is limited to relatively short periods of less than one hour. With slightly greater concentrations, exposure is unbearable with 5,000 to 10,000 ppm usually being fatal.

Commercial grade anhydrous ammonia as used by the fertilizer industry is shipped almost entirely in 11,000 gallon tankcars of I.C.C. specification 105A-300. Cars spotted for unloading should be on a level track, have brakes set, wheels blocked, and regulation blue "Tankcar Connected" signs affixed to the rails. Derails should be placed at one or both ends of the unloading track, approximately one car length from the car being unloaded, unless the car is protected by a closed and locked switch or gate.

After the car is properly spotted and protected, the following safety equipment should be readily available for any and all workers who are to engage in unloading operations:

1. Respiratory equipment, approved by the United States Bureau of Mines, and used in strict compliance with the manufacturer's instructions. A canister-type industrial full-face mask may be used for gas concentrations of 3 per cent and under for a brief exposure period, but if gas concentration exceeds 3 per cent, is unknown, or if exposure is prolonged, supplied-air respiratory equipment of proper design with full-face masks and protective clothing should be used.

2. Protective clothing, consisting of felt or treated fibre hats, rubber suits, gloves, shoes, should be available at all times for emergency use. Safety goggles should be worn at all times when handling ammonia.

3. Emergency equipment, consisting of the following should be located as close as possible to the area where ammonia is being handled:

a. Safety shower of treadle type.
b. Bubble-type drinking or eye-wash fountain.
c. Respiratory equipment.
d. Stretcher and blanket.

Anhydrous ammonia tankcars are equipped with four valves in the dome, working as pairs, the two along the longitudinal axis of the car are the liquid valves and are connected to eduction pipes which extend almost to the bottom of the tank, while the two valves across or pointing to the sides of the car are the vapor lines and are connected to short pipes which extend into the vapor space above the liquid.

There are some dual purpose tankcars in ammonia service that are equipped with excess flow valves, whose purpose is to shut off immediately the flow in event of a broken or ruptured line between tankcar and storage.

Tankcar connections should be made with ten-ply flexible rubber steam hose, wire braided and armored, with high pressure screw couplings. As ammonia corrodes copper and some alloys, all pipe, valves, fittings, and couplings should be made of extra heavy black iron or designed especially for ammonia service. Only compressors designed for ammonia service should be used.

Storage tanks for anhydrous ammonia should be constructed and tested in accordance with the ASME Code for Unfired Pressure Vessels and for the working pressures indicated below.

Paragraphs U-68 and U-69 of the 1946 ASME Code—200 psig.

Paragraphs U-200 and U-201 of the 1949 ASME Code— 250 psig.

1950 ASME Code—250 psig.

Construction in accordance with the API-ASME Code with a design working pressure of 250 psig is likewise satisfactory. Tanks must be equipped with one or more spring-loaded safety relief valves set at 250 psig gauge pressure with vent pipes directed above and away from working areas.

In warm climates, a light shed covering is recommended to afford protection from direct rays of the sun on the storage tank. In very hot locations, the additional protection of cool water sprays over the tank are helpful in keeping vapor pressures low.

Tanks should be coated with light-reflecting paints, preferably white or aluminum. All tanks, valves, piping, and fittings should be inspected regularly, valves kept in top working condition, with safety valves tested on regular schedules.

After the installation is properly engineered and all equipment is in top working order, the human element enters the picture. These are the men for whom all the proper equipment and safety devices have been designed. If the personnel is not trained in their proper use, the best designed equipment will not prevent accidents.

A new operator should never be allowed to handle anhydrous ammonia until he has either been apprenticed to a skilled operator or has been taken step by step through the complete operation by a supervisor. Stress should be placed on disconnecting procedure, which is just as important as is connecting procedure.

It is not possible to place too much importance on safety rules and the necessity for strict compliance with them. The careless operator is a hazard not only to himself, but to all others in nearby areas.

Anyone who has anything to do with the handling of anhydrous ammonia should carefully study Chemical Safety Data Sheet SD-8 of the Manufacturing Chemists Association or Pamphlet G-2 of the Compressed Gas Association.

The technique and equipment for handling anhydrous ammonia is more exacting than that required for the other fertilizer ammoniating solutions covered by this paper. The same general precautions, however, should be followed for the other ammoniating solutions, as should the same protective equipments be kept available.

There are two types of ammoniating solution made specifically for the fertilizer industry in common usage today. Six nitrogen producers are manufacturing ammonium nitrate fortified solutions containing from 17 to 49 per cent N by weight with one producer offering a urea-ammonia solution containing around 45 per cent N.

The vapor pressures at 104°F. of these solutions vary from one psig for the 37 per cent solution to 50 psig for the 49 per cent solution, while the urea-ammonia solution, at the same temperature, has a vapor pressure of 50 to 64 psig. The lower pressures of these ammoniating solutions, as compared to anhydrous ammonia, is one of the reasons for their wide acceptance in the fertilizer industry. Due to the high corrosive properties of all of these solutions, most fertilizer plants use compressed air rather than pumps to transfer them.

The ammonium nitrate type of solutions, due to their lower vapor pressures, are usually shipped in 10,000 gallon welded steel tankcars although several manufacturers are gradually changing over to aluminum cars to combat corrosion. Most of these cars are equipped with either lead or aluminum rupture discs rather than spring-loaded valves, but in either case, the receiving plant should check the rupture disc pressure for unloading, so that they will not apply too high an air pressure in transferring.

The urea solutions are shipped in two types of tank cars, some being high pressure cars with relief valves set at 225 psig while others are low pressure cars with 75 psig relief valves. Relief valves on these cars are of the spring-loaded type, automatically re-seating, and the operator should check the relief valve pressure which is stencilled both on the end of the car and on the relief valve before applying air pressure to unload.

Storage tanks for ammonium nitrate solution should be fabricated of welded steel or preferably aluminum with a working pressure of at least 65 psig. Storage tanks for urea solutions should be designed for a 75 psig working pressure and a hydrostatic test pressure of 150 psig.

Storage tanks should be protected from freezing to prevent crystallization of solids, and from direct rays of sun in summer to keep vapor pressures low. All should be equipped with the necessary relief valves. Before installing any storage tank, a review of applicable state laws should be made to insure compliance.

Piping, fittings, and valves for all types of solution should be, in order of preference, stainless steel, aluminum, or black iron. Diaphragm valves are best, with lubricated plug-cock valves as second choice. All valves, piping, and fittings should be specified for ammonia service. Measuring or weighing tanks should be of all welded stainless steel or aluminum construction, equipped with pressure relief valves with free vents to the outside atmosphere. No copper, brass, bronze, or similar alloy should be used anywhere in the system.

All of the producers of fertilizer am-

moniating solutions maintain service departments to assist customers in the proper installation of equipment and in methods of handling their product so it would be well for any user to take advantage of this free service when contemplating making new installations or modifying old ones.

There are entirely too many accidents resulting from working on and around tankcars and unloading racks—the purely physical type accident resulting from falls, slipping, etc. Most of these accidents, as far as handling ammonia is concerned, result from improperly designed or poorly maintained unloading racks, improper tools, shoddy shoes and clothing.

The unloading rack should be sturdily constructed, having regulation railroad clearance, secure stairs with handrails, and a hinged bridge also with handrails, so that the worker has safe, sure access to the car dome. A locker can usually be conveniently built under the rack in which should be kept the proper tools for connecting lines and the required safety equipment. A safety shower should be close by.

Since 15 to 20 per cent concentrations of ammonia gas are flammable, no arc or acetylene cutting or welding should be performed on ammonia tanks or lines until they have been thoroughly purged.

There is no reason why ammonia or the ammonia solutions cannot be safely handled providing these cardinal rules for the handling of any hazardous liquid are observed: Approved installations, knowledge of physical properties, available safety equipment, and competent operators.

Handling Bulk Storage

By U. C. ELLIS

General Superintendent, Plant Food Div., Swift & Co., Chicago, Ill.

Any operation in the handling of bulk fertilizer materials or mixed goods is hazardous if carlessness or indifference to safety is permitted. The handling of bulk is probably the most hazardous aspect of fertilizer plant operations. There are many ways for accidents to occur in all phases of bulk handling.

Some of the potential dangers, however, are known, and something can be done about them. It is to those known hazards that I want to devote this report. In doing so, though, many possible hazards which are considered less frequent and less severe must necessarily be disregarded.

There are many different types of bulkheads in use but probably the three most commonly used are the bag wall, the sheath type, and the bookshelf.

The bag wall was quite extensively used some years ago but has been gradually abandoned until now it seems to be used only in special cases and on a temporary basis. A bag wall is a safe wall if properly constructed. It is built by partially filling bags with the product being stored and laying them flat with the mouth toward the storage pile.

The wall must be constructed as the pile builds up. The product being stored ties in the bags. Safe bag walls must be built on an absolute perpendicular under normal storage conditions. There is always the danger of a backward misstep resulting in a fall and obviously such an accident could result in a fatality.

The sheath type wall is an effective and safe type, if properly constructed. It is built by edging boards, usually 2 by 12 inches, one on top of the other, between two building columns, then tying them to the columns. Frequently a wall of this type is re-enforced by the use of a perpendicular bracer of 6x8 or 8x8 timber and sometimes, depending upon conditions, the wall is further strengthened by running steel rods, usually 1 inch in diameter, from bracer to bracer thru the bay or bin.

The bookshelf type wall has come into quite common use and is as safe or safer than the bag wall or the sheath type. The bookshelf type wall is particularly adaptable, where the wall is to be permanent. The main hazards with this type occur where the wall is on an alleyway and entrance must be gained to the product.

This means that the boards making up the wall must be removed as the product is taken from the bin and the employes must work at high levels when removing the boards. If careless, a serious fall could result.

Dynamite and dynamite caps should be stored separately. Safety recommendations of explosive manufacturers are always reliable and if followed, the storage and handling of dynamite and explosives are relatively safe.

The real hazards of handling bulk in fertilizer plants are not in the storing or the retaining walls but are in the work in connection with removing the product from storage, that is, the disintegrating preparatory to removal. Most fertilizer raw materials and mixed goods get hard or cake during storage and disintegration is necessary prior to removal.

Dynamite is commonly used for the purpose. Blasting the pile frequently leaves overhangs, loose material on pile face, and deeply cracked piles with dangerous slopes. Herein lies the real danger to employes removing the materials with payloaders, buggies, or wheelbarrows. Overhead crane type plants do not present these hazards, since the operators are working above the level of the materials in storage.

Swift & Company Plant Food Division has had, over a period of years, three fatalities attributable to the use of dynamite but none due directly to the explosion. All three occurred during preparations for making a shot or blast. Consistent with company efforts to safeguard employes from accidents, the three fatalities were carefully investigated.

The first accident occurred in an "A" frame building. Superphosphate was being removed with a dragline. The line had cut a trench almost to the floor level. The sides leading up from the trench were quite steep. The dynamite man was in the trench getting ready to make a shot. Some loose material from near the top of the pile slid and covered the employe, suffocating him.

The second fatality was in a mill type plant where the product was piled about 20 feet deep. There was an overhang to the pile caused by a blast. The dynamite man started to bore a horizontal hole four or five feet above the floor level and the foreman in charge of the operation instructed the employe to move over from that point to a safer location—that the overhang was dangerous.

The supervisor proceeded to another point and the dynamite man moved a few feet but didn't clear the overhang. It gave way, covering the employe, and he was suffocated. This was in a mixed goods storage section.

The third fatal accident occurred in a mill type building where superphosphate was stored. The dynamite man was getting ready to make a shot near the base of the pile. The face of the pile sloped back at from 10 to 15 degrees off of the perpendicular.

The pile had been observed by a number of employes including a former dynamite man who was himself at one time injured in a slide, and there were no obvious dangers. Yet, within a one-minute interval while the tractor man was on the way to an elevator with a load, the dynamite man was covered by loose material sloughing off and sliding down on top of him. Probably an examination of the top of the pile would have disclosed the danger.

The result of the investigations was a determination to make the use of dynamite in fertilizer plants a safer operation. The problem was given considerable study by the Company and several outside organizations, including the manufacturer from whom we obtain our supplies. The results were that:

1. Our training division was asked to develop a safety program dealing particularly with our established practices in the use of dynamite. This was for the purpose of making the job safer until a less hazardous plan could be established. This was done and the program has been presented to every plant that we have except where materials handling is done exclusively by crane.

Reports from superintendents have, without exception, been very favorable to the program. As an *educational* program, it involved not only all supervisors connected with dynamiting, but also hourly paid employes who have any connection with dynamiting and who are in position to contribute to the prevention of accidents. The presentation required from 45 minutes to an hour, depending upon the amount of discussion developed.

A very important development, as our organization views it, is the emphasis on boring single shot holes perpendicular instead of horizontal. The theory is that if the employe is on top of the pile, the pile can't be on top of the employe. Our study has indicated that there is no good reason why,

when single shots are made, the pile cannot be bored perpendicularly. This applies in all cases where the pile or any part of it, is steeper than the angle of repose of the product stored.

2. We have done considerable work with the aid and direction of an expert from the dynamite manufacturer on multiple shots instead of the single shot practice we have heretofore followed. This work has led to the conclusion that multiple shots are much safer and, incidentally, more economical.

In a typical storage pile, instead of using about four sticks of dynamite in one hole, we placed 25 sticks of dynamite into three holes across the bottom of the pile approximately four feet from the floor, two holes about four or five feet above the bottom line, but the two holes equally spaced between the three bottom holes, and into each hole was placed five sticks of dynamite. Delayed firing caps were used to give three firing stages.

The results were that the pile was left with a safe slope on its face and the plant shipped more than 200 tons without further dynamiting.

Again, in a pile of superphosphate in an "A" frame building, 76 sticks of dynamite with delayed action caps were used in a planned boring arrangement. In this instance about 450 tons of superphosphate were well disintegrated and the pile was left with a safe slope. If the pile has been 35 feet high instead of 25 feet, it was estimated that 700 or 800 tons would have been put into good condition for handling.

The work so far indicates that the punishment to buildings is less severe than shooting one hole at a time. Dynamite blast follows the way of least resistance. Therefore, by arranging the order of firing the different holes, the shock on building columns can to some extent be controlled.

Another desirable feature of the multiple shot plan is that the direction of movement of the product, due to the blast, can in a measure be controlled.

In summary, let me recommend that serious consideration be given to the two principal points that I have tried to present, which are:

1. Drill vertical holes when a single shot is to be made and that no exception be allowed unless the dynamite man is authorized by the supervisor to bore a horizontal hole, and then only if the pile presents no questionable slopes.

2. Institute a multiple shot program, augmented by single shots as necessary. Multiple shots greatly reduce the occurrence of overhangs and dangerous slopes thru control of the force by placement of charges and order of firing.

Importance of Good Housekeeping in Lowering Costs

By M. F. WHARTON
Vice-Pres., Arizona Fertilizers, Inc., Phoenix, Ariz.

The subject of good housekeeping in industry as a whole has been generally well covered in various articles, in trade magazines and particularly well done by bulletins from the National Safety Council. The fertilizer industry has not had particular attention given to it, and if there is any industry that has had a reputation for poor housekeeping it certainly has been the fertilizer industry. This may be understandable due to the type of materials used and the manner of processing them.

In many cases a makeshift of cheap equipment was the beginning of many of our reasonably large fertilizing companies today and due to the nature of their beginning, habit of cheap operation with cheap labor has held on. There are a few of the newer and more elaborate plants that have been especially designed to provide maximum safety and opportunity for easy housekeeping. It is my intention to point out a few poor housekeeping methods that in my opinion are quite costly.

1. *Light.* Generally speaking fertilizing plants are poorly lighted, either because of lack of windows or insufficient artificial lighting. In some instances the facilities are there but negligence in keeping the windows clean or bulbs replaced brings about an undesirable situation. A dim and gloomy atmosphere can bring about costly mistakes in many ways. Probably the greatest of these is improper weighing or improper formulation where visibility is improper for reading dials or formulas.

2. *Dust Control.* Practically all fertilizer materials are very dusty and to control this dust in processing is often the major problem. It is easy to allow this to become neglected, and as one manufacturer remarked, "What difference does it make compared to the cost of taking care of it?" I have seen plants where the mixing room had so much dust in the air that a lighted electric globe was barely visible for ten feet. How can labor be accurate and efficient under these conditions? How can machinery be well taken car of when covered with a heavy layer of dust and grease? How can the package that goes to the consumer be clean, neat and attractive if handled under dusty conditions?

It is impossible for machinery to operate efficiently since dust is abrasive and naturally shortens the life of the machinery. It is impossible for management to properly check dirty machinery and know when it is in need of repair or maintenance attention. I have seen plants, where, as the saying goes, "it is clean enough to eat off the floor." I have investigated their maintenance and breakdown records and find them much less than those of dirty plants. The life expectancy of machinery therefore is greater. I maintain this makes for greater savings.

3. *Cleanliness.* Cleanliness is another very important item in good housekeeping, particularly as it refers to safety. We all know that present insurance rates are unnecessarily high and it is believed that they will be much lower if good working conditions are provided. A floor that is one or two inches deep in dust, spilled in chemicals and plain dirty is conducive to accidents. The very slowdown brought about by having to work or move materials over a floor with a coating of inert material is costly in itself.

4. *Orderliness.* Orderliness is another very important point. Recently I had a crew of men put up two piles of sacks. One of them was piled in a straight and orderly manner. It did not lean to one side or the other and the bags were easily counted in inventory. The same crew was sent to the other end of the warehouse and unloaded another car of bags and threw them into the pile in a careless manner. When they had finished, the stack was leaning dangerously to one side and it was impossible to count the bags properly. The men did not know what was going on and an accurate time was kept on this crew which put up both stacks.

Actually it took twenty minutes less time to stack fifty tons of bagged material properly than it did in a haphazard manner. We kept accurate track of how many bags were broken as these stacks were taken down and delivered to consumers' trucks. There were six bags broken in the orderly stacks, and fifty-three in the carelessly piled material. Restacking this is costly.

While this experiment was in process an accident happened in a competitor's plant not far away. A stack of material was carelessly set up. The workman saw a protruding sack two-thirds of the way down and remarked, "I am going to pull that out and it will all fall down and we can load the truck quickly." He did, the stack fell on him and at the end of three months he is still in a cast with a broken back. Costly? I would say so—from the standpoint of injury, of insurance rate, from the number of bags broken in turning over the stack, and the time wasted cleaning up afterward.

Poor housekeeping breeds an atmosphere of carelessness, and carelessness breeds mistakes, and any mistake costs money.

5. *Labor.* It became necessary for the writer and his partner to rebuild their fertilizer and mixing plant after 15 years of operation. We did this with an idea of providing plenty of light, ventilation and dust control. Without increasing the salary scale we found that in a short time we were actually getting a much higher quality of labor. In talking with these men we found that many of them were from other fertilizer plants. When asked why they made the change, invariably the remark was, "I had much rather work under clean conditions for less money." Perhaps this does not indicate lowering costs, yet we were surprised to find increased efficiency of better than 20 per cent as measured by output.

There is another thing concerned with labor that we have noticed as I am sure most of you have. While a piece of machinery is new and freshly painted, it receives careful attention. As the machinery

becomes older the dirt is accumulating with the grease and hiding the fresh paint and it gradually receives less and less attention.

In talking with an operator of a mixing plant in California in July, he remarked that his program of cleaning up and repainting each slack season had very greatly reduced his repair bills. It is only human nature to have pride in something clean and orderly. Where there is pride there is going to be efficiency. Where there is efficiency there will be increased output and unit costs will correspondingly be reduced.

This is my first introduction into the organized ranks of safety precaution in my industry. Good housekeeping certainly is an outstanding safety measure. Create working conditions with good lighting, freshly painted rooms and machinery, a clean floor and, as the saying goes, "everything in its place and a place for everything," and you have a situation in which labor will be proud to work, proud to maintain its orderliness and clean appearance, and this will make for quality products, produced efficiently.

7. Pride and Morale with a Labor Team

In industry it is just as important as on the football field or in a military battalion. This can only be had under favorable working conditions. Favorable working conditions can only be had by good housekeeping.

The last thought that I would like to leave with you may not have a direct bearing, but to me it is essential to good selling practice. It is a compliment to management when the salesmen and fieldmen bring customers through the processing plant. When a customer sees an orderly, clean processing job being done with good labor proud of what they are doing, I believe it ties him to the company and makes him a loyal booster. This increases sales and any time you increase production we all know it in turn reduces unit cost.

Operation of Mobile Plant Equipment

By C. K. KILLEBREW
Sales Mgr., Frank G. Hough Co., Libertyville, Ill.

Our reference to the Frank G. Hough Co. and "Payloaders" is not an attempt to convert the meeting into a sales session. Generally the comments will apply to various makes of mobile equipment but we are most familiar with "Payloaders."

A manufacturer of material handling equipment must decide what phase he is interested in. In our particular case, we have stayed more to the bulk side, whereas, the lift truck people deal more with the package side. For years we built loaders for installation on industrial tractors, which found their way into fertilizer and chemical plants.

In 1938 we decided there was a tremendous field which could not be reached by the loader attachment field, so we started developing the "Payloader" for unloading cars and working other places where limited space was a major factor.

The basic requirements were pretty well in mind before the first drawings were made. The unit had to be easy to handle, fast, powerful, rugged, have good visibility and operator comfort, be highly maneuverable, have good service accessibility.

The first Model HA was hand made and after a little preliminary running at the plant, was taken on a tour of all types of plants (fertilizer, chemical, foundries, metal working, sand, gravel, crushed stone, etc.) for checking its adaptability, using the unit for inside hard surface and outside yard work on semi-hard surfaced areas.

The original transmission high gear speed was a top of 16 mph. in reverse. Much to our surprise in every plant we were told the unit must be slowed down. The speed was too dangerous. Our reply was that there were two speed ranges and a foot accelerator, so in effect the speed was anything from 1 mph. to 16 mph. and the operator could control the unit to fit the job. We drew a comparison to cars, some of which will go 100 mph., but even though they can, most people drive 60 to 65 on the road and much less around sharp curves and in conjested traffic.

We were told all we were saying was quite true, but did not apply to mobile plant equipment. They said mobile plant equipment had only one speed and that was high gear—wide open.

As a result, we reduced the top speed forward to about 7 mph. and top speed reverse to about 10 to 11 mph. Perhaps all of us would agree that this would enforce safety to some extent much the same as if 50 mph. top speed was the limit for cars.

Some of you would probably say the machines are still too fast—others would like to see faster travel on long straight hauls in wide aisles.

Some plants have removed the speed range lever and have the unit locked in low range giving 2.9 mph. forward and 4.75 mph. reverse. This applies to car work only and where there is a narrow platform.

In some plants, we find units operating at speeds well over the specification speed. It is done by disconnecting the governor. The resulting excessive engine speed will seriously affect hydraulic pump life and engine life. We use a rotary vane type pump on the Model HA and its critical speed is about 1,900 rpm. We use gear pumps where engine speeds are 2,000 rpm. to 2,200 rpm. All manufacturers would certainly agree that governors should not be tampered with.

We would like to see higher speeds built into the units for the benefit of the people who can safely use higher speeds so we are at it again. The new Model HAH with four forward and four reverse speeds will do up to 28 mph. and on a reasonably smooth surface handles nicely at that speed—returning empty. Those who desire to do so can lock out fourth gear, giving a top of 12 to 13 mph. in third, or lock out third and fourth gears, giving a top of about 7 mph. in second gear.

We have two reasons for higher reverse speeds. First we require a crowding action in the face of the pile for loading the bucket. The engine power through a higher gear ratio (slower speed) gives us that. In reverse we convert the power into speed for a fast working cycle, also higher travel speeds in reverse, particularly with a load, gives the operator better control if he has to stop suddenly. The machine retains its stability, whereas a quick stop going forward makes the machine stand on its nose. Also in fast travel in reverse, dust from the bucket blows away from the operator instead of in his face and eyes. There are exceptions—on sloping ramps, the bucket should always be on the uphill end of the machine. Go forward up ramps and back down them.

Steering control is a safety "must." I am amazed to see operators travel at high speeds with a half turn of slack in the steering wheel. There are only two simple adjustments in the steering housing, and the tie rod ends can be easily replaced. The bushings can be replaced in the bell crank when needed. These points should be looked after more closely, we think. A good lubrication program will extend the life of the parts.

We have found some machines in operation with a dirty rag in the gasoline filler cap instead of the regular cap. The results—a fire hazard, dirty fuel, dirty carburetor and inefficient combustion. Also, we sometimes find a leaking carburetor bowl, due to a sticking float. We even go one step farther on fire protection to supply, on request, a gas filler cap listed by the Underwriters Laboratory.

On the air intake side the oil bath air-cleaner is far more than just an air cleaner. When properly serviced it is an air cleaner but, equally as important, it is an Underwriters approved type of backfire arrester. Its effectiveness fails completely as a cleaner and fire protection agent if it is not serviced.

There is one further and equally serious consideration. If the stack becomes clogged, preventing the free flow of air, it amounts to the same thing as running the engine with the choke on. It is bad enough that it results in crankcase dilution, rapid ring, piston, bearing and cylinder wear, and high fuel consumption, but worse when the operator and perhaps others are injured because of the carbon monoxide and other poisonous gases thrown off from the engine, due to inefficient combustion. An efficient fuel air ratio adjustment at the carburetor is not possible if there are obstructions other places.

We do not have toxic gas problems where combustion is clean and complete, as in engines in good repair and adjustment.

I have mentioned only one phase of combustion control. Other phases are compression ratio, condition of spark plugs, fuel quality, etc.

A good program of preventive maintenance is, therefore, essential to operating safety.

A further elaboration of the value of pre-

ventive maintenance is the plan used by Cadillac Motor Car Company, which over a period of five years reduced the plant equipment breakdown time 83 per cent. At the beginning, their maintenance crew was divided—75 per cent to preventive maintenance and the remaining 25 per cent to breakdowns. At the end of one year the preventive maintenance crew was reduced by 5 per cent and the breakdown crew by 50 per cent, making those men available for productive work. Such planning reduces costs, increases production, and everyone benefits.

Water mufflers or dry type exhaust spark arresters are available as fire prevention equipment, but neither has any control over toxic gases. While talking in the fire control category, it is well to mention good maintenance on fuse blocks, terminals, wiring harnesses and battery tie down fittings, any of which can cause a fire. Another item is the careless use of light bulbs or heating elements under the hood during overnight storage. It is a type of condensation control and an aid to starting the next morning, but should be handled carefully because of the fire hazard.

In some plants a definite safety aid would be more adequate lighting, and more effective dust control, if possible.

We have observed bin partitions in questionable repair and tie bars or cross braces too low to permit the operator to get under without ducking. Operators have suffered injuries by striking their heads on cross braces. One operator fatality resulted when he tried to reach the bucket under a dock only steering wheel height. His foot slipped off the clutch and he was pinned between the machine and dock.

In our current literature there is a picture of an operator who has dug under a pile. The picture was snapped as the operator was looking up seemingly expecting the pile to come down on him any second. This is a dangerous practice. The pile should be "shot." A loose pile is easier to work, a higher rate of production will result and it is easier on the machine.

The operator should climb on and off the machine only when the bucket is on the ground. A higher rate of production and greater safety will result from the use of good quality plates to go between dock and car. We see cases of machines that are damaged and work stoppage results from plates slipping and dropping machine wheels between car and dock. We also find cases of docks in questionable repair.

In the garage area we see men working in and around machines without sufficient safety precautions, a unit supported on a chain hoist without safety blocks below; working under bucket without safety measures. A good many injuries have resulted from buckets being lowered on men working down in front of the machine.

Individual plant managers and superintendents should establish their own code of safety regulations to fit plant conditions. We favor regulation stops or speed regulations at dangerous intersections. Drivers must be forced to adhere to the established rules. Operators must be cautioned not to carry the bucket too high, thus raising the center of gravity, which will result in overturning the machines.

Where the operator dumps into a large pit or hopper, heavy timbers should be installed to stop the machine, providing the operator fails to stop. Injuries have resulted where drivers have driven through the ends of buildings, off loading docks, off ship docks and into hoppers. Ample lift eyes and harness should be provided where machines are lowered into ships' holds.

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Current Safety Topics in the

COAL MINING INDUSTRY

As presented in the Sessions of the Coal Mining Section at the 1951 National Safety Congress

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39th National Safety Congress

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THE COAL MINING SECTION

This volume is a record of the sessions held at the 1951 National Safety Congress by the Coal Mining Section. The conduct of these Congress sessions each year is only one of the many cooperative activities which the Coal Mining Section carries on in behalf of its members, and for the benefit of accident prevention work in the coal mining industry generally. The Section gives guidance in the preparation of a great variety of technical and educational material useful in the day-to-day safety programs of coal mines. The activities of the Section are under the direction of its Executive Committee, the members of which are listed at the close of this volume.

Prevention and Control of Fire Hazards in Belt Conveyor Installations

By GEORGE H. SAMBROOK
Director of Mine Inspection, United States Steel Co., Pittsburgh, Pa.

More coal is transported by belt conveyor systems today than ever before in the history of the coal industry. As a result, the prevention and control of fires in their use has assumed a place of vital importance in the protection of life and property.

When coal was transported by animals there was practically no danger from fires. Then industry changed to motor transportation which resulted in some fires, but they were more easily controlled as the motor and electrical systems were protected by automatic breakers and fuses.

At present, however, with coal being transported by belt conveyors made from highly inflammable rubber which can be readily ignited by friction, together with other causes, the fire hazard has increased greatly.

There are two major types of belt conveyor systems:

First, the permanent system, which hauls the coal from the main dumping point to the surface. The belts are usually of various lengths, some belts running from a rotary dump located in the coal seam, with the belt extending through a rock slope to the tipple. Others may run from a main dumping point underground and extend through the mine for a distance of several miles before reaching the main loading point.

The second type is the gathering or room and entry system.

This type of system transports the coal from sections of the mine and dumps it onto a mother belt which in turn discharges it into mine cars.

From a fire hazard standpoint a belt conveyor system requires careful consideration of the type of equipment to be used; and the correct installation, inspection, and maintenance of this equipment. The electric motors, junction boxes and switches should be of the permissible type. A belting of flame resistant qualities such as neoprene would be most desirable. Considerable work along experimental lines is now being done with the use of steel as belting to be used in mines.

Of the two belt-conveyor systems, the permanent belt is usually a much better installation, and there is much less danger of a fire. Permanent conveyor structure should be supported by steel or concrete, lined and leveled by engineers, thus properly training the belt. If the belt is not leveled and lined it will run to one side or the other, thus requiring belt guides for control to make the belt follow the rollers. Any unevenness in the run of the belt becomes a fire hazard.

Gathering belts are usually installed with less attention being given to proper training of the belt, causing undue belt friction and possibilities of a fire. In too many instances, the job of installation of gathering belts is not done as thoroughly or completely as in the permanent belt installation. The installation is not expected to be used for any great length of time, so a more casual attitude is taken in its installation. This results in a very inferior job and greatly increases fire hazards.

A fire caused from a small gathering belt system is as dangerous and can cause as much property damage as a fire caused from a permanent conveyor system.

One cause of belt fires, the failure of bearings, may be minimized by installing a centralized lubricating system or permanently sealed bearings. The latter eliminates the danger of bearings running dry and becoming overheated. It also prevents leakage of oil and grease which becomes a very dangerous fire hazard when mixed with fine coal.

There should be a regular inspection of the rollers to see that they are turning and not running hot. They must be greased or oiled at definite times. They must at all times be free of grit and other foreign substances which might cause undue friction when the belt is running.

If accumulations of oil or grease are allowed around rollers, and if for any cause the rollers fail to revolve, the belt will immediately start to generate heat and may

ignite the oil and fine coal accumulations, causing, in a very short time, a fire.

A careful check-up should be made on the length of time rollers may be used. This may be done by carefully noting the length of time former rollers have been safely used before becoming worn enough to discard. Additional information may be gained from the manufacturer and from a study of the type of bearing that is installed.

Electrical installations, with proper maintenance thereof, should be given special attention, as they are the source of many belt fires. The motor and electrical cables should be of sufficient size to carry the maximum load. If the cables are too small to carry the load, they will heat and may cause a fire. The cables should be insulated and supported by insulators and not touch any other object.

Fuses or circuit breakers should be of capacity that will protect the electrical system from short circuits or over-loads. The belts should be wired so that if for some reason a belt stops, all other belts by the stopped belt would stop immediately. If for any reason they continue to run, they will discharge a pile of coal, resulting in friction, which creates a fire hazard.

Poor electrical ground connections are another cause of fires. Ground connections should be checked to see that a proper ground is furnished.

The practice of plugging or wiring around fuse plugs or over-load switches is one that should not be tolerated for any reason, as the effectiveness of the electrical protection is lost in this manner.

This practice is sometimes used to save a few minutes when no fuse is immediately at hand or the circuit breakers, for some unknown reason, will not stay closed. There is quite a tendency to resort to "plugging." These time-savers might save a few minutes at the particular point or gain a few extra tons of coal on any particular shift, but if carried on for any length of time, will eventually result in a fire with a probable loss of life and equipment. When a circuit is subjected to an overload the motors and cables give way at the weakest point. Fire resulting from a cable or motor failure is usually a very hot one.

A roller switch is adaptable for use on practically any belt conveyor. It is installed at or near the head section to protect the belt, or at any transfer point along the line to control feeder conveyors. It is driven by the conveyor belt and is adjustable for operation at any speed within the minimum and maximum range.

Contacts in the centrifugal type switch coupled to the roller of the switch are opened and closed automatically at the predetermined belt speeds. The switch will operate when turning in either direction and may be installed on either side of the conveyor. However, when installed for use with feeder conveyors it must be wired for forward direction only.

The switch can be wired to any magnetic type controller and has a definite operating range. Should the belt speed fall below a predetermined point the contacts of the switch open and power is automatically cut off. This affords protection against excessive belt slippage at the drive pulley which causes undue belt wear and may result in a belt fire.

When the belt is loaded beyond its rated maximum carrying capacity it places a strain on the drive motor and electric wiring. If this over-loading continues for a period of time, the insulation will heat and eventually fail, causing a short-circuit of the electric motor or cable. There is a commercial device available which may be placed under the belt to cut off the power when the belt is loaded beyond a predetermined capacity.

A slate fall, due to the lack of adequate roof protection is another cause of belt fires. Roof protection of permanent belt installations is usually done in a workmanlike manner. Quite often the roof is supported by steel timbering and lagging. In other cases, masonry is used.

If these types are not used, workmanlike jobs of wood timbering or roof bolts may be employed. Thus careful attention to roof protection results in a minimum danger of fires from roof hazards. Usually a main belt installation is traveled by more workmen and is inspected at more frequent intervals than the gathering belt systems. This results in detection of loose or dangerous roof conditions before a possible fall occurs.

The roof protection of gathering belts does not usually receive the same careful attention as that of permanent belts. Permanent belts usually transport the entire output of the mine, while the gathering belt, in most cases, transports only the coal from one section of the mine. It is, therefore, a natural economy to use a minimum amount of protection over the belt. Fewer workmen travel gathering belts, with a subsequent failure to immediately become aware of slards. If doubtful roof conditions exist over a gathering belt, there is an inclination to neglect their immediate repair.

If the roof is allowed to fall there is a chance that the electric wiring may be torn down which may cause a short circuit or a possible fouling of the belt. Either of these might result in a dangerous fire.

The maintenance and inspection of the belt is a must.

There is always danger of fires in belt conveyor installations caused by friction at the drive pulley or at rollers along the length of the conveyor. A fire at a roller may be caused by the rotation of the roller while rubbing against a piece of wood or material at only a small area of contact.

This may ignite any fine coal dust in contact with the hot surface and lead to a smoldering combustion, which may sometime later set fire to the belt. The detection of such a condition is a hard one, and stress must be placed on the need to prevent contact of the roller with foreign bodies and of avoidance of accumulation of coal dust and grease around the rollers.

A check must be made of the belt to see that there are no tears or breaks in the belting. A loose piece of belting might stall the belt or one of the rollers while the driving pulley continues to rotate, thus creating sufficient friction to start a fire. This hazard may be eliminated by cutting out any worn or torn spots and splicing in a new section of belt, or by vulcanizing the worn or torn spots.

The adjustment of the belt must be checked regularly for tightness. Slippage at the drive rapidly generates an excessive amount of heat.

To minimize the abuse of the belts, attention should be paid to the distance the material has to drop from one belt to the other. Care must be taken that excessively large pieces of coal or slate are not loaded on to the belt, and that scrap iron is not loaded at the face, which might be carried along with the coal from the loading point, cutting or fouling the belt with a resulting serious damage or fire.

Belts or rollers must not rub against or contact stationary objects such as posts, slate piles, door frames or the like. If the belt rubs against any stationary object it may be on fire in a short time.

Cleanliness is a very important function around a belt installation. Grease and fine coal should be controlled around drive motors, head and tail pulleys and at transfer stations where the coal discharges from one belt to the other.

The spot at which fine coal accumulates around rollers and pulleys is one of the most difficult places to keep clean, and a steady clean-up program must be maintained to prevent belt fires from this origin.

One of the main points to keep clean is underneath the belt carriage. This should be checked frequently as it is a very difficult one to see and clean and one which workmen have a tendency to miss. The accumulation of grease and fine coal under the return rollers and belt becomes a fire hazard.

In order to clean this area efficiently, ample clearance should be provided on each side of the belt to allow workmen sufficient space to perform their work.

Control of coal dust plays a very important part in the prevention of coal fires.

The initial defense is rock dust. The belt heading should be kept clean at all times and a very liberal coating of rock dust should be distributed over the floor. Bags of rock dust should be stored in quantities at all drive motors, discharge points, tail pulleys and at frequent intervals along the belt line.

Fire extinguishers likewise should be placed at discharge points, drive motors and at least one should be placed at the working face of each unit. These can be employed to great advantage in extinguishing a fire if used immediately upon its discovery or before the blaze has made headway. At or near these locations there should be available protective equipment, such as all-service gas masks or Chesnox for men fighting the fire.

Water is the principal means of allaying dust. Dust is produced by many operations in the mining of coal. At the face, the cutting, blasting and loading of coal produces large quantities of dust unless water is used through the cutter bar of all cutting machines, and on the head of loading machines. The out of coal after it is blasted should be sprinkled.

The importance of fire fighting equipment along a belt system cannot be over-emphasized. A water line should be laid along all belt lines. It should be of sufficient size to deliver a minimum of one hundred gallons per minute through a 2½ inch hose connected to a ¾ inch nozzle. The water taps should not be further apart than the distance the intervening hose will reach.

Telephones, as of now, are the only satisfactory means available for communication with men who may be trapped back of a belt fire. It, therefore, becomes very necessary to have telephones at strategic locations as determined by the local management.

At this point it might be well to mention the use of self-rescuers as a means of escape for men trapped by smoke. There are now available on the market self-rescuers approved by the Bureau of Mines that are designed primarily for storage at convenient locations where they would be readily available.

All permanent belt installations should be on a separate split of air. This minimizes the danger of smoke being carried into the working sections and endangering the lives of the workmen.

The extension of this same principle to gathering or room heading belts is more difficult of accomplishment, but can be of lesser importance only because of the generally shorter distances involved. Good practice demands that these belts should not be on the main intake air current, in order that the men may have a means of escape through an intake heading that is independent of the belt heading in the case of fire.

To provide this independent heading a row of stoppings must be placed on each side of the belt heading and a regulator established on the inby end to control the amount of air flowing over the belt. However, it is recognized that, because of the large volumes of air required, the accomplishment of this objective may overload airways beyond practical limits under some plans of mining, particularly in the thinner seam mines.

A careful scrutiny of the general mining plan is warranted in this case, because in many mines the principle of mining one side on advance and the other side on retreat can be adopted without any sacrifice of economy or production, and at the same time it will make possible the limiting of air requirements to reasonable volumes.

Admittedly, as with most schemes that are thoroughly planned and carefully executed the ventilation plan described here for belt installations is initially more expensive than haphazard and poorly maintained systems, but in case of a belt fire its adoption would pay dividends in the saving of human lives and property and in helping to control and extinguish the fire.

As has been demonstrated, numerous factors enter into the prevention and control of fire hazards in belt conveyor installations. The highly inflammable materials used in the construction of belts, the dangerous accumulation of dust and grease at vital points, the many points of friction, the hazards of the roof, the easy misalignment of the belt, the menace of short circuits and many other ever-lurking dangers to life and equipment must be guarded against at all times.

The proper installation and inspection of belts, the removal of oil and grease at vital points, training of the belt, efficient wiring, safety switches, adequate supply of rock dust, water, proper ventilation, and telephones installed, as well as many other factors, all of utmost importance in the guarding of human life, must be carried out and adhered to rigidly to reduce fire hazards.

Cooperative Safety Training of Safety Committeemen and Miners

By CHARLES FERGUSON

Assistant Safety Director, International Union, United Mine Workers of America, Washington, D. C.

The International Union of the United Mine Workers of America, through its safety division, has adopted the training of safety committeemen and miners in accident prevention as a component part of its safety program.

The United Mine Workers of America is and has every right to be genuinely interested in the health and safety of its membership, and subscribes wholeheartedly to any practical activity that might tend to reduce injuries. After all, what meaning is there to good wages and working conditions if a miner loses his life or health, or is prevented through injury from enjoying their benefits.

The organization's attitude toward safety has been well demonstrated by the constant and intensive struggle it has waged for reasonable safety in the industry. These efforts have been carried on in Congress and state legislatures, at the bargaining table and through our membership at the mines. Such efforts, together with the cooperation of the safety-conscious segments of the industry, have resulted in some safety improvements.

My organization is not content with the injury rate as it now stands. Moreover, it will not be satisfied with any rate which includes injuries that could by reasonable precautions have been prevented. The organization will continue to operate with determination and through every channel available in an attempt to revise the sordid story of unnecessary deaths and injuries to its membership.

The organization has for many years contended that its members at each mine were entitled to a committee from their own ranks and of their own choice to represent them in matters pertaining to safety. As a result of joint negotiations in the year 1941, provisions for such a committee were for the first time written into our wage agreement.

The organization continued to strive for greater participation in safety matters and for better safety cooperation on a national and local level on the part of the operators. This effort resulted in several changes in the safety provisions of the contract agreed to by the operators in 1947. These amendments changed the manner in which the committeemen were selected, removed the grass service clause, eliminated the experience requirement, granted them authority in instances of imminent danger, and incorporated by reference the Federal Mine Safety Code.

The new provisions caused the safety committeemen to feel that they were at last recognized as having a part in the safety effort, and resulted in a very notable increase in their interest and activities. This in turn, created a desire in the committeemen for a greater knowledge of the principles of mine safety in order that they might better perform their duties. Such desire was revealed by requests from many committeemen for a comprehensive safety course that would include instruction in the provisions of the Code.

The United States Bureau of Mines, aware of this opportunity to improve conditions through safety training, formulated a course of instruction late in 1946, and organized the first class for instruction at Welch, West Virginia, early in January, 1947. Originally, the course was intended for safety committeemen, but it soon became obvious that many rank and file miners also would participate in the activity if given the oportunity to do so.

The Bureau of Mines consequently broadened the scope of training to include any and all men engaged in the mining of coal. The original course dealt with safety measures in bituminous mines, and shortly thereafter a similar course, adapted to the safety needs at anthracite mines, was prepared and offered.

The training was sponsored by the United States Bureau of Mines and our various district organizations; also by our safety division shortly after its establishment by the International Union in June, 1947. Our district officers encouraged and promoted the training through circular letters of endorsement and by pointing out the value of the course to local union officers and committeemen at meetings called specifically for that purpose.

Our safety division also has cooperated in this endeavor by urging all local unions to participate in the training; our membership has been encouraged to avail themselves of this training by means of circular letter, publicity in our Journal, and through personal contacts by members of the safety division staff wherever the opportunity has been present.

Inasmuch as safety education is recognized as a vital factor in any mine safety program, and the success or failure of such a program affects proportionately the mine costs, we had hoped that the operators would take full advantage of the opportunity by

making the training a cooperative undertaking. We were soon to find, however, that many operators were very skeptical of such training and either openly or passively opposed it.

The argument advanced against the course was that it would cause a know-it-all attitude on the part of the committeemen, thereby resulting in a wave of unjustified withdrawals of men from the mines. These predictions, however, failed to materialize and the more progressive operators soon began to demonstrate an interest in the training by providing facilities for holding classes. Up to the present time, twenty operators have cooperated to an extent that made it possible to secure 100 per cent participation in the training at their mines.

During the period this training has been in progress—January 1, 1947 to July 1, 1951—approximately 35,000 men have completed it. Of those completing the course, approximately 34,000 were members of our organization. Eighteen states and some 3,000 mines are represented in this number.

During the present calendar year, the Bureau of Mines formulated and is now conducting classes in two additional safety courses. These courses deal with roof-fall and haulage accidents, the two largest killers of miners. Classes in the course designed to prevent roof-fall accidents are conducted for all underground employees. Generally classes are held at or near the mine immediately before the men enter or depart. The length of the instruction period is determined largely by the trainees and usually is from one to two hours.

The haulage accident-prevention course is given in a similar manner to all haulage employees who desire to participate. These courses are proving to be very popular and as of August 1, had resulted in the training of 14,799 men this year; 3,879 in the roof-fall course, and 10,920 in the haulage course.

Even though these courses are very brief and each deals with only one type of accident, they undoubtedly will produce a favorable effect on the injury rate, and our safety division endorses them wholeheartedly. We do not, however, regard them as a substitute for the standard 20-hour course, but rather as a supplement to it.

The value of safety education has been well demonstrated at a mine where all of the employees completed the standard accident-prevention course in 1949. At the end of that year the mine had a rate of 98.5 injuries per million man-hours of exposure —nearly twice the average rate for the nation. At the end of 1950, the first year after the training was completed, the rate had taken a nosedive to 11.0 injuries per million man-hours, a phenomenal reduction of more than 88 per cent in the injury rate. For the first half of 1951, the rate was reduced still further to 4.6 injuries per million man-hours, which undoubtedly is one of the lowest rates in the nation.

I do not imply that safety training alone was responsible for the remarkable improvement in the safety record at this mine. I do, however, maintain that it was a vital component part of the safety program and was indispensable in the achievement of such a record. Notable reductions in injuries also have been accomplished at many other mines where there was considerable participation in the training.

I do not feel that it is necessary to give further proof of the merits of safety training, because I believe that it is the consensus of this group that such training is indispensable, if the best interests of safety are to be served.

This leads to the question of what our organization and the operators can and will do to further promote and expedite the training program. As I stated previously, our safety division has adopted total safety training as one of the many objectives in its safety effort. It must be borne in mind, however, that the United Mine Workers of America is truly a democratic organization, and that we do not have and do not desire the authority to force our members to participate in any activity against their own will.

This being the circumstance, it logically follows that our method of approach must be to develop in our members an appreciation of the vital importance of the training and the desire to avail themselves of the opportunity to increase their knowledge of safe mining practices. I assure you that the safety division will employ every means at its command to this end.

I. O. U. Safety

By O. C. GIBSON
Superintendent, Dun Glen No. 11 Mine, Hanna Coal Company, Dun Glen, Ohio

"I.O.U. SAFETY" happens to be the safety slogan of our company. It was chosen from some approximately 2,500 slogans submitted by our employees. This safety slogan is part of the propaganda which we use in our attempt to bolster up interest in our accident prevention program. My use of the word propaganda is in its proper sense. This word has wrongly come to mean the type of opiates spread widely abroad by dictators and subversive elements. One of the most effective media in selling any article or bill of goods is through well gotten up and well circulatized information designed to create a desire on the part of potential customers to possess such article. Our magazines, newspapers, radios and television are full of propaganda designed to sell goods to prospective customers.

The basic idea behind a safety slogan is identical with this. Safety is an article which we want to sell to our people and we believe that, when we look at the success of advertising propaganda generally, we are forced to the conclusion that any copying of successful advertising techniques should help us in our job of selling our fill of safety goods.

During the latter part of 1946, the operating officials and safety department of the Hanna Coal Company began taking serious inventory of actually how good a safety program we had and how effective it was in reducing the occurrence of accidents. At that time, the accident frequency rate of our underground mines was 74.68, which we considered to be inexcusably high.

While this paper is not intended to discuss the details of our revitalized program which we attempted to initiate at that time, it suffices to say that it included, as a prime part of it, the premise that the safety program must be taken to the man at the working face through his supervisor with the cooperation and assistance of the safety department. This meant increased emphasis on the man's work habits and involved the necessity of keeping his thinking along proper lines so far as the accident prevention program in general was concerned and so far as his day-to-day safety performance was concerned.

After four full years of hard work, we took inventory of the results to date and found that the 74.68 frequency of 1946 had been reduced to a frequency of 23.08 for these three underground mines for the year 1950. We credit this measure of success to taking the safety program where it belongs —to the man at the face and his supervisor.

We found it desirable and helpful to use safety propaganda to aid and abet this fundamental aspect of our accident prevention program. In order to spark initial interest in our revitalized safety program, we conducted our first safety slogan contest during the first part of 1947. In this contest, we invited all of our union employees to submit one or more safety slogans. We offered as a prize for the winning slogan an airplane trip to New York City for the winner and his wife for three days of seeing the sights of the "big town."

These slogans were judged by a joint union-management committee at each mine with the committee at one mine judging the slogans submitted by employees at another mine. In this way, we avoided any accusations of favoritism on the part of the committee in rendering their judgments. We offered prizes of lesser value, such as furniture and household appliances, for the winner at each individual mine. Then these winning slogans at the mines were submitted to a committee composed of the operating vice president, the general manager of underground mines, general manager of surface mines, safety director and manager of industrial relations, who chose the winning company slogan.

In this first safety slogan contest, 218 employees submitted entries with a total of 250 individual entries. Our last contest, which was held approximately a year and a half ago, brought forth participants to the extent of 672 employees with 2,311 slogan entries submitted, which we believe was a remarkably good response.

Our basic thinking behind these safety slogan contests is that, while we want to get a short, terse and meaningful slogan, we believe that even more important than arriving at a good slogan is the thought provocation which is provided on the subject of safety. It is not only the employee who is trying to think up a good slogan but the subject is discussed at the dinner table at home, the youngsters discuss it at school and, in many cases, we have found that family caucuses were held to try to arrive at a good slogan to submit in the contest. We have thus accomplished one of the main objectives which we set out to do and that was to get our employees thinking about safety and about good safety practices.

It is probably needless to point out that there are limitations to the number of appropriate slogans which can be invented. We held four safety slogan contests and each time it became more difficult to choose a slogan which would have the zip and brevity which a good slogan should have. The last contest resulted in "I.O.U. SAFETY" being selected. We believe that this slogan is the best we have had and has infinite possibilities for development and publicity.

After the slogan was chosen and when the first publicity was given to it in our house organ, *Hanna Coal News*, some of these possibilities were developed pictorially. We showed a series of cartoons, beginning with the employee himself as he faced himself in the mirror in the morning. We had him, in the cartoon, telling his reflection that "I.O.U. SAFETY." Then, "I.O.U. SAFETY" were his parting words to his wife and youngsters as he left for work. He next met his supervisor and, as they greeted each other in the morning, each assured the other that "I.O.U. SAFETY." He met his buddy and they exchanged a pledge of the debt of safety they owe each other. The series was climaxed with the president of the company, from behind his desk, giving the same pledge to the employees of the company.

We had printed a number of "I.O.U. SAFETY" pledge cards which were wallet size. One group of these cards read: "To My Men. I.O.U. SAFETY.", with a place for the signature of the supervisor. Each supervisor signed one of these cards and presented it to each of his men. The mine superintendent signed such cards and presented one to each member of the miners' safety committee as safety representatives of the men; and the safety committee signed cards reading: "To the Management. I.O.U. SAFETY."

Our method of further publicizing our safety slogan consisted of the following: Each piece of mining equipment, including loading machines, cutting machines, drills, locomotives and mine cars, has a reflectorized ribbon bearing the words, "I.O.U. SAFETY." We have had decals made up for each of our employees to attach to their hard hats.

We have also distributed to our employees reflectorized decals of the company insignia, in red, which we believe is an added safety factor, particularly underground. These decals are placed on the back of the hard hat and, of course, they provide a safety precaution in that any light hitting them will cause a reflection from this insignia.

We had several thousand windshield stickers bearing our safety slogan, and these were distributed to all of our employees who wanted them. We found that many of them put stickers both on the windshield and on the rear window of their automobiles. Just recently, we purchased some reflectorized bumper strips bearing the "I.O.U. SAFETY" slogan with the name of the company also imprinted thereon. These have been in great demand by our people and we have heard many interesting comments about them. In touring various parts of the country while on vacation, many of our employees reported inquiries made of them as to what the sign means, where it originated, etc.

There is another interesting sidelight to these bumper strips in that some of our people are conscientious enough that they tell us they don't want them on because it might place them in an embarrassing position in case a highway patrolman stopped them for a highway law or a speed infraction.

While in one sense of the word this seems to be humorous, seriously it gives us some insight into the safety thinking of such individuals; and we believe that perhaps those individuals are ones upon whom we need to devote some special safety effort because, if they have ideas in their heads that they might violate some highway laws, it is also reasonable to think that these same people might think they can violate some laws of safety at their work.

We have further publicized this safety slogan through large reflectorized billboards, placed strategically around our properties, both on the surface and underground. At various main highway intersections near our mines, we have placed signs indicating the direction to the mine; and we have placed reflectorized versions of our safety slogan in one corner of these signs.

Our *Hanna Coal News* carries the safety slogan at the bottom of each page; and the safety page, gotten up by the safety department, always carries some reference to the safety slogan. Our safety calendar, which is prepared each month and mailed to our employees with their copy of the *Hanna Coal News* and which depicts photographically the right and wrong way of doing specific jobs, carries the safety slogan in large type.

Our employees are not allowed to forget that "I.O.U. Safety" pays because, on their pay checks, the words of the slogan appear; and they realize that, as well as their job paying them in a monetary sense, safety also pays in this same way by keeping them able to earn a living and saving them from the high cost of an accident and the suffering and distress caused by an accident to themselves and their families.

It seems paradoxical that we humans should have to be urged to do things which rebound to our own good. It seems strange, doesn't it, that you and I have to be cajoled and urged to work safely when the absence of safe work habits may cost us our lives. We must, however, recognize that this is one of the basic frailties to which human kind is heir. It is not sufficient by any means to occasionally "put on a drive" for safety. We must continually hammer at this thing and must continually work with men on their work habits because we have found that any let-up causes an almost immediate increase in the occurrence of accidents.

We believe that continual advertising of safety, continual talking about it and the continual placing in front of our employees of such reminders as a safety slogan, are fundamental. We believe that many of our smartest advertisers in the business world recognize the value of this.

While we do not believe that a safety slogan contest, as such, can make a material decrease in our accident record, we do believe very strongly that propaganda of this nature is an invaluable adjunct to a well executed, down-to-earth safety program. No phase of the safety program can stand alone. We can't get a safety program by merely putting on a safety man; we can't get a safety program without properly trained supervisors who know how to train a man in safety; we can't get a good safety program without the cooperation of the miners, individually and officially; nor can we get a good safety record with just a safety slogan.

By using a well proportioned balance of all the various elements which affect human behavior, a good safety record can be attained; and through constant attention, constant reminder and constant effort, men can be taught to habitually do their work safely.

Accident Record in Roof Bolted Sections As Compared to Timbered Sections

By JOHN W. WILLIAMSON
Supt., Peabody Coal Co., Mine No. 40, Galatia, Ill.

By far the greatest cause of accidents in the mining industry is roof falls. More than half of the yearly accidental deaths and more than a fourth of all non fatal injuries occurring in bituminous coal mines result from such causes. To alleviate roof hazards we have, since the beginning of the mining of coal, utilized some phase of roof support.

It is a known fact that the most dangerous area in a coal mine is at or near the immediate working face. A study of a large number of roof fall accidents discloses that

about 85 per cent of all fatalities from this cause occur at the working face of a room or entry or in pillar work.

Inasmuch as 65 to 75 per cent of the underground employees spend approximately 90 per cent of their working hours at the face, it is logical that most injuries will occur here. It is important then to stress roof control in this locality particularly if we are to insure the safety of the worker.

We all recognize that timbering, either cross-baring or using vertical leg supports, is a potential threat to everyone connected with the operation. There are records of fatalities to men digging hitchings, scaling or taking down loose rock or coal, knocking safety timbers, failing to set safety timbers, resetting straight timbers for loading efficiency, knocking out legs and crossbars with mining machinery, derailed cars knocking out timbers and crossbars, and the continuous danger of timber failure anywhere in the mine.

During the period from 1906 through June 1951 inclusive, 34,269 fatalities occurred underground in the bituminous coal mines of the United States from falls of roof and coal.

This would be comparable to two full infantry divisions annihilated. These accidents occurred during the attempted roof control through the use of timbers, crossbars, safety jacks and a systematic form of timbering. It is easy to understand that it has become a necessity to develop a roof control plan which will offset the accidents and handicaps encountered in the above system.

Up to the present time the prevention of roof fall accidents has been the most difficult problem in the attempt to bring about greater safety in mining coal. Falls of roof receive little public attention, because they do not arouse the spectacular interest that a disastrous mine fire or explosion arouses.

In order to insure at the working areas, increased safety, freedom of movement of equipment, and higher efficiency in mining and loading coal, roof bolting was definitely the answer. There is no danger of lack of safety timbers since each roof bolt properly installed is this factor, crossbars are not needed, because as we know that in roof bolting the principle of tying the layers of rock together forms a beam or crossbar, no danger of knocking legs or crossbar vertical supports as there aren't any utilized, and there are no "hitchings" to cut, which have sometimes loose caded rock and has resulted in accidents. We can comprehend then, that the accident potential is greatly reduced when the mining operation is made safe by the use of roof bolts.

The origin of roof bolting as a means of roof support is obscure. During the past 23 years a method was developed by the St. Joseph Lead Company, at its mines in Southeastern Missouri, ranging from occasional use of single bolts with small bearing plate to systematic networks of bolts utilizing continuous bearing plates.

Many instances of occasional use of roof bolts have come to light during the past few years in widely separated mining districts. A few of the known installations have been in place as long as 40 years.

These installations usually were made to supplement wooden timbering in mine openings where space was constricted, although it has been reported that roof bolting was started as a systematic means of roof support in at least three instances but was abandoned because the cost of installation was excessive.

With mining now almost completely mechanized, it has shown in the past two years that greater efficiency can be realized in eliminating lost time and fatal accidents as well as increasing production in all phases of mining through the nation. Hence the original cost in installation of bolts is now negligible.

Timbering on a 100 per cent basis in a number of mines in Illinois, in the past three years has decreased in prominence since Mr. C. C. Conway, then Chief Engineer for Consolidated Coal Co., now Chief Electrical Engineer for the Peabody Coal Co. first successfully utilized roof bolts.

The widespread application of roof bolting since then has been phenomenal. In fact, within the last two years, roof bolts have been installed in over 450 mines to secure approximately 1,000 miles of mine roof. This certainly indicates excellent progress in the use of roof bolts to control bad top, thus decreasing accidents from this cause.

One of the toughest problems of roof bolting was that of convincing the men that this form of roof support was not only practical, but actually safer than timbering. Among the first explanations was to compare roof bolting and timbering at the working face. In timbering it is necessary to set props about seven feet from the face before shooting down the coal. After the coal has been shot down, another eight feet of shale top will be exposed. This leaves 15 feet of roof unsupported until it is loaded out and timbered.

Everyone knows that unsupported roof is the direct cause of falls and accidents, thus if roof bolts were installed up to the vertical coal face in the shale top, it would leave only the area that had been last shot down with unsupported roof. Hence timbering exposes 15 feet of shale unsupported and roof bolting exposes eight feet of shale unsupported and assists in holding that bridge of rock, we can see then that the accident potential is decreased almost 50 per cent during the use of rock bolts.

To prove there is strength in bolting the roof together, take five pieces of plywood, three-eighths inch thick, six inches wide and six feet long, put them on two trestels, one at each end. When pressure is applied in the middle, the wood will bend from four to six inches. This would be comparable to using x-bars. Then bore three-eighths inch holes through the plywood and put three-eighths inch bolts through them and bolt tight—the bending of the plywood when bolted together is negligible during the time that weight is applied in the same location.

It can be figured that by tying or binding slate or shale together to keep it from drawing in the middle, the shale would become substantially the same as a fixed beam and the ribs would act as a vertical support. It has been noted that where crossbars have been installed on vertical legs and then bolts were put around these timbers and the bolts tightened, the slate was pulled back together, thus turning the bars loose without being touched. This is a definite point that bolts tie the rock together and will, of course, hold more consistently than timbers.

To cite an example of roof control with bolts, it is a matter of record that the Concord Mine of the Tennessee Coal, Iron and Railroad Company is now supporting eight and a half million square feet of roof with bolts that no other system would support. The coal bed at this mine is over 8ft by thinly bedded marl shale, ranging in thickness from 18 inches to 36 inches.

We know that the average size piece of rock that caused a fatality in 1950 was 12 feet by eight feet by 1 foot. With this in mind the rock did ride out wooden crossbars at this mine and was a source of continued accident possibility.

In May, 1949, after extensive experimentation, the use of roof bolting was adopted exclusively and all of the possibilities of accidents mentioned previously when using conventional timbering were eliminated. We can therefore comprehend the magnificent job of roof control with bolts that has been accomplished under such treacherous roof conditions.

There has been, and probably in the future will be failures in roof control through the use of bolts. The reason primarily for this, however, is that some personnel have the mistaken idea that roof bolting is a cure-all, regardless of the roof material or methods of installation.

To date, practically all failures of bolted roof investigated reveal poor or incorrect supervision, faulty or improper installation. One fault of installation is not using temporary safety jacks or straight safety timbers while bolts are being installed. The records show that three fatal accidents have occurred because of inefficiency during installation. A comparable state exists, however, using timbering in roof control.

The records point to the fact that in the State of Illinois there are at present 29 mines installing roof bolts, securing approximately 67 miles of entry and 5,309,250 square feet of mine roof supported in this manner, without one record of a fatality due to failure of roof bolts. This can certainly not be stated as true in mines now timbering exclusively.

Speaking from a true experience, I know of a fatality in a section where timbering was used exclusively. All other sections of the mine were being bolted at the time. The roof bolting during this period was being carried forward on an experimental basis, hence the bolted sections and timbered section combination. If that section had been bolted, this man would be alive today.

One fatality was caused when a second man started to scale some top coal down at the immediate face. The coal and rock fell, injuring the man fatally. Had the top been bolted to the vertical face of the coal,

A Program for Prevention of Haulage Accidents

By DONALD S. KINGERY

Chief, Haulage Section, Department of Interior, Health and Safety Division, Bureau of Mines, Washington, D. C.

Mine haulage accidents have been recognized as a major source of coal-mine injuries since the inception of mine safety. Recent investigations revealed that on the basis of exposure, haulage is one of the most hazardous occupations in mines. Furthermore, accident records show that haulage injuries occur in essentially the same manner year after year and now account for approximately 25 per cent of the fatal and non-fatal coal mine injuries.

A brief objective study of this particular safety problem brings to light the following salient, influencing factors.

1. *Management appreciation:* Much of the responsibility for safety in haulage rests upon management. There is no doubt about the importance of the transportation system in mine efficiency. Every mine official appreciates that a high-potential face-loading rate is of little value unless the transportation system is equally efficient.

Experience has shown, however, that sometimes the planning, development, and maintenance of the transportation system are given less consideration than production. Investigations have shown that in many mines the transportation system is taken for granted and receives little attention unless it fails and needs to be repaired.

2. *Job training:* It is not the general practice of many mining companies to provide specific training for a job. Most transportation employees gain their knowledge and experience by doing. They learn to appreciate danger through narrow escapes and grow into the job of solving their problems through observation, brief instruction, or plain trial and error. Twenty-five per cent of the motormen killed in 1950 were inexperienced or substitute employees. There is no doubt that they were able to start, stop, and generally operate the equipment, but when confronted by an emergency or an unusual condition they were unable to cope with it.

3. *Supervision:* As is true of most mine employees, those engaged in haulage are not directly supervised. Usually, the section foreman, mine foreman and dispatcher, or transportation foreman supervises such employees, and as these officials have other responsibilities their supervision is limited to routine instructions at the start of each shift, supplemented by telephone or trolley-phone instructions during the shift.

As a result, haulage employees operate very much on their own and are governed chiefly by company policy, personal experience, and individual characteristics. It is a human trait to cut corners and indulge in practices not considered safe. In the absence of supervisional restraint, these hazardous practices become routine and often are limited only by circumstances or individual daring.

4. *Human equation:* The human equation is most significant in safe and efficient haulage operations. Solution of this human equation is difficult and intangible. Most persons are not logical animals; they seldom reason with their minds but are influenced by their emotions, habits, and individual temperament. The roots that cause and influence emotions and temperament go deep and are constantly agitated by day-to-day conditions of life. This means that a man will bring his personal problems to work with him and in the course of his job may become so preoccupied as to commit some involuntary, unsafe act that results in an accident.

Another individual, owing to unstable temperament influenced by individual problems, may develop an irrational approach, be difficult to handle, and deliberately take chances. Most of us fall somewhere between these extremes in behavior, and investigation into the personal problems, background, and environment of individuals involved in accidents would disclose very important contributing causes.

The problem of human emotions as a hazard in haulage employment can be solved by taking a personal interest in employees, recognizing their individuality, and learning something about their environment, ambitions, hobbies, weakness, and strength. Make the individual part of a team and encourage his initiative. Select transportation employees on the basis of stability, intelligence, ambition, and physique.

Haulage safety, as this brief analysis showed, constitutes a complex problem and is comprised of numerous influencing variables. It is doubtful if any standard formula or physical solution can be developed that will solve all these contributing and not always obvious factors.

It is our opinion that the approach must be through a study of haulage-accident causes, a study of individual haulage conditions, and the application of haulage safety fundamentals. Training in job safety or repetitive specialized instruction for transportation employees should also be included in the program. It was upon this premise that the Haulage Safety Section of the Bureau of Mines established its "Program for Preventing Haulage Accidents."

The first step of the program was a study of fatal haulage accidents that occurred in 1950. The information came from the federal mine inspectors' investigation reports of fatal accidents, and an attempt was made to compile pertinent data into a useful summary. The information derived from this study was broken down as follows:

1. The principle manners of haulage accident occurrence.
2. The work classification of the victims.
3. The action of the victim at the time of accident.
4. The physical hazards contributing to the accident.
5. The unsafe practices contributing to the accident.
6. Preventive measures.

This information was published as Bureau of Mines Information Circular No. 7604, *Analysis of Haulage Fatalities in Bituminous Coal Mines in 1950*, released in June 1951.

The information obtained from this study was not novel; it paralleled, to a great extent, information that has been presented from this rostrum and before other safety institutes. It did prove the recurring pattern of haulage accidents and provided focal points for special effort, individual study, and a possible approach to the problem.

The study of individual haulage conditions in various mines is a part of the federal coal mine inspector's duties. We have conducted a special training course for the federal coal mine inspection force, acquainting them with the causes of haulage accidents, the manner of their occurrence, physical hazards, and corrective measures. The inspector is in a position to contribute much to the safety and efficiency of the haulage system through his contacts with management and haulage employees.

The application of haulage safety fundamentals is most important to the operation of any transportation system. These fundamentals are not new, yet often, in the interest of expediency, may not be given full consideration. Briefly stated, the principle fundamentals are as follows:

1. *Safe equipment.* This means equipment suitable for the job, maintained in good operating condition, and provided with the proper accessories. Equipment upon which the operator rides should be provided with protected seating space and other safety design features.

2. *Safe haulage roads, slopes, and shafts.* This refers to proper alinement, gradient, drainage, size of rail and the installation of the road-bed, adequate clearance, shelter holes, illumination, trolley-wire installation, and roof support of the haulage roads. It also includes a preventive maintenance program, ample side-track capacity, signal systems, protective devices, and controls for slopes and shafts.

3. *Safe auxiliaries and accessories.* These are the dispatching and communication systems, including the "block signal" systems, automatic switches, signal lights, derails, special man-trip, explosive cars, and other auxillary equipment.

4. *Safe practices.* Such a program would result in haulage personnel so well trained that they could be expected to conduct themselves in a safe manner under any conditions.

Complete application of these fundamentals is probably not possible, but if they were applied to the maximum practical extent in all coal mines we would note immediate and marked improvement in both our safety and efficiency records.

Specialized instruction or job safety training for haulage employees constitutes a

in mines, as was pointed out by Sir Andrew Bryan in a Cadman Memorial Lecture in 1951[3]. Nevertheless, it is well to remember the fire risk associated with thousands of belt conveyors; the new hazards introduced by Diesel and other locomotives[4]; and the potential dangers of man-riding, especially where the number of men who may be involved in any accident is many times the number who ride in the main winding shaft at one time. For example, there are mines where the man-riding train holds more than 200 men as compared with the present maximum of 128 men in two cages in any main winding shaft in this country.

To facilitate further consideration of these accidents, the number of persons killed and reportably injured in the three years, 1948, 1949, and 1950, are reclassified and shown in the following table, which is based on data in the Report of the Chief Inspector of Mines for 1950[5]:

Table I

Persons Killed and Reportably Injured by Haulage Accidents

Classification	1948		1949		1950	
	Deaths	Reportably Injured	Deaths	Reportably Injured	Deaths	Reportably Injured
Breakages of ropes or drawgear, excluding derailments	8	12	5	10	6	12
Runaways	18	74	24	59	16	64
Derailments and while re-railing	10	105	6	80	11	103
Coupling, uncoupling, attaching or detaching or otherwise manipulating tubs	18	106	15	81	18	104
Contact with machinery, ropes or pulleys	2	50	8	42	1	35
Others	38	179	34	128	28	99
Total tub haulage	94	526	90	400	80	431
Drawn into or crushed by conveyor machinery and structures	7	34	9	43	6	47
Trapped by roof, props, bars, etc., due to movement of conveyors	8	58	10	40	6	59
Total conveyors	15	92	19	83	12	86
Grand Totals	109	618	109	483	92	517

Rope Haulage

General: The wire rope driven by electric or compressed air power is the principal means of haulage in our coal mines. Despite the changes in practice rope haulage will remain in use for many years during the reorganization of the mines and it will continue in use where systems of mining preclude the application of locomotives and conveyors.[6] Great efforts are being made to increase the efficiency and safety of wire-rope haulage, which usually requires much more ancillary apparatus and workmen than locomotive haulage.

The endless rope system predominates, and it is suitable for roads with any undulating, favorable or adverse gradient not exceeding that on which the coal will not remain in the tub. It is used with parallel tracks in the road so that full tubs are hauled to the shaft and empty tubs to the inbye loading point at the same time. The tubs are small, have plain bearings and move at a speed of between one and two miles per hour along the tracks, which have relatively narrow gauges and lightweight rails. The hauling rope is either over or under the tubs, according to the type of haulage. The tubs are coupled to or uncoupled from each other by manual effort, which is also required to attach clips and chains to the sets of tubs and the moving rope. Since this system requires many haulage hands to be in contact with moving apparatus, the risk of accidents is much greater than that due to haulage by locomotives or conveyors.

The main or direct rope system is used in many mines where the gradient of the roadway is neither undulating nor less steep than that on which the empty tubs with the attached rope will gravitate to the inbye loading point at the necessary speed. This is much higher than the speed of the endless rope because the load on the rope is not so large, the delivery of coal is more intermittent and the rope is stationary when the sets of tubs are attached or detached. For these reasons the tubs are usually larger and run on tracks which have heavier rails. The great majority of these haulages are used with a single track in the road, but some recent installations have two tracks so that the unbalanced load is reduced and the delivery of coal is more frequent. The main and tail rope system is a variation of the main rope system and it is used in many mines where the road has a single track with undulating gradients. The main rope hauls the set of full tubs to the shaft and the tail rope then pulls a set of empty tubs and the attached main rope back to the inbye loading point.

Table I shows that tub haulage was responsible for 511 or nearly 84 per cent of the serious casualties due to haulage accidents in 1950 and that 316 of these casualties were due to three outstanding causes, namely, runaways, derailments and while rerailing, and coupling or uncoupling or otherwise manipulating tubs.

An analysis of recent fatal accidents due to runaways shows that the main causes were as follows: Accidental uncoupling of tubs as a result of defective or improperly tightened rope clips, lashing chain hooks being too wide, and shacklepins rising. Failure of haulage hands to use the stop blocks, jack catches, tub lockers, warwicks, derail switches, and other safety equipment provided by the management. Inadequate or defective brake of haulage engines or faulty operation of these engines. These causes of accidents indicate the appropriate remedies that are being applied. The very few runaway accidents due to the breakage of ropes or drawgear can be attributed to the relatively high standards of design, construction and maintenance. Nevertheless, experience has shown that safety factors should be improved in some cases and that there is much to be said in favor of the extended use of weldless couplings and drawgear made of 1.5 per cent manganese steel or other suitable steel. Such materials are free of the embrittlement in service, which is such a characteristic disadvantage of wrought iron.

Derailments are a major source of serious casualties and steps are being taken to reduce them. It has become clear that the standards of inspection and maintenance of some existing rolling stock and track should be improved. Tubs should not be allowed to run with substandard drawgear, bad buffers, defective bearings, bent axles, or wheels that are badly worn or have excessive clearance on the axles. Mechanical apparatus, which will gradually arrest, control and hold tubs at loading and unloading points, is being installed because it is efficient and conducive to the maintenance of good rolling stock and to safety. Rail tracks should be of sufficient strength and be kept clean, properly aligned and to the correct gauge. Crossings and points should be in good condition and curves should have superelevation and check rails where required. The position of any curve should be marked on the haulage distance indicator so that the driver can reduce the speed if necessary.

The greatest number of serious casualties was due to accidents during coupling or uncoupling or manipulating tubs. Some of these were caused by unexpected movements of haulage ropes, horses, or ponies, while others occurred during the attachment and detachment of clips or lashing chains and also while persons were walking in front of the tubs they were trying to control. Since the risk of accident is related to the number of coupling operations, which is a function of the capacity of the tubs used for haulage, it is anticipated that there will be a great reduction in this type of casualty as larger tubs and mine cars are installed.

Our mining engineers are well aware of the advantages to be derived from the use of large and well-designed mine cars with anti-friction bearings and automatic couplings; mechanically operated apparatus to move and control cars at loading and unloading points; and wide-gauge track which is

properly ballasted and constructed of relatively heavy rails and large ties. Many mines have such equipment, but a considerable period of time is bound to elapse before similar equipment is in use at the great majority of the mines in our comparatively old coal field.

Man-riding: The potential dangers of man-riding in inclined roadways below ground are certainly not less and are often greater than those due to winding men in vertical shafts. For that reason, much attention has been given to the standards of design, construction, inspection, and maintenance of man-riding apparatus, which should not be inferior to those necessary for the main man-winder. Acceptance of this basic principle calls for provisions which are already made in many mines and which are briefly discussed below.

Any haulage engine should have a road contour and distance indicator with a device which warns the driver automatically when the train is approaching the end of its journey. There should also be a device which automatically cuts off the supply of power to the engine and applies the brakes in the event of excessive speed, overwinding of the train and loss of control by the driver. The brakes should be so designed that they are able to decelerate the train at a reasonable rate at all times.

The hauling rope, cappings, and the train of carriages should be of such strength and construction that the safety of the men is ensured. In this connection, there are usually two schools of thought: One maintains that the primary standards of strength should always be sufficient to preclude breakage of the rope or drawgear, and that additional safety devices are unnecessary; the other school considers that where the gradient is not too steep the carriages should be so designed that they are brought to rest safely and automatically in the unlikely event of failure of the rope or drawgear.

Protection against overwinding the train can be obtained in many ways, but much can be said in favor of a track limit switch at each end of the riding plane, because the overtravel allowed by these switches is not affected by any slipping of the rope on the surge wheel or bad coiling of the rope on the drum. The switches are included in the emergency trip circuit, which consists of a pull wire suspended over the track and an AC relay in the no-volt circuit of the main switch in the engine room; the relay is normally closed. When the trip wire is pulled by any person on the train or the limit switches are operated by the train in the event of overtravel, the relay is de-energized, the no-volt circuit of the main switch is broken and the supply of electric power to the haulage is cut off. Since the emergency brake is normally held in the "off" position by a solenoid or thruster energized by electric power from the main switch, the brake is applied whenever the pull wire or the track limit switch is operated.

Protection against overspeed is often provided by a small centrifugal governor driven by a suitable high-speed shaft of the haulage gear. In the event of overspeed the governor operates and opens the no-volt circuit of the main switch, which cuts off the supply of power and applies the brake as previously described. It is also advantageous to have the so-called "dead man's handle" so arranged that the supply of power is cut off and the brake is applied in the event of loss of control by the engineman.

Many devices have been developed with a view to preventing a train or part of a train from running away in the event of breakage of the rope or drawgear. Some devices are operated automatically by loss of tension in the rope or drawgear, while others have to be applied manually by some person or persons riding on the train. The latter have the insuperable disadvantage that a few seconds delay in applying the brakes on some gradients would allow the runaway train to acquire a dangerous speed.

There is, however, one device that automatically brakes the train whenever its speed exceeds that for which the device was set. This is fully described in two papers[4,5] and has been fitted to some man-riding haulages. The train consists of several cars, each of which has four self-aligning track brake shoes attached to the car frame, which is normally lifted clear of the rails by a special system of levers pivoted on the axles and is held in this position by a ratchet wheel and pawl. Each car is coupled to the adjacent car and so on to the first car, which has an overspeed governor driven by one of the axles. If the rope or drawgear breaks, the cars accelerate down the gradient, the governor or a special connection between the cars operates and trips the pawls, which allow each car to fall so that all the brakes come into contact with the rails. This device has been thoroughly tested and is effective on all gradients up to the limit of about 1 in 2½.

As regards ropes, long experience has shown that the haulage drum should be of such diameter and width that the number of layers of rope is as small as practicable and that the rope can be constructed of substantial wires. The rope should be supported by relatively large pulleys wherever a marked change in the gradient of the road causes a large reaction on the rope. The short life, excessive wear, and the breakage of wires of a rope are often due to the excessive pressure per unit length of rope on small rollers at the top of an incline. Where the gradient is uniform, the rope should be supported by rollers whose inertia, bearings, and spacings are such that the slip is small. In order to minimize the effect on the rope of the slip, which invariably occurs when the moving rope comes into contact with a roller, some mines are using rubberized rollers.

Conveyors

General: There were about 1,653 shaker conveyors, 2,581 scrapers or chain conveyors, and 12,459 belt conveyors in our coal mines in 1949. These conveyors transported about 181 of the 203 million tons of deep-mined coal raised in that year.

Table I shows that conveyor haulage was responsible for 98, or nearly 16 per cent of the serious casualties due to haulage accidents in 1950, and that 53 of these casualties resulted from persons being drawn into or crushed by conveyor machinery and structures. The remaining 45 were caused by movements of conveyors, which trapped persons against roofs, props and bars, etc. These casualties indicate that workmen should be made aware of and regularly reminded of the dangers associated with conveyors and that steps should be taken to promote safety by providing adequate fencing; means to stop a conveyor and keep it stopped when necessary from any place along its length; places where persons can cross a conveyor safely; and stricter supervision to prevent unauthorized man-riding.

In view of a recent fire at a scraper conveyor and the application of hydraulic couplings and torque converters to underground conveyors, etc., attention is directed to the safety aspects of this apparatus. Such couplings are usually fitted with a fusible plug, which ejects the oil when its temperature is abnormally high. It is suggested that tests should be made to prove that fusible plugs are reliable and that the fusing temperature should provide for safety having regard to the quality of the oil. Means should be provided to trap any oil that is ejected through a fused plug. The quantity, quality and flash point of the oil in the coupling and the heat-dissipation capacity of the coupling should be adequate for the power that is transmitted. The overload trips of any electric motor used with a hydraulic coupling should be set to stop the motor before it develops excessive torque in the event of the coupling being stalled by excessive load on its output shaft. Finally, there should be equipment for fighting an oil fire in the vicinity of the coupling.

The serious hazards associated with the use of rubber-belt conveyors have been considered by Bryan in an excellent paper, "Roadway Conveyors and Safety,"[6] which evoked substantial discussion in 1949. The author gives statistics of conveyor fires and suggests standards of design, construction, inspection and maintenance, which may prevent or reduce the risk from the three main dangers which he lists. Firstly, there is the danger from fires from a variety of causes; secondly, there is the danger of propagation of a firedamp explosion by coal-dust; and, thirdly, there is the discomfort and danger to health of the persons employed, arising from air-borne dust. As that paper is available in the transactions of the Institution of Mining Engineers, London, I shall confine my observations to one or two mechanical-engineering aspects of the problem.

Main roadway conveyors should be located so that the clearances above, below and on both sides of conveyors are sufficient to provide for the transport of mineral and for the requisite standards of inspection and maintenance of the belt, structure, rollers, drums and driving units. Sufficient spare rollers should be provided so that any roller on the conveyor can be taken out of use at predetermined intervals and dismantled, thoroughly examined, repaired and re-lubricated before it is put into serv-

ice again. There is much to be said in favour of rollers which are so arranged that the lubricant can be replenished while they are revolving. The "greaser" employed for this purpose will patrol the conveyor track during his shift and be in a position to detect any damage to the belt or any frictional heating which might otherwise result in a fire. Where the tension in the belt is not automatically maintained at the predetermined value by a deadweight tensioning device, it is good policy to provide means to indicate the tension which is induced by any other manually or mechanically operated device. It is advantageous to load an important and costly conveyor by means of an auxiliary belt which transfers the load uniformly in the same direction and at the same speed as the main belt.

During the last few years, many devices have been developed to provide for the sequence control of interconnected belts and to stop the belt in some circumstance which might be dangerous. There are several types of devices which are designed to stop a belt when its speed is more than a declared amount below normal. The majority of these devices are driven by a roller in contact with the belt, and thus they measure the speed of the belt. When this speed is affected by wide variation in the frequency or voltage of the electrical-supply system or by overloading, the belt with mineral, etc., it is necessary to set the device to allow for the change in speed; in some cases, a drop of 20 to 25 per cent in speed is allowed. Thus, there is no protection against belt slip less than that value. For this reason, devices have been developed which measure the relative speed of the belt and its driving roller and which can be set to stop the belt whenever the slip exceeds about 5 per cent.

There is much difference of opinion as to whether conveyor belts should be used for transporting persons. Normally, they can only transport persons in one direction, and other means would have to be provided to transport in the other direction or the men would have to walk. But in some countries the belts are reversible so that men can be transported in either direction. There should, of course, be good standards of construction, inspection and maintenance wherever man-riding is permitted on conveyor belts. It is thought that consideration of this problem will be facilitated by the following brief summary of some regulations for man-riding on conveyor belts in the mines of the Netherlands.[30]

The clear height above the belt must be at least 3.3 feet at stepping-off stations, which must be at least 33 feet from the end of the belt and 33 feet long. These stations must be made recognizable in an effective manner and kept free of obstructions. So must a sufficiently wide pathway alongside the belt. The clear height above the belt at other places must be at least 16 inches.

The belt must always be in good repair and its speed must not exceed 295 feet per minute. The distance between adjacent persons on the belt must be at least 9 feet 10 inches. Above the whole length of the belt there must be an emergency brake wire within easy reach of any person on the belt. This wire must be maintained in proper working order so that the conveyor may be stopped immediately. The conveyor-belt system and the road must be inspected by a supervising official during each shift.

The conveyor cannot be used for transporting persons until an Inspector of Mines has given his approval after he has made an inspection.

Locomotive Haulage

General: A few electric storage battery locomotives had been used in coal mines in Great Britain before the 1930's, but it was not until 1934, when the first Diesel locomotive of 50 h.p. was introduced in a naked light mine at Kingshill, Scotland[31], that any appreciable interest was shown in locomotive haulage. Following this development and the successful use of Diesel locomotives in the mines of Western Europe over a period of several years, two British manufacturers designed and built two prototype flame-proof Diesel locomotives which were approved by the Mines Department in 1939 after stringent tests at the Safety in Mines Research Board's Testing Station at Buxton. One of these locomotives developed 48 h.p., while the other developed 25 h.p., weighed 4.7 tons and was the first to be used in a safety lamp coal mine in this country. This was at Rossington in Yorkshire, where the locomotive has successfully worked a man-riding train during the thirteen year period 1939-1951.[32] Unfortunately,

the further application of Diesel and other types of locomotives was practically stopped until about the end of the Second World War.

Since the early 1940's our mining engineers have investigated and reviewed haulage practices in coal mines in the U.S.A., Germany, Holland, Belgium, France and this country, so that the most suitable, efficient and safe systems could be selected for our mines. As a result of these investigations large numbers of locomotives have been installed, as shown in Table II below:

Table II
Locomotives in British Coal Mines

Year	Diesel	Battery	Total
1939	3	4*	7*
1943	35	6*	41*
1945	55	8*	63*
1947	88	10	98
1948	170	15	185
1949	279	52	331
1950	323	58	345

*Approximate numbers.

The majority of the locomotives were installed on existing roadways, which had been driven in the coal seams and used for haulage by wire ropes. While the gradients of the roads were quite moderate for rope haulage, they were comparatively steep for locomotive haulage and severely limited the weight of the trains to that which could be brought to rest within a reasonable distance.[33] On the other hand, some of the locomotives were installed on new roadways in reorganized or new mines where the horizon mining system was adopted. These roadways were driven through the strata at a uniform gradient of between 1 in 200 and 1 in 500 in favor of the load. Such gradients are very suitable for haulage, because they practically eliminate the runaway hazard, reduce the braking problem and enable locomotives of moderate weight and horse power to haul heavy trains at comparatively high speeds.

The horizon mining system is practiced extensively in Western Europe and especially in the Ruhr, where locomotives are used exclusively for main haulage and the roads are driven through the strata with a uniform and favorable gradient of 1 in 400 or 500. Table III shows the numbers and types of locomotives in the Ruhr coalfield whose annual output is about one half of that in Great Britain. This table is interesting in view of the application and potential use of locomotives in this country.

Table III
Locomotives in Ruhr Coal Mines

Type	Number in use in the year 1938	1940	1948
Electric Trolley	1,525	1,794	1,237
Electric Battery	246	558	457
Compressed Air	1,887	1,209	1,307
Benzol	227	8	22
Diesel	51	428	544
Total	3,146	3,291	3,567

Until 1949 all locomotives in British coal mines were subject to Special Regulations established separately at each mine, but the regulations were very similar as they were based on a Model Code. Since then any locomotive has been subject to the Coal Mines (Locomotives) General Regulations, 1949,[34] which provide for the design, equipment, operation, inspection and maintenance of locomotives; the limiting gradient; the construction, inspection and maintenance of the track; the ventilation, clearances, inspection and maintenance of the roads; and the construction and equipment of locomotive stations, fuel oil filling stations and battery charging stations. In addition, the Regulations remove the former prohibition on the use of electric trolley wire locomotives and allow these locomotives to be used with the prior consent of the Minister and subject to Special Regulations based on a Model Code. Man-riding by locomotives is being dealt with by Special Regulations until the proposed General Regulations governing installations for man-riding by locomotives or rope haulage are introduced.

Some aspects of the aforesaid requirements of locomotive haulage, the riding of men, and Diesel, battery, compressed air and trolley locomotives are considered in the following sub-sections.

Roads, Tracks and Apparatus: In general, locomotive haulage roads are so constructed and maintained that, after allowing for the lateral movement and swing of the train when in motion, there are minimum clearances of one foot between the top of any locomotive cab and the roof of the road or its supports; one foot between any locomotive or truck on any adjacent tracks; two feet between the side of the widest vehicle and the side of the road on which refuge holes are provided; and one foot between the side of the widest vehicle and the other side of the road.

Until 1948 refuge holes on mineral haulage roads were provided at intervals of 10 or 20 yards according to statutory require-

ments. These were modified at that time to allow for the developments in locomotive haulage which reduced the runaway hazard as compared with rope haulage. Refuge holes can now be fixed according to Special Regulations for each mine, which in general provide for the intervals to be, firstly, in the range of 20-100 yards according to the gradient in straight roads, including any curved sections exceeding 300 feet in radius, and secondly, 20, 30 or 50 yards where the radius of the curve does not exceed 100 feet, or exceeds 100 but does not exceed 200 feet, or exceeds 200 but does not exceed 300 feet, respectively. The intervals are broadly related to the speed acquired by a runaway and the speed at which a person can run to a refuge hole, and also to the limitation of the driver's vision when travelling in the locomotive round the curve.

Unless exemption is granted by the Inspector of the Division, the weight of the rail used for the haulage of mineral or persons must not be less than 10-lb. plus 5-lb. for each ton of weight on one pair of wheels, and in any case not less than 40-lb. per yard of rail. Rail joints are secured by suitable fish plates having at least four bolts and the rails are attached to sleepers whose centers do not exceed 2 ft. 9 ins. The sleepers are ballasted so as to resist lateral and longitudinal displacement of the track and to distribute the load so that the safe bearing pressure of the floor is not exceeded. Since this pressure is adversely affected by water, provision is made to drain the track where necessary.

Provision is also made for any curve to be of such radius as is safe and to have the outer rail raised and a check rail fitted where necessary. The radius is not specified, because it depends on several factors which include rail gauge, wheel gauge, length of rigid wheel base of any vehicle, diameter of wheel, super-elevation of track and speed of train. However, the Memorandum[4] on the Regulations stresses the advantages of a large radius and suggests that 100 feet might be taken as the minimum on main haulage roads. The Memorandum also recommends that rail tracks should be regularly inspected at frequent intervals and maintained properly by men under the charge of a ganger or track foreman. Rails, fishplates, fastenings and bolts should be kept tight, and the super-elevation and alignment of any curves and all crossings and switches should be checked and adjusted if necessary. Further, any loose sleepers should be packed and any vertical or lateral mis-alignment should be corrected.

Many locomotives haul trains of small tubs, but some haul large capacity mine cars constructed to standards adopted by the National Coal Board after a review of modern practice and the conditions in British mines. The majority of the mine cars are equipped with hand-operated brakes so that the cars can be properly controlled and parked without using sprags or lockers which cause flats on the wheels. Springs are usually interposed between the axle and the under-carriage of any mine car, which has wheels fitted with roller bearings and couplings of the pin and link or spring loaded automatic type.

Since the primary object of the drawgear is to pull the train safely at all times, the gear must be so designed, constructed, operated, inspected and maintained that no part of it will break or become accidentally uncoupled during service. The strength of the gear should be so related to the magnitude and the frequency of the dynamic load to which it is subjected, that the fatigue limit will not be exceeded. As the dynamic load depends on the maximum tractive effort of the locomotive, the relative velocity of the locomotive or truck and any attached truck being accelerated, and the weight of the train behind any coupling, it is apparent that the dynamic load will be less with "tight" couplings of the automatic or link and pin type than with "slack" couplings of the three link and hook type.

The necessary standard of strength is probably provided where the relation between the breaking load of any portion of the drawgear and the maximum tractive effort of the locomotive is not less than 10 with "slack" couplings or 8 with "tight" couplings. This is the standard adopted for some 6 ton drop bottom mine cars in the South Yorkshire Coalfield which are equipped with A.S.F. couplers having a breaking load of about 72 tons for a maximum tractive effort of 9 tons. The major parts of these couplers are made of 1.5 per cent manganese steel which is free of the embrittlement inseparable from wrought iron couplings and therefore need not be heat treated in service.

To preclude accidental uncoupling of the train the drawgear must be able to withstand any tendency to uncoupling caused by forces produced by acceleration, deceleration and any horizontal or vertical curves in the track. The gear should allow for sufficient movement in the horizontal and vertical planes and be so constructed that any slackening of the couplings when the cars bump together will not cause to gear to uncouple. The releasing mechanism of any automatic coupling should be so arranged that it can be locked positively in that position which will prevent the couplings from being uncoupled accidentally.

Where there is doubt about the drawgear being free from accidental uncoupling, additional means are provided to eliminate this possibility. The normal coupling in the center of any car may be supplemented by a coupling chain at either side, but these are not desirable and have to be disconnected at the right time where cars are fitted with swivel couplings so that they may be discharged in a rotary tippler without being uncoupled from the train. An alternative safeguard, which has not been adopted yet in British mines, is to have cars fitted with compressed air brakes so that they can be applied normally by the driver and automatically in the event of any portion of the train becoming disconnected due to failure of the drawgear. Such brakes have outstanding advantages where it is necessary to haul heavy loads at high speeds over long distances in very large mines.

Another alternative is to have a banking locomotive whose weight and braking power are sufficient to arrest and hold all the cars in front of it when the drawgear between the front locomotive and the first car breaks. Such locomotives are used on the steep gradients on main line railways and also in some mines in the U.S.A., and provision has been made for their use in electric trolley haulage schemes in our mines, in accordance with the Model Code of Special Regulations.

Braking: Regulation 10 of the Coal Mines (Locomotives) General Regulations, 1949, requires the manager to determine the maximum load to be hauled by any locomotive and the maximum speed of any train, and also to give to each driver written instructions as to loads, speeds and all precautions necessary for safe running of the locomotives and trains. This cannot be done properly unless he ascertains either directly or from his engineering staff these relations between the gradient of the road, maximum load, weight of locomotive, braking power and speed of train which will ensure that the train can be stopped at all times within the limiting distance he considers safe having regard to all conditions in the haulage road. In other words, the ratio of the maximum load to the weight of the locomotive, which is usually the only braked vehicle, must be so selected that the brakes will produce the necessary rate of deceleration. These matters were fully considered in my paper entitled "Some Fundamentals of Underground Haulage by Locomotives," which was read before and discussed by two Federated Institutes of the Institution of Mining Engineers in 1947.[5] A summary of the most important points in the Braking Section of that paper is given in the following paragraphs.

While every *mining* locomotive has a mechanical brake with shoes which can be applied to the wheels by manual effort, the great majority are so arranged that these shoes can be applied also by compressed air power. This is generated on the locomotive and stored in a receiver of adequate capacity. One or two battery locomotives have magnetic track brakes in addition to the manually operated mechanical brakes, but these track brakes may be troublesome where there are points and crossings. An electric locomotive can also have regenerative or rheostatic brakes which are normally used to control the train down long gradients, but as previously stated, an independent mechanical brake is always provided.

When a car wheel is running and not slipping on the rail, the maximum braking effort which can be applied to the wheel is limited to the product of the weight on the wheel and the coefficient of static friction between the wheel and the rail. If any attempt is made to exceed that product the wheel will slip on the rail and the coefficient of friction will fall until it is equal to the coefficient of dynamic friction at the particular slipping speed. The braking effort of a locked wheel sliding on the rail is therefore much less than that which can be obtained when the wheel is revolving on the rail.

The coefficient of friction between the

means of haulage, but their radius of action is limited and their power is reduced as the battery runs down.

Large numbers of compressed-air locomotives are used in Ruhr coal mines, and some interest in their possibilities has been shown by many mining engineers.

Electric trolley locomotives are used extensively in the coal mines of many countries, but there are none in British coal mines. However, pilot installations of these locomotives are being planned, and some are expected to be ready for use in the near future.

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Allaying Dust During Operation of Continuous-Mining Machines and by Water Infiltration of Coal Pillars

By WILLIAM M. MERRITTS
Mining Eng., U. S. Bureau of Mines, Salt Lake City, Utah
and E. O. JACKSON
Gen. Supt., Coal Mining Dept., Independent Coal & Coke Co., Kenilworth, Utah

The object of this paper is to summarize briefly some of the results obtained during water-infusion, or infiltration, tests in the Kenilworth mine, Independent Coal & Coke Co., Kenilworth, Utah, and to call attention to the possible application of the water-infusion method in American coal mines as an aid in suppressing dust.

The necessity of controlling air-borne coal dust created and released during drilling and blasting operations in the pillar sections of the Kenilworth mine was fully recognized by the mine officials. Even though recognized dust-abatement methods were used during other mining operations, it was apparent that these methods should be supplemented by another method or methods so that the dust created and released during drilling and blasting would be abated at its source.

The mine officials made an all-out effort to allay this dust. After many trials with recognized methods, the method of infiltrating pillars with water and water mixed with a wetting agent, known as water infusion or infiltration of coal pillars, was instituted in the pillar sections of the Kenilworth mine.

The infiltration or infusion method consists of injecting water or water mixed with a wetting agent into coal in place to allay dust and to prevent the dispersion of small particles of dust in subsequent mining operations. In addition to reducing air-borne dust in the Kenilworth mine during all mining operations, infusion was credited with eliminating pillar heating and stopping one fire, thus saving 700,000 tons of coal for uninterrupted mining operations.

As a result of observations made and of dust counts obtained during tests while mining a pillar that was not infused, a pillar infused inadequately with water, and a pillar infused adequately with a mixture of water and a wetting agent, the following conclusions are drawn:

1. Dust can be allayed satisfactorily by water infusion, especially if water mixed with a wetting agent is used as the infusion solution. Dust counts can be reduced within safe limits, thus fulfilling the recommendations of the Federal Mine Safety Code.

2. Approximately 70 to 90 per cent of the air-borne dust comes from cracks in pillars and from thin crusts of crushed coal bordering these cracks. The amount of dust normally released can be limited, under extreme conditions (blasting out stumps) to about 12.3 million particles per cubic foot. Further, by washing out the dust in stump boreholes before blasting, the amount of dust normally released by blasting out stumps can be reduced from about 18.3 million to about 12.6 million particles per cubic foot.

3. The application of the water-infusion method proves to be effective for fire-fighting purposes under conditions similar to those encountered in the Kenilworth mine when heat, supposedly caused by friction when a portion of a pillar was moved down the pitch by the forces of a bounce, started a smoldering fire in the pillar.

4. Efficiency and safe mining operations are increased because of better visibility when dust is allayed.

5. When numerous pillars are infused in a section, there is a marked decrease in temperature, which made conditions more comfortable for the workmen.

6. The water-infusion method discussed in this paper can be adapted for dust suppression in coal beds having structures similar to those encountered in the Kenilworth coal bed, especially in the Kenilworth pillar areas.

It is believed that water infusion has important secondary advantages, as follows:

a. It partially degasses the working faces and thus reduces the hazards of ignition during other mining operations.

b. It causes incipient fracture of the coal, with consequent easing of cutting and, to a lesser extent, blasting.

The added moisture to the coal during infusion has no adverse effect upon preparation or on the marketing properties of the Kenilworth coal. Moisture is reduced greatly by evaporation during haulage.

General Theory of Water Infusion*

"The aim of infusion is to control air-borne dust production by increasing the surface moisture content of the coal in advance of mining.

"It has long been recognized that an obviously wet sample of coal contains surface or adherent moisture as well as inherent moisture. The former covers the particle surfaces and lines the cracks large and small in the pieces of coal. The latter is held internally in the coal itself.

"Up until recently a common method of differentiating between the two has been to

*Newey, U. O., Review of Water Infusion of Pillar Coal in Coal Mines of Australia. Paper prepared for and sent to W. M. Merritts.

determine the percentage of moisture remaining in a coal sample after drying in air and also the percentage lost by the sample after drying in air, and also the percentage lost by the sample when heated at 105° C. for one hour. The former was called 'inherent' moisture, the latter 'total' moisture, and the difference between them—or that percentage lost by air drying—'surface' or 'adherent' moisture.

"This practice, although still commonly followed, is unsatisfactory in certain respects. The chief difficulty arises from the fact that the 'inherent' moisture value so determined is not fixed, but varies for any given coal sample and depends on the relative humidity, that is, vapor pressure of the air in which it is dried. If the air is nearly saturated, a higher value is obtained than results from drying in very dry air.

"Recent fundamental research on coal structure has provided a clearer understanding of the manner in which moisture is held internally in the coal. It is considered that coal is composed of submicroscopic bodies called 'micelles' in contact one with the other but having still smaller spaces between them to which the name 'intermicellar spaces' has been given.

"The whole structure is roughly analogous to a large number of extremely small, distorted marbles in close contact, the marbles being the micelles and the spaces between them the intermicellar spaces. Moisture occupying these spaces is termed inherent moisture, and when all these spaces are filled the coal is said to be at its maximum inherent moisture value.

"The maximum inherent moisture value of a coal is a definite property, just as is the percentage fixed carbon or the coking index and is related to the rank of the coal. In the case of low-rank coals such as lignites, the intermicellar spaces are relatively open, and the coal has a high maximum inherent moisture value—up to 80 per cent. On the other hand, high-rank bituminous coals may have maximum inherent moisture values as low as 1.71 per cent. In the latter case the micelles are believed to be crowded together, so that the intermicellar spaces are relatively small.

"When a sample of coal, which has its maximum inherent moisture value and adherent moisture present as well, is allowed to dry in unsaturated air, all of the adherent and some of the inherent moisture evaporates. The vapor pressure of the inherent moisture remaining after air drying is in equilibrium with the vapor pressure of the surrounding air. It will thus be seen that the old expression 'inherent' moisture is really only a variable percentage of the real maximum inherent moisture value.

"If the air dried sample of the preceding paragraph is allowed to stand in saturated air or in water for a sufficient time, the intermicellar spaces refill and the coal regains its maximum inherent moisture value. The percentage adherent moisture of a coal sample so treated is the difference between its total moisture percentage and its maximum inherent moisture value. As the total moisture percentage of coal beds is normally higher than the maximum inherent moisture value, adherent moisture is normally present in situ. As the adherent moisture has obviously been present over extended periods, it can safely be assumed that the maximum inherent moisture demands of the coal are satisfied. The percentage adherent moisture can then be evaluated by difference.

"The practical importance of the maximum inherent moisture determination lies in the fact that it enables the percentage adherent moisture to be determined. This latter figure is of prime importance in dust control, screenability, and similar investigations. Moisture increases the coherence between small particles if the moisture is present on the particle surfaces. But as the intermicellar spaces are far smaller than the smallest dust particle, it would appear probable that moisture held in them is not available for dust control.

"This is borne out by practical experience. A sample of subbituminous coal at its maximum inherent moisture value, say 20 per cent, can be as dusty as a Bulli seam coal at 1.71 per cent and considerable more dusty than a Bulli seam coal at 2.71 per cent, that is with 1.00 per cent adherent moisture.

"Water forced into holes drilled into coal pillars travels through the coal along the cleat planes naturally occurring within the coal. Coal that is strongly cleated at close intervals may be expected to offer greater opportunity to water flow from the drill hole than a coal which is more massive in structure.

"However, it is apparent that within the one area of coal, or even within the one pillar, there are zones which permit greater water flows than others. This is believed to be due to the effects of roof pressures and roof-floor convergence.

"Visual observation of a pillar indicates that the periphery of a pillar consists of coal broken away from the solid coal by parallel pressure cracks caused by mining. These cracks are more or less open and extend to a depth into the pillar dependent mainly on the depth from the surface and the strength of the coal and associated strata.

"In the Bulli seam of the Southern coal field of New South Wales, Australia, a pillar measuring 150 feet by 180 feet and lying at a depth of approximately 1,500 feet from the surface commonly has these pressure cracks extending up to 10 feet into the pillar. If infusion holes drilled into such a pillar are not sealed beyond this broken periphery, the water escapes along these cracks to the floor.

"It is noteworthy that, if holes are sealed beyond this periphery and infused, the infusion water does not take the shortest path to the outside of the pillar via the first cleat planes intersected by the hole. On the contrary, the water travels through the cleats within the pillar itself. This phenomenon is regarded as due to the closing of the cleat by compression of the columns of coal bounded by the cleat within a zone of greater roof pressure adjacent to the roadways already driven."

The Kemilworth mine, Independent Coal & Coke Co., is at Kemilworth, Carbon County, Utah, and is developed in the Kenilworth coal bed, which ranges from 9 to 16 feet in thickness and dips about 5 degrees north in this mine. The coal is of bituminous grade, is very hard, and contains an appreciable amount of resin. The maximum over-burden at the present working faces is about 2,200 feet.

The proximate analyses of the coal are as follows:

	As submitted, per cent	Moisture free, per cent
Moisture, at 105° C.	2.8	.....
Combustible, volatile matter	41.8	43.0
Fixed carbon	48.4	49.9
Ash	5.0	5.1
Total	100.0	100.0
Sulfur	0.5 to 0.7	per cent
B.t.u.	12,960	13,370

The ratio of volatile to the total combustible of the coal in this mine is 0.475, indicating that the coal dust is highly explosive.

The mine was developed by the room-and-pillar method and by a panel-and-entry system, and pillars were recovered by splitting them on the retreat. Entries were driven 14 to 20 feet wide and rooms 18 to 24 feet wide.

The mine is classed gassy by the Safety Division of the Industrial Commission of Utah.

Electric power, 440 volts a.c. and 250 volts d.c., was used underground.

The mining equipment used in the working places of the pillar area of one and two west entries was: 11-BU caterpillar-mounted loading machines; track-mounted universal mining machines; hand-held electrically operated coal augers, which drilled holes 2½ inches in diameter; all-steel mine cars having a capacity of six tons; and trolley and cable-reel electric locomotives.

The coal was blasted with sheathed permissible explosives.

A pillar section in one and two west entries off Number four slope was selected for water-infusion tests. This section of the mine was developed during the period 1943 to 1945; the pillars therefore had been standing for some time. As a result, the floor had heaved in some places to within six feet of the roof, the pillars were badly crushed, and much sloughing had occurred. Original coal height was about 16 feet. Heaving still is in progress, requiring repeated bottom lifting during pillar recovery.

As elsewhere in the mine, water is piped under pressure to all working faces for use on cutting and loading machines, for washing down the face before shooting, for washing out drill holes, and for sprinkling the loose coal before and during loading. Sprays also are installed on all main partings and at other points along the main haulageways for sprinkling the tops of loaded mine cars.

The pillars are diamond-shaped and normally 57 feet by 132 feet in size. An individual pillar is mined by driving pockets approximately 25 feet wide across it, usually from the lower side, leaving eight-foot feeders.

Infusion boreholes normally are drilled on approximately the center lines of the pock-

a post about 25 feet from the face with the flattened discharge nozzle pointing toward the face. When the shotfirer has connected the wiring of his shots he turns the water and compressed air into the gun and regulates each until the discharge is in the form of a mist. He then goes to a safe place and fires the shots, and it has been found that he and the rest of the face crew can return to the face immediately, so that not more than five minutes are lost by waiting for the place to clear of smoke and fumes. About 12 pounds of powder is used per round of 8 shots. The device uses surprisingly little water. A test we made in the shops yesterday indicated only about 2 gallons per minute.

"The device used here seems to have been developed about 20 years ago by our present State Mine Inspector W. J. Evans at the Carbonado Mine of the Pacific Coast Coal Co., but was apparently not used extensively for a number of years. We have been using it about two years now.

"There is a good description on page 114 of the August, 1948 issue of *Coal Age* of an identical device used by the Hudson Coal Co. of Scranton, Pennsylvania. Also, of a much larger device used by the Walsh Construction Company in extensive rock tunnel work on the Delaware Aqueduct water system for New York City, as described on page 6224 of the August, and page 6230 of the September, 1940, issues of *Compressed Air Magazine*, from all of which it would seem that you should be able to effect improvements by the use of mist-sprays in the working faces of your Potash Mines."

Roof Drilling with Dust-Control Equipment

By JAMES WESTFIELD
Chief, Accident Prevention and Health Division, Region VIII, Bureau of Mines, Pittsburgh, Pa.

Drillings for roof bolting have created a new dust problem for the coal-mining industry. Drilling is inherently dusty, and control of the dust produced by drilling vertical, or nearly vertical holes is much more difficult than control of that produced by drilling flat or down holes. Moreover, the dust produced by roof drilling differs in composition from that produced by drilling or cutting the coal face, in that it contains a significantly greater amount of free silica and therefore presents a greater potential hazard of causing the lung disease, silicosis.

Roof bolting has been practiced successfully in the mines of the St. Joseph Lead Co. in southeastern Missouri for over 20 years, but it was not until 1947 and 1948 that large-scale roof-bolting experiments were first conducted in coal mines. Although the need for dust control in conjunction with roof drilling was recognized from the beginning, the development and acceptance of roof bolting progressed so rapidly during 1949 and 1950 that solution of the dust problem lagged behind other engineering phases of the technique.

The roof generally is bolted where the immediate roof is soft and in many instances where the roof bolts can be secured firmly into a harder or more substantial formation above. The types of strata found in drilling a roof are coal, shale, sandstone, limestone, and all the impure and intermediate variations of these materials.

A comprehensive study of the geologic sections of the immediate roof of mines in Region VIII of the Bureau of Mines, where roof-bolting studies are in progress, reveals that 67.7 per cent of the footage of all the holes drilled for roof bolts is in shale, 23.4 per cent is in sandstone and sandy shale, 7.1 per cent is in coal and coaly shale, and 1.8 per cent is in limestone.

Shale consists chiefly of kaolin, muscovite, and quartz, with small amounts of many other minerals. Sandstone consists principally of quartz, with a cementing material of silica, calcite, or limonite. A limestone consists chiefly of calcite, with varying amounts of quartz. Even the coal may contain a small percentage of quartz. Thus, quartz is present in significant amounts in about 91 per cent of all the rock drilling for roof bolting.

The free-silica content of a mineral material (quartz is the most abundant form of free silica) is determined most accurately by the X-ray diffraction method, which is based upon the specific diffractive properties of crystalline substances. This method requires only a small sample, and the small size of industrial dusts does not affect the results adversely. Determination of free silica by this method was developed in part in the Bureau of Mines, where it is now used for quantitative analysis of samples of rock, rock dust, drill cuttings, and air-borne dust.

The free-silica content of the roof strata of 51 coal mines has been determined by X-ray diffraction analysis from roof rock, drill cuttings, and midget-impinger samples of air-borne dust collected in mines in nine Eastern States.

The average free-silica content of 80 samples from these mines is 31 per cent, and it ranges from seven to 88 per cent. The free-silica content of the roof strata of 43 of the mines classified as having shale roof averages 26.5 per cent and ranges from seven to 62 per cent. The free-silica content of the roof strata of eight of the mines classified as having sandstone roof averages 55 per cent and ranges from 31 to 88 per cent.

These results show that wide variation may exist in the composition of various roof strata and that the content of free silica encountered in drilling a shale roof may equal or exceed that found in drilling a so-called sandstone roof.

Although the composition of a mineral source material may not be considered an exact index of the composition of air-borne dust produced by mechanical disintegration of the material, some evidence on this subject is available. Unpublished data developed by the Bureau of Mines indicate that the quartz content of air-borne dust decreases as the time of settling increases, and direct comparison of analyses available in the Health Branch of the Bureau of Mines also indicates that the free-silica content of the air-borne dust produced by drilling is somewhat, but not significantly, less than the free-silica content of the material drilled.

These results, though too limited to be conclusive, give some justification for using the analysis of the source material in evaluating the dust hazard, particularly since the error, if any, is on the side of safety. It may be pointed out also that Industrial Code 53 of the State of New York, Control of Silica Dust in Rock Drilling, bases its definition of "injurious silica-dust concentration" upon analysis of the source material drilled.

Any dust breathed in large quantities over a long period can impair the health of a worker, and silica is recognized as definitely harmful when inhaled into the lungs. Coal dust is less harmful but should not be considered completely harmless.

The hazard of exposure to silica-bearing dust is commonly gaged by the number of dust particles found in a unit volume of air and the free-silica content of the dust. Limits for occupational exposure expressed in such terms have been suggested by evaluation of the results of numerous clinical and engineering studies.

The Bureau of Mines has made the following tentative recommendations on allowable limits of air dustiness:

"In bituminous and lignite mines, the average full-shift concentration of atmospheric dust to which a workman may be exposed should not exceed 20 million particles per cubic foot of air, and a maximum concentration for any single operation should not exceed 40 million particles of dust per cubic foot of air. When the dust contains silica, not more than five million particles of silica dust per cubic foot of air should be present in the above limiting concentrations.

"The dust count may be multiplied by the percentage of silica concentration, and if the result is less than five million the dust concentration will be considered safe. The above limiting concentrations are based on impinger samples in which light-field counts are made under a microscope."

To maintain these standards a dust concentration higher than 18.9 million particles per cubic foot of air would not be allowable when the average shale roof is drilled, and a dust concentration higher than 9.1 million

would not be allowable when the average sandstone roof is drilled. A dust concentration no higher than 5.7 million would be required in some instances.

Table I lists the types of drilling equipment used for roof drilling, the number of mines using each type, and the number of mines using or not using a dust-control method with each type. It can be seen that at 71.1 per cent of the mines roof is drilled with no dust-control equipment; contrary to the Bureau of Mines recommendation that "a dust respirator is not to be used as a permanent substitute for dust-control measures," reliance is placed upon the protection offered by respirators.

Table I.—Roof-Drilling Dust-Control Practice, All Coal Mines, Region VIII

Drilling Equipment	Total Number	Some Method	No Method
Pneumatic percussion	278	91	187
Electric rotary	57	2	55
Hydraulic rotary	8	5	3
Pneumatic percussion and electric rotary	6	5	1
Pneumatic percussion and hydraulic rotary	4	1	3
Total, all types	323	102	251
Per cent, all types	100.0	28.9	71.1

Table 2 shows what dust-control methods are used in conjunction with pneumatic percussion, electric rotary, and hydraulic rotary drills. Note that the applications of dust collectors outnumber the applications of water.

Table 2.—Dust-Control Method and Application to Drilling Equipment, All Coal Mines, Region VIII

Dust-control method	Drilling Equipment: Pneumatic percussion	Electric rotary	Hydraulic rotary	Totals: Number	Per cent
Application of water	46	—	3	49	13.5
Dust collector	51	7	1	59	16.3
None	191	56	8	255	70.2
Total applications				*363	100.0

*Includes 10 mines using 2 types of drilling equipment.

Dust concentrations recently observed in five mines where stopper-type pneumatic drills are used without dust-control equipment averaged 607 million particles per cubic foot of air and ranged from 51 to 1,194 million particles per cubic foot. In six mines where electric rotary drills were used without dust-control equipment, the dust concentration averaged 313 million particles per cubic foot and ranged from 10 to 1,185 million particles per cubic foot.

The dust concentrations cited are indicative of the dust exposure of the driller but were obtained under such variable conditions that they should not be used for direct comparison. For instance, the averages indicate that pneumatic drilling produces twice as much dust as electric rotary drilling; actually the ratio may be higher.

The ranges indicate that either type of drill may produce dust concentrations higher than one billion particles per cubic foot of air. This amount of dust can pollute the air to such an extent as to constitute a serious menace to the health, not only of the drillers, but of any persons working in the return air from the place where drilling is being done.

Dust produced by roof drilling must be arrested or collected at its source if it is to be controlled adequately. This can be done by water or a dust collector. Water can be used effectively with pneumatic percussion or hydraulic rotary drills. Dust collectors can be adapted to any type of drilling equipment.

Introduction of water to the bottom of the hole through the drill steel when drilling is done with pneumatic percussion drills has been accepted as standard practice in metal mines. This practice is applicable to roof drilling and complies with the Federal Mine Safety Code requirements. Successful control by this method depends mainly upon maintaining the flow of enough water through the drill, using water continuously during the drilling period, and providing positive ventilation as needed.

High dust concentrations can result if too little water is used, especially when vertical holes are drilled with a stoper-type drill. It is advisable to maintain adequate water pressure so that a full flow of water can be realized. Collaring dry—that is, drilling the first few inches of hole before opening water valve—can also cause high dust concentrations and should not be allowed.

During recently observed roof drilling with a wet stoper drill, dust concentrations averaged 13.3 million particles per cubic foot of air and doubtless would have been lower had not all the holes been collared dry, as conditions for maintaining low dust concentrations otherwise were excellent. Wet drilling must be supplemented by ventilation to obtain the desired control, as the water does not arrest the dust completely. Other conditions being favorable, normal ventilating currents should prove adequate but will have to be directed to the drilling operation.

The most frequent objection to wet, pneumatic percussion drilling is that it is a disagreeable task. The splashing of the water and drill cuttings and the wetness underfoot are particularly objectionable to the driller when the headroom is limited, as in many coal mines.

Various hydraulic rotary drills have been developed, and the use of water to control the dust reportedly has been successfully applied to them. The Bureau of Mines has not as yet had opportunity to observe the results obtained.

The need for a water-distribution system or the use of inconvenient pressure tanks, the adverse effect upon some mine roof and floor, and the difficulty of using water with electric drills are other factors that limit the use of water to allay drilling dusts. Results of tests conducted with wetting agents, foam, and various types of water sprays, all with the hope of minimizing these factors, have been unfavorable. Satisfactory equipment for producing and applying foams has not been developed; water sprays have proved inefficient, and thus far the performance of wetting agents has not justified their use.

The operating principle of most dust collectors is application of exhaust ventilation near the source of the dust. Numerous dust-control systems based upon this principle have been devised for controlling dust produced by all types of pneumatic rock drills.

Some of these have demonstrated that, by proper application of this principle, successful results could be obtained, even under the most difficult conditions. Regardless of results, unfavorable operating features restricted their complete development.

With the advent of roof drilling, the possibility that their use here might overcome the serious objections to wet drilling and the fact that they were applicable to electric rotary drilling again stimulated their further development. To meet this need, several types of dust collectors now have been made available commercially, and others have been developed and used locally.

In 1950, the Bureau of Mines inaugurated a program at the Experimental Mine, Bruceton, Pa., for testing dust-collecting devices developed commercially for application to roof drilling in coal mines. The reasons for conducting these tests were to assist the designers of the equipment by evaluating the effectiveness of the devices under controlled test conditions and to enable the Bureau of Mines to obtain information on dissemination of dust during roof drilling, and on methods of controlling it, that will be beneficial to the mining industry.

Under this program, performance tests were conducted for six different types of dust-collecting systems. Each design has included a collecting head, an exhaust ventilating system, and means for removing the entrained dust load from the air passing through the system before releasing it to the mine atmosphere.

The design of the hood is most important because it affects the dust-collecting efficiency directly and dictates the performance required of the other parts of the collector. Drilling in hard roof produces fine, readily transported particles, whereas drilling in soft roof, such as occurs above the Pittsburgh seam, produces large, scalelike particles that tend to plug a dust collector unless it is designed to accommodate their transport. The collectors apparently most successful have overcome this difficulty by avoiding restrictions and using the effect of gravity to full advantage in moving the drill cuttings from the hole.

The provisions for a tight seal where the drill steel passes through the hood are more critical than the provision for a seal where the hood contacts the roof. Unfavorable results caused by an ineffective drill-rod seal cannot be overcome by any reasonable amount of exhaust ventilation. Either positive pressure exhausters or air injectors can provide an adequate rate of exhaust ventilation if the previously mentioned difficulties are avoided.

Removal of the dust load from air passing through the system has been no problem, being accomplished either by gravity

separation of the large particles and mechanical filtration of the fine particles or, more simply, by mechanical filtration alone. Two collectors have been designed for removing the dust load by a washing action.

No attempt has been made to evaluate the features of the various collectors other than their collecting efficiencies. It is obvious that size, weight, and portability should be given more consideration. It is noteworthy that one of the most successful dust collectors is so compact that one man alone can move it about and set it up with ease.

The results of some performance tests have shown that it is possible to reduce roof-drilling dust concentrations to five million particles per cubic foot of air with dry-dust collectors and that a dust collector can perform satisfactorily with either pneumatic percussion or electric rotary drills.

The favorable results obtained under severe test conditions indicate that dust produced by pneumatic roof drilling can be controlled more effectively by the use of an efficient dry dust collector than by the application of water.

The performance tests are not to be construed as approval tests, such as are conducted by the Bureau of Mines on other types of equipment under provisions of appropriate published schedules. Such a schedule, establishing permissibility tests, is being prepared and upon completion will allow the Bureau of Mines to grant formal approval to equipment passing the prescribed tests. Approval-schedule procedure tests have demonstrated the ability of dry-dust-collecting equipment to control dust in accordance with the tentative Bureau of Mines recommendations previously discussed.

Article IX, Section 1h, of the Federal Mine Safety Code is specific in requiring the use of water for controlling dust where roof or other rock is being drilled with percussion drills. This precludes the use of dry-dust collectors, unfortunately or otherwise, and the federal coal-mine inspector has no alternative but to cite a violation of the code where the practice is observed.

The citation is not capitalized, as normally would be done when a serious hazard to health exists, if, in the inspector's opinion, the dust collector is doing a good job. Statements of the views of the mine are included in the report under the heading "General Information." The Bureau of Mines recognizes the situation of an operator thus cited and suggests that he appeal from the citation to the Joint Industry Safety Committee.

Acceptable dry-dust collectors have been developed, and the Bureau of Mines has proposed to the Joint Industry Safety Committee a revision of Article IX, Section 1h, to permit the use of dry-dust collectors with pneumatic drills.

Article XI, Section 7g, of the code states that men exposed to gas, dust, fume, and mist inhalation for short periods shall wear permissible respiratory equipment. Rock drilling, other than roof drilling, has been excepted from dust-control provisions, in many instances, under this section.

A comprehensive study of the airborne dust resulting from rock drilling in coal mines has been undertaken by the Bureau of Mines; and data obtained from this survey indicate that, in some instances, rock drillers and other workmen are being exposed to injurious concentrations of dust. The application of dust control to roof drilling will stimulate the application of dust control to other rock-drilling tasks. Rock drilling without dust control cannot be justified if and when suitable control methods can be applied.

Summary

1. In Region VIII, 353 coal mines are using roof bolting, and 63 million square feet of roof area are being supported by roof bolts.

2. The roof strata drilled for roof bolting contain significant amounts of free silica. The samples taken from 51 mines in Region VIII show that the free-silica content averages 31 per cent.

3. Roof drilling without provisions for dust control results in a serious health hazard, as drillers and other workmen in the return air from the place where drilling is being done are exposed to dangerously high concentrations of silica-bearing dusts.

4. Dust-control methods are not used in conjunction with roof drilling at 71 per cent of all the mines in Region VIII where roof bolting is being practiced.

5. Wet pneumatic roof drilling, if properly conducted, results in favorable dust concentrations, but it can affect the mine roof and floor adversely, is a disagreeable task, (particularly in low coal), and requires a water-distribution system or use of pressure tanks.

6. The development of dust collectors has been stimulated by the need for overcoming the objectionable features that accompany wet pneumatic roof drilling and by the fact that they can be adapted to electric rotary drills.

7. The Bureau of Mines inaugurated a program for testing the efficiency of dust-collecting devices developed commercially for application to roof drilling in coal mines, and the test work proved that the principles applied in these dust collectors are adequate.

8. In inspecting mines the federal inspector is forced to cite a violation of the Federal Mine Safety Code when roof drilling is done with a pneumatic drill, even if a dry-dust collector is used successfully; as a result, the Bureau of Mines has asked the Joint Industry Safety Committee to revise the code to permit use of dry-dust collectors in connection with roof drilling.

9. Control of the dust produced by roof drilling is difficult but must be accomplished. The effort being expended toward proper application of wet methods and newly developed supplementary devices should result in a high degree of success.

10. Rock drilling other than roof drilling has been excepted from dust-control provisions in many instances by the Federal Mine Safety Code. This exception has resulted in rock drillers and other workmen being exposed to injurious concentrations of dust. Development and application of dust control to roof drilling will stimulate application of dust control to other rock drilling tasks. Rock drilling without dust control cannot be justified if and when suitable control methods can be applied.

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As presented in the Sessions of the Construction Section at the 1951 National Safety Congress

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39th National Safety Congress

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If safety is to keep pace with today's rapidly advancing technology, we must continually have "new ideas."

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In preparing these Transactions, the proceedings of the Congress have been condensed and edited for reference purposes. Complete original manuscripts, with any charts or illustrations which were used, are available in National Safety Council files. Views expressed at the Congress or in this record are those of the Congress participants and are not necessarily those of the National Safety Council.

THE CONSTRUCTION SECTION

This volume is a record of the sessions held at the 1951 National Safety Congress by the Construction Section. The conduct of these Congress sessions each year is only one of the many cooperative activities which the Construction Section carries on in behalf of its members, and for the benefit of accident prevention work in the construction industry generally. The Section gives guidance in the preparation of a great variety of technical and educational material useful in the day-to-day safety programs of construction companies. The activities of the Section are under the direction of its Executive Committee, the members of which are listed at the close of this volume.

Safety Is Good Public Relations

By GEORGE M. SCHMELTZER
Executive Director, Keystone Building Contractors Assn., Harrisburg, Pa.

Good public relations are of extreme importance to the construction industry and to all those who are engaged in the industry, particularly general contractors. I stress this point because there seems evident, in many situations, a tendency to minimize the value of securing and retaining good will in a field where such a large part of a firm's business results strictly and exclusively upon direct competitive effort.

In public work, especially, it is true that contract awards are based primarily on criterion of the lowest price submitted by a responsible bidder. However, it is not the province of this paper to establish the desirability or essentiality of promoting public relations as an indispensable element in the operation of a successful unit within the construction industry.

It is felt that those in the industry generally recognize the necessity for a good public relations program; and it suffices, for purposes of this presentation, to say to those who fail to give proper cognizance to the worth of public good will that it behooves them to look into this matter.

"Safety is Good Public Relations" is the tare level placed on this talk. For the purpose of providing a suitable point-of-departure, it may be well to amplify, to a degree, the subject to encompass sufficient territory so as to permit an examination and exploration of the ways in which the practice of safety produces in the public mind a favorable and friendly attitude toward a person; a firm; a group of firms or an association, if you will; or an entire industry.

It may also be advisable to define what it meant by the term "good public relations," and I should like to submit, for your consideration, the following definition:

Good public relations is the end product resulting from the conscious translation into everyday actions of a plan which has as its purpose the earning of public good will through the proper presentation of your firm, or your industry, to its clients, to others engaged in the same or related activities, and to people in general. It has, as its objective, the creation of a situation in which the public will think well of you, and place confidence in your ability to do a job adequately.

So much for the definition of "good public relations," and now for a brief consideration of another principal term in the title, namely, "safety," or with your permission, "safety practice." It is fully appreciated that a definition of this term, to be all inclusive, could be quite lengthy; however, for the instant application, a simple and short treatment will meet the need.

By safety practice is meant utilization of all reasonable precautions to prevent accidents involving men, machines or materials.

I might say, parenthetically, that when thought is given to the fact that the economic impact, including both direct and indirect costs, of accidents in the construction industry annually amounts to almost a billion dollars, it is obvious that little further need be said in justifying sizable expenditures for accident prevention measures.

In the third revised edition of the *Manual of Accident Prevention in Construction* issued in 1949 by the Associated General Contractors of America, there appears on page six under the general heading of public relations this statement, and I quote, "Accidents on the job are probably the greatest single source of bad public relations for the general contractor."

This statement, in obverse fashion, sums up my main thesis, and perhaps goes further in that stated in a positive way, it may be said that safety practices are the best single source of good public relations for the general contractor.

Let us enumerate and examine the manner in which the utilization of a safety program can be the means of establishing good public relations.

Good will, as the keystone of a good public relations program, begins at home. A firm's good reputation is limited only by

the extent to which it has earned the good will of its own employees. No better method of gaining employee good will is available than that of a sincere demonstrated effort to provide for the physical well being of the individual worker.

Philosophically, this point could be much enlarged by reference to the underlying basic and Christian principle with respect to recognition of the individual worker as a human being endowed with God-given rights and as one entitled to be treated in accordance with the dignity which is his inherent right as an individual creature of God.

So commence your good public relations program by initiating a safety movement through your own workers. Make full utilization of the innumerable tangible concrete devices with which you may legitimately impress your good interest upon your workers and also upon others who may be in a position to observe your operations. Let the public know that a safe job is under way.

Here in Chicago on one of the jobs done by the Henry Ericsson Company, a local firm, there was used a "Scotchlite" sign which conveyed the information that a safe job was in progress in a manner which made the sign visible day and night to thousands of persons. In reading a message such as this, the public cannot help but regard the contractor in a favorable light.

Make proper use of the countless excellent posters available through the National Safety Council. Plan your poster display with a proper eye to their public relations value as well as to their safety lessons. In this connection, four general rules recommended in the AGC Accident Prevention Manual are: 1. Select posters objectively. 2. Place posters strategically. 3. Display posters attractively. 4. Change posters frequently.

Get your safety message across on an individual basis. In this regard, exploit fully the use of safety instruction cards which may be placed in the hands of each worker. Properly handled, this particular method, utilizing as it does the sound psychology of establishing a definite means of personal relationship between the foreman and the workers directly in his charge, is hard to beat. The foreman, by handing these cards to the worker, is in an excellent position to impress upon him the importance which management and he, himself, places on the worker's welfare.

The employment of suggestion systems, in connection with accident prevention, offers another fine medium to obtain the good will of employees. However, suggestion systems here, as in other phases of management, must be administered properly or they may result in doing more harm than good. Accordingly, the following general conditions are to be observed:

1. Suitable and adequate recognition should be given workers who submit suggestions. 2. Worthwhile suggestions offered by workers should not be appropriated by foremen or others in positions of authority who take credit for them. 3. Facilitate the manner in which employees may make suggestions. 4. Provide for proper review of suggestions presented at regular intervals. 5. Acknowledge suggestions, and inform each person regarding the disposition of his suggestion. 6. Top management should periodically give individual recognition to workers who manifest their interest in a suggestion system.

Take full advantage of safety meetings to promote good will. This effort should be directed not only toward those who participate in such meetings, but it should also be aimed at others by an effective publicity approach.

Publicize to the greatest possible extent activities of this sort. Invite outsiders, including representatives of the press, to such meetings. Have a photographer on hand. Search out the dramatic elements of special news value, and play them up in your presentation to newsmen. In those situations where awards are made, provide for their public display in store windows, hotel lobbies, and similar places. Tie-in such displays with appropriate advertising on occasion.

The Pennsylvania Builders Chapter of the Associated General Contractors of America—the Chapter I serve as Executive Director—annually awards to successful participating members plaques emblematic of outstanding safety experience records achieved by their firms during the year.

In addition, the firm of H. B. Alexander and Son, Incorporated, of Harrisburg, Pennsylvania, has donated, in honor of its president, the H. B. Alexander Trophy which is awarded each year to the member firm enjoying the best safety record.

Presentation of these awards has now become a traditional part of our annual convention proceedings and I want to assure you that we possess no single facet of operation of better value from a public relations angle.

Practice safety in your organization and, then do yourself full justice in telling your story to the public. Do note hide your light under a bushel. Tell the world, and tell the world in a variety of ways:

1. Use the bulletin boards in your office and on your job sites to convey a message. 2. Let all your employees including your office force know about your safety programs. 3. Enlist the interest and cooperation of architects, engineers and sub-contractors in your safety campaign.

4. Talk to your suppliers, equipment manufacturers and distributors in terms of safety as applied to your jobs. 5. Let your customers know that a good safety record on your jobs enables you to construct more efficiently and more economically.

6. Promote participation on the part of your firm's principals in civic and public safety activities where opportunities may be developed to put across the story of your company's safety program.

The Associated General Contractors of America recognize and appreciate the public relations impact of a good safety program when it provides for a full fledged division of its national office to carry on its accident prevention functions.

Certainly, the many chapters and branches of the same association, carrying on extensive safety activities, are fully aware of the nature and worth of such endeavors from a public relations angle. An examination of the various newsletters, bulletins and magazines put out by these chapters and branches provides testimony to this statement.

Look at the work of these men: W. W. McLaughlin, Jr., of the Memphis AGC Chapter; Julian Capers of the Dallas AGC Chapter; Robert J. Hendershott of the AGC Chapter of Minnesota; Loy W. Duddleston of the Houston AGC Chapter; George H. Benish of the Milwaukee AGC Chapter; Ralph A. MacMullan of the Detroit AGC Chapter; Thurman C. Tejan of the Constructors Association of Western Pennsylvania, AGC.

This is to enumerate but a few, and there is being put into motion programs of similar nature in many other divisions of the Associated General Contractors organization. The various public displays made by these groups invariably feature safety elements.

In Harrisburg, Pennsylvania, two of my own chapter members, Ritter Brothers and H. B. Alexander & Son, Inc., donate a very sizable display space at the Central Pennsylvania Builders Show, to our chapter and this space has been well used to exploit our safety activities and accomplishments. Such exhibits have been viewed by crowds of approximately three hundred thousand people in what has been billed as the world's largest builders show.

7. Another way to translate safety practice into good public relations is to make evident that your concern for safety covers the general public as well as your own employees. Incidentally, such effort need not be an entirely selfless one; if your insurance program does not include coverage for liability for completed work, this caution becomes a must.

8. Quite often newspapers work up special display pages or sections which may combine news and advertising with respect to a particular completed construction project. General contractors are frequently solicited by newspapers, on such occasions, to buy space; however, too frequently, the general contractors regard such solicitations merely as another nibble at their profits.

Influenced by such feelings, and with jaundiced eye, they grudgingly acquiesce to taking space, but neglect to take advantage of an excellent opportunity to win good will by putting across a story on the firm's safety accomplishments on the job. Instead, such advertisements usually carry merely a bare statement complimenting the owner.

9. Enclosures of safety messages in the pay envelope, or imprinting safety suggestions on the envelope itself in a simple but effective way keep the subject in the minds of the workers. Use this method to point up the economic benefit to the worker with reference to safety practice as a causative factor.

10. When circumstances warrant, employ one or several of the informational media:

newspapers, radio, direct mail, display signs, pay envelope safety reminders and the like.

In summary, plan your safety program properly with top management taking an aggressive, sincere and active lead. Determine the over-all policies to be followed, and arrange for the initiation of required procedures to properly effectuate the safety plan, and do not fail to make provision for adequate follow-up.

Such an approach to safety will guarantee insurance against accidents within the range of controllable limits. I quote the familiar National Safety Council admonition, "accidents do not happen. They are caused." When all reasonable precautions are exercised, accidents will be measured in terms of the irreducible minimum.

It would not be appropriate to close such a discussion without making reference to the costs involved in making safety into good public relations for your firm. Apropos of the entire subject of costs, I should like to refer you to my earlier statement that lack of safety will cost almost a billion dollars this year, and, then, I should like you to make your own determination.

It may well be that safety, as an integral part of your public relations, does not cost you anything; rather it will be found that safety, in being good public relations, will pay you.

Ned H. Dearborn, President of the National Safety Council, made this observation, in the February 1950 issue of the *National Safety News*, regarding a statement of philosophy expressed by a professional safety man:

"I know we save some lives, prevent some property damage. Just how many and how much we don't know. But this is, to me, a minor part of the value of the work of the safety movement.

"The one tremendously important fact about our work is that it offers one of the best opportunities in our civilization for men and women to apply in practical matters the Christian principles of living in a cooperative effort to help each other. I think that this lesson of Christian living is the most important lesson our world has to learn. If we don't learn it, we're going to destroy ourselves."

In this atomic age—in these days of the H-bomb, it is refreshing to realize that there are also constructive factors at work—forces which have as their aim the preservation rather than the destruction of life and limb.

The practice of safety, based on Christian principles, is our obligation, and no one has yet established that such practice is not good public relations—not good business.

Job Placement Physical Examinations

(A Panel Discussion)

Discussion Leader: J. A. De Lucca, Jr., Division Superintendent, Construction Division, E. I. du Pont de Nemours & Co., Wilmington, Del.

Participants:

S. K. Eastwood, Representative of Office of Vice-President, Erecting Dept., American Bridge Co., Pittsburgh, Pa.

Dr. Harold L. Meyer, Medical Director, Illinois Bell Telephone Co., Chicago.

R. E. McFarland, Secretary-Treasurer, Construction and General Laborers' Union, Local 341, Anchorage, Alaska.

Allen Bulley, Bulley and Andrews, Chicago.

Morris E. DeWitt, Porter DeWitt Construction Co., Poplar Bluff, Mo.

James D. Hoag, Safety Engineer, Atomic Energy Commission, Albuquerque, N. M.

Chairman De Lucca: The benefits of pre-employment examinations to insure physical fitness for the job are well known. But the system is also subject to certain abuses. The various aspects of the subject will be presented by the six members of our panel.

Dr. Meyer: I was not aware that this subject was controversial. As a doctor, I feel that these examinations are essential. We have many people in hazardous jobs and they must be able to work without causing injury to themselves or others.

Doctors are between workers and management. The worker is entitled to work at jobs for which he is physically able. Management is in business to make money and is entitled to know what it is getting when a man is hired. The worker must also be protected against employment on jobs which might aggravate his disability or subject him to increased accident risk.

Greater emphasis should be placed on the worker's abilities than on his disabilities. We should stress the positive rather than the negative.

We must match the demands of the job with the individual's capacities. The physician must know both the man and the job—the industrial environment and its hazards.

In examining the job applicant, the physician must estimate:

What can the employee do?
How much can he do it?
How long can he do it?

Is the worker to be hired for temporary or permanent, regular or intermittent work? For a lifetime job requirements will naturally be more exacting.

Mr. McFarland: Speaking as a representative of organized labor, I am in favor of preplacement physical examinations, but many members are not. We must sell them. They have seen the blackball used too often.

Misunderstandings are particularly likely to occur on construction jobs. Often the introduction of physical examinations comes as an edict, and labor doesn't like edicts.

Some companies seem to think that the safety program begins and ends with physical examinations.

In the ranks of labor are many men who have been injured in industrial accidents. They are somebody's problem—but whose? Organized labor's, industry's, society's? They are everybody's, and employers should be in their pitching with organized labor to see they are taken care of.

Mr. De Witt: Before a construction job is finished, the men have actually had physical examinations. They have shown whether they are fit or unfit, and it is much better to find it out before they start on the job.

Physical condition is important in all production work and physical check-ups are of value to employee and his family, to the employer and to society.

Not all of the opposition to physical examinations comes from organized labor. Many employers are not in favor of them.

Chairman De Luca: Labor will not be better informed until management lets them in on its plans and proves its sincerity.

Mr. Bulley: I am heartily in favor of physical examinations since our insurance rates are based on accident experience and any improvement reduces costs.

However, physical examinations are not the way to judge employees. Among our bricklayers, for example, are many who have been with the company for many years. They are getting on in years. They are good workers, but according to medical standards they are poor risks. What shall we do with them?

We have a local welfare fund in addition to compensation insurance. Contractors should get together with unions to support pre-employment examinations.

Mr. De Luca: Let no one believe that management wants examinations to keep men from work. They are merely to exclude the dangerous ones. Screening is for placement, not exclusion. Other agencies can and should be used for screening—the personnel department, the gang foreman all have a part in placing. The process doesn't end with the doctor.

Mr. Eastwood: My interest in examinations is increased by my business—steel erection. It is far down the list among hazardous industries. While progress has been made during the past ten years, the severity rate is still high.

When physical examinations were introduced, most of the men were willing. Recently the trend has been the other way. Now about half the men take examinations.

Generally, it is the physically fit men who want to erect steel; rejections have averaged only about 1 per cent.

Physical defects do not necessarily cause accidents. Fit men take chances.

When defects exist, recovery from injury is often slower and many a man is unable to return to his trade. Frequently it is the men who won't take examinations who prove to be unfit.

Give the man a chance to correct his defects and qualify for the job. If a man knows defects he can often "favor" himself and avoid accidents and unnecessary strain. It permits supervisors to put men in less hazardous positions.

Examinations bring possibility of reduced severity and compensation through shortened disability, also avoids the physical and mental misery of the man who cannot return to his trade.

MR. HOAG: I favor pre-employment examinations for equipment operators, laborers in heavy work, and men working at elevated locations. Also important is a program of education to make workers better informed about physical examinations.

Question: What attempts have been made to sell examinations to the workers?

MR. EASTWOOD: We had some experience when starting a project employing 600 to 1,000 structural steel workers. At first the unions were willing to go along with the program; then they changed their minds. They charged discrimination, claiming that we wanted to bring in our own men instead of employing local workers. Rules should be established to prevent discrimination and we hope to get everybody to play fair.

An example of the results of lack of examinations—one man with a double hernia was employed at handling material. He was struck by a timber and his intestines were squeezed between the truss and pelvis. Peritonitis developed and he's gone.

Question: To what extent are psychological tests used to detect neurotics and other undesirables?

DR. MAYER: A few companies employ psychologists, psychiatrists. However, I can speak only for the telephone industry. The staff of our employment department has been trained in the technique of interviewing and study of histories of applicants to detect psychosomatics. Questionnaires can often reveal backgrounds and attitudes.

MR. DE LUCA: I would not want to be responsible for blocking progress, as a representative of either management or labor.

Accident Prevention Made Easy

By HOWARD J. SCHULTE
Safety Director, Corps of Engineers, K. C. Dist., Kansas City, Mo.

Most safety engineers are convinced that there is no way to make accident prevention easy. Certainly, there is good cause for this conviction on the part of the safety engineer. Safety engineering is a comparatively new profession. Like all new professions it has taken a pioneering spirit, a thick skin and, nearly if not in fact, a martyr-like devotion to the cause on the part of those, especially the old-timers who have contributed so much to it.

I have been in accident prevention work only a few years. I know from personal experience that the work today is trying, or to use a plain word, "rough"; it must have been much worse in the earlier days. I personally feel that we here, and the nation as a whole, owe a real debt of gratitude to the old-timers who pioneered safety engineering. They contributed substantially all of the basic standards for accident prevention. This contribution was made in spite of the belittlement and ridicule and, in a great many instances at a sacrifice in monetary recognition.

I would like to relate some of my personal experiences and conceptions of safety engineering prior to my entering the field. I do not relate these things because I feel that in themselves they are important, but rather that they are perhaps typical of that which is going on in the minds of far too many misinformed people.

I was engaged in heavy construction and engineering work in various parts of the country. At that time I thought the safety engineer was just another efficiency expert. I thought that the safety man, if he had to be tolerated, should personally do all the work involved; that he should be kept in the background and, certainly in a position subordinate to the rest of the force.

I worked a short time for a contractor. I was convinced that he, the contractor, had ample protection under his insurance and, as a consequence, did not need advice from the safety people. I also was convinced that the contractor knew from past experience what his insurance costs were and that these were included in his bid; he couldn't lose, so why should we get excited about a few hazards as long as we met our progress schedules. I later worked as a construction inspector and, accident prevention aside from the humanitarian aspect, seemed even sillier to me. I felt that I was a construction man, and as such my duty included only a concern with the completed structure, to assure that it was constructed strictly in accordance with the plans and specifications.

Naturally, I felt sorry for the injured. I thought it rough luck when someone got hurt; however, the word luck and all it implies was exactly how I mentally accounted for injuries. I reasoned that a man had to work and, on heavy construction there had always been and always would be accidents, especially if you wanted to complete the job in a reasonable time and at a reasonable cost. I had a number of good sound arguments, so I thought, stored back in my mind that would really set the safety man back on his heels. I thought "If these theorists know so much why aren't they in the contracting business?"

Perhaps these thoughts that I have related as being formerly harbored in my mind are not actually typical. Perhaps I was slower to "catch on" than others. I certainly hope that is the case, but I doubt it. In any event, if we analyze more closely than I was able to do, we find that these seemingly logical arguments against, or at least compromising an adequate and effective accident prevention program, are entirely unsound and even foolish. Many successes in life have been made in spite of the probabilities against them; many contractors have made a success in spite of inefficiencies. There are in my opinion some persons who are born lucky, as controversial as that statement may be. However, the man who plays the game in a manner as to make the probabilities work for him may be the last winner—but nevertheless *the* winner.

Safety engineers are sometimes prone to doubt their convictions when they encounter opposition from someone possessing a long and diversified experience record. Remember, "good judgment" comes from experience, but experiences comes from "bad judgment"—how can one tell which of the cycles the individual is in? Furthermore, very much of that which we call experience consists of exposure only. Two people may drive from Chicago to Kansas City—the record would show identical experiences. However, one saw only the centerline of the highway and possibly worried about the problems he expected to encounter upon arrival at his destination. The other may have been mentally alert to the scenery; the towns; farm lands; advertising; and, in general, he may have pondered over or associated these things with his business and the economic outlook. Have the experiences actually been the same? The record would show them so.

By nature we human beings are biased; we are prejudiced; we are filled with idiosyncracies; we lie to ourselves; and we lie that we don't lie to ourselves. Many of us fall into the category of knowing the price of everything and the value of nothing—we usually find what we want to find. We may have a friend who we think is the finest person in the world—he just doesn't have faults. But, if we happen to have a serious disagreement with him, isn't it surprising how we suddenly find so many people who also have "found him out"?

Therefore, to make accident prevention easy it is necessary for the top man of the firm to mentally grab hold of himself and to conscientiously vow that he will make an honest study of the business of accident

prevention. He should say to himself, "I'm going to forget what I thought of some safety man and his silly act; I'm going to quit patting myself on the back and saying I've done pretty well thus far in life; I'm going to take an honest and open-minded inventory of this accident prevention business to determine whether or not I can increase the efficiency of my firm."

Now, when we do this we are fighting against natural human behavior. Man resents changes. You ask an individual why he does a job a certain way and he will often have but one reason such as, "well, we have always done it this way and it worked." The Model "T" worked didn't it?

Whether you be foreman, superintendent, or owner of a construction firm, accident prevention on work under you will only be as effective as your convictions as to the merits of accident prevention are profound. Some of us are so unrealistic in our thinking that we can even put an accident program on paper, then look out the window and say, "well that takes care of my accident prevention problems."

I think money is wasted on an accident prevention program unless the top people actually get down to honest and realistic thinking about accident prevention. Some construction firms get an idea here and there about accident prevention and they think "we ought to do something." Then, they search around and find a handy-man and call him their "safety engineer." That takes care of their safety problem.

The boss then can say over a few cocktails, "Yes sir, we believe in safety—why say, I've got a full-time safety engineer." He's full-time except when he's going after the mail or driving over to deliver a message to the superintendent, preparing insurance papers, or doing other menial or administrative tasks. I've talked with contractors who tell me, "well now every one of my men are safety minded, we sure don't want accidents." It's like a man saying "my door is always open to every man in my organization, I have time to talk to them anytime." But, let such a man keep a record of the men who have come in to talk, and he will likely find he's kidding himself just as surely as he is if he thinks all of his employees are working voluntarily and intelligently to prevent accidents.

Men do not come in to see the boss, the boss goes to the man. Accident prevention, that is adequate efficient and effective accident prevention, does not start with the men—it must start with the boss. How can a man say that the men in the organization are all safety-minded when he himself obviously does not know what a safety program should include?

Now, that statement may sound radical, but it's truer than most of us like to admit. As an example, we require our contractors to submit a safety program covering the work provided for under the contract prior to commencing the work. If you were to read some of these programs as submitted, you would not doubt my statement. There are, of course, many contractors who are doing a commendable job in accident prevention.

In one of our districts the contractor submitted his insurance policy—he thought that was his safety program. In many cases the programs submitted contain elaboration on how many first-aid kits will be on hand; what arrangement have been made to obtain ambulance services and doctor services. But nothing it said about indoctrination of new employees; assignment of safety responsibilities; safety meetings; safety posters, etc. In other words, the program covers the treatment of the injured almost up to and including the disposal of the dead, but it fails to present a workable plan for the prevention of accidents.

It is very obvious that the firm that prepares and submits such a program does not know what an accident prevention program consists of. In some cases the transmittal letter will read, "There is transmitted our safety program which has been prepared by our safety department." This, to me, indicates two things—the so-called safety department does not know what should be included in a safety program and, the boss doesn't know either. Also, that the boss has such a small amount of confidence in his safety department that he states "prepared by our safety department." Then, if the program is as bad as it might be, the boss can blame it on his scapegoat. If he knew it was good, he'd take the credit for it.

Of course I mean this latter statement jokingly, although there may be a bit of truth in it. However, I again say with every ounce of sincerity I can muster, that the most essential element to making accident prevention easy, is that the top man take time and effort to honestly study his problem.

He must learn what an accident prevention program is, what *it is worth to him*, how far he should go in developing the program. An accident prevention program to be understood requires study, and it requires honesty in thinking and, of course honesty in thinking means honest records to support honest thinking. In the first place an accident prevention program is designed to keep something from happening. If you have a program such as was issued for this Congress and the meetings are successfully carried out, there is no question but that the program was a tangible success—the schedules were met. If you set out to dig a ditch, when it is completed you can see your accomplishment. An accident prevention program is successful in that which does not happen.

It's hard to see profit in a zero. Some firms do not consider that they have had an accident if they can keep it off the record, or if there is no insurance claim. The law of probability tells us that there are many costly incidents on a job to every injury. If a man runs a nail in his foot there is a good indication that many men for days have been walking slowly and carefully to avoid all those nails in boards cluttered about the job. If a man falls over certain debris and sprains his ankle, how much lost time have you had prior to this injury as a result of men walking around or climbing over debris?

If a man suffers an eye injury while using an emery wheel and while not wearing goggles, is it logical to believe that incident, coming to your attention because of the injury, was the first time the wheel had been used by anyone not equipped with goggles—is it not logical to believe that costly parts have been ruined when the operator with squint eyes failed to see clearly the extent of the grinding; was not time wasted when operators discontinued grinding to get someone else to discontinue work to remove a speck from their eyes?

When an old boom fails, is it not logical to believe that reliable and competent workmen have quit your job because they were afraid to work around that shaky old boom? When you have had a lost time injury on the job, must you not in addition to insurance cost, count the time men spent on the job in excitement or commotion after the accident while not producing and on your payroll; didn't someone have to leave his productive work on your job to take the injured to the doctor; is it not costly and burdensome to your organization to do the paper work required after an accident?

If the conditions are bad, especially after an accident occurs, good men may resign. The injured may have been skilled and therefore you must train someone else. These are only a few of the losses from accidents that sometimes are overlooked. It requires thinking and real study to get down to the merits of an effective accident prevention program.

We often refer to "accident cost," but actually an accident is a loss. A cost is something received for a sum of money generally, while no one receives anything from an accident—it is an out and out loss. Bear in mind, and I'm sure it has been said before by other speakers, that accidents are only the end product of bad conditions all the way around. The accident in itself many times is relatively unimportant, the important thing being that which is reflected thereby. If the work is done properly and efficiently, accident prevention will necessarily be taken care of. Conversely, if the accident rate is high, should not the top man begin to be concerned about the over-all management of his work—his money?

If your supervisor fails to plan his work, accidents are more likely to occur. If he fails to plan his work the production will suffer. All of this takes study for appreciation and, appreciation of what can be saved or earned from an adequate accident prevention program is required to fire the conviction on the part of the boss to the point necessary to make accident prevention easy.

Remember this, if you have a safety man in your organization, you only have him because he needs a job. Since he needs that job he cannot afford to buck the whole organization, jeopardize his welfare, just in order to force safety onto you, his employer, or onto other top men of your firm. He can only recommend to management—I know some of you are thinking, the workmen cause or have the accidents, not the top men and that I have failed to include this group. That is exactly right, but why

put salve on your foot if your head is hurt. Safety must start at the top; it must be fired with the action that it will surely get if the top man thoroughly accepts and understands the true merits of accident prevention.

After the top man has convinced himself of the merits of accident prevention, he will see to it that the supervisors on down the line give adequate thought to the problem with a minimum of guidance. Appreciation of an accident prevention program, and I do not mean the usual run of lip service, but a realistic and intelligent conviction about accident prevention, can be brought about only through real thinking on the part of the individual.

Most of us do not like to think. Therefore the boss, unless otherwise forced by his insurance losses, etc., must, as I've stated before, voluntarily grab himself by the seat of the pants and force himself to think about accident prevention—to learn of the losses, hidden as many of them are, that he is suffering by the lack of an adequate accident prevention program.

Some of you may use the term education to cover all of this. I haven't used this term as so many think of education as something someone will give us—a pill of wisdom. Knowledge is gained by guidance, of course, but it must be accepted in the mind of the possessor. I heard a very prominent man a short time ago state that you could not convince anyone with facts. A few people in the audience were shocked by the statement because they failed to understand it. Actually the philosophy is as old as time—man only learns that which he mentally accepts.

All of the foregoing in a nutshell simply means that the top man must question his supervisors; his safety man; and his bookkeeper to obtain all the facts he can about his accident losses. Then he must ponder over and carefully analyze these data in a cold, realistic manner. When the boss is fired with an honest conviction about accident losses, he will guide or force his organization into the same kind of thinking.

A real convert will not say, all of my people are safety-minded. He will say, "I'm doing this and that to keep my organization on the beam the best I can"—he will offer something constructive. A man has not given much thought to accident prevention if he writes a program and thinks that his endorsement is all that is needed. You cannot simply explain a safety regulation and think that men will follow it.

In many instances accident prevention programs of firms are analogous to the father who bemoans that he gave his son everything and the boy just hasn't made good. He likely refers to his money, but did he give his time, personal guidance and companionship. The boss may spend his money on accident prevention and many firms do just that—spend their money. But, if they want to make a solid investment of their money in accident prevention they must give their time toward it. The most wasteful slogan in the world is likely "Advertising p[illegible]here are millions wasted on advertising because someone failed to plan—it pays only when properly handled.

If the boss inspects a job with his safety man, this inspection from purely the psychological import is worth more than a half dozen inspections made by the safety man alone. Hiring a safety engineer and signing a safety program that he may develop is money wasted even if you have the best safety engineer in the country if you, the boss, fail to give time and support to the program. If the boss is convinced that a badly constructed scaffold indicates badly constructed concrete forms; that bad housekeeping on the job indicates sloppy thinking on the part of the supervisor, then and not until then, will accident prevention be made easy.

In conclusion, I want to say again if a contractor studies his accident problems he will convincingly learn that accident prevention is simply doing the job in the most efficient manner. It takes an honest study but if he will make the effort it will make him money. If the contractor convinces himself profoundly that accidents are caused by bad management throughout the job, which is the actual truth, he will be fired with a conviction wherein he will fire any man in his organization who does not make a sincere effort to eliminate accidents. Accident prevention can be made easy if the boss sincerely wants it.

One Hundred Ways to Save a Buck

By JOHN A. VOLPE
President & Treasurer, Volpe Construction Co., Malden, Mass.

In my opinion, procuring and retaining the interest and complete cooperation of top management is one of the most important and yet perhaps the most difficult phase of our over-all efforts in accident prevention. Top management must be sold on the fact that a well-rounded Safety Program will reduce costs.

We should appeal to the boss' sense of fair play and responsibility to preserve human life. Each accident causes anguish and suffering not only to the injured, but to his family as well. The boss should be made to accept the fact that a good program would minimize this suffering. Although safety begins as a humane problem, its result is economic as far as the contractor is concerned. It sometimes becomes necessary to substitute dollars and cents for emotions to win management over to the side of safety.

On the whole, materials costs, procurement and methods of contractors are similar. The one variable, which can be most easily controlled by the individual contractor is the cost of insurance. Management must be shown that sales can be won or lost as a result of insurance costs, which are based on the accident experience. On a large job in the Boston area, the difference in the insurance premium on estimated payroll between the low bidder and the fourth bidder was $[illegible]—this is the difference between a 30 per cent credit and a 27 per cent charge. On insurance bids and cost plus work, insurance costs are a major factor when closely qualified contractors are being considered.

You have heard of the hidden or incidental indirect costs tie-in with the direct insurance costs. These indirect costs amount to 3 to 4 times the direct costs. These hidden costs are built up to a staggering sum through loss of production, time required to replace personnel, loss of expensive equipment involved in so-called "minor accidents," loss of supervisory time to investigate accidents and make adjustments, loss of employee time and efficiency during and after a serious accident and so on down a long list.

Either curiosity or the desire to help causes almost everyone in the immediate vicinity of an accident to rush to the scene. Almost no one goes back to work until the injured man is carried off, or goes back to the job. When the spectators do go back to work, they may be so emotionally affected that they cannot produce properly for some time. A recent survey by a large firm revealed that from 20 to 30 minutes of productive time was lost with even the slightest accident. These are some of the costs that go unnoticed and are never found when the annual profit is arrived at.

Construction rates are based on the statewide experience of all contractors. If all contractors improved their accident records, the over-all rates would go down state-wide. This may seem an insurmountable job, but look how the steel erectors in the midwest lowered their insurance rates when they instituted an effective accident prevention campaign.

Management must be convinced that to begin a program is only half the job. Administration of the program is vital if any progress is to be made. The program must be followed up and progress checked relentlessly in order that employees find no slackening or loss of interest by management.

Prepare an interesting letter to be given to each new employee when he is hired so that he knows immediately that you have a definite safety program and are interested in his safety.

Distribute to each employee on your projects a monthly letter telling him of the progress being made in Accident Prevention; list any lost time accidents that have occurred and in general work to get his cooperation with supervisors so that they and all concerned may enjoy a good record.

Often a new job takes us into unfamiliar locations where employees and conditions must be taken at face value. Many of us experienced hostility from the people of various towns and sections. We should never lose sight of the public relations angle and the good to be gained by informing strangers

of the regard we hold for the safety of others. This is probably the easiest method to win over public approval and acceptance.

Every sort of device including pins, emblems, posters, signs, news pictures, etc., should be utilized in the publicizing of your safety efforts. In the case of a large project, use a National Safety Council Jumbo Poster. One of the first things sent to all of our projects, even before equipment is sent, is a National Safety Council Green Cross Flag.

In awarding pins or emblems for outstanding safety records, avoid using the "Tin Badge" variety. Spend some time on the design of *these, and, a little money,* too. After all, if a man has turned in an outstanding money saving accident record for us, the least we owe him is a pin he can feel proud to wear.

Once again, join the various national trade organizations. Become associated with groups working for the same goal in safety as yourselves. Compete in the National Safety Contests which they hold for various types of contractors. They come up with good ideas, which you can work into your own safety programs.

Have delievered to each of your employees a monthly booklet or magazine which further emphasizes your safety program. We have *The Safe Worker,* a monthly booklet, published by the National Safety Council, delivered to each employee every month.

When you suffer a serious accident on one of your jobs, don't hide it! Write it up in an impersonal manner and post it on your jobs in order that your men can profit by it and avoid a similar mishap. Point out the causes and the means and ways of correcting such a situation.

Make it difficult for accidents to happen, but if they do occur, make it difficult for them to go unnoticed. Play up every phase of your safety program. Keep it before your employees and the public. When your accident record is good, publicize it and when it starts going badly, let your employees know it. Strive to gain their cooperation in bettering it. Most of us will prod our men when things aren't going well, but let's not forget to pat them on the back when things are looking up.

It is essential that we attempt not to so standardize our safety operations that they supposedly run automatically. While we can go ahead and adopt safety programs, either our own or those of a servicing company, we must realize that a general program does not always conform easily to our particular operations. For a successful job safety program, you must "tailor it" so that it applies to the particular job under construction.

Before actual operations are begun, your safety work should be assigned to capable personnel. You must impress safety on your personnel from the very beginning of the job. Be sure to impress upon the employees that safety is everyone's job and everyone's responsibility on the job. Encourage them to make suggestions and to assume job safety as a personal problem.

To avoid "post mortems" and expensive delays, plan each operation before it starts and plan it safely. *To overcome the feeling* that little can be done in accident prevention on the job, carry competition in accident records between jobs.

A weekly report, signed by your superintendents, should be submitted to you. This need not be a lengthy report but should summarize just what has been done safety-wise in all work classifications. The current accident record for the week should also be included.

All serious accidents on the job should be investigated by the foreman involved and a report submitted by him. The report should cover the cause of the accident, how it occurred and, most important, what he has done to prevent a re-occurrence.

Your key personnel should be required to set the example for the other employees and expect the employees to do likewise. Procure for each superintendent and foreman a copy of the *AGC Manual of Accident Prevention.* You will find it a worthwhile investment.

Set up a system of awards to key personnel which is both financially profitable to the individual but which also gives him a feeling of satisfaction of winning something. All of us like to be winners and it is no different in a safety contest.

On our average operations a contest is developed among the various trade groups on each project. The contest among these groups is instituted so that each month the foreman of the grade group that develops the best record is given an award of $10.00. This, of course, is open to each job.

All of the awards are distributed at a monthly dinner safety meeting to which all of the superintendents and foremen are invited with the "boss" making the presentations. Wherever possible, this is publicized in the press.

A good speaker or a film is shown at each of these meetings and a great deal of good will is built up among your supervisory force. This pays off not only safety-wise but in good morale.

An important phase in making safe workers is the indoctrination of new employees, particularly in an industry that is almost constantly employing new personnel. Each man should be questioned as to his previous work record and wherever possible placed on an operation with which he is familiar. He should be made familiar with the general safety policies and the necessity for good housekeeping on the job. He should be warned to report even the smallest injury immediately for first aid treatment.

He should be reminded that all unsafe conditions around the area he is working in, which he cannot personally correct, should be reported to his foreman so that they can be corrected. He should be told of the firm's participation in accident prevention contests.

Finally, the employee should be made to realize that he must assume personal responsibility for his own safety and to take pride in the safety record being established on the job.

There are many insurance carriers who provide facilities to contractors in connection with their accident prevention work.

The insurance carried should be asked for a quarterly accident statement broken down by jobs and foremen, listing all accidents and indicating the compensation, and medical costs. This would serve as a complete digest of the quarterly accident picture which could be reviewed by management in a few minutes and clearly show where additional safety effort was required.

A competent sales production representative as well as a safety engineer should contact the chief executive periodically in order that he be kept up to date in regard to his insurance costs and needs.

Each year these insurance representatives should sit down with management when the new insurance rates are promulgated. The record for the past year should be reviewed and the causes for the present insurance charge or credit explained in detail. In no better way could management be shown where their accident prevention efforts are lacking or inadequate.

The engineering department of the insurance company should be utilized in an advisory capacity in the formulation and administration of any safety program. Their experience in this field is wide and varied and can help in eliminating or avoiding the common pitfalls and breakdowns of unsuccessful programs.

The carriers' safety engineers should inspect jobs periodically according to the job's size. In this way they can both check on physical condition of the job and also rate your jobs in comparison with the many other jobs which they service.

When particularly hazardous or unusual operations are encountered, the carrier's engineering department will work with you to advise and suggest safety measures to be taken to avoid serious mishap.

In addition to having a wealth of safety material and information at their disposal, the insurance safety engineers can often give you a "fresh" viewpoint on out-dated methods which you have been using for years. Their views are not clouded by too close an association with your company.

Although the insurance carrier has considerable material and personnel on hand to aid you in reducing accident costs, there often is some laxity in forwarding this help to the contractor. To avoid such a situation the contractor should inform the carrier that he wishes to avail himself of all the service that the carrier has to offer, to help him in his efforts in accident prevention.

Many small accidents can become serious unless they receive proper attention. The maintenance of adequate first aid facilities is a must on every job and the following points are suggested:

Although our efforts to prevent accidents should not slacken, recognition should be given to the necessity for immediate attention to injuries. When first aid facilities are readily available, there is less temptation to tell a man to go back to work and let a wound go until quitting time.

It should be impressed upon all employees that cuts and punctures treated immediately, are not as apt to become infected.

More and more contractors are finding out that where the size of a job warrants it, a certified first aid man can save much time and money. Your insurance carrier stands ready to help you establish adequate first aid facilities. The carrier will set up and supply your station and might also procure a qualified first aid attendant or nurse.

It must be impressed upon employees to refrain from administering to the injured when they are not qualified. You can receive help from your local Red Cross Chapter which has organized first aid instruction classes. It would be worthwhile to send some of your permanent employees to these classes to have at least one certified first aid man on each of your jobs.

First aid supplies should be checked and maintained on each job whether there is a first aid attendant or not. It is too late to order supplies after an injury has occurred. Here again, both your carrier and state agencies have prescribed regulations governing first aid facilities.

For the new job, the most important point to be considered are the operations to be included in the job's progress. Check job plans for particularly hazardous operations, blasting, underpinning, shoveling, etc., which may be necessary. Try to evaluate their effect on surrounding or adjoining structures or properties.

The job site itself may present a possible source of property damage loss due to poor location in reference to abutting or adjoining properties or structures. Such locations may require the contractor to work in "close quarters." Exposures may be hidden as well as visible in the form of utility and service lines cutting through the site.

The extensive use of reinforced concrete requires great amounts of wooden forms, panels, bracing and tarpaulins and other combustible materials, all of which create a potential fire hazard. During winter months there is the added exposure of salamanders and stoves, both in your shanties and those of subcontractors. Close supervision of these conditions, is necessary to avoid the beginning of an expensive job fire. In addition, construction job fires often go unchecked because water lines are not carried up with structures and are inadequate as no alarm system is in use.

Every precaution should be taken to protect the safety and property of the public. Adequate "warning" signs, barricades and fences should be constructed to protect the general public as well as the numerous and unavoidable "Sidewalk Superintendents." In addition to the general public, there are also the "small fry" to think of and an effort should be made to eliminate the "attractive nuisances" on the job which have caused serious injury and involved large settlements each year by contractor's carriers.

In the case of large jobs, consider the huge amounts of material and heavy equipment which will be moved in and out of your job site. This involves a traffic problem which may interfere with or disrupt normal traffic in the area. Consideration should be given to routing vehicles in and around the job site and the possible need for uniformed police to direct operations.

Some of you may not know that your coverage for property damage and public liability is rated by your experience just as your compensation coverage. The better the job you do in property damage prevention, the lower your coverage rates will be.

Examine your bid price to make sure that you haven't omitted expensive precautionary methods which would be necessary if hazardous operations are present in the specifications. Don't put yourself in the position where inadequate or half-safe measures will be necessary because your price was too low.

Housekeeping will do much to eliminate the deep mystery of "material shrinkage." Constant clean-up will generally result in your knowing where every stick of lumber is on your job site.

Good housekeeping will lend itself to a smooth flow of material from one section of the job to another. A clean job leaves no room for unused material to be buried until it is needed, which then requires twice as many laborers to salvage it.

If a quick housekeeping survey of your job is made daily, it is almost unbelievable how many other conditions can be noted. On one particular job a labor foreman noted the following conditions in just 15 minutes while inspecting for housekeeping: uncovered and unprotected tile; uncovered, open storage of cement; fuel drum leaking on tarpaulins. Any one of these conditions could have developed into a loss far greater than the salary of the foreman for one-quarter of an hour.

You must remember that a clean-up crew can't possibly take care of all the housekeeping. It's up to each man on the job to do his share, every hour of every shift.

While safety meetings are necessary there is another type of meeting which is extremely effective on the job. They are called "Tool Box" meetings and are usually called by the foreman for his gang for a few minutes when the day's work begins. He can spend five or ten minutes with his group in the morning highlighting some particular hazard to be encountered during the day of some general hazard of the job. This type of meeting can be held once a week in addition to the regular monthly meeting. The few minutes pays great dividends in accident prevention.

It is generally known that the greater percentage of accidents are caused through unsafe acts of employees rather than unsafe conditions. This allows us to concentrate our efforts where they are needed—on employees! Accident prevention, for the most part revolves around a personnel problem and it becomes the responsibility of the foremen to help overcome it.

Foremen are more closely associated with employees than anyone else and are in a better position to know them and deal with them. Foremen should be impressed with this responsibility and steps taken to help them to help their gang work safely. In this connection we send to each foreman monthly, one of a series of 12 pamphlets entitled *Safety in Foremanship*. These pamphlets which are published by the National Safety Council together with a letter on safety are mailed to the foremen at their homes.

The care, use, and maintenance of equipment and machinery to be used on the job must be discussed with the foreman and all information passed along by them. The hazards involved in the use and presence of the various pieces of equipment should be made known to all personnel and appropriate signs posted to warn of particular dangers. Employees should be instructed in the use of any new or unusual equipment or tools before they are allowed to operate them.

While it would appear that excavation operations are well regulated and the dangers known, still, each year an unnecessary number of fatalities occur in connection with excavation operations. The rules for shoring and the stay-bracing of unstable material should be enforced and no deviation allowed. Adequate barricading and lighting must be maintained for the protection of the public as well as the employees.

Concreting operations require planning to insure smooth progress as well as safe completion. Plan routing of buggies, lay-out of runs, operation of bucket and dump, set-up and moving of chutes and inspection of forms while pour is being made. Consideration of concreting operations from a safety angle may save a man his life or save a form from letting go. Either situation would obliterate any saving in the per yard cost of pouring concrete which might be made by substituting speed for safety.

Strange as it seems, carpenters more often than not, in building stagings for their own work, are not as careful as the average construction employee when he builds a staging for others to use. Continual checking on stagings, particularly those erected on filled ground, is necessary to avoid serious falls. Framing operations when well planned can be performed both safely and efficiently. Setting up a mill is an operation which requires good planning by experienced personnel.

Masonry operations present hazards which can be overcome by proper supervision. Insist on the use of goggles in the cutting of tile and blocks with masonry saws. See that the area under the person operating the saw is clean and dry. Watch the overloading of stagings. See that ladders are well made and properly fastened.

Encourage a weekly inspection of your project by a three-man inspection party. My firm requires a weekly report from such a team signed by the superintendent. The team is made up of a representative of the supervisory force and two mechanics or one mechanic and one laborer. The personnel of the inspection team is changed each week, and the men are required to sign a report indicating the hazards found together with any constructive criticism they have to offer. These reports are reviewed at the main office and all superintendents advised of pertinent comments, to the end that all hazards are removed insofar as possible.

In summary, publicize your safety program so that it reaches both your key personnel, your employees and the public; de-

velop a safety program tailored to each job; create an incentive among your key personnel by providing cash awards on a competitive basis; be certain that new employees particularly, are well indoctrinated in their duties; enlist the support and cooperation of your insurance carrier, they can be of great help—use them; maintain adequate first aid facilities, they will save time, money and pain; remember that the safety of the public and property damage prevention are important adjuncts of a successful program; promote good housekeeping, not once a month or once a week, but every day by every workman; see that your foreman and employees carry out safety in the actual job operations not spasmodically, but day in and day out; and finally see to it that the "boss" maintains an active interest in the safety program. Be sure that he personally makes the safety awards and is cognizant of the savings he is effecting.

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Current Safety Topics in the

ELECTRICAL EQUIPMENT INDUSTRY

As presented in the Sessions of the Electrical Equipment Section at the 1951 National Safety Congress

Volume 9
Transactions
39th National Safety Congress

NATIONAL SAFETY COUNCIL
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New Ideas...

If safety is to keep pace with today's rapidly advancing technology, we must continually have "new ideas."

Each year, at the National Safety Congress, the ideas and experiences of many of the nation's top safety men are presented in the various sessions. Many of these ideas, devices and methods, first presented at a Congress session, later become generally accepted within their fields.

In order to present this information conveniently and at small cost, the Congress Transactions are published in volumes, one for each Section or Division, along with a General Sessions and Detailed Index to all volumes. The 34 volumes of the 1951 Congress Transactions are listed on the last page of this volume.

Safety directors everywhere have found the Congress Transactions a useful aid in their accident prevention programs. In industry, for example, their judicious distribution to key personnel in management and supervision has proved to be of invaluable service.

In preparing these Transactions, the proceedings of the Congress have been condensed and edited for reference purposes. Complete original manuscripts, with any charts or illustrations which were used, are available in National Safety Council files. Views expressed at the Congress or in this record are those of the Congress participants and are not necessarily those of the National Safety Council.

THE ELECTRICAL EQUIPMENT SECTION

This volume is a record of the sessions held at the 1951 National Safety Congress by the Electrical Equipment Section. The conduct of these Congress sessions each year is only one of the many co-operative activities which the Electrical Equipment Section carries on in behalf of its members, and for the benefit of accident prevention work in electrical equipment operations generally. The Section gives guidance in the preparation of a great variety of technical and educational material useful in the day-to-day safety programs of plants manufacturing electrical equipment. The activities of the Section are under the direction of its Executive Committee, the members of which are listed at the close of this volume.

Progress in Electric Safety

By CHAS. L. SMITH
Electrical Field Engineer, National Fire Protection Assn.

Initially, the practical utilization of electricity was an idea in the minds of dreamers. In the laboratory it had been demonstrated that electricity could be produced and made to perform certain functions, but it required tremendous faith on the part of the early experimenters to proceed with their work in the belief that electricity could eventually take its place in the field of competitive business.

At the time the Pearl Street Station was placed in commercial operation, gas lighting was considered the ultimate in modern illumination, steam provided the motive force for the factories, and human labor performed all of the many tasks incident to the maintenance and operation of the American home. The growth of the electrical industry since that early day is a tribute not only to the faith of those early experimenters, but also to the tremendous amount of hard work and sound judgment that has made electric service an accepted fact in our modern civilization.

Since electricity is a form of energy, it was immediately apparent that it must be utilized with caution, but in this respect, it was not particularly different from other forms of energy then being utilized. The immediate question was, "What special causes must be observed in the use of this energy form because of its inherent characteristics."

There is no art that has developed so fast as the art of things electrical. Things that are new today are old tomorrow, and year after year has brought us uses for this form of energy that were undreamed of in the years before.

Side by side with this rapid growth has come a steady development of those more or less simple requirements in the use of electricity which has guaranteed that safety to life and property which is so essential to the development of any great industry; and it may be fairly said that part of the tremendous development in the electrical field has been due to the safety provisions with which this development has been surrounded.

From those years when electricity first came into commercial use there have come down to us standards designed to point out the way wherein to make the employment of this form of energy quite safe:

The National Electrical Code

One of the most widely known national standards and certainly the most widely used by the communities throughout the United States is the National Electrical Code.

It is a collection of rules and regulations governing the installation and to a certain extent, the use of electrical equipment. Its purpose is to reduce the hazard of electrical fires and electrical accidents and it does this by specifying the exact manner in which electrical materials, devices, fittings and appliances shall be both originally installed and later maintained. A strict compliance with the requirements of the National Electrical Code will produce an electrical installation which may be deemed reasonably safe from electrical fires or accidents at the time of its installation and which, with proper maintenance, should remain in a safe condition over a period of years.

History of the National Electrical Code

The supervision of electrical installations through a code goes back to October, 1881 when a standard for electrical light wires, lamps, etc., was issued by the New York Board of Fire Underwriters.

Later, a joint committee of varied interests adopted a code of rules and in 1885, this code of rules was given the name of the National Electrical Code.

The preparation of the National Electrical Code is now under the supervision of the National Fire Protection Association.

The electrical section of NFPA which has at present recorded some 400 members, meets annually to discuss proposed revisions of the NEC which may be from anyone having interest in electrical safety.

The actual work of writing code revisions is done by the committee called ma-

tional electrical code committee and has as its steering committee a smaller group known as the correlating committee.

The National Electrical Code Committee has a number of sub-committees called code-making panels, 17 to be exact, which have within their scope related articles of the code. These 17 code-making panels have referred to them proposals for code changes and after completing their studies of the proposals, report recommendations for code changes to the correlating committee which reviews and processes such recommendations, seeing that they are reported to the electrical section and then to the general meeting of the National Fire Protection Association and to the American Standards Association for subsequent approval.

The orderly procedure now provided for revisions of the National Electrical Code, provide for two types of amendments:

1. Called a tentative interim amendment which is intended to provide for such urgent need of revision as may be necessary from time to time.

2. A general revision, which may, at intervals of three to four years, be a complete re-editing of the entire standard.

I think you will perhaps understand the need for a constant provision for revisions as the electrical industry is one of the most rapidly developing industries of our time.

It is not expected that the code is to be regarded as a design specification or as a manual for untrained persons but is intended as a *minimum* standard for the guidance of electrical inspectors, contractors, journeymen, wiremen, manufacturers, utilities, insurance rating bureaus, and others interested in electrical safety.

The prevention of electrical fires and accidents is of importance from many standpoints. It is quite obvious that to the user of electricity the safety of electrical installation is of prime importance. It is equally evident that electrical safety in theaters, stores, offices and factories and other locations where persons may gather or where they are employed, is also of importance.

Insurance companies were the first to develop electrical codes and are directly interested from the standpoint of losses which may develop from electrical fires or electrical accidents.

The manufacturer wants to construct his product so that it is safe to use and manufacturers of electrical equipment must conform to the code requirements in the construction of their product. Manufacturers also have a direct interest in the uniform application of the code, as the construction of special apparatus designed to comply with certain special rules is costly and uneconomical. The manufacturer who constructs his equipment in full compliance with the NEC specifications is interested in seeing that only equipment which meets this standard is used.

The electrical wholesaler, jobber, and dealer has an interest in the NEC quite similar to that of the manufacturer.

The electrical contractor and wireman must comply with the code and its uniform application to all contractors alike and to all territories.

The electrical utilities' interest in the code lies in its legal and moral responsibility in the safe supply of its current to the consumer.

The inspectors whose responsibility it is to administer the electrical code in their communities has a real responsibility which goes far beyond the simple administration of a body of discreet rules. It is their job to protect the public from evils inherent in a powerful energy, energy which can kill and maim and burn and destroy life and property. But properly applied, it is safe, secure and capable of providing useful power, light and uncounted benefits to all of us.

All of the foregoing groups and others participate in the continual production of subsequent editions of the code. All contribute freely, time, money and the best available expert advice to assure a balance of representation as required by the American Standards Association for approval of the code as an American Standard.

Industrial Interest

Many of you have to do with industrial plants and here the code has a further useful field aside from its value as a fire and life protection. The foreman of a plant or the man in charge of machinery and equipment has an obligation to his employer and to his fellow workers in maintaining his equipment in such a condition that it will continue to function without delays and

shutdowns. In many plants the failure of a particular machine or group of machines, or the failure of the lights which afford the necessary illumination for the operation of these machines may throw out of order the whole factory schedule, and generally such failure reflects upon the particular individual in charge.

The NEC, in addition to providing a safeguard against fires and accidents, incidentally provides a protection against shutdowns and experience in many industrial plants has shown that a strict compliance with the code provisions both in the original installation and in the plant maintenance, tends to guarantee the continual operation of the plant.

The owner, he who must pay the bills for maintenance and upkeep, and also the bills involved in shutdowns—and these bills sometimes represent more than the mere time lost—is directly concerned with a compliance with this code, for here also experience has clearly shown that an installation in strict compliance with the code rules represents an economical installation.

The industrial plant managers had to learn the value of light in the matter of production. The 60-watt drop light shining in the eyes of the man at a lathe, has been replaced by general illumination that not only increases the speed of production but makes for better and safer operation.

Neither is the owner of a store on the main street content with a few drop lights in his store and his show window with these lights turned on toward evening or when it became dark. This individual now recognizes the value of light in improving his sales. He now has a flood of illumination in use from the time his store opens in the morning until it closes at night.

In the Home

The electrical equipment of the ordinary home that was wired thirty years ago would be considered primitive in the light of the present day needs. Thirty years ago the people had not learned to use electricity, and even though they were willing to learn they were handicapped by the lack of facilities and the cost of bringing current to the equipment.

To promote the demands of the current-using public has presented a difficult situation. As in any other line of business the individual had to be acquainted with the possibilities in the electrical field. He has had to be shown the value of sight and the important position that illumination occupies in the saving of eyes. He has had to be shown that the value and satisfaction that comes from reading and study, are immensely increased by proper illumination.

The public is much more aware of electrical hazards today than ever before, no doubt as a result of reading the almost daily press reports of electrocutions and costly explosions and fires attributed to electrical origin. Explosions and fires and electrocutions caused by electricity are commonly classified as originating from three sources of electricity, i.e., power circuits, static electricity, and lightning. With reference to press reports, it should be stated that rather a large number of calamities are attributed to electrical origin simply because of failure or incompetence to ascertain the true cause. However, many of these disasters are due to electrical origin.

Causes of Fires and Accidents

What causes electrical fires and accidents in our homes and in our factories? While many of these fires and accidents are due to causes beyond our control, many of them are due to failure to comply with those reasonable rules and regulations designed to guarantee our safety, and many of them are caused by neglect or often the wilful violation of these provisions.

Anyone who has had the responsibility for, or the supervision of, any extensive electrical equipment can recall and point out many instances where through carelessness, or through failure to comply with standard rules, fires or accidents have occurred.

We learn by experience and, in dealing with electricity, each fire and accident has its lesson. As experience is the best teacher, there can be conveyed to your minds in no clearer manner probably the necessity for care, than by describing some of the results in the progress of electrical safety.

It seems to be part of human nature to

picture tubes, the RTMA became concerned with the hazards arising from the improper handling of such tubes. As can be readily appreciated, an evacuated glass bulb of the sizes used has a tremendous atmospheric pressure on the external surface. While adherence to the U.L. requirements for television receiving appliances gives protection to the user of the receiver in the normal operation in the rare cases of implosion of the picture tube in the receiver, it was *felt that the real hazard existed* when the tube was *improperly* handled *outside* of the set.

It was also felt that both tube and receiver manufacturers could benefit by specific recommendations on the handling of picture tubes in their plants. Accordingly, a committee, under the chairmanship of Mr. R. E. Carlson, was established to study the problems and prepare appropriate information directed at four groups. These groups were:

1. Television set owners
2. Television dealers and servicemen
3. Television receiver manufacturers
4. Picture tube manufacturers

Obviously it was desirable to avoid "scare" stories particularly to the first two groups but necessary to give factual information to enable them to avoid accidents by taking the proper precautions. Four releases were prepared and distributed. The one entitled *Safety for TV Owners* contains information of general interest and bears repeating here as follows:

"The introduction of new mechanical services into the home is often accompanied by new potential hazards for the careless or negligent user. But the hazard is in the improper use, rather than in the device itself.

"The gas light of another generation was no more dangerous than an oil lamp unless the householder tried to blow out the flame instead of turning a valve. The electric light and the many electrical appliances which followed it, the householder soon learned, were harmless so long as one didn't tamper with a live wire.

"Television is bringing a new electronic device into the home. Like the refrigerator or the oil burner, it functions best and without danger to its owner so long as he doesn't tamper with some of the components which are encased in a protective cabinet and behind a safety glass.

"While similar to the radio receiver that has become so commonplace in the American home, the television set is considerably more complex and contains one element, in particular, which can become hazardous if improperly handled. This is the picture tube.

"This picture tube is harmless so long as it is left intact in the receiver and not tampered with. *It* becomes hazardous when removed from the set or when an untrained person attempts to repair his TV receiver. Consequently, it is always essential for a television receiver owner to call a competent serviceman whenever trouble develops and never to attempt repairs or interior adjustments himself.

"The glass envelope of the picture tube contains a high vacuum; thus any action which might break or crack this glass accidentally should be carefully avoided.

"The Underwriters Laboratories have established safety standards for television receivers and their label on the instrument indicates compliance with those standards.

"Five basic rules, if followed by the TV set owner, will insure his safety and that of his family. These rules are:

1. "Read carefully the manufacturer's manual of instructions for the set owner and carefully observe all precautions.

2. "Don't tinker with the inside equipment of your set in case of trouble; call a reputable serviceman.

3. "Don't let members of the family hover around a serviceman when he works on your set, especially when a picture tube is exposed.

4. "Ask the serviceman immediately to put the used picture tube in the protective container and to take it away when he leaves.

5. "Don't try to dust or clean the interior of a television receiver. The serviceman should do this whenever he makes adjustments or repairs."

The dealers and servicemen were advised as follows: "Servicemen who install or service television receivers have a great responsibility both to the public and to the industry, as well as a personal interest, in seeing to it that no accident due to carelessness or negligence will occur to arouse fear of this new instrument of home entertainment.

"The television receiver, largely because of the presence of the picture tube, contains certain potential hazards that were not in the radio set. But these hazards need not cause anyone apprehension provided a few simple precautionary rules are observed by the serviceman. *The picture tube is not dangerous if properly handled.*

"There are two ways in which injury can occur if a picture tube is carelessly handled either in a service shop or at a set owner's home. One is from the breakage of the picture tube possibly resulting in flying glass, and the other is from high voltage shock. Most trained servicemen know how to guard against shocks, but the breakage of picture tubes can result from carelessness regardless of the serviceman's experience.

"Any serviceman can be sure that he will neither injure himself nor cause injury to someone else by following a few simple safety rules. These are:

1. "Don't expose picture tube until you are ready to use it.

2. "Always wear goggles when handling a naked tube.

3. "Keep people away at a safe distance when a picture tube is exposed.

4. "Place the used tube in the carton which contained the new tube and *take it away.*

5. "Always keep the picture tube in the protective container whenever possible. Always place an exposed tube on some sort of clean soft padding when necessary to set it down.

6. "Don't leave any picture tubes lying around. There are two safe ways of disposing used tubes:

a. "Place the old tube in a shipping carton properly sealed and then drive a crowbar or similar instrument through the closed top of the container.

b. "An alternative method in the disposing of more than one tube, is to use a metal ash can with a plunger operated through the closed top.

7. "Don't use regular picture tubes for display purposes. Make contact with your supplier for special display tubes."

For the receiver and tube manufacturers there were a number of specific and detailed precautions listed which do not need repetition here. However, the statements on basic safety organization in plants introducing the releases give the general intent of the information. They are as follows:

A. "Operators and others who handle and operate tubes should be educated in safe procedures. They should be impressed with the danger of careless or unprotected operation.

B. "Techniques should be applied which reduce the handling of tubes to a minimum, but where tubes must be handled practical and safe procedures should be planned.

C. "Safely designed tube storage methods and storage areas should be developed for all sections needing them, even when storage is temporary.

D. "Each foreman should be held rigidly responsible for enforcing all safe practices involved in his section."

I have gone into this particular phase of our safety activities as an example of our concern with safety programs and as indicative of the methods we have used and will use again when occasion arises to promote safety in our sphere of activity.

To summarize, we see that safety activity in the RTMA has developed and established a three point program namely:

1. Continuing work with the Underwriters Laboratories on their "requirements" for both radio and television receivers.

2. Sponsoring special investigations which promote safety knowledge.

3. Study of new hazards with release of appropriate information to avoid accidents.

Uniform Acceptance of Nationally Recognized Standards

By LESLIE D. PRICE
Mgr., Engineering and Safety Regulations Department,
National Electrical Manufacturers Assn., New York City

Safety is the concern of all of us gathered at this National Safety Congress. Safety is the concern of all public minded citizens. It is the concern of the governmental and legislative authorities at all levels, who are responsible for the promulgation and administration of the laws, ordinances and regulations affecting the welfare of the public.

Utopia to all of us would be the attainment of absolute safety—the elimination of the pain, the sorrow and the suffering that inevitably result from accidents. But the attainment of this objective is as impossible as the attainment of absolute zero temperature. Admitting that absolute zero has perhaps been approached more closely than absolute safety, a parallel may be drawn, based on practicability. The extremely low temperatures approaching absolute zero have been reached only at tremendous expense and under precisely controlled conditions.

On the other hand, practical refrigeration for the preservation of foods and for improving the comfort and living of the public is available to almost everyone—at reasonable cost.

To achieve the same relative approach to absolute safety, we would have to control all human and animal performance, emotions, reactions, and thinking. We would have to control nature and the elements. We would be faced with the construction and maintenance of the perfect mechanical machines, structures, devices, and materials. With our present understanding of life, matter and energy, these are impossible, regardless of their desirability. What then, can we do practically?

As our scientists, engineers and production experts continue their skills and knowledge to make available to the public more and better refrigeration equipment, so may we combine our knowledge and experience with that of other informed individuals and groups to provide an increased degree of reasonable safety to the public.

The superintendent of one factory here learns, through study of an accident, of an industrial procedure that is unsafe. A fire chief over there, after analysis of some fires investigated by his department, finds a way to remove a cause of conflagration. A scientist in a laboratory some other place develops a way to make some material safer.

The experience of each of these individuals is helpful, of course, but only in a limited way. That factory superintendent, for example, may retire before the occurrence of another situation in his particular plant that would require the knowledge he has gained, and the information may die with him, in spite of the fact that the knowledge may be needed in thousands of other factories. Or, it may be that the solution he evolves fails to take some other matter into consideration and does more harm than good, whereas someone else has already learned of the other matter and the two together could produce the ideal solution.

It is thus easily demonstrated that real progress toward maximum safety depends on the proper piecing together of the knowledge, experience, and intelligence of many people.

This fact has been recognized and, as a result, there have been formed many committees of informed people working on the development and revision of safety standards in numerous fields. As the work of such committees is reviewed through orderly procedures by bodies comprising those who would have knowledge of or particular interest in the specific subject, the manuals and standards produced are refined and become nationally recognized so that they are available for the use of all.

In order for practices and installations to follow such standards, it is frequently necessary that equipment be manufactured with special features so that it is capable of being installed or operated in accordance with the standards. It is, therefore, natural that manufacturers depend on these standards in the establishment of mass production and distribution. By incorporating the features requisite for compliance with such standards into regular production models, the manufacturers are able to give the public the most for the least cost.

Equally interested in such standards are the various governmental bodies responsible for public safety, and it is only natural that many of these standards are given legal force by being enacted into laws and ordinances in numerous states and municipalities.

This seems like an outstanding opportunity for the national standards to be utilized effectively. But what happens? The national standards are used by the local government, to be sure, but in some cases only as a starting point—a stepping stone for the creation of a monument to local creativeness.

The local authorities take the standards as a basis for local regulations but start tinkering with them. The pet ideas and private dislikes for certain types of materials, on the part of those in authority, are written in. Pressure groups of all kinds attempt to mould the regulations so as to improve their positions. Local committees are set up and, although these frequently include professional people, they generally do not have a specialized experience with safety matters and may be unfamiliar with the preparation of standards. The result is that such committees may, in good faith, emasculate the standards in the course of preparing local regulations.

At times, when ordinances are written, portions of the standards are copied without any intent to change the meaning, but are given some presumably purely editorial revision which inadvertently twists the entire sense.

Moreover, when one city adopts a new safety ordinance, other surrounding localities frequently follow suit, and any bad features are copied along with the rest, thus multiplying the undesirable effect. Sometimes even typographical errors are thus copied.

All these forces combine to upset the effect contemplated in the preparation of the national standards. Even if, by some happy chance, a local code different from the national standard will achieve equal safety, the simple fact of such difference defeats the economy and efficiency that are possible through the use of a single universal standard.

Special equipment manufactured to meet the requirements of a small part of the total market necessarily costs more, and inspection, test, and control are made more difficult.

In many cases, there are side effects of special local codes which actually increase hazards. For instance, in the electrical field, restrictive local codes, by requiring the use of methods or materials more expensive than necessary for safety, have frequently caused initial installations to be pared to a minimum with the result that later additions in the use of electricity are made by the employment of taps and lamp-cord, and other temporary wiring, with a consequent introduction of hazards.

We must also be careful to distinguish between minimum standards of *safety* and performance or adequacy standards. The latter have important usefulness in industry or in relations between buyer and seller, but their provisions should not be confused with safety or be incorporated into laws having the purpose of protecting people and property against hazards. It is necessary for the good of all concerned that safety laws permit a free choice of materials and methods. A safety standard for automobiles might appropriately provide for brakes, but should certainly permit an absolutely free choice of body styles. Even with respect to the brakes, a safety standard should not specify hydraulic, or mechanical, or air operation, but should permit any other existing or yet-to-be developed type that will do the necessary job.

Let us take a moment to ask ourselves, what are we looking for; what is our goal in safety standardization?—absolute zero, to resume my refrigeration analogy? No, Utopia is not here. The absolutely safe automobile would probably be one with the engine removed so it could not get into danger on the highway, but any safety standard requiring automobiles to be so constructed would defeat its own purpose. It would either be disregarded or would prevent the employment of a useful tool of mankind.

What we are after, and what we can attain, is reasonable safety coupled with practical efficiency and economy. This is a practical goal to which we can aspire and to

which most of the nationally recognized safety standards are directed.

My own principal interest in standardization has been with respect to the electrical industry. We all know that, when it is not properly controlled, electricity can become a terrible hazard. But it has been properly controlled, and it has become a dutiful and valuable servant of mankind. This success has been due to the long and patient effort of all concerned to develop proper codes and standards of construction, installation, and operation of power systems and equipment.

Members of the committees which are responsible for all such codes give constant attention to the problems which arise in the effort to assure safety. The two principal codes in this field are the National Electrical Code (ASA Standard C1), developed by the National Fire Protection Association and dealing with installations in and around buildings, and the National Electrical Safety Code (ASA Standard C2), sponsored by the United States Bureau of Standards and dealing with power houses, substations, distribution lines, and operation. It is significant that these safety standards were the first two electrical projects listed by ASA when it was organized. Each had been in existence long before that time.

In the preparation of these safety standards, the representatives of the manufacturers, of the electric utilities, of the electrical inspectors, of insurance groups, of contractors, of labor, of government, and of all other interested and concerned groups meet and collaborate. Personal participation keeps these codes and standards alive and in step with technological advances and current good practice.

The largest contributing factor to the advancement of safety is the uniform use of such carefully prepared, nationally recognized standards, and the latest revisions thereof, without modification. In order that this contribution may be enhanced, it is necessary that all branches of industry and all those sincerely concerned with safety cooperate in the effort to secure the uniform acceptance throughout the country of these safety standards.

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ELECTRICAL EQUIPMENT SECTION

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1951

Current Safety Topics in

FARM SAFETY

As presented in the Farm Safety Sessions of the 1951 National Safety Congress

Volume 10
Transactions
39th National Safety Congress

NATIONAL SAFETY COUNCIL
425 No. Michigan Avenue • Chicago 11, Ill.

New Ideas...

If safety is to keep pace with today's rapidly advancing technology, we must continually have "new ideas."

Each year, at the National Safety Congress, the ideas and experiences of many of the nation's top safety men are presented in the various sessions. Many of these ideas, devices and methods, first presented at a Congress session, later become generally accepted within their fields.

In order to present this information conveniently and at small cost, the Congress Transactions are published in volumes, one for each Section or Division, along with a General Sessions and Detailed Index to all volumes. The 34 volumes of the 1951 Congress Transactions are listed on the last page of this volume.

Safety directors everywhere have found the Congress Transactions a useful aid in their accident prevention programs. In industry, for example, their judicious distribution to key personnel in management and supervision has proved to be of invaluable service.

In preparing these Transactions, the proceedings of the Congress have been condensed and edited for reference purposes. Complete original manuscripts, with any charts or illustrations which were used, are available in National Safety Council files. Views expressed at the Congress or in this record are those of the Congress participants and are not necessarily those of the National Safety Council.

THE FARM CONFERENCE

This volume is a record of the sessions held at the 1951 National Safety Congress by the Farm Conference. The conduct of these Congress sessions each year is only one of the many cooperative activities which the Conference carries on for the benefit of accident prevention work on the farm. The activities of the Conference are under the direction of the officers of the Conference listed at the close of this volume.

Farm Safety Opportunities of the Agricultural Colleges

By A. J. SCHWANTES
Chief, Agricultural Engineering, University of Minnesota, Minneapolis, Minn.

The scope of safety education within the field of agriculture as defined in the report of the Agricultural Education Section of the National Conference on Safety Education in Colleges and Universities includes both farm and home safety in rural communities and safety on rural highways as well as the protection of lives and property from destructive fires. The report states that farm safety includes the safeguarding of farm people from all accidents to which they may be exposed. It states further that farm safety education is a family affair, affording protection to farm populations of all ages.

Because of the nature of life and work on the farm, a farm safety education program must necessarily be different than one for an industrial plant where many individuals are employed—each performing a rather highly specialized job under a single management. Under these conditions the jobs can be analyzed and the matter of carrying out not only in the individual job, but the whole program of plant activity is designed for a maximum of safety to the employees.

In the case of a farm the hazards are numerous and varied. Further, the individual farm worker performs a number of different tasks during the course of a day and in general he makes his own decision with regard to the details of doing the work. All members of the family are involved in activities in the home and about the farmstead.

Thus the matter of prescribing safety precautions and providing an incentive to carry them out involves an educational program which must become effective with each person on the farm. Safety features can be incorporated in the design of equipment and facilities made for use on the farm, but there still remain potential hazards in carrying on the everyday activity on the farm and each person must be conscious of these potential hazards involved.

Safety Education, a Responsibility of Agricultural Colleges

It is generally recognized that education in farm and home safety is a responsibility of the state agricultural colleges. As evidence of the recognition of such responsibility may be cited the participation of agricultural college representatives in various types of safety activities on the local, state and national levels. In many states agricultural extension workers include farm safety, appropriate with their subject matter, in their work program.

The 4-H organizations, under the leadership of the agricultural colleges, have for some time had farm safety as one of their major activities. During the past few years resident instruction in farm safety has been initiated by agricultural colleges in several of the states.

The work of the agricultural colleges in carrying out their broad general objective of education in agriculture is usually organized in three separate and distinct categories, namely, that of research, resident teaching and extension. As has already been mentioned, in some of the colleges work pertaining to safety on the farm is already underway in the last two categories. That research in the field of farm safety is necessary appears self-evident from the standpoint of a continuing and developing program of resident teaching and extension. New subject matter must be developed in accordance with the changing needs.

Farm Safety Extension

To date more progress has been made in the field of agricultural extension than in the other two fields. This is doubtless due to the fact that the occupational and home accident situation has presented itself and those in extension activities have carried out obviously necessary agricultural programs. The subject matter of those programs has consisted of calling the attention of farm people to the prevalence and types of accidents that have occurred, of analyzing some of the hazards and of urging greater precautions in hazardous activities.

One of the earliest organized activities in the field of agricultural extension is the

work carried on by the 4-H groups in farm safety. Mr. T. A. Erickson, formerly state 4-H leader of Minnesota, was to a large extent responsible for beginning safety education in connection with 4-H work.

Mr. Erickson, in his bulletin entitled "The Origin and Progress of Farm Safety Education," makes the following statement: "The first definite farm safety education began in about 1934 when the Agricultural Extension Service through its 4-H clubs in two or three states announced farm safety activities. Minnesota added a farm safety project to the 4-H program in 1934. It was felt that avoiding accidents was largely a matter of education and that it fitted very effectively in the 4-H club work. Besides the pioneering work started with the 4-H clubs in Minnesota, some activities were also underway in Ohio, Kansas and Illinois. These seem to have been the earliest states to make beginnings, all of them working independently."

At present there are farm safety specialists in a number of the states and the programs of these specialists are becoming crystallized and rather clearly defined. Five states have farm safety specialists working in the Agricultural Extension Service. In ten other states safety specialists are employed by the Industrial Commission or by a farm organization. While the latter are independent of the agricultural colleges, their programs are usually integrated with those of the Agricultural Extension Service.

The specialists representing both groups work closely together and exchange ideas with regard to their programs. In Minnesota Mr. W. A. Dickinson has been working with the Minnesota Farm Bureau Federation as safety director for about fifteen years. The Agricultural Extension Service has had a safety specialist for the past two years.

While a good deal of the time of the safety specialist is naturally devoted to speaking at meetings of local groups in the state, he can and should consider his job to be much more than that. He should act as a catalyst in urging safety activity on the part of other groups on the state, county and local level. Where there is an agricultural committee of the state safety council or other similar group, the extension specialist can work with that group to influence an effective state-wide safety program. County agricultural safety committees can likewise be organized. In some states there exists at least a skeleton county safety council in most every county, and in many of these a farm safety committee is part of the council.

While the extension specialist and the county agricultural agent can assist materially in effecting organizations of this type, it is felt that the county agricultural agent should not be an officer of this organization. He can be more effective in bringing advice to the group. Having the organization consist entirely of laymen will bring more people into active participation in the safety program.

On the county level there should be opportunities to encourage other groups to participate in farm safety activities. Examples of such are: Implement dealers associations, livestock associations, and farm organizations such as the Grange, Farm Bureau, and Farmers Union. It is generally felt that the safety program will be effective to the extent that all interested groups will participate in it. It is obvious that the programs of all such organizations should be integrated to form a unified program for the county. Such integration could well be effected by the central county safety council.

In Watonwon County, Minnesota, for instance, one of the implement dealers has become interested in the farm safety program, and realizing the significance of such a program in the implement industry, and in his own business, has been instrumental in effecting an organization of fourteen implement dealers in the county.

Home safety is not to be forgotten in extension work. Home demonstration agents in their regular programs are giving attention to safety. This activity can well be developed and integrated into a general and comprehensive program of farm safety on a county as well as on a state basis.

Resident Teaching

In the resident teaching program the agricultural colleges have a special opportunity for disseminating safety information through the teaching of teachers and the training of men and women who will be engaged in various activities in which they will make contact with farm people.

Although resident teaching has not been practiced as long as extension in the field of farm safety, beginnings have been made at several colleges and consideration is being given to the problem at others. So far as we know, the only colleges offering course work in farm and home safety are Ohio State University and Iowa State College. At the University of Minnesota the faculty has appointed a committee to facilitate the implementation of instruction in farm and home safety in the various areas where it is pertinent.

In considering the teaching of safety, there is some question about the advisability of incorporating the instruction in one or more courses designed especially for that purpose, or whether it would be more effective to integrate safety instruction in a number of courses in which the prevention of accidents and emphasis on safe practices would be pertinent. With regard to this point I would like to cite the information available.

Mr. W. E. Stuckey, Farm Safety Specialist at Ohio University, states as follows: "Here in Ohio we believe that the basic way to teach safety is to integrate it in all courses. We believe this to be true even in our High Schools. However, we found that we were not getting this integration."

Mr. Stuckey states further that they have developed a one-hour seminar which was included in the curriculum in Agricultural Engineering. This course was an elective and was chosen by eighty students the first time it was offered. The majority of the students were majors in Agricultural Education, Agricultural and Home Economics Extension, and Vocational Home Economics.

Mr. Stuckey states that the objective of the course is "to develop a safety consciousness on the part of the students, then give them basic principles and information on the problem and aid them in formulating a program for their respective communities when they are graduated and out on the job."

I quote also from a communication by Mr. N. J. Wardle, extension agricultural engineer at Iowa State College in farm safety: "Iowa State College now offers one course in farm safety. This course is open to seniors only. All instructors in the Division of Agriculture are encouraged to teach safety in each course as it affects the subject matter involved. The purpose of the special course in farm safety is to coordinate safety in all phases of agriculture, to give instruction in special phases of safety which might have no logical place in any other classes, and to give instruction on how to develop and carry out safety programs with farm people. The emphasis is on how to develop and carry out the safety programs. The course is particularly intended for students planning to be teachers of Vocational Agriculture or to be extension workers."

Mr. Wardle states that there was a good enrollment in the course the first time it was offered and that it was well received by the students taking the course.

At the University of Minnesota the steps taken thus far are only by way of preparation. Last year the faculty appointed a committee to study the need for additional instruction in safety education in the college. This committee recommended that no special course or courses in safety education be established but that it be made a part of existing courses in the subject matter in which it is pertinent.

The committee felt that such a procedure would make the instruction more meaningful and a larger number of students would receive instruction than would very likely be the case in a special course or courses. The assumed weaknesses in this recommended procedure are that the addition of subject matter in safety must be made at the expense of other subject matter now being taught, the subject matter is not readily available especially in organized form such as textbooks or bulletins and that the instructors in some of the courses concerned may not be familiar with hazards or remedies for them.

The faculty thereupon appointed a standing committee on safety education which is charged with the repsonsibility of facilitating and implementing farm and home safety in the various areas. This standing committee is now at work. Small sub-committees are being appointed to represent certain subject matter fields such as home economics, animal industry, and agricultural engineering. The personnel on these sub-committees will very likely include principally the instructors in the courses concerned but not necessarily so.

At the National Conference on Safety Education by Colleges and Universities held in November of 1950 S. S. Steinberg, Dean,

College of Engineering, University of Maryland, reported on an experimental endeavor in his college to determine a practical method of integrating safety into the engineering curriculum. Some features of his report might be of interest to us. Dean Steinberg states that sixteen courses in the mechanical engineering curriculum were selected as best suited to integrate accident prevention.

As an introduction of the idea to the freshmen a practicing safety engineer was invited to address them in their course in Introduction to Engineering. Also during the freshman year safety was to be integrated into the English courses, mainly Composition and Literature, to take the form of themes relating to safety and into the public speaking course.

During the sophomore year an attempt to bring safety to the functional level was implemented by inserting material in the shop courses. Since the courses during the junior year were basically theoretical in nature, only an occasional lecture was provided with supplementary reading material to keep the student conscious of the safety problem. During the senior year there were specific insertions in the rather specialized courses.

Dean Steinberg states by way of conclusion, "It is our present thinking that integration into engineering is the proper approach since it builds the safety factor into specific courses and causes the student engineer to think of production efficiency."

From the information at hand it is evident that agricultural colleges are recognizing the opportunities for promoting farm safety through the teaching of those who will again teach others in formal classes or in extension activities and those who will be engaged in activities in which they may be in position to exercise an influence on farm people. It is also evident that the method of organizing and carrying out this instruction is definitely in the experimental stage.

That this problem is receiving attention, and is being experimented with, is encouraging. Most of those who are concerned with it agree that integration into existing courses would be the ideal, but the opinion seems to obtain that this presents some difficulties. In any case it appears that the primary responsibility for farm and home safety instruction on a campus must be assumed by a certain individual or a committee. An exchange of ideas and experiences in this effort will certainly be well worthwhile.

Research

To keep a farm and home safety program in progress and to keep it correlated with new farm developments and new practices, a program of research is important. Perhaps one of the most significant activities that could be engaged in on the local or county level is a survey of accidents that occur. It would appear that exact information with regard to the cause of accidents and details of the circumstances surrounding the accidents would be helpful in preventing future accidents. Such details are very often difficult to obtain and usually a local committee or group is in the best position to obtain the facts that are significant. A number of excellent reports of this nature have been made by local county groups.

At the University of Minnesota a study is now underway to determine the exact cause of fatal tractor accidents. A survey blank has been developed for this purpose and the extension farm safety specialist has obtained information with regard to fifty-three such accidents. It is hoped that the information to become available from this study will point out the relative importance of various causes and also suggest remedies. This type of study might be extended over a wide range to include not only fatal accidents, but that large group which may or may not result in the injury of someone, but not in death. It might also include the operation of other farm machines and accidents due to livestock, falls and other causes.

Certainly there is room for studies aimed at the improvement of mechanical equipment from the standpoint of the safety of the operator. In this connection the work of the farm equipment manufacturers through the Farm Safety Committee of the Farm Equipment Institute is to be commended. It is doubtless appropriate that certain studies in this category might well be engaged in by the research divisions of the land grant agricultural colleges.

Much can be done in studies of equipment, facilities, and even features of buildings themselves, in the home and about the farmstead toward reducing hazards of those who live and work there. It is possible that studies relating to human behavior under certain circumstances would yield helpful information in preventing accidents.

It might be stated by way of conclusion that the agricultural colleges have not only tremendous opportunities, but also responsibilities to improve the well-being of the people in agriculture through the development and the promotion of an aggressive program in farm and farm home safety.

Broadening the Interest in Farm Safety

By J. T. CALLAWAY
Goodyear Tire & Rubber Co., Akron, Ohio.

"Taint what it used to be, down on the farm! The hillbillies have been drafted by the honky-tonk and merged with the city masses. The disgruntled sharecroppers and the oil-stained Okies have trekked through Arizona to California, lured by the feather-bedding tones of the Townsendites. It seemed alarming at the time but this evacuation of the parasitic farmer was an omen of better days and a boon to technical modernization. *Farm manpower has decreased 1.3-million in the past ten years, while farm horsepower has reached an astonishing new high of 750-million, not including what's left of old Dobbin. Horsepower in the flesh has decreased from 20-million in 1920 to 5-million, as of now.*

At the turn of the century, we had about 2-million miles of farm-to-market roads—poorly kept and useless in bad weather. Today we have 3-million miles of farm-to-market roads, one-half of which are surfaced and the other half maintained for all weather use. Even though sadly antiquated for 50-million-vehicle traffic, these roads have lured the gypsy in every American. These roads have simplified telephone extensions to the far corners, and we can see no end to rural electrification. The average farmer and his family have acquired the polish of the city cousin, and just about as much of it as the country gentleman can stand and still be comfortable.

Scattered among the modern farmers of today, we find industrialists and merchants. A few bankers in every urban area have farms out on the highway, about the size some of them came from originally. A few executives in every sizable corporation have entered a category known as "The Check-book Farmer."

Automotive practice of the past twenty years has evolved an ever increasing exchange of influences between the urban and the rural. The city boys are calling on the country girls, and the city girls find the country boys quite refreshing. 4-H Clubs have given every farm boy and girl encouragement and opportunity in the development of character. In fact, 4-H has become noteworthy as a stepping-stone to personal achievement in agriculture. A step higher, we find the Future Farmers of America competing in big league fashion—pointing scientifically to quality-quantity harvests at lower costs.

Our agricultural colleges have grown to be practical with experimental acreage for proving grounds. *The average American is inches taller and pounds heavier than his great-grandfather. And to how many people do we owe thanks for the extra nourishment in every forkful that America eats? To the agricultural scientists who pack more into every acre . . . to the farmers who squeeze more out . . . to the designers and manufacturers of equipment who lock it in during shipping and storage . . . to entomologists, vitamin-makers, refrigeration engineers, dairymen, frozen food packers and to the highway haulers of America . . . all a part of the evolution in modern agriculture. Rural America today collaborates with all industry—with diligence, ingenuity and skill, to make Americans the best fed people in the world.*

It has been truly said that the extent of potential progress in any form of industry will attract the press and, ere long, such industry can be measured by the growth in numbers and importance of business papers. It is obvious when we understand that business magazines, both objectively and functionally, are industry's lines of com-

munication. In keeping with the general aggrandizement and vast growth of farm purchasing power, we have seen no end to sectional farm papers, such as the *Southern Agriculturist, The Progressive Farmer, The Prairie Farmer, Capper's Farmer*, and dozens of others. Nationally, we have such papers as the *Country Gentleman*, which caters to the farm field just as the *Saturday Evening Post* caters to the metropolitan. Dominant among the trade papers are *Implement & Tractor, Farm Implement News* and *Implement Record*, which we must thank for their pioneering suppo[redacted]
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205 acres, possibly a little more.

As we determine minimum depth, mineral-richness and normal productive life of top soil, it is easier to understand such long-range planning as the Missouri Basin Project, the purpose of which is to perpetuate and expand productivity in the big "Bread Baskets" of America. We have the Columbia River Project which, in a way, is prone to resemble TVA. And, throughout the states, we find Army Engineer civil planning and projection designed, true enough, to supply our metropolitan areas with adequate water but, primarily, to provide flood control, combined with reservoired water for irrigation and rural electrification—simultaneously not only saving the top soil but activating millions of semi-arid mineral-rich areas. The Missouri Basin Project alone means 20 years and much more than 20-billion dollars in the completed cost of salvage. However we may attribute such projects to politics, the ravaging of the rampaging Missouri River this year alone should substantiate the merit of the plan and help us to make a distinction between politics and the preservation of agriculture.

Another angle which might be of interest to you for future contemplation is the pres-
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We have a never-ending challenge because farm mechanization cannot turn backward. The world could not breed horses and mules fast enough to backslide into farming methods of 30 years ago and still feed the people. While we wait for the latest Bureau of Census figures, it seems probable, and it is the popular belief, that about 4-million tractors are now operating on American farms. At 12 years' average life, this would mean an annual replacement of 333,-333 tires; at 15 years, it would mean 266,667 in replacements, and the number is likely to step up considerably within the next few years.

Tractor production, as we have noted, commenced to step up about 1940 and 1941. This larger number of tractors is not far from the the age replacement, and it will not be too many years before some of the *half-million annually* produced in the late 40's will be worn out. This means that replacements toward the the middle and end of the present decade will be far greater than now. We estimate this year's production to *approximate 480,000* — restricted somewhat due to the allocation of materials to year, was 5.8-million—better than [redacted]
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wheel tools, 95 per cent of which are leaving the production lines today on rubber. This means 21.2-million additional implements on the farm, as of now—and, in direct ratio we must account for 31.8-million wheel implements to accompany a probable 6-million round-wheel rubber-tired tractors at the tentative saturation point. Because of the tractor-size tires not accounted for otherwise, we should supplement the farm inventory with 53,400 self-propelled combines in operation today.

Still, the inventory would not be complete unless we took one additional look at agriculture's modernization on these 5,379,000 farms, as of 1950. The total farm ownership of automobiles, as of January 1st last per farm; in trucks, it was 2.2-million, or about one-half truck per farm. Pneumatic-equipped farm wagons are included with implements.

Perhaps you would like to know the total of farm wheels now on rubber? Who wouldn't? When you try to figure it out, be sure to include bicycles. There are too many qualifications for steel wheel life and the unknown date of replacement by rubber, not to mention the absence of legal registration. Why not take the tentative
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We doubt that any Korean development can or will change present trends materially. Our defense program has hardly started and will step up later this year and continue through 1952, regardless of any cease-fire order. The need for high-speed production will continue. The winter wheat crop this year will be disappointing, and the unprecedented floods in the midwest will have hurt corn considerably. So next year calls for another all-out production program for farm equipment, commensurate with manpower shortage and influenced by the disappointing harvests of 1951.

munication. In keeping with the general aggrandizement and vast growth of farm purchasing power, we have seen no end to sectional farm papers, such as the *Southern Agriculturist, The Progressive Farmer, The Prairie Farmer, Capper's Farmer,* and dozens of others. Nationally, we have such papers as the *Country Gentleman,* which caters to the farm field just as the *Saturday Evening Post* caters to the metropolitan. Dominant among the trade papers are *Implement & Tractor, Farm Implement News* and *Implement Record,* which we must thank for their pioneering support during the diaper days of farm tires.

With all this accentuation, certain forms of organized farming are to be expected. *There is* a wholesome influence to be found in such factors as The National Grange and The America Farm Bureau Federation. These groups have acquired respected stature and stand for sane economy.

We find the definition of a farm changing also. Back in the 40's, it was regarded as any three acres, *or more,* that would yield $250 worth of produce, or more, per year. Today we find that the growth of our cities has encompassed many of the small farms, reclassifying them as vegetable gardens. We should not be alarmed, therefore, when the Bureau of Census taken in 1950 shows that in ten years we have had a decrease in the number of farms yielding a minimum of $250 annually. From 5,859,000 farms in 1940, according to the census, we have declined to 5,379,000 in 1950. On these census figures, we find slightly increased acreages on the medium and large size farms. Also it means that the average farm today, instead of 191 acres as of 1940, is 205 acres, possibly a little more.

As we determine minimum depth, mineral-richness and normal productive life of top soil, it is easier to understand such long-range planning as the Missouri Basin Project, the purpose of which is to perpetuate and expand productivity in the big "Bread Baskets" of America. We have the Columbia River Project which, in a way, is prone to resemble TVA. And, throughout the states, we find Army Engineer civil planning and projection designed, true enough, to supply our metropolitan areas with adequate water but, primarily, to provide flood control, combined with reservoired water for irrigation and rural electrification—simultaneously not only saving the top soil but activating millions of semi-arid mineral-rich areas. The Missouri Basin Project alone means 20 years and much more than 20-billion dollars in the completed cost of salvage. However we may attribute such projects to politics, the ravaging of the rampaging Missouri River this year alone should substantiate the merit of the plan and help us to make a distinction between politics and the preservation of agriculture.

Another angle which might be of interest to you for future contemplation is the present rate of population increase, which now amounts to about two million a year. If continued, this will mean a national total of 200-million by the mid-1970's. This will call for more acreage or more intensive cultivation of present acreage, or a mixture of both. It all adds up to greater use of tractors and mechanized equipment. If more has to be grown from present acreages, it will mean more fertilization, greater use of insecticides, fungicides and herbicides, all of which means more hours of work for tractors in the fields.

Such are some of the agricultural highlights endowing a higher standard of living everywhere . . . what's the big total and what about the wheel inventory? The Bureau of Agricultural Economics, a division of the Department of Agriculture, through the Federal Reserve Bank of Chicago, stated that on *January 1st this year the total asset value of American agriculture had reached the amazing figure of 137-billion dollars.* The figures were approximately 130-billion in 1949 and 120-billion in 1940. *This same authority reminds us once more that agriculture remains America's No. 1 industry, exceeding in assets those of iron, steel and transportation combined.*

We have a never-ending challenge because farm mechanization cannot turn backward. The world could not breed horses and mules fast enough to backslide into farming methods of 30 years ago and still feed the people. *While* we wait for the latest Bureau of Census figures, it seems probable, and it is the popular belief, that about 4-million tractors are now operating on American farms. At 12 years' average life, this would mean an annual replacement of 333,-333 tires; at 15 years, it would mean 266,667 in replacements, and the number is likely to step up considerably within the next few years.

Tractor production, as we have noted, commenced to step up about 1940-and 1941. This larger number of tractors is not far from the age replacement, and it will not be too many years before some of the *half-million annually* produced in the late 40's will be worn out. This means that replacements toward the the middle and end of the present decade will be far greater than now. We estimate this year's production to *approximate 480,000*—restricted somewhat due to the allocation of materials to war, was 3.8-million—better than one car defense. Making due allowance for replacements, this would make 150,000 to 300,000 available for further mechanization. With current trends continuing—that is, the increased acreages per farm and the lower manpower available (1.3-million less than 10 years ago) there seems little likelihood for the saturation point to be reached for many years. *The use of multiple tractors is increasing rapidly. With multiple usage on the increase, a total of 6-million within a few years does not appear improbable.*

While trying to analyze this inventory, let's not overlook the fact that for every tractor on the farm we have 5.3 additional wheel tools, 95 per cent of which are leaving the production lines today on rubber. This means 21.2-million additional implements on the farm, as of now—and, in direct ratio we must account for 31.8-million wheel implements to accompany a probable 6-million round-wheel rubber-tired tractors at the tentative saturation point. Because of the tractor-size tires not accounted for otherwise, we should supplement the farm inventory with 53,400 self-propelled combines in operation today.

Still, the inventory would not be complete unless we took one additional look at agriculture's modernization on these 5,379,000 farms, as of 1950. The total farm ownership of automobiles, as of January 1st last per farm; in trucks, it was 2.2-million, or about one-*half* truck per farm. Pneumatic-equipped farm wagons are included with implements.

Perhaps you would like to know the total of farm wheels now on rubber? Who wouldn't? When you try to figure it out, be sure to include bicycles. There are too many qualifications for steel wheel life and the unknown date of replacement by rubber, not to mention the absence of legal registration. Why not take the tentative saturation point, using ratio trends, and build around 6-million tractors . . . say for the year 1960?

For example: Quite probable in 1960 . . .

5,300,000 Farms	6,000,000	Tractors	@ 4	24,000,000	Tires
5.3 per Tractor	31,800,000	Implements	@ 4	127,200,000	Tires
1½ per Farm approx.	8,000,000	Autos	@ 5	40,000,000	Tires
1 per Farm	5,300,000	Trucks	@ 6	31,800,000	Tires
Estimated	100,000	Combines	@ 4	400,000	Tires
Estimated	10,000,000	Bicycles	@ 2	20,000,000	Tires
1960 Total for Replacement				243,400,000	Tires

Take it or leave it but, just for fun, check the figure in 1960. And please don't ask how we arrive at 750,000,000 mechanical horsepower! That's out of our line but worth acceptance because it has been published by the Farm Equipment Institute and estimated as ten times greater than implemented horsepower utilized by any other given industry. We know, of course, that the horsepower rating of stationary engines, such as individual home generator units and the consumption of electric power, are involved. The telephony are most surprising of all figures, showing post-World War II rural expansion of 3 to 1, as compared to one-half to 1 for the strictly urban.

We doubt that any Korean development can or will change present trends materially. Our defense program has hardly started and will step up later this year and continue through 1952, regardless of any cease-fire order. The need for high-speed production will continue. The winter wheat crop this year will be disappointing, and the unprecedented floods in the midwest will have hurt corn considerably. So next year calls for another all-out production program for farm equipment, commensurate with manpower shortage and influenced by the disappointing harvests of 1951.

All this adds up to the great responsibility that all manufacturers of farm equipment or component parts have for safety in agriculture. This will be a continuous responsibility as more machines are used and as newer machines are developed. No one can evade this responsibility—all must accept a share.

West Virginia 4-H Farm and Home Safety Program

By C. P. DORSEY
Assoc. 4-H Leader, Univ. of West Virginia, Morgantown, W. Va.

Through the years we have talked much about safety and have achieved some worthwhile accomplishments. However, it is only recently that we have made a special effort to emphasize this program.

In 1950 we actually got under way with a definite program. The special interest in this program may be primarily attributed to the fact that Farm Safety representatives of the National Safety Council assisted West Virginia extension workers with special leadership training conferences for extension workers and local club leaders.

In 1949 a representative of the Farm Safety Division of the National Safety Council discussed the National Farm and Home Safety Program with extension workers at a Winter 4-H Conference. Later in the year he met with a special committee in Morgantown to discuss possible procedures for a definite program. Later that year another Farm Safety representative assisted us with a state conference for local 4-H club leaders. This group did some excellent thinking and planning. As a result of this work the group recommended that extension workers, 4-H club leaders, and members place more emphasis on a 4-H farm and home safety program during the coming years. For the 1949-50 4-H club year they recommended that special emphasis be placed on "Make Steps Safe." This suggestion was unanimously accepted by the volunteer 4-H club leaders and extension workers in attendance at the conference.

This general plan was also accepted by the state 4-H club staff, the extension workers and local 4-H club leaders throughout the state.

Soon after this conference a special committee was set up to formulate a program and outline specific procedures. This committee did outline a program and prepared a bulletin outlining specific suggestions for 4-H club members, local leaders, and county extension workers. Included in this bulletin were specific suggestions to local 4-H club leaders relative to how to get started and how to carry out the program. I think you will be interested in these specific items:

Things Leaders May Do to Get Started

1. Leaders should advise club members of the great loss of life, property and time caused by farm and home accidents. Tell members of the opportunity for them to reduce the number of accidents on the farm and in the home.

2. Leaders and 4-H club members select a farm and home safety committee and if possible have an adult council member to work with this committee.

3. Leaders assist committees in making a study of the farm and home accident problems and of plans which have proved effective in reducing the number of accidents.

4. Leaders advise the clubs of the West Virginia 4-H club plan to emphasize "Make Steps Safe" during 1950. "Watch Your Steps" is the safety watchword for 1950.

The Leaders May Offer the Following Helps to the Members of the Group:

1. Ask each member to check on steps and stairways at home for hazards and then arrange to have these hazards eliminated.

2. Have the club sponsor a community "Make Steps Safe" campaign. The group or the farm and home safety committee could make a survey of the hazards found on steps and stairways in the community or neighborhood, then place the West Virginia 4-H skull-cross-bones safety card at each hazard until it is eliminated. At some later date, conduct a survey or tour to determine the number of hazards that have been eliminated. (This work should all be done under the supervision of the club leader, assistant leader or adult council member, and the skull-cross-bones cards may be obtained from your county extension workers.)

3. Take pictures before and after hazards are eliminated. These pictures may be used in the local newspapers along with a story about the 4-H safety program.

4. Make a safety checkup at the 4-H club meeting place and eliminate any hazards found there.

5. Encourage all 4-H members to use the special safety checkup guide for West Virginia 4-H club members entitled, "Check Sheet for Making Steps Safe."

6. Arrange for some member to keep a record of all accidents which occur in the community or neighborhood during the 4-H club year. Report to the local newspaper and the county extension office and give suggestions as to how these accidents might have been prevented.

7. Have talks, skits and demonstrations at local club meetings on "Make Steps Safe."

8. Prepare posters on "Make Steps Safe" for posting in schools and other public places.

9. Conduct a "Make Steps Safe" poster contest among the members of your club.

10. Conduct an essay or short story contest on "Make Steps Safe."

11. Have a safety quiz at local 4-H club meetings.

12. Arrange for store window display on "Make Steps Safe."

13. Prepare a special "Make Steps Safe" educational exhibit for community 4-H club exhibit or county fair.

14. Arrange for a farm and home safety demonstration team from your club to enter the county demonstration contest. These demonstrations should relate to "Make Steps Safe." (Ask your county extension worker for suggestions.)

15. Arrange for public meeting and put on a farm and home safety program including talks, demonstrations, colored slides or movies.

16. At the close of the 4-H club year, make a complete report of all of the farm and home safety activities carried out by the group.

We prepared four special forms to be used in connection with this program:

Form No. 1 was a check sheet for making steps safe to be used by local 4-H club members.

Form No. 2 was an individual farm and home accident report form to be used by local 4-H club members in reporting accidents in their community.

Form No. 3 was a local 4-H club farm and home safety activity report form to be used by the leader and officers of each local 4-H club in making their annual report.

Form No. 4 was a county 4-H farm and home safety report form to be used by the county agricultural extension workers in making their annual report on 4-H farm and home safety program.

The bulletin also included suggestions for safety demonstrations, an outline for a safety demonstration, available reference material for safety programs, available films on safety and some information relative to the National 4-H Farm and Home Safety Contest sponsored by the National Committee on Boys and Girls Club Work.

Our official 4-H club year in West Virginia begins on October 1 and closes on September 30. After the close of the 1949-50 4-H club year, we secured reports from county extension workers summarizing their 4-H farm and home safety activities. Below is the state summary of these county reports:

The data listed below covered the activities of both the negro and white 4-H club members in West Virginia during the club year beginning October 1, 1949, and closing September 30, 1950. During this period we had 29,047 white club members enrolled in 1,433 4-H clubs, and 5,295 negro club members enrolled in 224 clubs:

Number of clubs participating in special 4-H Farm and Home Safety Campaigns: 1263.

Number of clubs filing a farm and home safety report: 737.

Number of club members using the W. Va. Safety Checkup Guide: 2281.

Number of hazards found: 8981.

Number of hazards corrected: 5915.

Number of clubs keeping a record of accidents *in community*: 121.

Number of accidents reported: 207.

Number of clubs holding public farm and home safety meetings: 174.

Number of talks, skits, and/or demonstrations given at local 4-H club meetings: 1822.

Number of clubs sponsoring safety poster contests: 52.

a. Number of posters prepared: 364.
b. Number of posters displayed in public places: 195.

Number of clubs arranging store-window safety displays: 22.

Number of clubs preparing special educational exhibits for community 4-H exhibits or county fairs: 32.

Number of clubs sponsoring a safety essay contest: 70.

Number of clubs having a farm and home safety demonstration team: 83.

During the spring and summer of 1950, committees of local leaders and extension workers reviewed the 1949-50 program and outlined plans for a program for the 1950-51 4-H club year. It was decided to emphasize "Safety First With Tools" during this club year. The program has been carried out in a similar manner to the "Make Steps Safe" program but a report of the results will not be available until after the close of the present club year.

We are proud of our 4-H farm and home safety program in West Virginia, but we are not satisfied. We hope to continually expand and improve the program.

The results of this program may be attributed to the following factors:

1. Suggestions and advice of representatives of the Farm Safety Division of the National Safety Council.

2. The thinking and planning of local people plus suggestions and guidance from county and state extension workers.

3. The selection of one specific phase of safety to emphasize during one year.

4. The follow-up by a special state committee and by county committees.

5. The preparation of a special bulletin outlining specific suggestions and procedures.

6. Letters to county extension workers and local leaders and publicity in newspapers.

7. The securing of a summary of the year's activities facilitated by special report forms being made available to local leaders and county extension workers.

It is a privilege to present this information and I hope that it may prove helpful in furthering the Farm and Home Safety Program throughout the country.

Iowa State Committee

By J. S. RUSSELL

Editor, *Iowa Farm and Home Register (Register and Tribune)* and Chairman, Iowa Farm Safety Committee, Des Moines, Iowa

Iowa has a farm safety set up and program which has proved adaptable enough to be co-ordinated with almost any type of organization.

The Iowa Farm Safety Committee became the farm safety section of the Iowa Safety Congress when it was decided to organize an all-over safety organization in Iowa—traffic, home, schools, farm, recreation, industry, aviation, fire, etc.

The committee cooperates with Iowa State college and much of the success of the farm safety program in Iowa is due to the fact that Dr. Norval Wardle, full time extension farm safety specialist at the college, also serves as secretary of the Iowa committee.

When the Iowa Farm Bureau federation decided to make farm safety a major factor in its program and hired Howard Hass of radio station WHO as fulltime safety specialist, this activity was tied in with the Iowa Farm Safety committee.

The result has been to get Iowans interested in farm safety—and that includes just about every organization and individual connected with agriculture in any way—working together and all on the same beam.

Cooperation with the Iowa Safety congress has made possible the full support of this organization in stressing farm safety and especially the seasonal programs. National Farm Safety week has been observed regularly in Iowa but even more timely and important has been special emphasis in the fall of the year on prevention of cornpicker and other autumn harvest accidents. In the spring a pickup, tuneup, clean up campaign has been sponsored by the Iowa Farm Safety committee. Fire prevention week each October is backed by the committee too.

The Iowa Farm Safety committee has a membership of 102 organizations and individuals and includes representatives of farm organization, educational representatives, publications, radio stations, state and federal departments of agriculture and their respective agencies, machinery and implement firms and organizations, insurance companies, automobile associations and state departments of safety, health and vital statistics.

Fire prevention work incidentally is a part of the program of the Rural Iowa farm safety committee and the group interested in rural fire prevention preferred this setup to one with general fire prevention when the Iowa Safety congress was organized.

The emphasis placed on formation of county farm safety committees has paid off the last year and the assistance of the Iowa Farm Bureau federation has helped a lot. Howard Hass has worked through the county farm bureaus and Norval Wardle through the county extension directors and at present county committees have been set up in 78 of the 99 counties in the state.

The drive for farm safety has received much of its impetus from the farm publications and radio stations in Iowa.

Kirk Fox of *Successful Farming* has been a leader for years in this respect not only in Iowa but in the nation. Chuck Worcester of WMT, Cedar Rapids, and Herb Plambeck, of WHO, Des Moines have rendered outstanding support while WOI, Iowa State college radio station, has boosted farm safety at every opportunity. Merrill Gregory, managing editor of *Wallaces' Farmer*, is vice-chairman of the Iowa Farm Safety committee.

Iowa State college has played and is playing an important part in making possible a farm safety program in Iowa. In addition to making the services of Norval Wardle available the college through President Charles Friley and Dean of Agriculture Floyd Andre has made possible research on farm safety at the state and county levels and a course in farm safety (A. E. 410) is being started at the college.

Wardle is at present supplying monthly work kits to farm safety committees. Most of these are set up under the Iowa Farm Safety Committee program but work is carried on as well with those who are county farm section chairmen for the Iowa Safety Congress or who are county farm bureau safety chairmen. In many instances these posts are held by the same person so coordination is relatively simple.

Just about everybody works at farm safety in Iowa and they find that their interests overlap quite a bit.

Take the matter of safety on the highway. This is primarily a job for the highway traffic safety folks to handle. But it is a matter to be tackled by the farm safety folks, too. A campaign to get farmers to come to a full stop before entering any main road will help promote safety for all motorists. The Iowa Farm safety drive to get some identification on tractors or other slow moving traffic on the highway should help all motorists since collisions between farm tractors and automobiles have been taking a toll of between 15 and 20 lives annually. An ordinary red banderlorchief tied to the top of a fishpole and displayed on the tractor is being urged as a means of warning the motorists from both directions that they'd better slow down and proceed with caution.

And so the cause of farm safety on the farm, in the farm house, on the highway and wherever farm folks work, live or play is the objective of the Iowa farm safety committee.

Just because several organizations are working on farm safety is no reason for them to get in each other's way. The Iowans feel that they can and should work together.

Teamwork in Texas

By E. C. MARTIN

State Agricultural Leader, Texas Agricultural Extension Sevice, Texas A. & M. College System, College Station, Texas

After three years of effort in trying to develop an effective farm safety program, the farm safety groups of Texas were invited to meet with the Texas Safety Association in their annual meeting in San Antonio last March 27. At this meeting, which was attended by a good group of farm and ranch people, agency representatives, and others, steps were taken to set up a more effective farm and ranch safety committee.

Mr. J. Walter Hammond, President of the Texas Farm Bureau Federation, was elected State Chairman. This proved to be a very wise selection as Mr. Hammond and his organization have contributed wholehearted support to the program. Mr. Marvin Carter, Organization Director for the Farm Bureau, is also a member of the State committee and serves as a chairman of the Finance Committee.

In the San Antonio meeting, Mr. Hammond and the committee Secretary were asked to invite farm groups, agencies, and related industries to name representatives to serve on a State Farm Safety Committee. Thirty-eight letters were sent out and 32 replied accepting the responsibility and naming someone of their organization to serve. In most cases that individual was the head of the organization or group. Four additional names have been added giving a state committee of 36.

The Chairman called the first committee meeting under the new setup in Waco, June 23. At this first meeting 22 out of the 36 were present.

The enthusiasm and cooperation in this meeting was more than could be expected.

Six committees were set up:

1. Publicity Committee—representing both radio and press—C. G. Scruggs, *The Progressive Farmer*, is chairman.

2. Youth Training Committee—Dr. F. C. Bolton, Retired President of Texas A. and M. College, is chairman.

3. Statistics and Study Committee—John C. White, State Commissioner of Agriculture, is chairman.

4. Women's Activities Committee—Mrs. R. M. Almanrode, President of Texas Home Demonstration Association, is chairman.

5. Finance Committee—Marvin Carter, Texas Farm Bureau Federation, is chairman.

6. Awards Committee—C. T. Johnson, Director, Southwestern Public Relations, The Sears-Roebuck Foundation, is chairman.

It was thought wise not to add too many committees at the first meeting. Others will be added as needed.

On the team that is working hardest to make our safety program effective, too much praise cannot be given to our farm organizations such as the Farm Bureau, the Grange, and cooperatives. All agencies have worked on a definite program in their respective fields and allied industries have shown a wonderful spirit of cooperation.

Our annual report this year will show many new names and new ideas put to work to make up teamwork in Texas. It would take too much time to name each individual and organization that has made a definite contribution, but I would like to mention a few.

Texas Farm Bureau Federation—Some 150 or more news clippings on farm and ranch safety appeared in weekly and daily papers. Clippings from the *Texas Agriculturist* and *Nation's Agriculture* magazines were sent to some 50,000 farm and ranch families in Texas. Attention was given to safety in all meetings.

Texas Agricultural Experiment Station—A safety educational program is continuous in the Station program of work. During safety week, special emphasis was given to the following items:

1. Safety in the handling of farm machinery, especially hay baling which was then in season.

2. Range fire prevention, checking of equipment for putting out grass fires and preparation of fire lanes.

3. The inspection of electrical equipment, especially machines using considerable amperage, for insulation protection and grounding.

Department of Agriculture—News releases were given to radio farm directors of the state. Releases stressed the part that education could play in farm and ranch safety. National figures on farm and ranch accidents were given.

Texas Education Agency—Teachers of vocational agriculture used class periods to teach safety education. Placards were placed in shops to direct attention of boys to the necessity of using caution in the shops. Continued to sponsor a state-wide contest in which the person who has done the greatest amount of safety work receives a $100 award.

Texas Department of Public Safety—Several thousand copies of the pamphlets listed here were distributed through Texas teachers who have taken numerous courses in safety education in Texas. They are: Farm Fire Safety Inspection Blank, Safety Guide for Farm and Home Front, Safety in the Home.

Stanolind Oil and Gas Company—The Stanolind Oil and Gas Company continued to sponsor the 4-H Club Tractor Maintenance Project in Texas which specifically sets out the safe operation of farm machinery. This project is made available to all 4-H Club members in the State and has been active in 165 counties. 4-H Club leaders selected by the county agricultural agents receive a short course in safety conducted by the Extension Service of the U. S. Department of Agriculture in cooperation with the Texas A. and M. College and the sponsoring company. The leaders, after having received training, conduct the program in local communities for adult farmers and 4-H Club members. The Extension Service and representative of the sponsor assist with the program at county level as far as possible. This is a continuous program throughout the year. New leaders are trained each year.

Stanolind Oil and Gas Company has large operations throughout the State of Texas which are restricted to production of petroleum products. There are no marketing facilities in Texas. An elaborate safety program for employees on the job and in the home is carried out. Some very good safety records have been established within the organization.

Soil Conservation Service—Field memoranda were sent out by the regional and state offices to Soil Conservation field personnel to coordinate their programs with other agency representatives in the counties in observing farm safety week. Verbal attention was given to safety week in meetings and in visitations. Items on farm and ranch safety week appeared in an unknown but considerable number of local papers, particularly in soil conservation district news columns.

Texas Agricultural Extension Service—Copies of 10 4-H Club leaflets on safety and fire prevention were distributed to 4-H Club members throughout the state. Staff members and 532 agents all devoted time to farm safety during farm and ranch safety week. A large number of agents held special meetings on safety and others stressed safety at all meetings of Club members and adults. There are no figures on the exact number of radio programs or news releases given during the safety week but this type of educational work was carried on in almost every county in the state. During the report year of 1950, 31,761 4-H Club members received special training in fire and accident prevention.

We do feel that we have made much progress and that we are on the road to greater success in the field of farm and ranch safety in our state.

The Use of Color in Safety

By S. W. QUISENBERRY

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Since Arnold Nicholson's article on "Paint Will Protect You" appeared in the January issue of *Country Gentlemen*, considerable interest has been evident as to the part color can play in making the farm a safer place to work. Personally I think color can be

used to advantage and your committee is investigating its possibilities.

I was asked to tell you something about the part the safety color code has played in industry to promote safety. Color has been widely applied to the industrial scene for many years. Yet because it has been used inconsistently and often without meaning, it was necessary that someone do something to uniform the thinking on color as a safety factor and to provide if possible a standard safety color code that was practical and sound.

In 1942 the Du Pont Company, as the result of its study on functional color, got together with members of The National Safety Council and recognized color consultants to develop a standard color code for this purpose.

The safety color code is primarily a recommendation to industry to regularize the identification of plant safety equipment and hazards by specific colors and color symbols. In developing this code we have respected traditional associations of colors, such as red for fire protection, green for safety, and blue for caution, while applying basic knowledge of color psychology and hue visibility.

If color is to contribute its maximum effect upon industrial safety, it must do more than merely attract the eye. Simple logic and scientific knowledge should combine with standardization of practice in color identification procedure.

This color code avoids such common errors in current color safety practice as overdoing the use of color by haphazard applications that cry wolf so frequently that the system defeats itself by failing to impress the worker if not *actually distracting* his attention. Also, if a certain color is used to indicate a danger hazard, it should not be used as an identifying symbol for protective equipment.

Each color should have a specific assignment so that the employees will associate this color with one precise safety message everywhere it appears.

Six basic color standards have been recommended, yellow, orange, green, red, blue and white. The meaning of each color is clearly indicated and is assigned a definite symbol for the benefit of the color blind.

Yellow, being of highest visibility in the spectrum is recommended for us in conjunction with black striping to mark strike against, stumbling or falling hazards.

Orange, psychologically the most stimulating and aggressive of *all hues is chosen* to command attention to machine hazards, which cut, crush, grind, or harm an operator. A triangle or arrow in this color which we term "alert orange" may indicate the critical point of the hazard.

The traditional color and symbol of safety is a *green* cross. Therefore, we have adopted this color and symbol to indicate safety equipment, first-aid rooms, stretchers, *gas masks*, respirators, and first-aid kits.

Red, because of its long association with fire fighting equipment, has been assigned this duty exclusively. The practice of identifying danger with red is dangerous. Scientifically red is a poor color for this purpose, being low in visibility. Red squares on walls or bands on pillars indicate the location of extinguishers, hose connections, exits, and so forth, and the use of red squares on the floor beneath such apparatus as well as in front of fire doors, tends to discourage obstruction with litter, cartons, and waste receptacles.

Borrowing from the railroad industry, the code establishes a solid *blue* circle as a symbol of caution *against starting, moving* or handling any machine, device or equipment. The "precaution blue" sign should be hung on control valves, equipment condemned or undergoing repairs, such as elevators, boilers, valves, crushers, tanks, etc. This symbol indicates that this equipment should not be used until the blue sign has been removed.

The six standards include the use of *white*, or as alternate choices gray or black, as good housekeeping colors. These colors are used to direct traffic, mark aisles and storage spaces, and to locate waste receptacles, cuspidors, rubbish boxes, and the like. Where management is insistent upon extreme neatness a white star may be conspicuously placed on waste containers or on the wall above the container.

In summary, the color code for industry is designed to do these things:

1. Employ few colors, each distinct and readily recognized.
2. Establish specific and uniform meanings for each color.
3. Provide ready identification of hazards or safety equipment.
4. Reduce to a minimum the effort required to learn and retain color meanings.
5. *Readily identify and locate fire protection* and safety equipment.
6. Encourage good housekeeping.

That this code is effective is indicated by an article which appeared in *The New York Herald Tribune*, dealing with the use of safety color code by the U. S. Army.

It stated; "use of the safety color code resulted in substantial reduction in accidents at 26 Quartermaster & Army Service Depots in the War Department reports.

"Certain types of accidents resulting in disabling injuries were entirely eliminated. Others were reduced from a frequency of 46.14 to a yearly average of 5.58 since employment of the code.

"One depot reported during the first year after adoption of the code, disabling injuries were cut from 13.25 to 6.99 per million man-hours worked."

In 1946 the New York City Board of Transportation initiated an accident prevention program for its 38,000 employees. Accidents in the shops began to fall off at once. Eighteen months after the introduction of the plan, the accident rate had dropped 42.3 per cent.

Here's how it was done:

Supervisors and foremen were given a course in safety practice. At the same time, the Du Pont Safety Color Code was installed throughout the shops. Hazards were marked in the specified paint colors by the workers themselves. Men familiar with special equipment and machines became painters. Careful checking of the work assured consistency. The change-over was made quickly so that the test had a definite starting time. Statisticians were assigned especially to follow the progress in accident prevention.

Not only was the color-with-instruction program a marked long-range success, but its savings in injuries were immediate and dramatic.

These are very interesting statements because accurate records were kept by an impartial source. We have in our files many letters from nationally known concerns that contain equally favorable comments regarding the ability of the safety color code to help reduce personal injuries. We are confident that it can do much to help improve the safety record in your industry.

Testing for Safety

By DAVID W. JUST
Assistant Secretary, Underwriters' Laboratories, Inc., Chicago

Testing for safety is the watchword, the avowed purpose, of Underwriters' Laboratories, Inc. Born in a fire station, fathered by insurance interests, nurtured by electrical fires in an incandescent lamp demonstration at the Worlds' Columbian Exposition 57 years ago, the Laboratories has from the beginning operated as a service organization.

In its infancy the National Board of Fire Underwriters, the capital stock insurance company organization, provided some financial assistance. But in 1917, as it matured, it was weaned and has operated as an independent, self-supporting, not-for-profit engineering organization ever since. We still enjoy the nominal sponsorship of the National Board.

At its present state of maturity the Laboratories has expanded from its meager electrical beginning to an organization employing hundreds of engineers, each a specialist in his own field, hundreds of inspectors located all over the United States, with main Laboratories in Chicago having 17 laboratories plus office space in a set of buildings totalling over 110,000 sq. ft. of floor area. Branch laboratories exist in San Francisco and New York. There are inspection centers in 168 cities.

To the original Electrical Department there have been added a Chemical Department, Gases and Oils Dept., Casualty and Automotive Dept., Burglary Protection Dept., and Fire Protection Department.

Bearing in mind that the Laboratories' only interest is Safety, let's see what contribution each of these departments makes to Safety on the Farm.

Starting with the toughest one first—let's look at the Burglary Protection Department. We have had inquiries from rural residents relating difficulties with chicken thieves and melon patch marauders, but these are a little out of our line. However, if we broaden our view a little, it's not too difficult to find an association between the Burglary Protection Department and the farmer. In this day and age some farmers have money. Others have mortgages, it's true. Both deal with the local bank in town, and the chances are very good that that bank has had its vaults certified by U.L. engineers for an alarm system of one type or another.

Did you think I had to reach pretty far for that tie-in? Let's try another. How about our Casualty and Automotive Department? *Until recently* all passenger cars and most trucks were under our inspection. This program had reached such a point that our safety requirements were so well accepted by the manufacturers, and had become such an integral part of their business, that our inspectors and engineers were convinced that their services were no longer needed. Accordingly we dropped out of the picture the first of this year. We now confine our efforts to tests on fuel systems and fittings, gauges and instruments, *heaters, mufflers,* fuel tanks, switches, signals and other pieces and parts that effect safety.

In the Casualty field, testing for safety techniques are applied to many products. Only yesterday, in the September-October issue of the *Farm Safety Review*, reference was made to records of farm accidents from the State Industrial Safety Division of California. The total of 12,845 accidents reported in the first eleven months of 1950 showed the leading causes to be: working surfaces 1927; vehicles 1401; hand tools 1360; ladders 1225; trees or logs 808. These account for over half the total.

Looking at the first offender, working surfaces, there *is little we can do to help* a farmer keep his barn floor in sound condition and free of loose boards, rubbish, tripping hazards; true, but the list of appliances inspected for accident hazards begins with antislip materials, including floor treatment materials, walkway construction materials and oil and grease absorbents for 357 manufacturers, and covering 18 printed pages. While the majority of these would be less applicable to the farm than to factories, stores and offices, some of the oil and grease absorbents would fit the needs of modern agriculture's trend to mechanization.

We have already discussed work with vehicles, the second offender. Number three, hand tools, is next. Among these I am sure we would find included portable electrical tools, and our Casualty engineers have worked with our Electrical Department with respect to guards to be required. Activity of testing for safety in this field has developed only within a year and a half. We hope to see these figures reduced someday when old type tools have been replaced by new.

Number four on the list is ladders. Ladders, ladder accessories, and ladder shoes all find places in Underwriters' Casualty Lists, tests being made on those bearing labels to assure structural strength and safety of operation.

Another part of this group's work is with refrigeration equipment — primarily due to compressor unit pressures. These have been observed to reach several hundred pounds per square inch under adverse conditions. The old time hazard of toxic refrigerants is a thing of the past with Freon in common use today.

The farm, today, that doesn't have a deep freeze unit is somebody's prospective customer in the very near future.

At one time, years ago, refrigeration equipment earned a well deserved bad name for fires. Largely through the efforts of the Underwriters' Testing for Safety program, these devices have been equipped with overload protective devices on compressor motor circuits. As a result, fire incidence has been reduced to the point of normal expectancy with any equipment, which is very low.

In the Gases and Oils Department, there are many investigations of oil-fired equipment that have equal bearing on farm and urban properties, although perhaps safety from fire hazards should be taken more seriously in areas more remote from fire departments. But bypassing the usual home equipment such as oil burners, oil-fired furnace units, oil stoves, and oil-fired water heaters, let's look at some of the newer products.

Instigated by the hybrid seed corn growers, the use of artificial heat for drying operations to prevent spoilage of damp crops from freezing and mold has brought forth crop driers. The end use of these devices being beyond the Laboratories' control, these have been covered as air heaters.

Of two types submitted, direct and indirect fired, the direct fired type wherein exhaust gases from the heater are mingled with the air stream is not recommended for use with combustible crops due to the danger from incandescent sparks. The indirect fired type, while it avoids this hazard, and can more safely be used for crops of combustible nature, bears additional thought as well.

These are not "over-the-counter" types of equipment, and anyone purchasing one on that basis may be sadly fooled. Regardless of the degree of safety built into the unit itself, installation at the farm plays a great part in safety of operation. Proper installation of automatic heat controls, proper interlocking of blowers and firing systems, must be complemented by precautions as to fuel supply and its handling, and other common sense safety precautions such as ordinary good housekeeping and availability of fire extinguishers.

There have been submitted, investigated, and listed some insecticidal fog applicators. These vaporize to a fog insecticides by the use of air pressure and heat. It is to be noted that only nonflammable fumigants and insecticides have been covered as suitable for use with such equipment under ordinary conditions. Some attempts to use other than water base types have already been disastrous, creating several serious explosions.

Speaking of explosions brings to the front our Chemical Department. They are our explosion experts. The explosion-proof motors, switches, and other devices used in grain elevators, where explosive dust-air mixtures are so common, are tested by these specialists. Fundamentally, the possibility of preventing entrance of explosive mixtures into such equipment is almost impossible. Who is to know when such mixtures may enter during repair, servicing, or installation? In general, the requirement for these devices is that they be so constructed that they will confine an internal explosion without venting it to explode the whole building.

In addition, precautions must be taken to assure that external surface temperatures will not become high enough to cause ignitions, even under abnormal conditions such as the stalling of a motor.

Of considerable importance to the rural area is the work of the Fire Protection Department. Where rural fire departments have been organized, many of the tools of their trade come under the work of this group. Hose—both for water and for chemical engines—extinguishers of all types, the more recent equipment for adding chemicals to water streams to produce "wet-water" so effective in penetrating hay stacks and bows, and the "wet-water" chemicals themselves are but a few of the fire fighting appliances investigated.

Fire resistive roofing materials are labeled through the efforts of this group, tests being conducted with burning brands in a wind stream flowing over a model roof section.

With reports in evidence that farm electrification has, in some states, reached the 95 per cent or higher point toward complete service, and statements in the electrical magazines that the future source of load building for most utilities serving rural areas lies in adding "chore load" through further uses of appliances in the barns and other out-buildings, the future of the Electrical Department's efforts is evident.

While electrical incubators and brooders have long been listed, there are more and more submittals of such devices as watering through heaters, which indicate the trend toward electrical utilization on farms. Fire hazards, and electric shock hazards are the quarry hunted by the electrical engineers.

Not new, but still a source of trouble, are electric fences. Collections of data, newspaper clippings, and reports all indicate the home-made type to be the culprit. I doubt very much that there has even been a safe fence controller produced in a home workshop. Safety depends too much on machining skill coupled with extensive research into effects of electric current on the heart, nerve centers and organs of the human and animal bodies. Effective currents are beyond safe limits, and safety can only be accomplished by careful, reliable time regulation of the shock.

Lightning damage dictates special precautions in circuit separation and isolation.

There are no text books to adequately cover this whole subject, and I have yet to hear of the home-work-shop staffed by safety, electrical, and mechanical engineers, together with skilled mechanical and electrical workmen.

In the battle with nature's artillery, lightning, Laboratories' engineers are constantly in the front lines. Materials and fittings for lightning rod installations are labeled, but this is only a small part of the battle. The work of the installers is carefully checked, measurements made on the job, and if the installation is such as to meet safety requirements, a label is attached to the structure. Analysis of statistics on the many thousands of Master labeled installations has been most gratifying, for they show beyond doubt the effectiveness of this program.

Lest I leave you with the idea that all products are safe, that all are investigated, let me enter a word of caution. Such is not the case.

But for the best in safety, look for the label that tells you that Underwriters' Laboratories, Inc. has had its engineers on the job. Or check up to be sure the products are listed in Underwriters' published Lists of *Inspected Equipment*. Not all products bear labels, but many are identified through publication of the catalog or model numbers.

These Lists or labels tell you that the products are under continuous check-up by our inspectors and engineers. These are the symbols of safety.

Safety on the American Farm

By JAY BOUMA
F.F.A. Member, McBain, Mich.

Do you realize that the people in the United States drove and jumped to death, shot themselves, and drowned in accidents this past year at the rate of seven and one-half times the rate the communists have been able to kill the United States troops in Korea? Can you imagine that today over two hundred farm buildings will burn to the ground and that this very hour at least eight buildings are blazing, going up in smoke, to leave nothing but ashes as proof of their remains, destroying valuable accumulations that never can be replaced? The old sayings such as "An ounce of prevention is worth a pound of cure," and "A stitch in time saves nine," seem to have a very practical meaning to the American farmer.

The National Safety Council in its annual report showed that one out of 17 Americans suffered disabling injuries last year. It also showed that thousands of Americans died accidentally each month. The total loss is about $7,700,000,000 each year, or ⅛ the value of New York City. Just imagine that in three years' time the loss is equal to the entire value of New York City. This includes the property damages, wage losses, and medical expenses. Furthermore, this is only half the story. They do not include personal hardships and suffering, or the loss of a lifetime of hard work, or the loss of a hand or leg which never can be replaced; nor does it include the production losses of herds and farms deprived of their proper care.

Farm safety should be the constant concern of every American citizen, especially at a time like the present when our nation is faced with a national emergency.

Loss of life and property through carelessness has been increasing throughout America. If this trend is to be reversed, our citizens everywhere, each and everyone of us, must be reminded of the continuing need for taking every possible precaution to avoid the ever present threat of danger.

How many deathtraps are there on your farm? Certainly not any on your farm! Don't kid yourself. There are many deathtraps on every farm, and dozens on some.

It's something like the incident that took place in the southern part of our state a couple years ago. Bill Thomson and Jimmy Hudson were in high school one sunny day early in May, talking about the work that they intended to do that night after school.

As Jim told Bill that he was intending to harrow for his father with their new tractor, he was very happy. But the scene changed considerably that night. Jim went home and started harrowing; before long he ran into a stump, which he thought he would pull. So Jim, not realizing he was living the last minutes of his life, wrapped the chain around the axle and tied it to the stump. Then it happened! As he jerked the chain, the tractor came over backward and squeezed the life right out of him. Now the only evidence of Jim in his high school is the initials he carved in the face of one of his desks. How would you like to have a 36 hundred pound tractor lying on top of you, squeezing the life right out of you? It's too late for Jim to tell the careless driver the proper way to hitch to a stump. So from now on, always hitch to the drawbar unless you would like to have Jim's experience.

While talking about tractor safety, what about tractor safety on the highway? A great many of our tractor accidents take place on the highway because many farmers do considerable driving between one farm and another, and back and forth to town. Wheels set wide apart are fine for high speeds but are dangerous on the highway. It is too easy to let that left wheel drift over the center line. If you must travel on the highway with wheels set wide apart, or implements that take more than your share of the road, stay on the shoulder of the road and reduce your traveling speed. Remember half of the road belongs to someone else.

Tractors won't hold the road like an automobile. Don't let the comparatively slow speed of a tractor fool you. It takes only a few seconds to drift off the road. Keep your eyes ahead on the road for safe driving. The age when youngsters can handle a tractor on the highway is not determined by years but by experience. Driving onto the highway without looking both ways is very dangerous, especially when you are watching not to tear down the gate post. In the meantime, you are setting up an excellent road block which may be cause for the loss of your life. Also make sure that you have proper lights for highway travel at night. But, if at all possible, do your highway traveling during the day time.

While talking about tractor safety, what about automobile safety? It seems that we must call special attention to this type of accident because it claims more lives each year than any other type of accident. What kind of driver are you when you're on the main road, the traffic is heavy, and right in front of you is a truck as big as a box car? What do you do? Do you honk, fuss, fume, swear inwardly and outwardly, and finally take a long chance to pass? Or are you the driver who is patient and waits for a chance to pass?

Incidents like this are the kind that lead to steel crashing against steel, glass cutting through human flesh, and the loss of many a life.

Falls and other accidents around farm buildings claim the second largest amount of lives each year. The carelessly handled gasoline and kerosene, the faulty or uncleaned heating equipment, the thoughtlessly thrown cigaret or match, these are the things which cause many farm fires. No fire sirens blow, and no bells ring when a fire has been prevented. It is a sober routine of hard work. The reward is uninterrupted progress and happiness instead of suffering and hardships. The surprising thing is that it's an amazingly simple job. Every year the second week in October is set aside for fire prevention week. During this time nation-wide attention should be focused on the problem of fire waste. Everyone should take time to put his house and buildings in shape so that they will be safe from the threat of fire. Remember a little prevention is worth more than all the fire fighting equipment you can buy.

Falls from windmills, rotten ladders, haymows, and grain bins, children playing by water tanks, swinging on hay ropes and other forbidden places on the farm, are the causes of many broken bones. How are the ladders on your farm? The higher you climb the harder you fall! Remember, keep your ladders in repair unless you've learned to walk on air.

Many an American farmer loses a finger or hand on our modern farm of today with its power machinery. No accident-prevention program can be successful without the wholehearted cooperation of the person who is directly responsible for the operation of equipment.

To read accident reports from all over the country is to be convinced that a large

number of accidents can be prevented only by the operator who runs this machinery. No power-driven equipment, whether it be transportation or processing, whether it be on the highway, in the harvest field or in the industrial plant, can be safer than the man who is at the controls. If farm accidents are to be prevented—and they can be prevented—it will be done by the operators who accept a full measure of their responsibility.

It is true that the designer, the manufacturer, the safety engineer can *help*: and they will help, but their combined efforts can be wiped out by a single careless act of the operator.

So you see there are many ways in which people are killed and injured each day. Remember, be alert today, and you will be alive tomorrow! *Is it one of your friends*, or someone in your family, or even you yourself who will be one of the 275 people who will be killed accidentally today? Are you going to lose one of your fingers or a hand or even a leg accidentally this year? Remember the chances are one in four that *there* will be a hospital or medical bill in your family this coming year.

For all these reasons every citizen of our state should be urged to consider carefully the risks which may be present in his home, on his farm, in his place of business or employment, which might be the cause for *the loss* of his life, and to make every possible effort to eliminate these hazards. Always remember the life you save may be your own.

The Contribution of the Homemaker to Farm Safety

By GLADYS OLSON
Home Economics Education Dept., Iowa State College, Ames, Iowa

We need more women-homemakers, farm *homemakers*, saying, "all right, I'll do that," when asked to do some type of community work for safety, whether it is for farm, farm home, traffic, or recreational safety.

You as farm safety leaders are each frequently placed in situations in which it is necessary to secure speakers, members of panels, discussion leaders, people to preside at meetings, etc.

Don't you sometimes hesitate to ask people to do these things, especially busy and important people?

When the person to be asked is a girl or a woman, some factors arise which are not quite the same as when you ask a boy or man to perform. Of course, you may or may not agree with me on this point.

I think women are more likely than men to say, "Oh, I can't do it," when they probably could manage to do it. A man often says, "All right, I'll do that." Women are apt to be more reluctant partly because they do not see clearly how they can make a contribution.

When thinking of this reluctance and hesitation on the part of people who have been asked to do community work whether it is for safety or something else, one statement has helped me. Dr. Martin F. Fritz of the Psychology Department at Iowa State College made the statement. We were preparing for participation in a panel discussion. The topic under consideration was: ways to interest adults, farm men and women, in coming to educational meetings. Dr. Fritz reminded us that if you ask a person to come to a meeting it places them immediately on the side of proving or justifying why they cannot come. The same situation seems to be true when you request a person to take some community responsibility.

This seems like a very simple thing but it has helped me greatly. It made me stop and think of the process someone goes through as he or she weighs whether they will or will not be chairman of the safety committee. It is quite interesting to imagine the struggle going on as the person is thinking whether he or she can assume the responsibility, for we know so well what goes on in our minds in similar situations.

I do not want to seem unkind and I don't believe one should feel that we are when

we are giving someone a chance to decide whether they will make a contribution to safety work. Many people have never faced up to the problem, "Can I do something to further the safety of my farm and community."

Humor mixed with this request may help or a hint of the possible value to her if she assents may entice the homemaker to appear in a program.

In this connection of securing speakers for safety, a rather interesting incident occurred recently in our state. A young woman agreed to speak and appeared as a member of a panel representing home safety. Eleanor is a very vivacious and attractive young woman and was able to make a fine presentation for the cause of home safety.

Some months after her panel appearance, a young man joined her as she walked down the church steps one Sunday morning. They exchanged pleasant light conversation, got into their cars and drove to their respective homes. In a few hours the young man, Harold, telephoned Eleanor and explained that he had seen her before their encounter on the church steps. He had heard her as a member of the safety panel I mentioned and ever since had been interested in meeting her. Since that time, which is now a period of months, Eleanor and Harold have been seeing each other socially. New social experiences can bring added enticement for being on panels, chairmen of committees, etc. but we can't always guarantee such results!

All of these words, so far, have been intended to help us think over the ways we can assist homemakers to make contributions to community safety work.

Let's now move to consideration of the homemaker's contributions to the safety of the farm situation as she is at home with her family. Here her ability as a manager influences the safety of the home, in such ways as the following:

By proper emphasis of orderliness in the home: by this we do not mean precision orderliness which makes living unpleasant and uncomfortable. But we do mean such things as providing adequate storage, that is storage suitable to accommodate the articles to be stored and near the place of use. Suitable adequate storage space gives some assurance that articles will be returned to the storage place rather than left in traffic lanes.

Another way is by simplfying home furnishings. For example, hazards are reduced by eliminating brica-brac, small tables, footstools, magazine racks and other furnishings that complicate the task of housekeeping and contribute to hurry and fatigue, yet do not add comfort or beauty.

A homemaker can also avoid fatigue caused by wasted effort with such practices as the following:

1. By using a bulletin board for a daily schedule.
2. By not doing too much in one day.
3. By using time-saving equipment.
4. By taking time out for lunch and rest periods.
5. By not beginning too many jobs at one time; finishing one job before starting another.
6. By cancelling tasks that cannot be justified.

All of these management points help combat the hurry, flurry and fatigue factors of the homemaker's job.

In addition she promotes good management of energy and effort by developing good work habits of lifting, carrying, and sitting, and by keeping equipment in good working condition; by seeing that repair is done when needed and judging whether it is a job which can be repaired at home or one for an experienced or skilled workman is another way.

Occasionally she must insure safe living by arranging to have the load on electrical circuits checked when new appliances are added; also by eliminating trailing extension cords and adding outlets, light switches and lamps at points of need.

Perhaps her best contribution is made by securing family cooperation in taking responsibility for these good management practices. Planning activities together so that all family members have a part is important.

The homemaker's ability to promote good family relationships has its effect upon the safety of the entire farm and home situation. Each family member is a very important contributor to good family relationships but the homemaker, the mother, is

most likely to be the one who is keeping things moving in this direction.

The contribution of good management inside the farm home also affects the activities that go on outside the home in the farm operation. Those members of the family who do the work outside the house are better able to work efficiently and safely if the household activities are fairly well managed. We could go into this connection in detail but will treat it briefly, emphasizing only that relationships and attitudes are of utmost importance.

For example, the father and the children (at most age levels) may be rather nonchalant and careless of their own safety, but when mother is interested in their using safe practices, there is an added incentive. It means that the husband and children are not just protecting themselves—which might seem weak or sissy—but are also doing so for someone they hold dear.

Let's take an instance in quite another connection to illustrate how good relationships in the family promote safety. I'll tell about a real incident again. Bill, a fourteen-year-old 4-H boy came home from his club meeting one night about July 9. He brought home five hazard tags and inspection sheets. I presume we all know about this 4-H activity sponsored in relation to National Farm Safety Week, July 22-28.

As soon as Bill arrived home, even though it was quite late in the evening, his mother —and in this instance the father too—looked over the materials and discussed the purpose of the red tags. They thought of some places on the farm that might be classed among the worst hazards which, according to the directions, were the ones to be tagged.

I believe we would all label this opportunity to talk over safety activities as good family relationship. However, to me the next part of the incident shows special understanding on the part of the mother. Much of the time safety is a serious, rather grim and sorrowful subject, and thus sometimes safety is limited in its appeal to youth.

Now on the evening the red tags were brought home, Elizabeth, an adult guest, was visiting in Bill's home. She had gone to bed and to sleep before Bill returned from 4-H.

Before going upstairs to bed Bill said jokingly, "I think Lib is a hazard on this farm. Mother, would it be all right if I hung one of the red five-worst-hazards-on-the-farm-tags on Lib's bedroom door?" Mother said, "I think that would be fun."

In the night Lib got up to go to the bathroom and was much amused by the tag on her bedroom door. She went back to bed, then couldn't resist getting up and retaliating in some way. She used materials at hand and stretched a string between the casing of his bedroom door and attached a sign "Genius at Work."

For days the family had humorous as well as serious associations to make when the red tags were mentioned.

Of course the ability to make an interesting situation of a removal of hazardous situations must be partly attributed to the personal characteristics of these family members. However, it does give a concrete illustration of another contribution of the homemaker to farm safety. This is a less tangible type of contribution than the management role, but one of the angles on which we need to work with her. Help the homemaker in your community recognize the opportunities of exerting a strong influence in developing family attitudes and habits!

We have mentioned the homemaker's contributions to farm safety as a community member, as a home manager, and as a family counselor.

In closing I believe we might profitably mention a slogan which is just as suitable here as for organizations who are working upon the improvement of good group interaction and group productivity. The slogan is "Those Who Share Care." The more homemakers there are who not only contribute but who help family members share in safety activities, the more members of families there will be who care and share in safe living.

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Current Safety Topics in the

FOOD INDUSTRY

As presented in the Sessions of the Food Section at the 1951 National Safety Congress

(Proceedings of the Refrigeration Safety Committee Meeting are included in this volume)

Volume 11
Transactions
39th National Safety Congress

NATIONAL SAFETY COUNCIL
425 No. Michigan Avenue • Chicago 11, Ill.

New Ideas...

If safety is to keep pace with today's rapid, advancing technology, we must continually have "new ideas."

Each year, at the National Safety Congress, the ideas and experiences of many of the nation's top safety men are presented in the various sessions. Many of these ideas, devices and methods, first presented at a Congress session, later become generally accepted within their fields.

In order to present this information conveniently and at small cost, the Congress Transactions are published in volumes, one for each Section or Division, along with a General Sessions and Detailed Index to all volumes. The 34 volumes of the 1951 Congress Transactions are listed on the last page of this volume.

Safety directors everywhere have found the Congress Transactions a useful aid in their accident prevention programs. In industry, for example, their judicious distribution to key personnel in management and supervision has proved to be of invaluable service.

In preparing these Transactions, the proceedings of the Congress have been condensed and edited for reference purposes. Complete original manuscripts, with any charts or illustrations which were used, are available in National Safety Council files. Views expressed at the Congress or in this record are those of the Congress participants and are not necessarily those of the National Safety Council.

THE FOOD SECTION

This volume is a record of the sessions held at the 1951 National Safety Congress by the Food Section. The conduct of these Congress sessions each year is only one of the many cooperative activities which the Food Section carries on in behalf of its members, and for the benefit of accident prevention work in the food industry generally. The Section gives guidance in the preparation of a great variety of technical and educational material useful in the day-to-day safety programs of food plants. The activities of the Section are under the direction of its Executive Committee, the members of which are listed at the close of this volume.

Planning and Administering a Safety Program

(A Panel Discussion)

Discussion Leader: LeRoy J. Collins, Safety Director, Spencer Kellogg & Sons Co., Buffalo, N. Y.

Participants:

Roger J. Bear, Safety Dir., The Kroger Co., Cincinnati, O.

Gregg Meyers, Safety Dir., Fire Prevention & Plant Protection, Blatz Brewing Co., Milwaukee, Wis.

J. J. Frabolos, Supervising Safety Eng., National Distillers Products Corp., New York City.

N. E. Thiel, Dir. of Safety, Southern Dairies, Inc., Washington, D. C.

Summary of Discussion

For a safety program to be successful, there must be careful and complete planning on the part of the safety department, according to N. E. Thiel.

The safety meetings must be scheduled in advance and the material for the topic to be discussed must be in the hands of the individual responsible for each meeting, well before it is to take place. In this way the men are relieved of the task of preparing their own safety talks. Thus you avoid the common excuses of "No time for a meeting," or, "No topic prepared."

The material for the meeting should be factual material, from the industry involved, and whenever possible from the particular plants involved. This brings home to the men the importance of safety.

The posting of posters, plant and vehicle inspections, along with all other formal parts of the safety program should be planned well in advance. This insures that there will be no unforeseen stoppage of work for a safety meeting, which would upset the supervisor's production plans.

To effectively administer a safety program, you must have the backing of top management, J. J. Frabolos feels. Further, you must maintain a high level of interest all down the line. This can be done by contests, etc., and a thorough job of following up accident reports and hazards found through regular plant inspections.

When the accident frequency goes up on some particular job, or at some particular time of day, the safety man must look to the accident reports to tell him what the trouble is.

When you find that a lot of the men having accidents are new employees, then you must check the indoctrination system, to see if it is functioning properly. If a lot of accidents are happening at night, you must look at the supervisory personnel to see if they are doing their job. An accident report must always contain detailed information as to the conditions under which an accident occurred.

Roger J. Bear explained the value of statistics in maintaining an active and interested line organization. They have a need to know where they stand in their department, in their industry, and in industry as a whole.

The primary purpose of statistics, he explained, is in establishing a par of accidents for the particular plant or department, at which point you can begin to judge the effectiveness of your program.

In presenting statistics to the line organization, you must make them interesting, by making them real. They must show an improvement, as this gives an incentive to the men.

When statistics are used to compare different industries, or different departments, it is very important that the basis on which they are compared is fair to both parties. The number and severity of hazards which the several departments are subjected to along with the number of man-hours per department must be taken into consideration.

A brief account was given by Gregg Meyers of the problems he encountered when he set up a safety program in a plant which had never had one. While he had the backing of top management, he at first found little enthusiasm in the line organization.

The original inertia was overcome by selling the idea of safety to the individual men. In this he found invaluable aid in a cooperative medical department, along with the purchasing, housekeeping, accounting, and other departments. He found it expe-

cially effective to take the head nurse out through the plant with him to investigate the scene of an accident. The sight of the starched white uniform seemed to make the men a little more safety conscious.

During the question period which followed the discussion, Mr. Prabulos was asked how to keep safety in the minds of top management. He suggested that through reports and records-of-progress, top management interest could be maintained. Further, they could be induced to take part in various safety ceremonies, such as awarding safety plaques and prizes.

The problem of what basis to use when drawing up a safety progress report was raised. The point was brought out that it was difficult to estimate the cost of severe accidents, especially if they went through the courts, and that while the frequency of accidents tended to go down, the cost of medical and other expenses per individual accident had generally increased tremendously.

Neil A. Madigan, Director of Safety for General Mills' Eastern Division was asked to outline the safety program they maintained in their Buffalo, N. Y. plants. Among other things, he mentioned that they served violators of safety rules with a "safety summons," which required them to appear before their foreman and explain the causes for the infraction. Anyone in the plant could issue one, through the safety department, and everyone, from top management down, could receive one.

The question was raised as to whether this practice was not taking away a part of the foreman's job. Mr. Madigan felt that it was not, since the man's own foreman would handle any corrective measures involved. The summons is only a warning, and does not carry any penalty, except that the recipient of two summons in any three month period is exempted from the quarterly safety dividend of the company, usually an ten-pound sack of flour, or something similar.

Grain Handling and Processing Division

(Summary of a Round Table Discussion)

Presiding: E. F. Gomoll, safety supervisor, Clinton Foods Inc., Clinton, Iowa.

After brief introductory remarks by the chairman, the problems in accident prevention placed on the agenda were brought forth for general round table discussion. The problems presented were: What can be done to make sure belt guards are replaced following maintenance or repair?

Recommendations were: guards were hinged at the top so after repairs were completed they could be dropped back into place. Some plants have a standard incentive program where if a guard were left off, repairmen would receive a penalty resulting in a monetary loss. This system brings about good results.

Further, safety painting using contrasting colors with high visibility are used successfully in some plants. Also, improved design so repairmen can easily replace guards was advanced as a solution. Many guards are so heavy and poorly designed that extra help is required to replace them.

The second question concerned the hazards of deep tank cleaning and entry of grain bins. Recommendations were: Necessary precaution must be taken to make sure there is enough oxygen to sustain life and also to test for air contamination. Many types of hoists and safety belts are used.

The Gardner-Denver 450-foot cable electric hoist equiped with a transmission has been used to lower workers into deep grain bins. The Buckingham Belt Company manufactures a chair or boatswain's seat which keeps the man in a sitting position. This prevents the man from getting out of the seat while he is inside the bin.

Bin dischargers with rotating arms have been used with fair success in medium-size hoppers. Forced ventilation is used by some plants during these operations. Coppus blowers or a hose attached to a compressed air line are used to a good advantage.

Also, some plants have a definite procedure to be followed for tank cleaning operations; such as flushing the tank with a large volume of water first and testing the air for H_2S using lead acetate paper. Self-contained oxygen masks and fresh air hose masks are also required for those men who perform tank cleaning operations.

It was next asked what precautions were necessary in the use of cyani gas for grain fumigation.

Recommendations were: Since the gas is very hazardous to use, the first problem is to make sure all employees are out of the plant before gas is released. Only those trained in the use of this gas should be allowed to handle the project. Gas areas must be thoroughly ventilated and checked for contamination before opened for normal operations.

In considering the safe operation of power shovels for unloading grain; discussion revealed nothing new developed during the last year. It was brought out that magnetic cable is expensive and wears out too fast. Fluid drives were installed and used successfully by one plant.

The fifth question asked how to safeguard hoists at truck dumps for unloading grain.

Recommendations were: The steel chocks should be adjusted so they come up halfway on the rear wheels of the truck. One important factor was stressed—to be sure the brakes were not set before raising the truck.

It was reported that the Kewanee Company changed the design of their installation so the chucks raise six inches over the center. Two accidents were reported where trucks jumped wheel chocks—one resulting in a serious injury.

Reduction of fall type accidents was taken up next.

One recommendation was the use of the non-skid material which could be applied to the floor, dock boards, or any slippery area. It was generally agreed that this material offers fair protection against slipping hazards.

Question seven took up controlling static electricity in solvent extraction plants.

Most companies require workers in solvent plants to wear non-conducting shoes. However, one plant found they didn't wear well if they became exposed to vegetable oils. A non-sparking metal band which clamps to the worker's shoes is used successfully in some areas.

What incentives are used to assist foremen in holding departmental safety meetings was another of the questions.

Recommendations were: Furnish each foreman with proper material for a twenty-minute meeting. Those companies who have this type of program usually hold them after the close of the working day and men attending are paid overtime. One company reported that material is planned and furnished to the foremen for the whole year. Minutes of these meetings are forwarded to the Safety Department for whatever action is required.

In the General Discussion period, the idea of developing a single sheet card for short safety talks was discussed. These cards of suitable size with a single illustration on the front facing the audience and enough pertinent information on the back covering the subject for delivering the talk will be helpful to carry out foremen's safety meetings. These cards would be inexpensive and could cover a large number of subjects useful in any safety program. This ideas appealed to the majority of those present. George Steel of Ralston Purina took the floor and announced that this would be a fine project for the Grain Handling Division to take over for the coming year. He stated he would be glad to act as the coordinator with National Safety Council to get the job done.

The problem of unloading grain from box cars in which the floor was patched also was considered. It was brought out that some companies have recognized this hazard and posted warning signs on the grain doors on both sides of the box car stating the floor is patched and to use caution during unloading operations.

Distillers Division

(Summary of a Round Table Discussion)

Presiding: I. W. SHUTT, Dir. of Safety, Joseph E. Seagram & Sons, Inc., Louisville, Ky.

Chairman Shutt opened the discussion by giving the background and development of the three pamphlets now published by the National Safety Council for the Distillers' Section.

The three pamphlets are: 1. *Grain Handling and Milling*, No. F-6; 2. *Mashing, Fermenting, Distilling and Stillage Drying*, No. F-8; and 3. *Warehousing and Bottling*, No. F-7.

The question of the distribution of these pamphlets was discussed at some length. It was felt that the price of $0.45 per pamphlet might limit the distribution among the distillers, but it seemed to be the consensus of opinion that this obstacle could be overcome some way.

It seemed to be generally felt that the distribution outside the distillers' group could best be carried out by the National Safety Council since they are equipped to distribute other pamphlets in the Industrial Safety series.

No action was taken by the group other than agreeing to carry the matter over to the next meeting to be held in Louisville. It was felt there would be more persons attending this meeting.

Civil defense in the industry was discussed at considerable length. It developed that no one had actually done very much in the plants. Some discussion has been carried on and some plans tentatively made. A "wait and see" attitude seemed to prevail among the representatives. In general it seemed to be agreed that the best course to pursue at the moment would be a general tightening of plant protection and fire prevention work under existing policies, making some adaptations in recognition of the possibility of atomic attack.

There was also a general exchange of ideas on lightning protection of alcohol stored in outside tanks, barrel hoists or rickers and other miscellaneous discussion.

Accidents in Candy Industry

By R. E. DALSTROM
District Safety Director, Lumbermens Mutual Casualty Co., Chicago

What's behind the accidents which occur while making the candy we all enjoy? First of all, management's attitude. The accident frequency is in proportion to the effort put into safety by management. Then, it's how well the supervisors follow through in putting safety across to employees.

I believe we should be able to say it's just that simple. Wouldn't we all wish it was actually as simple as it sounds when you boil the problem down to basic policies?

After management is thoroughly sold on the need to prevent accidents to maintain maximum efficiency and when a program has been established to obtain full participation of supervisors and employees, we quickly find out the solution of the specific accident causes presents many interesting problems.

We have made an effort to help solve some of these problems by an analysis of 1000 accidents which either lost time or required medical attention.

Let's review these facts together. Behind this curtain of 1000 accidents will be revealed some of the story. We will look at one section at a time.

By removing this small section we find the problem of hand trucks. When you consider the large amount of hand truck movement in a candy plant as compared to other types of industry I am surprised it is not even greater than 3.5 per cent or 35 accidents in a thousand.

The old argument of pulling vs. pushing

trucks comes up here. About 13 of the accidents occurred while truck was being pulled and in 22 cases the truck struck another employee. *By pushing the truck we will* definitely prevent the thirteen accidents but what about the others?

I guess we will have to stick by our previous conclusion, namely "If a truck is piled to permit visibility and the operator is alert and aisles are adequate, this type of accident will be at a minimum."

We can pass by the next section quickly. *This miscellaneous group of almost 6 per* cent contains the cases of questionable accident history and a few unusual accident causes. Maybe the personnel managers can work out a procedure to win the confidence of the employees and avoid so many cases where injury is claimed at the plant even though some outside activities may have been the chief reason.

The sections are now getting larger. No wonder it's "hot substances." Kettles and cooking of ingredients is an essential part of candy making. A well organized plant will make it unnecessary for an employee to reach into a hot kettle area to operate valves or make any adjustments. Spillage is always a problem when hot liquids are involved. Allow for this by a margin of safety between top of liquid and top of container. If gloves are worn and kept in good condition burns need not occur when handling hot candy batches. By the way about 10 per cent of all disabling injuries fall in this group.

Seventy-six eye accidents as revealed in the next section seems too high for this class of business. However, like many maintenance employees who are only occasionally exposed to eye injury, the enforcement of eye protection becomes difficult. I'll just let you kick this one around.

What do you suppose are some of the items that fell 87 times to cause an injury to the employee? *Mixer* covers, cartons, bags, leveling bars and other tools. These falling items not only hurt but also resulted in considerable disability. Proper piling and safe procedures are the only real preventatives because it would not be considered practical to expect a large percentage of employees to wear safety shoes.

Here comes one of our old friends. "Handling materials." I'll bet you expected this to be much bigger. Wait till you see the section involving strains! These 108 cases are only the ones which result from getting caught between objects, bumping hands, slivers, etc. If management and supervisors will team up to provide even flow of materials without congestion these accidents can be controlled. Of course, we can never overlook the necessity for employee training and supervision.

This next one, "machinery," is most interesting and we could easily take up a whole session on this alone. I believe most candy executives want to effectively guard all dangerous moving parts where practical. Haven't you noticed however, a tendency on the part of candy maintenance men to be a little more lax in maintaining guards than in other types of plants? This may be primarily due to the need for more frequent adjustments and repairs. To simplify their own work they prefer to leave off some guards or fail to replace them after repairs, etc. The correction here depends on authorizing the foremen to refuse to accept any *machine for production which is not fully* protected.

Cleaning or adjusting machines while in motion accounts for 52 of the 129 accidents. Candy wrapping and packaging machines are the chief offenders. Isn't it true that machine manufacturers are continually working for greater speed or a larger number of wrappings per machine for each day? This means more frequent jam ups and faster moving machine parts which make increased alertness on the part of supervisors and employees essential. However, the new machines have made greater use of the hopper feeding device to reduce the exposure. The illustration now I believe shows one preventative step. A properly placed sign on each machine such as shown has reduced this type of accident by 60 per cent.

The most crippling injuries occur from machine operations so a high degree of concentration by the supervisors can reduce the severity by almost 40 per cent.

I know one plant which operated over 1,500,000 hours without a disabling injury only to have it spoiled by a serious machine accident.

There are two things humans do during working hours, one is picking up and setting down materials and the other is moving around on two feet or standing on two feet. When you watch a child learn how to walk

you realize that we all must learn to maintain proper balance to avoid falls. Since we are not walking on all fours it doesn't take much to tip us over or start us on the way down.

132 times in a thousand cases the employees fell—61 times on a level surface and 71 times from elevations.

Stairs are a real source of trouble in candy plants. The solution here would be to build one of those new modern plants with all operations on one floor. Till that can be done, however, we do have the problem of good treads, light and no running.

Slippery floors are a contributing factor and falling from machines or work platforms also result in severe injuries.

Almost one out of four accidents from falls result in some disability.

Why do so many employees have to step on objects or bump into fixed objects? 13.5 per cent of injuries occur in this way. It's safe to assume housekeeping and plant congestion is a real factor. Maybe an accident of this type may suggest investigating the eye sight of workers and certainly if he works in jerky motions rather than with a smooth action, some suggestions by the supervisor will be appropriate.

Protruding objects including nails should of course be eliminated or protected.

I imagine by now you can make out some interesting features in our photographs of a few activities within a candy plant. Can you guess what the largest and final section will reveal as an accident cause? Right you are! "Strains from the handling of objects." Over 18 per cent of all accidents result in strains and over 20 per cent of the disabling injuries. Most of them result from the handling of candy batches, but cartons, sugar bags and starch bags also are high on the list.

The selection of suitable employees for heavy handling presents a real problem particularly in war production periods. Preemployment physical examination will help control aggravated hernia situations which are rather prevalent.

Another important phase is getting set properly before picking up objects. I believe the strains in the candy business are due primarily to an attempt to move objects with the body in a twisted condition rather than the weight involved. In an audience of this type it is not necessary to emphasize the importance of lifting with the legs rather than the back.

Time does not permit a discussion of all the facts behind these accidents such as: production schedules vs. safety; environmental factors requiring broad engineering developments; employee relations and union co-operation; and types of safety programs.

However, I can recommend to you a procedure from which you will derive the greatest benefit from an accident analysis. At your safety meetings consider carefully each accident cause separately. In other words at your next meeting set up a committee to study strains and report for discussion the following month. Keep this on the agenda until all lifting equipment has been thoroughly analyzed and procedures developed which can be released in written form.

Then proceed to the next cause and continue on a step by step method of discussion. Even though this is not a new approach I do not believe it is used as much as possible.

The catastrophe possibilities have not been discussed because such occurrences are infrequent. However, the control of starch dust and eliminating all source of ignition from electrical systems is important. Most plants have made fine progress along these lines in recent years.

Air Contamination

By LEONARD M. SCHUMAN, M.D.
Deputy Dir., Division of Preventive Medicine, Ill. Dept. of Public Health, Springfield

It has always been platitudinous to speak of pendular swings in history and there have always been those who have contested such allusions to the unfolding of human progress. Perhaps, the compromise in such antipodal concepts may lie in an analogy to a pendulum with an ever increasing amplitude of vibration, starting with the zero

position as the point of complete ignorance.

Realms of endeavor in which there are large gaps of knowledge are especially susceptible to such pendular swings of theory and its corollary, practical application. As new information is gathered and tested the swing may be extended more in one direction than the other. Newer information may even reverse the swing completely. Finally, as the bulk of data has been collected, tested and theory has acquired unequivocal proof to become law, the pendulum is arrested at or near the top of a swing where it remains.

The subject of air contamination has, to a great extent, experienced such pendular swings because of inadequacy of knowledge in the past. In the Middle Ages and the Renaissance prior to the unfolding of the germ theory of disease, man was panicked by the violent spread of epidemic diseases even among individuals without any apparent contact with other cases and, having no knowledge of the role of the healthy carriers, postulated miasmas and malignant vapors for which those who would fend off such vapors were best advised to carry burning firebrands to "cleanse and purge" the air.

With the development of the germ theory of disease, based for the most part on the brilliant researches of Pasteur, miasmas were soon relegated to limbo and case-to-case or carrier-to-case contact transmission held sway to the almost complete exclusion of the role of the atmosphere as a vehicle of transmission of infection.

In fact, contact was generally held to be, for the most part, the modus operandi of spread of the acute respiratory and contagious diseases until 1934.[1] Since that time, many observations have been recorded of the transmission of certain specific infections to experimental animals via aerial contamination and these observations are now being extended to human population groups. The interest in this method of disease transmission has, in fact, led to serious questioning of the major role of contact in the spread of infection.

It it difficult to understand the lack of attention to air as a vehicle even though the bacteriologic researches of the second half of the 19th Century seemed to satisfy our philosophic demands for etiology—for the relationship of cause and effect. It is difficult to understand such lack of attention for almost half a century when, in the work by Pasteur in the days of the controversy on spontaneous generation, sterility of flasks of broth could be maintained if the microorganisms were filtered from the air by means of cotton plugs, or in the work of Tyndall, by open glass tubes bent so that air had to flow around a series of sharp corners during "breathing" of the flask.

It is even more difficult to understand this lack of attention when anatomists and physiologists have long known the relative areas of surfaces of exposure in the intestine as compared to the lung. The small intestine, specially adapted for absorption with its surface-increasing villi, has an approximate surface area of 10 square meters[2] whereas the alveolar surface of the lungs measures 90 square meters.[3] Furthermore, consider that the average adult, performing moderate physical work, inhales 36 to 180 pounds of air in eight hours.

Compare this with the total weight of food *and* water consumed by this man in an entire day. Then consider the potentialities of inhalation and absorption of air contaminants. And yet we become indignant at contamination of food, milk and water while ignoring air sanitation almost completely.

Then, too, respiration is quite an automatic process and the contaminants or pollutants of air are all to frequently invisible and insensible. The seemingly innocuous character of air contaminants may belie their vicious effects. They have undoubtedly stamped the history of man's relation to his environment with indelible though apparently subtle effects.

Unless certain contaminants are immediately irritating or productive of severe effects, they frequently pass unnoticed. Unless contaminants are visible or obviously odoriferous, they are ignored by the worker. The asthmatic knows immediately when he has been exposed to allergenic particles in the atmosphere. The average normal worker senses nothing when he breathes fine silica particles.

The sensitive individual soon appreciates the dermatitis developing on his hands after exposure to certain fumes, vapors or liquids. The average normal worker thinks nothing of (or even enjoys) the sweet odor of acetone or amyl acetate at

concentrations above the allowable maximum.

It is usually an epidemic of fatal illness such as the Donora Experience which teaches us the role of acute air pollution in disease production but the role of small dosages of contaminants in the production of chronic disease requires further detailed and intensive study. It is well then that an ever accelerating attack on air contamination and its role in disease is developing.

Although the literature on air contamination has become voluminous its study must still be considered as being in its infancy especially with reference to airborne infection. Great strides are nevertheless being made and much practical application is resulting therefrom.

The Categories of Air Pollutants

What are the basic categories of air pollutants or contaminants? If my initial remarks have left the impression that emphasis must necessarily be placed on the air-borne agents of infectious disease, I shall endeavor to disabuse this impression.

Among the several working environments a diversity of air contaminants may be operative. Air contaminants originate from many processes in addition to those occurring naturally, such as erosion, windstorm, earthquake, volcanic eruption and the biochemical or biological processes. Manufacturing, transportation and agricultural processes as well obviously contribute contaminants to the air.

At times such contaminants are classified as organic or inorganic, visible or invisible, microscopic or macroscopic, particulate or gaseous, toxic or harmless, beneficial or destructive. In general, the conventional approach to these categories of contaminants based on their origin or method of formation delineates: *dusts*, fumes, *smokes*, *mists*, fogs, vapors and gases.[1] In many industries any number of these physical and chemical agents may be present.

Their basic definitions are essential to the evaluation of hazards in any industry.

Dusts are solid particles projected into the air by natural or mechanical processes and are smaller than 100 microns in size.

Fumes are solid particles formed by condensation of vapors from solid materials as molten metals.

Smokes are very small solid particles formed in incomplete combustion of organic substances.

Mists are very small airborne droplets of materials which are ordinarily liquid at normal temperatures and pressures. Sneezing produces mists which contain microorganisms, but the difficulties in classifying such organisms will be discussed below.

Fogs are even smaller airborne droplets produced by condensation from the vapor stage of liquids. Both fogs and mists are termed aerosols.

Vapors are the gaseous phases of substances which are solids or liquids in their common state.

Gases are formless fluids at normal temperatures and pressures.

It becomes obvious that airborne living organisms do not lend themselves to such a classification too readily for these range from submicroscopic viruses to large pollen grains. Bacteria range from 0.2 to 5 microns, thus overlapping the dust and fog ranges in size as do fungus spores which measure 1 to 10 microns and pollen grains which vary from 5 to 150 microns.

Their classification as particulate matter is still further complicated by the confusion which has existed over the term "air-borne infection." An attempt to clarify this confusion which is quite pertinent to air sanitation both in disinfection of air (sanitary ventilation) and in prevention of aerial contamination (dust suppression) will appear in the discussion on pathogenic organisms as air contaminants later in this paper.

Air Contaminants Pertinent to the Food Industry

Dusts: "Dust is one of the most immense and widespread commonplaces . . . It is generally unpleasant, undesired. Dust in the eyes, mouth, lungs, effects, or imagination of human beings is generally anathema."[2] Dusts exist everywhere in the atmosphere and are of mineral, vegetable or animal origin. Persons exposed to dusty occupations comprise one of the largest industrial groups. Certain occupational diseases among workers in dusty atmospheres are due to entrance of dust into the body primarily by inhalation, but also by ingestion and absorption through the skin.

In the food industry one is immediately drawn to discussions of dusts of vegetable origin such as grains, flour, starches and pollens. Of immediate interest is the allergenic or allergy-producing character of many of these dusts, which need not be limited to the pollens alone. Pollens could be brought in with grains, though fungus spores which may serve as allergens for the hypersensitive individual may also present a hazard in this way. Hay fever, asthma, eczema and contact dermatitis are all allergic manifestations varying with the hypersensitive individual and induced in such individuals by protein materials specifically selective for these individuals.

Since such substances enter the body most commonly by inhalation, the role of inadequately controlled dusts comprised of certain grains such as wheat, of powdered milk and eggs and of pollens and fungus spores as hazardous air contaminants cannot be overlooked. Furthermore, non-specific dusts may also precipitate asthmatic attacks in allergic individuals even in the absence of specific allergens.

That *mineral* dusts may be of significance in the food industries is not often considered and yet pneumonoconiosis caused by cereal dusts has been reported among grain handlers.[3] In one study 21 of 84 grain handlers had pneumonoconiosis and chemical examination of samples of cereal dusts (wheat, oat and barley) obtained from silos disclosed appreciable amounts of free silica. Guinea pigs exposed to several months of inhalation of these cereal dusts presented pathologic processes identical to those in the grain handlers. The recommendation of extraction of dust from cereals by cyclone aspirators at the time of unloading was made in this situation.

One can also recall to mind the upper respiratory difficulties encountered among barley manipulators in the brewing industry and certainly the low grade bronchitis or bronchial catarrh with resulting emphysema from chronic coughing induced by grain dusts such as flour, cannot be minimized.

Finally the explosive character of organic dusts in food industries must not be overlooked. Starches as dust clouds are notorious in this respect. Similarly, wheat and sugar dusts in proper concentrations constitute major explosion hazards. It is difficult for most people to appreciate the explosive combustibility of organic dusts but it has repeatedly been shown that some dust mixtures ignite more readily than gaseous explosive mixtures[2] and that the finer the carbonaceous dust, the nearer the approach of flame velocity to that of gas explosions.

In general dust explosions depend upon: 1. Chemical and thermal properties of the dust; 2. particle size and shape; 3. concentration in air; 4. proportion of inert dust in air; 5. moisture content and composition of air; 6. size and temperature of ignition source; and 7. degree of dispersion of the dust cloud.[4]

Vapors and *Gases* are air contaminants of extreme hazard to health. Most of them are either irritants or poisons or both and their number is legion. Their diversity is matched only by the multiplicity of occupations in which they are involved and their presence is dictated by usage in industrial processes or by chance as by-products.

Because of their physical state their roles as industrial poisons are played as inhalants principally, but absorption through the skin may take place and in some instances, lead to severe skin irritations or dermatoses.

Industrial vapors and gases may generally be classified as asphyxiants, irritants and systemic poisons by virtue of their chemical characteristics and physiologic effects. The food industries share in the diversity of the gaseous air contaminants which are encountered.

It would be of interest to cite the several vapors and gases encountered in the food industries, their physiologic effects and specific occupations in which they are a distinct hazard,[4,5,10] remembering that for most of them acute poisoning by massive doses acting over a short period of time is dramatic, but that small and, at times, insensible doses acting over longer periods may produce effects which are at first subtle but no less productive of pathology.

1. *Acetaldehyde* is encountered by yeast and vinegar workers and leads to irritation of the eyes and respiratory tract, dyspnea, cough, cardiac acceleration and profuse night sweats.

2. *Acrolein*, a troublesome by-product in fat rendering, is a severe irritant and quite injurious to the eyes and respiratory tract. Inhaling massive doses rapidly leads to edema of the lung. Longer exposures of

smaller doses yield bronchial catarrh, abdominal pain and diarrhea. Renderers of bone and fat and makers of glue and lard frequently encounter this irritant.

3. *Ammonia*, representing an irritant, caustic gas, is primarily a refrigerant but is encountered by sugar refiners as well. Its action on the lungs is similar to that of acrolein.

4. *Amyl acetate* and *amyl alcohol* is contacted by alcohol-distillery workers and fruit-essence makers and yields irritation of the eyes, nose, throat, bronchi, headache, dizziness, drowsiness, oppression of the chest, cough and nausea.

5. *Carbon dioxide*, a simple asphyxiant, is encountered by bakers, brewers, carbonated water makers, dry-ice makers and vinegar and yeast workers.

6. *Carbon monoxide* is a chemical asphyxiant in that it combines with hemoglobin and reduces the latter's ability to transport oxygen to the tissues. Produced by faulty combustion, especially in coke furnaces it represents a hazard to bakers and cooks. Exposure to high concentrations for short periods may, through anoxia, produce degenerative changes in the body. Similarly chronic exposure to low concentrations may, according to some investigators, cause permanent tissue damage also. Poisoning in some individuals may proceed to the stage of collapse without causing any subjective symptoms and in others may produce painful eyeballs, throbbing headache, dizziness, nausea and vomiting.

7. *Formaldehyde* is an irritant poison. Its effects are on mucous membranes, skin and viscera, producing conjunctivitis, bronchitis, dermatitis, destruction of finger nails and liver degeneration. It is encountered by brewery workers.

8. *Formic acid* is similar to formaldehyde in action but produces even more severe dermatitis with ulceration and necrosis. Alcohol fermenters encounter this air contaminant.

9. *Hydrochloric acid*, encountered by sugar refiners, is similar in action to acetaldehyde and acrolein but in addition yields dental caries by dissolution of the enamel and pulmonary hemorrhages.

10. *Methyl bromide* and *methyl chloride* are troublesome refrigerant gases to which refrigeration repair and maintenance men are decidedly at risk. These gases are volatile drugs which cause organic change. Symptoms include progressive drowsiness, dizziness, nausea, staggering gait, mental confusion, visual disturbances, tremors and weakness.

11. *Sulfur-dioxide* is an irritant gas utilized as refrigerant and as a fruit bleach and hence posing a hazard to artificial ice makers, refrigerator repair men, fruit preservers, gelatine makers, sugar refiners and sulphurers of malt and hops. This gas makes itself felt immediately by irritation and inflammation of the eyes, trachea and lung with bronchial catarrh, digestive disturbance and blood-tinged mucus.

12. *Hydrogen sulfide*, an irritant and systemic poison to which starch makers and sugar refiners are exposed, produces irritation of eyes and respiratory tract with resultant conjunctivitis, bronchitis, rhinitis, pharyngitis, laryngitis and pulmonary edema as well as headache, vertigo, overventilation, gastrointestinal disturbances and slowing of the heart.

13. *Sulfuric acid*, which, like hydrochloric acid, produces a corrosive action on the skin and inflammation of the eyes and respiratory tract, also injures the teeth and induces a chronic bronchial catarrh. It is encountered by sugar refiners and yeast makers.

These examples should illustrate the potential hazards from vapors and gases in industries which the public would normally look upon as benign.

Air Contamination and Infectious Disease

Common to all occupations is the problem of air-borne infection. The communicable diseases can exist only where man, the susceptible host, congregates with his fellow men. Aggregation of population is an incisive factor in the spread of contagious disease and industry affords such aggregation.

As was pointed out in my introduction, the history of air contamination underwent cyclic swings with the elicitation of radically new truths. Miasma gave way to bacterial etiology with Pasteur and, although this researcher found bacteria in air, most of them proved to be harmless saprophytes.

Then again early experiments in this century suggested that most pathogenic bacteria either died rapidly or lost their virulence when exposed to air. Pulmonary anthrax infection by inhalation of spores by wool-sorters and secondary infection of wounds by tetanus spores remained the exceptions. The careful studies of Chapin[9] did much to swing epidemiologists away from the concept of air-borne infection toward contact and droplet infection.

This remained unchallenged until about 15 years ago when energetic attempts were begun to determine the importance of the role of air-borne infection in the spread of naturally occurring disease. Experimental data revealed that air-borne infection is a reality but its importance in nature as opposed to contact or droplet infection still remains to be proved.[10]

Only recently has the confusion in terminology been clarified[10]—terminology which left workers in this field confused and at variance with each other in interpretation. "Air-borne infection" has all too glibly been applied to a number of respiratory and contagious diseases and to secondary skin and wound infections which are known to be spread by contact.

An exact delineation of the routes of transmission of infectious agents is vital. *Contact* or direct transmission is illustrated in kissing or indirectly by contaminated material objects such as hands, instruments and toys. *Droplets* by sneezing and coughing are projected onto the conjunctiva, mouth, skin or open wounds. *Droplet nuclei*, however, are small residues resulting from evaporation of droplets, remaining in the air of enclosed spaces for varying lengths of time and readily inhaled. Finally *dusts* of infectious agents arising from secondary reservoirs of infection by settling on floors, clothes or bedding and redistributed by mechanical disturbance, remain suspended in air for short periods of time and may be inhaled.

These distinctions are important to honest considerations of true air-borne infection. *Droplets*, per se, containing microorganisms and expelled in liquid mists as by sneezing actually travel relatively short distances and must therefore be considered as part of the contact mechanism even though they are momentarily air contaminants. Furthermore, droplets are not appreciably affected by any devices of sanitary ventilation yet developed.

It is obvious that the propulsive emission of such droplets from the infected individual and their transmission directly and almost instantaneously to the recipient secondary host cannot be influenced by air disinfection or sterilization. True air-borne transmission must therefore concern itself only with those particles which may remain suspended in the air for appreciable lengths of time for only under these conditions may sanitary ventilation or disinfection of air be applied in control.

Droplet nuclei and dusts are thus the only two categories with which we may concern ourselves in this regard even though in industry we cannot overlook such relatively momentary air contaminants as are included under the category of the larger particles known as droplets.

The revival of interest in air-borne infection is predicated primarily upon experimental work. Canine distemper is readily transmitted experimentally by the air-borne route. Inhalation of atmospheres containing influenza virus readily infects mice and ferrets. Direct air-borne infection of rabbits with tubercle bacilli has been demonstrated.[11] Brucella suis, Malleomyces mallei and pseudomallei, Pasteurella tularense and the virus of psittacosis have been transmitted by inhalation.

Accidents in the laboratory and for that matter in field research have also yielded evidence of air-borne infection. I may cite the psittacosis outbreak among laboratory workers of the U. S. Public Health Service in 1930[12], the brucellosis outbreak in the laboratory of Michigan State College in 1938 in which the dissemination of the organism through the air by means of the Sharples centrifuge was a distinct possibility[13], and the outbreaks of Q fever in the U. S. Public Health Service Laboratories in 1940 and 1945.[14] Cases of infection by inhalation of virus of primary atypical pneumonia during field studies by the Commission on Acute Respiratory Diseases during World War II are described by Langmuir.[15]

It is studies of this type which lead us to clear cut scientific bases for the mechanisms of airborne infection. The w[illegible] of recent years has developed certain general conclusions. We know that the chance of infection after exposure to bacterial droplet nuclei and dusts is directly propor-

tional to the number of bacteria in the cloud, inversely proportional to the size of such particles in the cloud, directly proportional to the duration of exposure and finally requires the proper conditions of temperature and humidity. Influenza virus studies reveal rapid destruction of the virus at relative humidities of 50-60 per cent and greater survival both above and below this figure.

The strides in laboratory and experimental knowledge has on the one hand outstripped observations on naturally-occurring field events, but on the other hand, have been nowhere near the efforts of commercial exploitation of devices to sterilize or disinfect the air. In actual field applications certain results have been achieved but these have been far short of the expected.

Many variables appear and among these one must consider the seasonal changes which occur cyclically as in respiratory infections, the rate of turnover of susceptibles in a given closed population", the degree of aggregation or crowding and finally the as yet unmeasurable role of direct contact or spray-droplet infection which may in the end be proven to preponderate over air-borne transmission.

It becomes obvious then that we may expect such differences as 90 per cent elimination of air-borne organisms in the laboratory and only 30 per cent reduction in incidence when applied to "closed" human population groups.

Certain facts do, however, stand out. We know that such environments as barracks, institutions and hospital wards with their special conditions of aggregation of population do show a significant but small reduction in incidence of respiratory infections when certain procedures of air sanitation are applied, e.g., the 10-30 per cent reduction in incidence of infections in barracks and station hospitals with oiled floors and bedclothes for suppression of dust-borne bacteria. Actual bacterial dispersion itself was reduced by 90 per cent." This is of special interest since there is evidence that inhalation of dust-borne bacteria is more important than direct inhalation of infectious droplets or droplet nuclei in the spread of respiratory tract infections."

Glycol vapors have produced promising results in the laboratory utilizing clean air and relative humidities of 40-60 per cent. Humidity of 50 per cent is in itself destructive to many bacteria. In the presence of dust in the air glycol effectiveness is greatly reduced. Controlled experiments in the offices of a prominent business concern failed to reduce both the number of air-borne bacteria and the incidence of minor respiratory infections."

Ultraviolet radiation has also been exploited with equivocal results thus far. In naval barracks a 25 per cent reduction in respiratory infections was effectuated, whereas in a controlled study of six years' duration in which the amount of radiation was five times that recommended by the commercial manufacturers no significant decrease in incidence was noted among 400 inmates in the study. Studies are now proceeding in further hope of evaluating this proposed technique of air sterilization.

Conclusion

In conclusion may I say that whereas the control of chemical dusts, vapors and gases are definite and applicable, air-borne infection control does not enjoy this position at present. Complete protection against the transfer of infectious by air is impossible for reasons elucidated in the discussion of the role of contact and droplets in disease transmission as opposed to droplet-nuclei and dusts. At present there is not available adequate evidence that the air-borne route of transmission is predominant for any particular disease and for some, on the other hand, the contact mode is definitely predominant.

Dust suppression is, in general, good housekeeping and there is definite evidence of suppression of bacterial contamination of the air by such procedures as oiling of floors, blankets and bedding even though more study is required of its value in actual disease reduction. Certainly it should be applied where glycol vapors and ultraviolet radiation is attempted. These latter techniques have yielded even less certain results although there is good evidence of their value as adjuvants to aseptic techniques in certain highly specialized situations.

The case for and against glycol vapors is most ably presented by an excerpt from an editorial in the *Journal of the American Public Health Association*, dated February 1949:

"After two years the subcommittee [on Control of Air-Borne Infection] of the A.P.H.A. concluded:

"The available evidence strongly indicates that . . . glycol vapors are useful adjuvants to aseptic techniques in the reduction or elimination of air-borne infections in operating rooms, and in contagious disease and pediatric wards . . . The general use of disinfectant vapors in schools, barracks and in specialized industrial environments is not justified at the present time . . . There is great need for further carefully controlled field studies . . . There is no justification for indiscriminate use . . . in home, offices, or places of public congregation.

"In the past two years real progress has been made in the development of vaporizing devices, but there has been essentially no advance in our knowledge of the effectiveness of these vapors in the prevention of acut respiratory diseases. Until such knowledge becomes available, it is unwise to recommend the installation of glycol vaporizers except under carefully controlled experimental conditions. Present commercial campaigns of exploitation raise the real danger that the method may be discredited and that the rational development of this important field of air sanitation may be discouraged."

With respect to ultraviolet irradiation the original committee report" recommends:

"The general use of ultra-violet irradiation or disinfectant vapors in schools, barracks, and in specialized industrial environments is not justified at the present time. There is great need for further carefully controlled field studies to define the mechanisms of the spread of infections disease among these types of populations.

"There is no justification for the indiscriminate use of ultra-violet light or other methods for disinfecting air in homes, offices, or places of public congregation."

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Mechanical Means of Removal or Reduction of Air Contamination

By JOHN M. KANE

Mgr., Dust Control Div., American Air Filter Co., Inc., Louisville, Ky.

Air contamination can be broken down into a. impurities brought into the plant by the occupants or with the outside supply air and b. impurities or dust generated within the plant due to the nature of the process involved.

Outside air contains dust and smoke concentrations in the order of from .1 to 1.5 grains per 1000 cu. ft. Composition of the dust will vary with plant location but will consist of varying portions of carbonaceous material, finely divided organic and inorganic matter, and air borne impurities such as pollens, mold spores, and wild yeast spores.

Dust production from plant processes are usually produced by the finer floating particles released by handling of the product involved. The material will be normally uniform in composition, although varying widely in particle size. Concentrations will be many times those encountered in atmospheric air, although low in comparison with dusty operations in other industries. From operations such as mixers, packaging operations, material handling systems, weighing and screening, concentrations will be in the order of .5 to 3.0 grains per cubic foot where local exhaust ventilation is supplied to prevent dispersion from such operations. In other material handling operations, such as rotary dryers and coolers, pickup of solids by the exhaust air stream will be much greater, often running in the order of 6 to 20 grains per cubic foot.

From the above discussion, it will be recognized that concentrations of solids from process operations will be 1000 or more times as heavy as that encountered in the cleaning of atmospheric air before introducing it into the work space through heating, ventilation, air conditioning or supply air system. It explains the difference in air cleaning design between the air filter group designed to remove the small quantities of solids from outside air and the dust control device used for the much heavier loadings encountered as dust is released from process operations.

Air filters can generally be broken down into one of the following types:

1. *Viscous Impingement.* The least expensive of the filter types offering reasonably large dust holding capacity, moderate to good efficiency on coarser particles but minimum effectiveness on extremely fine particles. Trapping of the dust from the air stream is based on the principle of impinging of the dust particles onto the filter surface coated with a viscous material causing the dust to adhere to the filter element.

2. *Fabric Filtration.* Air filter designs in this group use a dry type media combining impingement and the straining principle to remove the solid particles from the air stream. Collection efficiencies on finer particles will be considerably higher than with the viscous impingement. In many cases, more frequent replacement or reconditioning will be involved although the collecting of the material in a dry state will in some cases aid maintenance operations.

3. *Electro-Static Filtration.* Using the well known principle of either charging the collecting media or ionizing fine particles in the air stream and collecting them on grounded collector plates, the Electro-Static filter offers the highest degree of air filtration available today. Efficiency is excellent even on particles in the smoke range. Electro-Static filters are considerably more expensive than either the viscous or fabric types and are recommended where highest degree of cleaning to prevent discoloration and product contamination is desired.

Where heavy loadings are encountered, filters of two different types are frequently used in series. Usually the viscous impingement type acts as a scalping filter or precleaner reducing the load and the maintenance involved on the more efficient final cleaner of either the fabric or Electro-Static type.

For industrial process dust control, local exhaust ventilation principles are normally employed. This system necessitates the use of a hood or enclosure close to the source of dust generation. Through the openings in the hood, inflow of air is maintained to prevent escapement of dust particles released. Air and entrained dust are carried through exhaust ducts with usual conveying velocity of 3000 to 3500 fpm. A dust collector will normally remove a high per cent of solid particles before the cleaned air is discharged to the atmosphere or back to the work room. Dust control devices operate on one or more of the following principles:

1. *Primary Collectors:* Primary collectors are usually of the dry centrifugal type. They have the advantage of low first cost and collection of material dry. They are most effective on coarser particles and the cleaned air must be discharged to the outside unless followed by a final cleaner.

2. *High Efficiency Collectors:* High efficiency collectors are either of the fabric type or of the wet type. Collection efficiency

of designs in either of these groups is extremely high even on particles in the low micron sizes. The fabric collector collects the material dry permitting salvage in many cases. Large filter areas are required as the velocity of the air passing through the filter media is normally in the two to five fpm range, meaning large equipment. Where quantities of material are collected, care must be exercised or secondary dust problems will result in the emptying of the collector. Wet type collectors normally will require less space than the fabric type design and eliminate all problems of secondary dust problems in the disposal of the collected material. Where the product has salvage value, primary collectors are oftentimes used to remove the bulk of the solids from the gas stream before the final fraction is removed by the wet type collector.

3. The above groups of dust collecting devices will include the types most commonly encountered in collection of contaminants from food processing operations. High voltage Electro-Static precipitation is another popular type of collecting device used extensively in some industries. Its cost, however, makes its application infrequent for most food processing operations as dust loadings and particle sizes involved seldom require this type of collector to obtain collection efficiency required.

The high voltage Electro-Static dust collector operating with voltage in the 70,000 volt range should not be confused with the low voltage Electro-Static air filter operating in the 7 to 14,000 volt range. This latter unit is designed only for the loadings encountered in the air filtration service and would plug quickly if used under the heavier loadings involved in dust control systems.

To remove atmospheric impurities and maintain work room air at maximum cleanliness, supply systems with air filters should maintain a positive pressure within the work room. In this way, a minimum of contamination from outside air will occur. Electro-Static precipitators and blanket type of media used in connection with dry filtration show exceptionally high efficiency even on bacteria and recent tests conducted on this combination of filters in dry air have given efficiencies in the order of 99.9+ per cent on bacteria and mold spores.

For process operations, exhaust systems involve the hooding of dust producing operations. A few operations will be discussed to illustrate typical hooding methods.

Mixers: Fine dust is released when dry ingredients are fed to a mixer or blender. Where the process is dry, dust will be released during the operating cycle and during the discharge of the material from the machine. Where machines tilt to dump, exhaust hoods can do double duty of preventing dust escapement during the filling, mixing, and discharge operations. Where the machine is stationary, tight connections to the container may answer the problem, or a local exhaust hood is often provided at the discharge point.

Where conveyors or vertical feed chutes are used, hoods often of the booth type, are the answer to the problem of dust confinement at that point.

Screens: Screening agitates material throwing fine particles into the surrounding area. Hood attached to screen deck, or complete enclosure of the screen will be practical in most cases.

Weighing: Some fine dust is dispersed during the transfer to and from containers or bins to weighing devices. In the case of small batches, enclosures or booths are indicated. For platform scales, it is often possible to put scale and container in a booth extending to the floor, or enclose the operation.

Coating Pans: The rotating coating pan can cause dense clouds of dust as the fine ingredients are added and the product rotated. This is especially true where supply air is introduced to dry or cool the product. A local hood will prevent dispersion from this operation, greatly improving working conditions and drastically reducing housekeeping.

Dryers & Coolers: Rotary dryers and coolers are frequently employed in the food processing industry. The necessary movement of air through the cascading product means considerable loss of material in the exhaust air. Supply air is filtered where contamination or discoloration could effect the product. Dust collectors remove the solids from the discharged air to salvage material and/or prevent neighborhood nuisance.

Two case histories will give added indication of the methods used in food processing industries to prevent contamination of their product.

In a bakery, sanitation is of utmost importance due to the constant danger of infestation of the flour. Prevention of flour dispersion reduces or eliminates the coatings that can deposit on floors, walls, stored materials, and equipment as the dry ingredients are processed.

Bags of flour can be upset in a ventilated blending booth. An inward flow of air over the booth opening will prevent flour dust escapement. Where cloth bags are used, the exhaust duct also serves as a sack cleaner, removing an average of nine ounces of flour adhering to the inside bag walls after the emptying operation.

From the blender, the flour can go to storage bins and then be fed through scale hoppers to the dough mixers. Small local hoods will collect the puff of flour dust caused by the release of air entrained during the filling of either the scale or the mixer. The mixed dough goes to the curing room where filtered, controlled air is supplied during the raising period.

As the dough is started on its way to the baking pans, it is dusted frequently at the rounder, former, and panner. Local hoods at each dusting point pick up some 250 pounds of floating material per eight hour day.

Four illustrations of air contamination control equipment can indicate types of equipment and effectiveness of control that can be obtained in this industry.

a. *Process Kettles:* Fumes and vapors from cooking kettles are gathered in a conical hood. Two sections of the hood are removable for filling and inspection and a 1 inch clearance is provided between the hood mouth and kettle edge to assure a controlled inflow of air around the periphery. An exhaust volume of 1000 cfm from each kettle is exhausted through the duct system and the air is scrubbed in a wet type collector.

b. *Margarine Processing and Packaging:* Clean air at controlled conditions is essential in this area. Unit air conditioning and dehumidifying are employed with both outside supply and recirculated air cleaned with electro-static filters placed in the duct system.

c. *Bottle Cleaning:* Sterilized bottles or jars can contain packing material from their shipping containers. Where air jets are used along the conveyor to remove this material, they can be installed in a tunnel type of enclosure. An exhaust volume of 300 to 400 cfm from each hood conveys the material to a dust collector. Such container cleaning stations keep the packing material out of the working area, greatly decreasing the housekeeping and saving heat by recirculation of the cleaned air.

d. *Main Air Conditioning System:* Importance of good air filtration can be deduced from the data on the 75,000 cfm air conditioning systems. Double filtration of viscous impingement and electro-static units are employed. Some four cubic feet of dirt is removed every two weeks from the primary filter sludge pan. Mold spore counts in the entering air, ranging from 71 to 350 were reduced 97.7 per cent during a four month test series. Typical of the air cleanliness was the series of 28 counts showing five readings of 3, three of 6, one of 9, and nineteen with no spores reported. Wild yeast counts are described as "consistently zero."

The systems also serves to drive home the difference between atmospheric and process loads. In one of the areas local exhaust ventilation was not supplied for the barrel upsetting operation at the screw conveyor feed to the mixer. The added dust load to the ventilation system was sufficient to plug the conditioning system air filters within a week, yet the small exhaust volume of 1500 cfm connected to a small dust collector unit was ample to confine the floating dust from this operation and permit the air filters to handle the dust loading for which air filters are designed.

This discussion has attempted to review the types of mechanical air cleaning equipment available and describe control methods for a few typical operations. The use of air filtration and dust control systems can provide the degree of air cleanliness required to prevent contamination of product and protect employees in food processing plants.

REFRIGERATION SAFETY COMMITTEE

(Arranged in Cooperation with Refrigeration Service Engineers Society)

Introductory Remarks

By PAUL E. REED
International Educational Dir., Refrigeration Service Engineers' Society, Milwaukee, Wis.

The refrigeration industry, although relatively young, is one of the largest industries in the United States. There is perhaps no other industry which has so many ramifications. Refrigeration, originally employed only in ice making, cold storage, and brewing, now reaches into practically every phase of American life. The food industry as we know it today would be impossible without refrigeration.

Under the leadership of the National Safety Council, many industries have united to correlate their safety programs, to interchange ideas and to help each other make their work more safe.

Like all other industries, the refrigeration industry has its hazards. Unlike most industries, however, there exists no centralized agency to coordinate safety between the various elements of the industry.

Lately, sentiment has formed that all of the elements of the refrigeration industry should work together on safety, in order to make the refrigeration industry a safer place to work. That is the purpose of this meeting.

The larger manufacturers of refrigeration equipment have their own plant safety programs, already closely correlated with the National Safety Council. It is not the purpose of this meeting to overtax the splendid work that those manufacturers are now doing within their own plants. This meeting concerns itself with field practices, although it is certainly desirable that field organizations work closely with the equipment manufacturers on any product designs that may present preventable hazards.

For about five years the Refrigeration Service Engineers Society has been very active in safety, for ours is a society of men who install, service, and maintain refrigeration equipment. Our object in sponsoring this meeting under the leadership of the National Safety Council is to get the various associations within the refrigeration industry to form an organization to coordinate the safety work of all elements, to help one another for the common good.

Objectives of the National Refrigeration Safety Committee

By GEORGE J. SCHULD, SR.
International Safety Dir., R. S. E. S., Cleveland, Ohio

It is difficult to explain the dangers in our industry. This job would be much easier, if we, in the industry, could form a separate refrigeration section in the National Safety Council. We should have a member from each branch of the industry appointed to form a refrigeration safety committee; this committee to meet three or four times a year with National Safety Council representatives to iron out unsafe practices and the publication of the safety bulletins, to guide all refrigeration men to practice safety on the job.

All safety measures are not practiced by manufacturers of refrigeration equipment even though most of them employ graduate engineers. It is commonly known that the men that work with the tools are generally

the ones that find out the ills in our industry. These men do not have the opportunity to get together with the engineering staff of the manufacturers, but it would be easy to do by working through committee meetings.

At the R.S.E.S. convention in Cleveland, Ohio, I was appointed to head the international safety committee. I did not expect at the time that this would continue for five years. I have always been safety minded and have collected many articles on hazards and accidents in our business, some of which we have brought to the attention of the refrigeration group, through photographs, cartoons, and lectures.

We were the first to publish the dangers of fluorescent lights such as disposing of the burned out lights, breaking of which causes infections and sores, if cut by same and the free mercury vapor that may be inhaled. The manufacturers of these lamps have made some changes since then but I am still not sure whether all dangers have been eliminated. Our committee has made up four large cartoons of men doing everything wrong and offered prizes for the men who find the most mistakes. We named this program "detect and correct." So far no one has discovered all the mistakes in the four-year period that this program was in progress.

We made six series of slides, of actual photographs of poor and unsafe installations and also cartoons showing unsafe practices. These slides are accompanied by a descriptive talk enabling the safety directors of our various chapters to give their members a good slant on what not to do.

We have designed cards to place above refrigeration compressors explaining the dangers of refrigerants, operating pressure and the amount of refrigerant in the job, etc. This not only helps the servicemen but also city firemen in case of fire. The identification tag on the machine is not adequate. It is like the fine print on a mortgage; no one ever reads it. The R.S.E.S. safety committee has, with the splendid cooperation of Paul Reed, compiled a bulletin on modern refrigeration for the National Safety Council *Manual*, which up to now had only a small amount of information on ice refrigeration and ammonia.

I have made many talks on safety to various chapters over the country, particularly in Ohio, and I believe this has accomplished a great deal of good, but this of course has been costly. Lecturing to different fire department groups has also brought results.

We have compiled a bulletin on eye and skin injuries and first aid methods of treatment due to refrigerants coming in contact with eyes and skin.

Special warnings have been issued, many of them instructing service men to remove hardware from abandoned ice boxes to prevent children from crawling in, playing hide and seek, doors closing and children suffocating before any one misses them. At least 62 deaths have resulted in this manner.

The R.S.E.S. and the National Safety Council together have sponsored April as National Refrigeration Safety Month with the slogan, "Safety in refrigeration pays allways every month in the year."

We have established libraries in Cleveland, Chicago and Milwaukee on accidents that happened in our and allied industries. Cartoons have appeared in the R.S.E.S. monthly magazine and the *Buckeye Gazette*, the latter, a monthly bulletin put out by the Buckeye State Association of R.S.E.S. Carl Howenstine of Canton, Ohio is editor.

I believe most of you gentlemen know that we have cut accidents in Ohio 50 per cent and I hope we played a part in this program. We have a good many ideas to make the industry more safe such as: Color identification of refrigerant cylinders, one color for each refrigerant regardless of the individual manufacturer; fusible plugs to be replaced by spring loaded relief valves.

High and low pressure control on air cooled compressors as well as water cooled; the color of receiver tanks and ex-valve tops to correspond with color scheme of refrigerant cylinders when adopted; larger name plates on compressors for better identification.

"Carbon tet" manufacturers to show a larger label on their product with skull and cross bones insignia and instructions as to its safety when used. Many deaths have resulted from lack of this knowledge.

It is my hope that some day in the near future we can form a group in the refrigeration industry, one man from each phase of our industry to iron out some of the problems. This should be done behind closed doors to prevent my face from turning red when I must bring out some of the things

in my talks that don't go over so well with the manufacturers. As you all know, you cannot censor safety if you do not have any program.

Unorthodox advertising has been one of the problems that can be avoided; such as fixture manufacturers, where one of their favorite ads says, just plug it in anywhere, no installation costs, etc. Safety, like floods can only be prevented and controlled at the source and not the mouth of a river.

The service man in the field is the person the manufacturers should listen to. They find out more ills in the business than the engineers who built the equipment. The practice in the past has been the manufacturers representatives getting a story from a service man that has not the required knowledge of his job. He probably tells an exaggerated story just to complain and the representative gets disgusted and probably thinks it does not pay to listen to any complaints regardless of whom they come from. This would be eliminated in committee meetings. Each man would have something concrete to report because everything would be screened by the local committees first.

It is not our intention to dictate to the manufacturers as to their policies. But there is one thing certain; as long as I am safety chairman, there will be no punches pulled in safety, if facts are brought by any person regarding hazards in our industry.

I believe the R.S.E.S. safety committee will conduct their safety program as they see fit and I am sure it has been O.K. so far.

Safety in Industrial Refrigeration

By EMERSON BRANDT

Secretary, National Assn. of Practical Refrigerating Engineers, Chicago

There is a disarming simplicity about many of our operations and activities. A few small pieces of ice on the floor of a low temperature room or ice plant are frequently overlooked, but neglect of them causes falls and serious injuries. The filling of a service cylinder with refrigerant is a simple job. Yet if you really fill it you have a time bomb on your hands.

Another basic problem is the size of the individual operation. Many industrial refrigeration plants employ relatively few people. Many plants that use refrigeration are not large in total number of workers employed. Any particular refrigeration service job usually involves only one or two people. The problem of education, supervision and group action to promote safety cannot be solved here by the procedure used in large manufacturing plants.

Further, this dispersion in the field tends to cover up what actually happens in our day to day operations. As a result the different segments of the industry may consider themselves relatively safe because the ambulance does not appear on the scene very often.

For instance in one type of refrigerating plant there was a general feeling of apathy because no one was aware of great hazards. When a detailed survey was made the accident frequency ran over 90. It gave a quick reason for the fact that a number of plants are bothered by mounting compensation insurance rates.

For many years refrigeration was wholly produced by ammonia systems. At that time ammonia was considered the primary hazard. Recent fires and explosions in ammonia plants have renewed the earlier apprehensions in some quarters. Yet if statistics were available they would probably show more casualties from workmen falling off the old two or three story A-frame machines than there were injuries chargeable to ammonia.

That statement certainly is not made to encourage carelessness with ammonia or ammonia equipment. It is a very strong and irritating gas. Costly and damaging fires or explosions have taken place in ammonia plants. But let us not become obsessed by one segment of the problem and then be bowled over by some other hazard we were quite content to neglect.

More than 20 years ago when I first had an opportunity to analyze specific data in this field there was a very serious injury to a workman which stuck in my mind. A

helper on a machine installation job was told to put a bend in a piece of one inch electric conduit. A large motor driven compressor was *nearby*—closer than the workbench. He stuck the conduit in the base of the idler frame and pushed to put the bend in the tube. A slip threw him into the belt and he was severely injured.

It demonstrates two well recognized facts. By thoughtless actions many people are able to create hazards where they apparently did not exist before. Also workmen do not recognize hazards until they are trained to be alert to avoid injury.

Some of our time in the industrial refrigeration industry has been wasted in arguments about what are the most important sources of injuries. Refrigerants have been compared, machines analyzed and installation methods argued. The Refrigeration Safety Code, B-9.1 has taken much of the wind out of these arguments. The next logical step is cooperation to determine definite accident experience. Then we will be in position to attack our problems on a specific basis.

Basically the problem in our field is to train men to give *them* a sharp perception of hazards and a general awareness of safe working methods. Past efforts in this field have been individualistic and have emphasized differences rather than the many points of common interest. Each segment of the field has felt it required rather special treatment in the realm of accident prevention. Meanwhile the injury experience is not good.

The specific accident described above involved electric conduit but the injury was caused by a refrigerant compressor drive. There are special electric hazards in the refrigerating field, however. They are related to the damp conditions frequently existing and the brine in use in many plants. A brief summary of the more prominent hazards in some segments of the field would be enlightening.

Handling of goods provides the most prolific source of accidents in cold storage plants. In this they parallel other activities such as packers and wholesale grocers. Yet they have numerous accidents, many quite severe, in connection with mechanical and electrical equipment and low temperatures.

A majority of the accidents in the ice industry occur in connection with the handling of the ice itself. But here again there are far too many injuries in connection with the refrigeration equipment and the electrical sections of the plant.

Dairies and breweries in most cases are now conducting well coordinated accident prevention programs. Yet some rather notable accidents have occurred in their plants which have involved the refrigerating equipment, low temperatures, or related operations in the plants.

No data is readily available on the experience of other activities employing refrigeration for industrial processing. It may be logical to conclude that their operations parallel the ones mentioned as far as accidents and injuries are concerned.

The specific items mentioned are not the whole story for all these activities. Traffic hazards are a problem in the ice, bakery, dairy and brewery businesses. The latter two and others also use glass containers which have their own specialized problems. Still others might be mentioned.

Despite the diversity of these problems all have a common desire to make their refrigeration plants and operations as safe as possible. The most efficient and effective way is to make it a cooperative job with people of like interests. That is a procedure in the best traditions of the great organized safety movement. Experience has amply demonstrated that it will work.

Progress in this field is already evident to give us encouragement. Not long ago, many who operated industrial refrigeration plants considered relief valves a leaky nuisance. They had a more or less standard practice of screwing a plug in the valve outlets.

High pressure cut-outs were not too generally used in the industrial refrigeration field until relatively recent times in many sections of the country. More plants presently operating need this protection. Such factors are covered in the Refrigeration Safety Code and everyone should promote wider observance of its provisions.

Pressure vessels of uncertain structure and strength have been numerous in the refrigeration field according to Paul Cassidy of the Hartford Inspection Service. (*Ice and Refrigeration*, Aug. '51, pg. 34). Convenient methods have been developed and used to check such vessels. By this process the weak ones are being replaced before they make their weaknesses known by failure during use.

The material scarcities during the war period and after have given much greater emphasis to protection of equipment and preventive maintenance programs. Rust and corrosion are no longer permitted to go on unchecked to the extent that was characteristic in so many plants. This process has considerably reduced the potential number of breaks and failures in piping and equipment. At the same time the accident potential has been reduced.

The increased electrical hazards in refrigeration plants have been mentioned before. Because of the low voltage usually involved, early plants did not give particular attention to the problem. The situation has been receiving more definite attention during recent years. Now adequate grounding methods are followed in all well operated plants. Current carrying lines and parts are properly shielded and regular maintenance keeps the protective measures at full effectiveness.

Summary

1. Much of the work in the industrial refrigeration field looks simple, easy and safe so we may have a false sense of security.

2. The small size of the average worker unit tends to mask the true situation in regard to accident experience. Also it makes safety work more difficult to organize.

3. Inaction will not solve the problem because people without specific safety training do not automatically adopt safe methods. Frequently they create hazards which did not previously exist.

4. The users of industrial refrigeration have a diversity in their activities which poses a variety of safety problems. All of these should have due attention, and the program of accident prevention should include the refrigeration field along with the others.

5. Much progress has already been made. By and large, equipment and installations are fulfilling the requirements of the Refrigeration Safety Code. Some units in the field have already demonstrated the good results to be obtained through well coordinated effort.

6. The next logical step is a cooperative program of accident prevention embracing a representative group from all phases of the industrial refrigeration field.

From the standpoint of equipment and design industrial refrigeration plants generally have reached a satisfactory standard in regard to safety and accident prevention. The next important and quite logical step is to do a commensurate job in safety training of personnel. Certain plants and companies in the industry have demonstrated the work that can be done in this field, as well as the results it will obtain. Because they know the benefits of cooperation they will undoubtedly make their experience available to all who wish to join with them for wider and more complete safety training in the industry.

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GLASS AND CERAMICS INDUSTRY

As presented in the Sessions of the Glass and Ceramics Section at the 1951 National Safety Congress

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Transactions
39th National Safety Congress

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THE GLASS AND CERAMICS SECTION

This volume is a record of the sessions held at the 1951 National Safety Congress by the Glass and Ceramics Section. The conduct of these Congress sessions each year is only one of the many cooperative activities which the Glass and Ceramics Section carries on in behalf of its members, and for the benefit of accident prevention work in the glass and ceramics industry generally. The Section gives guidance in the preparation of a great variety of technical and educational material useful in the day-to-day safety programs of glass and ceramics plants. The activities of the Section are under the direction of its Executive Committee, the members of which are listed at the close of this volume.

Medical Programs in Glass and Ceramic Industry and Small Plant Progress

By W. J. McCONNELL, M. D.
Dir., Industrial Health Bureau, Metropolitan Life Insurance Co., N. Y., N. Y.

The growing importance of the field of industrial health and hygiene is evident in the larger glass and ceramic plants generally throughout the nation. Considerable progress has been made in the elimination or control of environmental contaminants and in the provision of creditable health programs. These health conservation services touch the lives of hundreds of thousands of industrial workers whose good health and efficiency are most vital to the organizations they serve.

Less progress has been noticed among the smaller plants, although from a public health viewpoint extension of health services to include small plants is of great significance because an overwhelming majority of the industrial population is employed by the small organizations of the country. The management of a small concern is inclined to defer provision of a health service, much as one may be desired, because he believes it difficult to supply the required amount of services economically. This belief can no longer be substantiated.

Different groups of individuals and organizations have repeatedly demonstrated that it is practicable to provide a joint health service. This can be accomplished by grouping a number of small plants together and supplying medical supervision to each. The cost is not out of proportion to that which large plants pay. The employment of medical services used jointly with other industrial plants is not an unusual departure from accepted methods, since common services are given proportionately.

I had the opportunity, beginning in 1925, of directing a demonstration of cooperative health services to groups of small plants in Philadelphia under the auspices of the Philadelphia Health Council and Tuberculosis Committee. For administration purposes a unit of small plants with about 25 to 500 employees each, located reasonably near each other and making a total of 1,000 employees were grouped together. Each plant sharing a unit service provided a first-aid or clinic room with necessary equipment. It was supplied with medical and nursing services, first-aid instruction, health talks, and sanitary supervision.

A registered nurse with industrial nursing training was assigned to each unit. She divided her time among the plants according to a definite schedule. Not less than three hours of health work for each 100 employees was done in each plant each week. A physician experienced in industrial medicine and hygiene was assigned to a group of two units, giving half his time to each unit. These units were turned over to the plant managements for administration when they became sufficiently organized and were capable of continuing the service without supervision by the Council.

The medical supervision of these plants and others added from time to time was admirably directed by Dr. Glen S. Everts for over a period of twenty years before he turned them over to a successor.

The Health Committee of the Chamber of Commerce and of the Board of Trade of Philadelphia has fully endorsed these services. Only a few years ago this Health Committee prepared a pamphlet entitled "Why Plant Industrial Medical Service Should be Adopted." It gives in question and answer form many of the facts which businessmen want explained. These include What is the scope of a good medical service for a small plant? Will a medical service decrease time lost due to accidents? Will a medical service decrease man-hours lost through illness? Many other facts are discussed.

In recent years other areas in the country have developed similar plans to meet the medical needs of the small plant. These are comparable in scope and effectiveness to those in the larger plants. O'Connor[1] clearly summarizes four essential requirements for success of a small-plant medical program as follows: "1 The medical personnel must be truly interested in developing a real industrial health program; 2 The

medical service must come into the plant; 3 The program must have the interest and support of management; and 4 The primary aim must be the good of the employee."

He points out that one small plant of about 700 employees near Boston with a part-time service had $10,000 returned to them one year and $16,000 the next year through reduced compensation losses. Reduction in absenteeism was reflected in approximately 50 per cent reduction in their group insurance losses. One large company in New York City reports that its medical department has saved approximately $100,000 per year in reduced accidents alone during the past four years.

There are thousands of instances indicating the monetary savings and reduction in time lost from work through adequate health services. William B. Given, Jr., President, American Brake Shoe Co., so aptly said in his keynote address on "A Better Place to Work" a few years ago at the annual meeting of the Industrial Hygiene Foundation: "It is not a question of whether a company can afford an industrial health program, but whether it can afford not to have one."

Speaking more specifically of the glass and ceramic industry, I need not call the attention of this group to the complexity of the industry. It produces glassware of all kinds and descriptions, refractory bricks, electric and chemical porcelain and stoneware, sanitary ware, china, dinnerware, drain tile, sewer pipe, floor and wall tile, porcelain, and a host of other important products made entirely or chiefly from materials of an earthy nature.

In past years workers were exposed to many toxic metals, including lead, arsenic, cadmium, manganese, chromium, beryllium, irritant acids and alkali, and toxic solvents of many kinds. Sand, the silica base which makes up a great part of the batch particularly in glass, pottery, and electric porcelain mixes, presented an important hazard of silicosis, particularly from the dust in the mixing, cutting, grinding, and polishing operations.

Throughout the industry, carbon-monoxide was of importance because of the rather ill-exhausted flames which were so numerous. Many bad burns resulted from hydrofluoric acid used in etching of glassware. Lime burns occurred frequently. Glass blowing processes and work at the furnaces had their own peculiar hazards, including infections, strains, burns, eye injuries, heat exhaustion and heat cramps, rheumatism due to dampness and extreme changes in temperature.

To the great credit of the industrial leaders of the industry many of these hazards have been controlled or eliminated. Processes have been modernized so that many of them are now done entirely by machinery. Automatic mechanical methods have reduced the above hazards to a minimum.

Low solubility lead is now largely used in glazes. Mechanical handling equipment has been substituted for manual handling. Many of the dusty operations have been enclosed and ventilated. Bottom-dumping railway cars are used for bulk shipments. Many other improvements have been made.

However, as you are no doubt aware, these improvements are confined largely to the newer and larger plants. Even in these plants, adequate maintenance of equipment is essential. Best results are obtained where the engineering, planning, medical, and safety departments fully cooperate in detecting and controlling unhealthful exposures throughout the plant.

If management is fortunate enough to have a trained industrial hygiene engineer, he should be part of, or closely associated with the medical and engineering departments, and be responsible for the detection, evaluation, and control of health hazards throughout the organization.

Although the need for industrial hygiene services depends largely on the nature of the operations, rather than on the size of the plant, small organizations and others may obtain the necessary engineering services through state departments of industrial hygiene, through private organizations, and through consultants.

An industrial health program, to be most effective, must be tailored to serve the needs of the particular plant. Generally, the medical services should include, but not be limited to, the following:

1. Prompt and efficient medical and surgical treatment of all occupational injuries and occupational diseases to reduce disability to a minimum.

2. Treatment of minor non-occupational injuries and illness in an effort to enable the employee to complete his shift, thereby reducing lost time. In the event continuing care is required, workers should be referred to their personal physicians.

3. Preplacement physical examinations to all applicants for employment to insure physical and mental fitness for work. Workers should be assigned to tasks according to capabilities so that they will not be a hazard to themselves or others. To fit the applicant to his job the examining physician should cooperate closely with the personnel and safety departments so that he is well informed with respect to the processes carried on in the plant, the materials with which the worker comes into contact, and the environment under which he works.

4. Health examinations of all employees and executives should be made annually, as far as practicable. Such examinations are the basis of a diagnostic service of health education for the plant personnel. The findings should be carefully discussed by the physician with the person examined, and made the basis of any indicated correctional program.

5. Special periodic examinations, including necessary laboratory work, should be given to employees with special responsibilities, and to those who are exposed to toxic or hazardous processes. The frequency of these examinations is best based on individual plant experience, and may be changed from time to time. Persons found to have evidence of disease or of chemical intoxication should be removed from their work and placed under close medical supervision. Attention should be directed immediately toward controlling the hazardous exposure so that other employees will not be affected. Similar examinations should be made at the termination of employment.

All employees leaving the job because of injury or illness, and those returning to work following absence resulting from injury or illness should be cleared through the medical department to insure fitness to work safely and efficiently. This practice will also minimize the possibility of introducing communicable diseases into the plant.

6. Complete individual medical records for each employee should be kept in the medical department. These should include records of preplacement examinations, periodic physical examinations, medical and occupational injuries. Information regarding occupational injuries should be furnished promptly to the safety and other interested departments. The clinical information contained in the medical records should be confidential. General statements concerning physical fitness and classification of the worker should be furnished other departments upon request. Monthly summaries should be prepared. These would indicate the scope of the several activities of the medical department, the incidence and nature of various injuries and illnesses occuring in departments of the plant. This report should contain any pertinent recommendations for the correction of conditions causing an undue amount of sickness or of excessive injuries.

7. Other activities of a plant health program include the inspection at frequent intervals by the medical director or his representative of all operations and shops. These inspections are to detect working conditions and practices inimicable to health and efficiency, to become thoroughly familiar with the nature of the various tasks and potential health hazards associated therewith, and to observe unsanitary conditions.

8. The medical department should conduct a progressive program of health education for the employees. Plant physicians and nurses should utilize every opportunity by personal contacts, posters, pamphlets, news articles, lectures, and motion pictures to instruct employees in personal hygiene, nutrition, sanitation, and disease prevention. These activities should closely parallel the educational activities on safety. Finally, the medical department should maintain friendly and cooperative relationships with local health authorities and private physicians in the interest of maintaining the health and efficiency of plant employees.

Comprehensive industrial health services having for its objectives the reduction of accidents, illness and the promotion of optimum health among the plant employees can make its presence felt in industry by positive results. Its existence is justified to management in money saved by reduced accident costs, less absenteeism and improved quality of work.

An Analysis of Existing Types of Small-Plant Health Services in Northeastern United States. R. B. O'Connor, M.D., A.M.A. Archives of Industrial Hygiene and Occupational Medicine, January 1951, Vol. 3, pp. 75-84.

The Cost of Public Accidents to Industry

By W. GRAHAM COLE
Assistant Secy., Metropolitan Life Insurance Co., New York City

Summary of Remarks

Poor public relations result from accidents caused by neglected physical environment of plants or commercial vehicle operation or in the use of an industry product such as utilities.

Employees' accidents off the job are not covered by compensation and result in production time loss. Accidents to employees' family and friends are a source of worry to an employee and also causes susceptibility to accidents with resultant production time loss.

Two out of three deaths and three out of five injuries are the result of off-the-job accidents. While on-the-job accidents have caused four to five million hours of lost time, off-the-job accidents have caused 60,000,000 hours of lost time.

Industry has a definite interest in off-the-job accidents because it results in curtailment of production and the loss of the employee's services. A valued employee makes the cost considerable. In a particular case of six off-the-job accidents, three were due to traffic, two to home accidents, and one on a farm.

There is an additional cost of hiring and training replacements for injured employees. As far as costs go, it does not make much difference whether an employee was injured on-the-job or off-the-job. One firm found a ratio of 14 off-the-job to one on-the-job accidents. All are an economic and a social loss, the ultimate cost being paid by the consumer of the product.

Industry owes to itself and the public the exercise of its know-how to prevent accidents and to provide leadership to the community and to develop interest in the prevention of accidents. This will result in good will for the company.

There is a need for getting facts upon off-the-job accidents. It is important to get employees to think about safety all the time, which will benefit the employee as well as the employer.

Off-the-job safety activities can be integrated with our industrial program for on-the-job safety and can be the means of stimulating interest in various local meetings of the chamber of commerce, plant foremen, etc. Strong action should be taken in preventing off-the-job accidents.

Shielding for Radiant Heat in a Glass Plant

By KARL L. DUNN
Industrial Hygienist, Corning Glass Works, Corning, N. Y.

Until comparatively recently the high temperature industries have depended almost entirely upon convective or induced convective cooling to promote comfort in the work areas. Although direct radiation from hot surfaces was recognized as a major source of discomfort in the glass plants, only very sketchy work was attempted to reduce the intensity of this radiation.

About fifteen years ago it was called to our attention that over 50 per cent of the heat loss from surrounding tank furnaces was in the infra-red spectrum. Following this considerably more attention was given to radiant heat than had previously been given to it, but it was only after the organized study of several large glass industries under the direction of the Industrial Hygiene Foundation in a quantitative determination of heat sources that any real logical engineering work was attempted.

In review; the first thing to be done was to familiarize ourselves with the basic laws of radiant heat. This is probably best explained by the Stefan-Boltzman equation This equation says simply that the total

radiant flux is proportional to the fourth power of the absolute temperature of the radiating source. We have assigned a value of 1.0 to the emissivity, or the ability of the body to radiate. The Stefan-Boltzman constant is merely a factor to reduce the final radiant flux values to gram calories per square centimeter per second.

Assuming we have a furnace operating at 1,000° absolute, we find that we have a total radiant flux of gram calories per square centimeter per second of 1.35. If we increase the absolute temperature of this radiating object to 1,100°, the temperature increase has been increased by 10 per cent. The interesting fact, however, applying the Stefan-Boltzman Law, is that the radiant flux has increased 44 per cent.

To further illustrate the extreme importance of radiant heat in high temperature industry, we again increase the temperature to 2,000° absolute where we find a temperature increase of 100 per cent and striking increase of radiant flux of 1,500 per cent. These simple calculations impressed us and others with the importance that radiant heat plays in discomfort in workers of the high temperature industries.

After this review of the principles of radiant heat, we were then faced with the fact that the problem of heat in our plants and work spaces, if it were largely radiant heat, was one not primarily of convection or thermodynamics but rather one of optics, recognizing that infra-red obeys all the optical laws common to visible light. Interposition of opaque objects between the radiating source and the man seemed at first the simplest solution to the radiant heat problem.

This is true for short term exposures in which the opaque object does not rise in temperature to that of the surroundings. If the opaque shield is of high emissivity or conversely of high absorptivity, the opaque screen will eventually arrive at a temperature where it begins to reradiate itself, and if the shield or screen is closer to the man than the original radiating object, merely serves to intensify the problem. It seems then, that the correct approach to this problem of materials for opaque shields was to select an economic materjal which had an emissivity low for the infra-red and high in reflectivity.

Most metals have a high reflectivity to the wave length 2.0 microns which was selected as being about median in the temperature range that we were experiencing in the high temperature locations. Materials such as gold, silver and platinum were immediately abandoned because of the cost angle. Aluminum seemed, after an exhaustive search of materials, to be the ideal material for one to use for several reasons, the major one being the fact that aluminum oxidizes very slowly and the thin oxide coat retains most of the initial reflectivity.

Aluminum paint is only about 50 per cent reflective and was abandoned early in this study as a material suitable for reflective shields. Asbestos paper is extremely low, having its value primarily as an insulating material in convective heat problems. White paint, or white lacquer, again has an extremely low reflectivity to the infra-red, and conversely these three materials would have a high absorptivity to the infra-red and, in a short time, after being exposed to high radiant sources would tend to reradiate.

After considering this problem theoretically, we then decided to review the entire heat problem as far as the glass trade was concerned. We will attempt to illustrate the various steps through which we have passed in the glass trade in coping with the heat problem. First is the typical glass plant. A centrally located furnace supported upon pylons at the second floor level has as its only means of losing heat direct radiation and air flow or convective flow through an annular space which extends around the periphery of the furnace. The roof is constructed in a simple monitor form, allowing the heat and generated gases to escape by gravity from the open windows. For a great many years this was the only system used and the only one we could depend upon for cooling air within the plant walls themselves.

The next stage was that in which portable fans were used to circulate the air to keep the air in motion around and about the work spaces. Here we found the beginnings of opaque shielding. Materials such as wood, asbestos board, black iron, etc., were used. A great disadvantage of the portable fan was the fact that they tended to circulate air over the hot surfaces and multiply the problem in hot weather by recirculating and moving the super-heated air over the workmen.

The furnace continued to radiate to the steel structural and building walls. No provision was made for air supply from the basement or within the work space. The monitor remained in its conventional form dependent entirely upon gravity for removal of heat and gases from the furnace itself. This represents the condition that existed until a few short years ago in most of our plants.

With the application of the present knowledge of radiant heat, we continued to use the circulating fans in the space surrounding the furnace. Added to that were several sources of forced air supply through the floor in the workspace. In addition fans were placed in the walls of the building to produce a positive pressure within the building walls. Radiant shielding was installed by dropping corrugated aluminum sheeting from the roof level to within three feet of the floor and an extended hood type structure completely surrounding the furnace or hot object. To assure ourselves that positive flow would take place behind this shield, in some cases we have installed power type roof ventilators commonly used in the foundry trade.

The curtain or shield surrounding the furnace served two distinct purposes. They keep the radiant energy entirely confined to a central area. The infra-red cannot escape to be absorbed by the steel of the structural parts of the building which in turn mig become a secondary radiant. Generated gases stay within the structure and do not escape into the work space. We are sure that the temperature on the outside of these shields will remain within a few degrees of that of the outdoor temperature. Circulating fans remain to assure ourselves that the air will remain uniform in temperature throughout the work areas.

While this installation may not be a profound one engineeringwise, the following will illustrate an actual installation using this principle in which very effective results were obtained over one very hot summer. A light steel framework was erected entirely around the hot furnace. Corrugated aluminum was attached directly to this light structure by means of a blank cartridge actuated nailing device. In this way we were able to erect the entire shield in a comparatively short time.

We erected the shields to the roof level, allowing only very small openings for piping, electrical services and the necessary structural steel work. For an idea of the entire structure surrounding one large heated area; within the enclosure is a continuous type lehr or annealing oven. Openings at both ends were necessary to allow the continuous flow of materials. These openings were covered by a tilted hood type structure. Access openings along the sides of this annealing lehr were provided with overhead garage doors constructed or corrugated aluminum. Every other bay in the roof of the building was open to the sky either through gravity type ventilators or the power type.

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HOME SAFETY

As presented in the Home Safety Sessions of the 1951 National Safety Congress

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39th National Safety Congress

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In preparing these Transactions, the proceedings of the Congress have been condensed and edited for reference purposes. Complete original manuscripts, with any charts or illustrations which were used, are available in National Safety Council files. Views expressed at the Congress or in this record are those of the Congress participants and are not necessarily those of the National Safety Council.

THE HOME SAFETY CONFERENCE

This volume is a record of the sessions held at the 1951 National Safety Congress by the Home Safety Conference. The conduct of these Congress sessions each year is only one of the many cooperative activities which the Conference carries on for the benefit of accident prevention work in the home. The activities of the Conference are under the direction of the officers of the Conference listed at the close of this volume.

The Educator and Home Safety

By GARRY CLEVELAND MYERS, Ph.D.
Editor, HIGHLIGHTS FOR CHILDREN, Columbus, Ohio

The parents, who are chiefly responsible for home safety for themselves, their children, and other members of their families, are reached to some extent by able leaders of the National Safety Council through the P.T.A.'s and other groups, the press, radio, and television. But if we are to get very far with home safety education, we must do more among the parents of the future, the children now in our schools and colleges.

Those of you who have been working for safety through the schools have done more good than you will ever know, especially by your school safety patrols and councils, to practice children in safe behavior while on or near the school premises. You have thus rendered school children more conscious of accident hazards to themselves, their younger brothers and sisters, and the older members of their families at home.

But with all your fine efforts you often are discouraged because only a little of this good instruction and practice in safety at school apparently carries over to home life. You have been handicapped. So many jobs are crowded upon the teacher that she inclines, naturally, to resist taking on anything more in the classroom. With some notable exceptions, home safety education is not a regular part of the school curriculum, nor is it often adequately incorporated in any of the basic courses. Few teachers today in their training to be teachers were educated to think of safety as a fundamental subject. What is more, the average teacher has been steeped in the notion that you can't teach any kind of behavior with words except in the immediate situation. While this prevailing idea accepts such activities as the safety patrol, it hardly allows much of a place to talk about anybody's safety at home. Fortunately this viewpoint does grudgingly admit a bit of dramatizing at school, as in assembly programs, of some *home* safety, particularly on hazards to babies and tots. But the proposal to have children in elementary grades or higher study physical perils to their baby brothers and sisters or grandparents at home is usually regarded by the school as just talk, and out of step with modern education.

A means for putting this talk about safety into constructive motivating action is provided by the wonderful graded safety lesson units of the workbook type, for school children from the early grades through high school, prepared by the School and College Division of the National Safety Council. Also on the brighter side, modern education emphasizes appreciation by the teacher of each child as a person, and awareness of his home and family. Great teachers with such attributes can't easily deny pupils the opportunity of talking about their loved ones at home. How easy it is, then for the group to discuss accidents which members of their families have had at home or which nearly happened but were prevented. From such talk the teacher can stimulate the children to learn the most common home hazards and ways to remove or minimize these dangers. In such ways positive caution against home accidents can be rather effectively taught at school.

In my judgment one of the greatest hindrances to parents in training the preschool child in safety is the notion created in recent years that they should not spank the little child, even to save his life; that they merely must be ever watchful of him and so persuasive that he will choose to play only in safe places made attractive to him, gradually avoiding specific dangers which have been labeled and defined for him. The mother supposes, for instance, that she must never use pain in connection with his running into the street, playing too near a fire, or tampering with a gas jet. And this doctrine is being almost universally taught to future parents in our colleges and high schools. When in desperation the misled mother apprehends her youngster deliberately venturing into some of these hazards, she may, in spite of her convictions to the contrary, spank or even whip him. Then she usually discovers that the violent treatment has not "cured" him, and she suffers deep remorse, agreeing with the so-called "expert" that spanking will do no good. Such cases are practically always cited by those who say that physical pain won't help. Why should it be expected to work under such conditions? All animal life tends to approach or do what promises more pleasure than pain. Any tot, say from two to five, who gets repeated pleasure from rushing into the dangerous street, playing with fire or a gas jet, with only occasional discomfort from the act, can be expected to go on doing this exciting thing. Physical pain—preferrably a sharp slap with the flat hand on the young child's bare thigh—should be immediately connected with the first forbidden experience and always thereafter till it is automatically and permanently avoided. It is amazing what little pain is needed and how quickly and lastingly the youngster thus learns to stay away from known hazards, especially if he can always turn at once to another pleasurable but permissible activity. If the word No, uttered once in a moderate tone, is always connected with the pain, the word alone may later deter the youngster from new dangers and, moreover, make him cautious when in doubt.

This worked at very little cost of pain with our own three children when they were toddlers, and also with their children, four in each family. It has worked, too, according to objective records, with many of my students' children, when I was teaching parents of preschool children at Western Reserve University, and scores of parents throughout the country who have read my syndicated column have written to say it has worked with them also.

Many farmers have hit on a simple, inexpensive means of keeping cows inside a pasture. They string a single wire around the field on posts not much larger than broomsticks. The wire is charged with a little electric current, and one or a few contacts with it keep the cows inside, even after the charge is turned off. The secret is that pain occurs on the first offense and regularly thereafter. Electric wires are always dependable, but parents are not, though they could be. There are no exceptions with these cows, and pain always immediately results from the offense. The wire is identified with pain, so is avoided by the cow. Aren't our children as smart as cows? Aren't their lives a whole lot more precious? But let's not, of course, build wire fences around our lawns and electrify them. The dangers are too great. Besides, the tot needs to learn the connection between pain and No so the word alone will be effective in many other and new situations; so he will learn to recognize danger in time and respect it. Let's urge parents to build for their children an invisible protective fence which can be quickly thrown about them at any time by utterance of No.

There has been a general weakening of restraints for young children at home. The toddler who does about as he pleases won't easily learn good safety attitudes and habits, and he will manage to circumvent our most vigilent efforts to keep dangerous things beyond his reach. If the parents of our nation were convinced of the efficacy of teaching physical safety to the child under five or six through means of a little pain consistently applied by a self-disciplined adult, a large majority of the 8,000 of them whose lives are snuffed out in the streets and by falls, gunshot, poisons, burns, asphyxiation, etc. in their homes and elsewhere in the period of a year, and often in the very sight of their helpless parents, could be kept alive and whole.

How radio and television contribute to child safety we can't be sure exactly. Apparently they keep some youngsters physically safe while listening or watching. But because of their exciting effect they can cause children to be less self-controlled, less cautious of hazards at other times. They cut in on time for preschool children to be read to and older children to read to themselves, for creative play at home and fun with playthings and tools. Passive in appeal, they seem to lessen interest in more constructive activities.

Surely parents who read much to the young child at home, and cultivate in him the love of bood books are contributing to his safety. So do they also in providing him with good playthings and tools in the home, attracting his playmates there, stimulating his imagination and encouraging him to draw, color, paint, and make things out of paper, cloth, clay, cardboard, and wood. The modern school is making good contributions in this direction as are the children's magazines with their appeal to the imagination and emphasis on things to make and do at home.

All sorts of family companionship and enjoyment obviously contribute to home safety. They indicate a deep regard for

each member of the family as a person by every other member. Under such conditions parents can be more persuasive with their children concerning safety. Instead of scolding them with warnings about dangers, they talk companionably with their children about being careful and the children are receptive in proportion to how much mutual esteem and love prevail. A favorable atmosphere and relationship at home provide a background for the safety of each family member at home and elsewhere.

Having acquired in such a family atmosphere the essential self-restraints, the child is more ready to leave alone some things he likes but knows may be harmful. He will also be more cautious when facing strange experiences. Furthermore, these early self-restraints will stay with and help him as he grows older. Having learned in his very early years to stop and wait at the curb, for example, he will be more likely to do so when he is six, sixteen, or sixty. No person beyond the age of one or two can be safe without adequate self-discipline.

Let us, therefore, go on providing better home amusements for young children, in a family atmosphere of understanding and love. Let's give them more and better play places and supervision, for other people's children as well as our own. Let's be more vigilant at protecting the very young child from known home hazards, but we must also train the young child in safety, especially in his preschool years, by administering bodily pain and No selectively and consistently when he subjects himself to danger, thus teaching him to protect himself from accidents long before he can understand the danger.

The Safety Engineer and Home Safety

By H. W. HEINRICH

Assistant Supt., Engineering and Loss Control Division, The Travelers Insurance Co., Hartford, Conn.

At dinner one evening the head of a family held forth on his favorite topic "this dangerous age." Little five-year-old junior listened attentively while father spoke of the tragedies in air, rail, automobile, and marine transportation accidents, in the shops and on the farms. He lost the trend momentarily when his dad mentioned the new and different hazards brought about by advances in science and changes in materials, machines and processes. But when the old man said, "and don't think you can escape it all by going home and crawling between the sheets in bed. You're likely to have an accident even there," little junior's worst suspicions were confirmed. He said "Not last night, daddy, I was a good boy last night."

Seriously, as we all know only too well, our homes are far from safe places. We are concerned here with finding practical ways and means of preventing home accidents that result in personal injury or death, and we have two good reasons to be concerned—not only because the annual toll[1] of approximately 28,000 fatalities, four million disabling injuries, and over 800 million dollars lost is amazingly high, but also because so little of a constructive and continuing nature is being done about it.

The professional safety engineer has both responsibility and opportunity to assist substantially in the home safety program. Also, he is keenly interested, well informed as to causes and remedies for accidents, and imbued with a desire to serve the cause of safety. As to the enlistment of his services in home safety, therefore, it remains only to develop a practical community program whereby his knowledge, abilities and activities can be of help.

From his viewpoint there are two groups which, working cooperatively, can successfully sponsor, organize and make effective these much-to-be-desired community home safety programs. They are local safety councils and industrial establishments. Safety councils will find it advantageous to give more consideration to home safety. There seems to be no good reason why each and every council, with few exceptions, should not have a special section or committee on home safety, regular home sessions, meetings and talks. As to industry and its safety engineers, they are quite aware that their accident records are vitally affected not only by the on-the-job attitudes and environment, but also by off-the-job circumstances. When safety begins at home, it will carry on into the shop itself. Industrial management, therefore, has a responsibility and a splendid opportunity to serve itself and its community, and improve its public relations by encouraging, sponsoring, and taking a more active part in home safety.

An experienced safety engineer knows well the great advantage of careful preliminary planning. If he were asked what activities community home safety should include he would probably say let's get together and talk it over. He could readily suggest several things to do, but he would much prefer to follow his natural bent as an engineer—assemble the facts, consider the probability of effectiveness and practicality as to time, cost and personnel; prepare a basic activity outline, and fill in the details. Then and only then would he be satisfied that he and his fellow volunteers were set to go ahead with the job.

It would be his proposal, as it is mine, to hold, as the very first step, a preliminary meeting of interested persons in the community. Some one person usually is the spark plug, but in most cases he is not likely to be the practicing safety engineer, who from experience knows the difficulties of creating enthusiasm and continuity of action even in well-organized industrial establishments. He will anticipate an early lagging of interest. He will sense political obstacles and suspect, perhaps with good reason, that he has "stuck out his neck" only to have it collared with most of the work, though he is apt to be a bit modest about assuming leadership in civic affairs. But don't overlook the professional safety engineer, and there is at least one in every community. He can assist substantially in home safety, and he really wants to help.

This first step—arranging the preliminary meeting of a selected group—is the easiest of all, but some one has to handle the details and lay out the agenda. If you don't already know a safety engineer in your community, check the directory, inquire of a manufacturing plant, the town engineer, building inspector, police or fire chief, or the traffic engineer—find him and ask his help with the problem. Organization, system and order, with an action program, are of first concern, while technical detail can come later. Home safety is mostly a matter of common sense precaution, involving such simple things as keeping objects off the stairs, renewing frayed lamp cords, using a stepladder instead of a rickety chair, keeping pots with hot liquids and sharp objects away from children.

Personal contacts should be made with the town mayor or manager, radio and television stations, newspaper editors, health authorities, school principals, the P.T.A., churches, police and fire chiefs, building inspectors, chamber of commerce, insurance companies and their agents, scout master, Red Cross, luncheon clubs, women's club presidents, architects, house builders, the labor unions, and local manufacturers. At this point money isn't necessary. All you need to ask is "will you come to a meeting in the interests of home safety?" At this meeting of organization representatives and interested individuals its purpose will be explained, the need and value of organizing for home safety emphasized, and agreement reached on the formation of a permanent home safety committee. Subcommittees will be appointed as required for programs and arrangements, publicity, education, construction and repair, kitchens and interiors, yards, walks and ground, etc.

When the home safety committee has been organized and is ready to function, it must have a plan of action. It must do something effective to eliminate the causes of home accidents. Measures that should be considered are:

Publicity—Make full use of newspaper and radio publicity. Remember that editors want news, so prepare home safety material that will be acceptable as news. The formation of committees is news, so too are the reasons for your organization and your objectives. Assign to a committee member the task of checking with insurance companies, magazines, employers, safety equipment manufacturers, and safety councils for data and stories for local release. The committee should dig up interesting facts on the home accident problem locally, and prepare them for publication, including photographs whenever possible to increase reader attention. There are many sources of such data. One large multiple-line in-

[1] From *Accident Facts*, 1950 edition, National Safety Council, Chicago.

surance company[3] publishes a list of 38 different kinds of home accidents for which claims have been paid. In 1949, falls on stairs and steps were in first place. Cuts on sharp instruments and broken glass came second. Falls on slippery floors and rugs or on uneven ground and walks were next, etc. Over one and a quarter million dollars were paid out in benefits under personal accident policies for home accidents in 1949 by this one company alone.

Many a tragic and intensely interesting story lies in case histories of home accidents which can be obtained from hospitals and doctors. The pity of it is that although the great majority of them are readily and inexpensively preventable, they happen again and again. One approach in educational publicity that is particularly effective is to portray unsafe acts as not merely dangerous but also as something to be ashamed of, as silly or even close to moronic, being careful always, however, not to identify a particular person or location. In other words, there is great value in both imparting knowledge as to safety in habit and environment as well as in making dangerous acts so unpopular that the bragging chance-taker is set back on his heels.

Educational material—As a home safety committee cannot police homes for hazards, it must rely on persuasion to guide families in home safety through education. Home safety education means the imparting of knowledge about unsafe personal practices and dangerous physical conditions—the general causes of all accidents.

Surveys and voluntary inspections are another productive activity for the home safety committee. The professional safety engineer can and will assist in preparing a form or questionnaire, and survey teams can advise home owners and tenants about the removal of accident hazards found on their property. Schools can contribute to this project by encouraging pupils to take home one of the inspection forms for a self-survey by their parents.

Cooperation with industrial safety programs—In many communities there are industrial companies whose job safety programs endeavor to include employee safety while at home. Such activities are often known as after-the-whistle-blows safety campaigns, and offer fruitful opportunities for cooperation by the community home safety committee.

These are but a few of the many ways in which such a committee can apply its ability, knowledge, and zeal to reduce home accidents in its community. Other activities are contests, distribution of literature, sponsorship of safety clubs, lectures, debates, exhibits, and the showing of motion pictures.

Like charity, safety begins at home. Industrial and traffic safety engineers recognize the paramount influence of safe home life on accident occurrence in the shops and on the highways. They want to help our home safety programs, and they have something to offer. Being practical people they think the way to begin is to begin. There is no better time to begin than now, and it seems that we have already had enough talk. Action is the key now.

Let each one here carry the message of this home safety conference back to his own hometown. Let him recommend and effect positive, early action, so a beginning will have been made in all our communities to accomplish more in home safety for the benefit of the community, the state, the nation, and ourselves personally through the prevention of death, injury, and economic waste from home accidents.

[3] See *Protection*, April 26, 1950, The Travelers Insurance Co., Hartford, Conn.

The Public Health Official and Home Safety

By L. M. FISHER
Engineering Field Associate, American Public Health Association

Presented by DR. A. L. CHAPMAN
Medical Director, Region III, U. S. Public Health Service

The public health official of today is taking an increasing interest in home safety, and groping for an effective method which he can employ to reduce the huge toll from home accidents in fatalities, disabling injuries, monetary and property loss. He still has a certain feeling of doubt that it is an appropriate interest for him to have, but he cannot avoid a sense of concern when he studies the facts. Traditionally he has been responsible for preventing communicable diseases. He readily accepts this job, but is less ready to assume responsibility for measures to reduce home accidents. He has long looked at the prevention of accidental death—especially in the factory and on the highway—as the primary, if not the exclusive responsibility of those connected with the safety movement. He is now, seemingly, beginning to doubt that this aloof attitude is completely proper, and to wonder whether or not he should take a hand, especially in home safety. He has not yet fully made up his mind, probably for several reasons: 1. he is not quite sure that his help would be warmly welcomed by those already active in the field of accident prevention; 2. he is uncertain about the methods or procedures he could effectively follow to reduce the many deaths and disabilities resulting from home accidents, with their attendant economic loss; and 3. he has not been given a direct mandate implemented with funds and personnel to engage in home safety measures, perhaps because he has not sought one.

In spite of these influences he looks at the appalling problem uneasily, and does give serious thought to its magnitude and importance, brought home to him by the steadily high rate of fatalities in his own community from home accidents. He has a suppressed feeling of confidence that some of the methods he has employed in practically eliminating from the American home such one-time serious diseases as typhoid fever and malaria might also be effective in reducing most of the preventable home accidents. This somewhat uncertain confidence, combined with an increasingly urgent request for help from sources he cannot ignore, is prompting him to take a broader view of public health: a view which recognizes that the loss to the community is just as great when a child dies from accidental poisoning at home as from typhoid fever. He is greatly disturbed by the fact that more children between 1 and 14 die from accidents (10,741 in 1948) than from the six most important non-accidental causes of death taken together, with home accidents the leading killer, ahead of any single disease, in that age group.

When, therefore, he is urged to utilize his special skills for ferreting out various contributory causes of death in mobilizing official and community effort to reduce death from home accidents, he hesitates only because it is not quite clear to him how he should best proceed. With his present knowledge, he can more easily prevent communicable diseases in the home than accidents. After long and patient search by many health people, the causes of most communicable diseases are known to him and his staff, and this knowledge provides the basis for effective preventive measures. It has enabled him and his specialists—including engineers, sanitarians, bacteriologists, chemists, nurses, entomologists, statisticians, and many others—working together as a team to accomplish great triumphs in sanitation. The once-dreaded scourges of cholera, yellow fever, smallpox, and typhus are no longer terrifying American homes because this team knows what causes them and the nation possesses the economic strength to control them. Because of these and other accomplishments, people support the disease prevention work of the public health team willingly, but public resources placed at its disposal have not been adequate to enable effective application of all the preventive measures known in the field of communicable diseases alone. As long as this situation continues the health official hesitates to assume obligation also for home accident reduction, a field in which he is a newcomer. He sees great unsolved and intriguing problems in his traditional field of public health, and outside this he knows that the average length of life could be further increased if the causes of heart disease, cancer, and nephritis were better understood. He would like to find these causes and remove them, and is also worried by the fact that every other hospital bed is occupied by a patient with mental illness.

While commendably engrossed in seeking the solution to these challenging problems, he sees at the same time that accidents are still fourth among causes of death for all ages and, according to latest estimates, first for the ages of 1 to 38. He sees, too, that home accidents are still in ninth place as a cause of death, disregard-

ing differences by age groups, although some reduction was experienced in 1950.

The precise underlying factors in many home accidents are unclear, and effective measures for preventing many of them are obscure and difficult. Research into the incidence and causes of home accidents is needed, as they are not reportable by law and facts are scarce. There is insufficient official interest, and it can be said that governmental responsibility for home accident reduction does not exist except in rare cases. It is completely lacking in most states and municipalities, and until this is corrected it is a serious handicap to progress. The statement that "everybody's business is nobody's business" is true especially in home safety.

When the modern health official looks back over the years and sees what great progress was made before his day in controlling the principal causes of death and what has been done in his lifetime to prolong the average man's life by eliminating typhoid fever and malaria, for example, almost entirely, his confidence that the accidental death toll will some day be greatly reduced too, even though proven methods for this are not yet determined is justified. This confidence comes from having with him the same team which contributed so importantly to the achievements in disease prevention, and knowing what can be accomplished through professional and organized community effort.

The prevention of home accidents is strongly similar in basic requirements to the prevention of communicable disease. In both cases the increase in wealth, making possible a higher standard of living and better financial support of his efforts, contributes importantly. Just as malaria tended to disappear with the increase of wealth—enabling the farmer to drain a mosquito-producing swamp and cultivate the land, to build a better and fully screened house, to purchase medicine and medical care, and secure a more nutritious diet to build up bodily resistance—so an expanding economy with greater per capita wealth makes it easier to have better homes less hazardous in design, better maintained and equipped with better and safer appliances, therefore less conducive to fatigue and worry. All of these physical advantages undoubtedly are important in home safety. Probably no one knows better than the public health official the close relationship between poverty and disease, between a high standard of living and good health. It seems reasonable to assume that the same relationship exists between standard of living and home accidents.

The public health official is concerned with anything that adversely affects health and causes death, but he can be effective against it only if given adequate facilities, which for home accidents would consist of means to develop precise knowledge of the factors causing them and proven methods for removing these causes, and the personnel and funds necessary to effect those methods. In order to obtain the requisite knowledge about factors causing home accidents and about the best preventive measures, funds for further research are needed. Once such measures have been established, demonstration projects in local health departments help convince doubtful budgetary officials and civic leaders. A lively and intelligent personal interest in home safety on the part of public health officials is a prerequisite, and more of them are taking such an interest now than ever before.

Home accidents are caused in so many different ways and so constantly, with such a drain on the economy, that the interest and effort of nearly every individual, group, institution, and agency in almost every field should be enlisted. All individual and organization leaders trying to promote community betterment should take part in home safety programs. This can best be brought about, it is believed, under the responsible leadership of a public official. Official and voluntary agencies should cooperate to reduce the incidence and severity of home accidents, and the public health official has had much experience (and many headaches, at times) in stimulating and organizing such coordination. This background should prove invaluable to him in both giving and receiving assistance for home safety.

Splendid beginnings have already been made by the U. S. Public Health Service and the American Public Health Association, as well as some state and local health departments. They have been in the form of research and experimental programs, the production and distribution of materials, special training of personnel, the holding of forums and institutes, and support with grant-in-aid funds. Further steps for establishing home safety training courses in local health departments and seminars in schools of public health are being planned. All this

is coming about because an increasing number of health officials accept the thesis that home safety is a logical function of the health department. The U. S. Public Health Service now officially recognizes this fact, as do the American Public Health Association, the Conference of State and Territorial Health Officers, the National Organization of Public Health Nursing, and the National Safety Council.

This action by the National Safety Council should be particularly encouraging to those health officials who may still entertain doubts than any efforts on their part to prevent home accidents would be sincerely welcomed and supported in the safety profession. The mutual interests of safety councils and health departments in home safety have been developing satisfactorily at the state level, but only lip service is too often the rule at local levels. This attitude will disappear soon, we hope, for if any problem needs the concerted support of all groups it is the problem of preventing home accidents.

This area of public welfare is still greatly handicapped by the lack of governmental assistance like that which has been given to industrial and traffic safety for many years. This is perhaps because the general public is not yet fully aware of the seriousness of the situation. Spectacular accidents, like the loss of many lives in a theatre fire or in the burning and sinking of a ship, arouse public indignation and compel immediate remedial action by government. In the field of communicable diseases, an epidemic causing many deaths arouses people and requires the quick application of preventive measures. The funds necessary to correct the evil in such cases are made available promptly. But no such public feeling occurs when several members of a community are killed by ordinary home accidents, or over 27,000 nationally in a year. They happen privately, not in public view, usually one at a time instead of in large groups; they are not usually spectacular; they do not often make the front pages. A fatal or disabling home accident tends to be accepted as a matter of fact, with no one aware but the victim, his family and circle of friends. While they may take action to prevent a recurrence, little notice is given to the tragedy outside this small group, and the lessons that it might teach others are lost. No careful recording of all the facts in the case or search for the reasons is made. No information is ascertained about the physical and mental state of the victim before the accident, and little or none sought about the hazard involved, the wrongful act—either of the victim or of another person—to be studied for the benefit of others.

For in any accident there is one or a combination of causes: the dangerous condition and the unsafe practice. The elimination of either might have prevented the accident. A slippery rug on a polished floor is a fall hazard, but there will be no fall until someone steps on it. Some progress in cutting down accidents can be made by removing only one of these two factors, and rapid progress if both are eliminated. Sometimes the removal of a hazard is not as simple as in this illustration. It may be built into the house in the form of a dark hallway step, getting rid of which calls for preventive design or alteration. Some day the local public health engineer may have the opportunity to review house construction plans and be able to detect such built-in hazards before they materialize. As a member of the engineering profession he should be familiar with the principles of safe house design, construction, and maintenance, and with safety features which equipment going into modern homes should have. As an engineer he should have a special interest in household appliances, fixtures, etc., developed by the engineering profession, and assume a lively responsibility for preventing accidents in which such apparatus is involved.

The private nature of home accidents makes the public apathetic toward the problem. Therefore, much improvement will probably never come about through compulsory measures, and chief reliance will have to be on cooperative education. An effective way to arouse public interest seems to lie in the continued use of promotional and educational material presented as challengingly as possible. Progress made in this way is likely to be relatively slow, but probably sound.

With home accidents causing far more deaths and disabling injuries together (including about 110,000 permanent impairments in 1950) than any other type and costing the nation over $800,000,000 last year, there is ample justification to spend generously for research and experimental projects which give promise of disclosing the important information we need to perfect preventive measures. The Public Health

Service has made an important, though modest, contribution by trying, in cooperation with state and local health departments and the National Safety Council, to develop methods for health agencies to use to reduce home accidents in their jurisdiction. It is also making possible at least one research study in home safety this year.

That health departments can act effectively in reducing home accidents if given better facilities is being proven at Kalamazoo, Michigan, where the work of the city-county health department the past 2½ years has had such promising results that the program's sponsor, the Kellogg Foundation, is now supporting exploratory projects through three more local health departments in other sections of the country. There is hope, too, that a state-wide home safety program will be financed by this Foundation.

It was assumed before the studies at Kalamazoo were started that the friendly contacts of health department people with families afford opportunities to teach home safety in an informal manner on home premises where it would do the most good. This has been proven largely true. Safe home habits and conditions can thus be taught more effectively with minimum effort at the point where the lessons must be applied, but not all health workers are already proficient in such teaching. For maximum benefit they need special training in this field, as in other fields of public health. Because home accident prevention concerns everybody's health and welfare, it is logical to make it a community effort with mass education, but reliance must not be placed on this method alone. People are often slow to apply the information they receive, and will remember safety lessons longer if they engage in the corrective measures while a health worker is in the home. They profit most from what they see and experience. A model hazard-free home might be an effective educational demonstration.

The great need in this, as in other community problems, is competent leadership, implemented by trained personnel and public education funds. When public health workers are shown that carefully directed efforts such as they can make will appreciably reduce home accident fatalities and injuries, they will want to accept home safety as a regular function of their team. Great progress will have been made when this is done. Therefore it is important that the results obtained at Kalamazoo be impressed on health workers and the pupils, and if the outcome from one or more of the other three such experiments now under way is as favorable, a further long step forward will have been made toward safer homes for all. The training of health department personnel in the proven methods will follow, as will research into improving and perfecting those measures. Doubting public health officials will become convinced that their procedures for reducing preventable deaths in other fields of public health can be, with slight modification, equally successful in home accident prevention. With this assurance will come official leadership and requests for funds and personnel to deal with the problem thoroughly as a community responsibility, which it rightly is.

The Safety Council and Home Safety

By ROBERT R. SNODGRASS

Vice Pres., National Safety Council; Chairman, Conf. of Local Safety Organizations; and President, Atlas Auto Finance Co., Atlanta, Ga.

Home safety is the step-sister in our accident-prevention family. Dress up the members in their Sunday-best, line them up for a family photograph and here's what you're apt to see.

Traffic—the glamorous, headline-getting, popular child of every safety movement. Quick to seek publicity. Always the talk of the town. Acquainted with everyone from the corner beat man to the president of the leading bank.

Industry—the "family provider." No promoter need worry about him. Since he came of age he's been steady and dependable. Always willing to kick in to the family kitty. The right hand of safety everywhere.

Fleet—the hard-hitting extrovert. Inheriting the qualities of Traffic and Industry. Fleet is a more conservative Traffic and a more personalized Industry.

Fire—who comes into her own once a year and helps when she's needed.

But what about Home, the Cinderella of the family, who seldom shows up in the family portrait, and then only in the background? Yes, what about Home Safety? The skeleton in our family closet which we don't boast about. The step-sister of our profession.

Traffic safety is glamorous, but accidents in urban homes kill far more of our citizens than motor vehicles in towns and cities. Industrial safety is steady, but home accidents kill almost twice as many Americans as die from work accidents. Traffic and industrial safety use the easy strength of enforcement, but our homes are fertile environment for education, on which home safety must depend and which, in the long run, is more potent than enforcement and certainly longer lasting.

The Situation

Home accidents wear the No. 1 accident killer tag more years than not. Last year these deaths decreased 11 per cent under the 1949 total. This is the only appreciable reduction ever recorded, but some of it no doubt is attributable to a change in death cause classification in 1949. Home accidents still account for about a third of all accidental fatalities each year, and half of all the disabling injuries. A study made by the National Safety Council, and published in the 1951 edition of *Accident Facts*, shows the breakdown of accidental deaths in 38 representative cities for 1950. The information it contains is challenging! Only three of the 38 cities registered more accidental deaths in traffic than in homes. Home deaths led more than two to one.

I am cognizant of the difficulties facing a safety council or other organization working in home safety. Traffic safety attracts more operating funds. Enforcement powers in industry and traffic are a ready-made tool for improvements. Procedure and precedent are already established in the fields of traffic and industrial safety.

The neglected need today is *home* safety.

Only a few communities have faced this problem with an honest attempt to solve it. Most safety councils have a home safety section or division or committee on paper, but too often actually it is little more than a publicity campaign with spasmodic radio or press releases. Most safety councils are not taking full advantage of all the educational and engineering facilities available to them that can be used to prevent home accidents. Few safety councils use their inherent strength to supplant public complacency or indifference with awareness and active support.

What's the Answer for You?

This situation must be corrected, and it is up to the safety council to establish the program, instill and develop the interest that will do it, and act out its part as the recognized leader of all accident prevention in the community. Leadership is what is lacking most. There is some awareness of the problem by most organized groups and agencies. Industry has recognized somewhat that off-the-job safety is essential to good production. In their own way, many safety organizations, health and humanitarian groups and individuals are trying to promote education in home accident prevention. There are many who will help, but they must have the guidance, encouragement and example of the safety council.

Before a safety council can present a home safety program suited to local needs, interests, limitations and potentialities, it must know the exact problem in its own community. How serious are home accidents comparatively there? How and where are they happening? To what age groups? Such facts are obtainable on a national level from *Accident Facts*. Quite possibly the picture is the same in your community. If so, you cannot help but perceive a need for home safety promotion slanted to particular age groups and accident types, primarily:

Falls among people over 65 years of age; fire burns among children under five and adults over 65; poisoning among children under five.

These are some specific problems you quite likely will discover as outstanding in your community. The approach is then apparent: Concentrate first on eliminating the causes of the most home accident deaths in your locality. This cannot be done solely by publicity or propaganda. Although these rudiments are essential and have their place, they are not the answer. The answer lies in continuous participation in a definite pro-

gram by all members of the community, *individually* and collectively.

The Proof's in the Pudding

I learn best when I try to teach others what I've learned. So do other people. When I advocate something, I try to follow my own advice. Because I am now very interested in safety, and active in its promotion, I am more *safety-conscious* personally than before. By helping the safety movement I become a *safer person myself.*

I think this personal participation is the reason for the outstanding success of "Operation Safety" in the traffic field. I see no reason whatsoever why this procedure cannot be used effectively in home safety too. A few safety councils have "Operation Home Safety" programs modeled after the traffic version, but it is *still only a pioneering* field. I believe more councils should consider *this approach.*

Let me give you an example. The Greater Atlanta Safety Council, of which I am a member, initiated its public safety programs last year and now has a full year's experience behind it. It was quick to organize "Operation Safety" with *leading groups* sponsoring specific phases of traffic accident prevention. Why, asked Manager Bob Leopold, couldn't the same type of program be used in *home safety, and in farm safety?* There are actually over 1000 well organized *groups* in Atlanta, with members eager to improve their community, which could be brought into the job. The answer is obvious. They can and will work for safety in Atlanta; Los Angeles; Portland, Oregon; or Portland, Maine, if they are shown the way.

The Atlanta Red Cross chapter made available to the new Safety Council its records of hospitalized accident cases secured after organization of a reporting system in each hospital. These did not include all accidents in the area, but did cover most of those serious enough to require hospital attention. An analysis of this information gave us the picture on non-fatal injuries, which, besides statistics on fatalities from death certificates, is so essential in planning emphasis and activities. Such facts can be obtained in any community, but perhaps not always as easily as in Atlanta. *Still, they* must be had, as the first step in any successful community home safety program.

Next, a roster of organizations in the metropolitan area was secured from the Chamber of Commerce. Parenthetically, a good mailing list is necessary for a well-rounded public information program, as direct mail pieces are particularly helpful to home safety education.

There should be no difficulty getting *leading groups to sponsor* and conduct programs for the safety council once they're sold on *the need.* Much care must be used, however, in choosing groups which will achieve the best results in an appropriate job and which will have the highest degree of membership participation.

In Atlanta, those organizations were selected which the staff thought could best handle special phases of home safety needing *intensive promotion.* A *meeting* of representatives from these groups was called and the plan presented to them. The results were gratifying: every group accepted the assignment suggested and a schedule for the first year's program was set up. It was inaugurated in September 1950 with the Girl Scouts sponsoring "Child Safety in the Home." The Women's Chamber of Commerce took "Fire Safety in the Home" during October. The Business and Professional Women's Club readily accepted the job for November, but the theme had to be changed from "Old Folks in the Home" to "Adult Safety in the Home." They didn't like the implication in "old folks."

The Federation of Women's Clubs undertook "Safe Housekeeping" during December and January. The Atlanta Chapter, American Institute of Architects, sponsored "Safe Equipment and Construction" during February and March; an organization composed of 135 Garden Clubs worked on "Yard and Garden Safety" during April; and the Boy Scouts sponsored "Child Safety Outdoors" during May.

There were no program sponsors for the summer months this year because most groups disband during the vacation period, but we will have summer sponsors for home safety next year.

The Recipe in Atlanta

Six weeks or more before each campaign, the safety council staff holds a planning meeting with key people of the sponsoring groups to discuss its facilities and a plan of action. No two campaigns are alike, just as no two organizations are alike, so each must be handled individually. Every project is tailored to the people who are conducting it, and the individual members grasp their responsibilities immediately.

When the program is agreed upon, the Safety Council prepares a kit including a fact sheet on the subject, a quiz, talk outline, program for club meetings, or some other tool for making member participation easier. In the campaign outline with this kit, it is emphasized that members should pass on what they learn to others, thus promoting home safety outside as well as within their own group. The Safety Council works closely with the group's leaders in carrying out campaigns through its members for the most widespread benefit.

The staff handles all publicity on such special activities and carefully directs it so there is no conflict or duplication with other important safety information supplied regularly to radio, press and other media by the Council. Experience taught us that this is the only way. During one of the early campaigns, three different Scout troops contacted one radio station requesting time for the same campaign. Now the staff makes all such contacts and channels the publicity, securing the radio and television participants from the sponsoring organization. Press releases are handled the same way; the sponsor contributes news, names, ideas, etc., which a staff member writes up and releases. The newspapers and radio stations appreciate this, for it means one agent contacting them for local safety promotion, rather *than several. The staff member* handling public information finds that it makes his *contacts with the outlets pleasanter,* personal, and more fruitful.

The Direct Approach

But again let me emphasize that publicity is only a part of the home safety program. It is valuable in telling the public the need for home accident prevention—yes—and what they can do to make themselves and their families safer at home; but it also enables public recognition of the efforts of participating organizations and their members. For what they do is newsworthy—their activities make news—good, legitimate news which is more interesting generally than straight safety propaganda.

The Atlanta Girl Scouts made news when they sponsored "Child Safety in the Home." They made a survey of hazards in 4,000 homes and followed it up with a report of improvements. The soundness and potency of this approach can be gauged by some comments which I quote verbatim from the reports:

"*Smoking* is now not allowed in beds."

"Sewed anchors to rugs to prevent slipping."

"We have been trying to remember to turn pot handles to back of the stove."

"Mother and Daddy stopped smoking in bed."

"I painted the bottom step to the basement white."

"Dad gave me some money to buy a step-ladder for the kitchen. Also, I got a metal can from the store for oily rags."

"I have been making my little brother and sister pick up their toys and put them away after playing."

"Mother said she would turn pot handles in a safe place if I would stay out of the kitchen when she is cooking."

How's that for results! Children learning *to do things safely—teaching* and reminding their parents about accident prevention! You can be sure that these children will be a strong influence for safety in their homes.

The girls presented skits at PTA meetings. They went on the air several times with panel discussions on various aspects of home safety. They made talks to their troops.

As part of the home fire safety campaign of the Women's Chamber of Commerce, a highly respected group of business women, a speakers bureau was formed which made talks to other groups. Civic and service clubs helped reach tens of thousands of people with fire prevention advice. Preachers were contacted and urged to have fire drills for their Sunday Schools. A radio and TV subcommittee presented home safety panels and other broadcasts.

Another successful program, judging by the cooperation achieved, was "Safe Housekeeping" led by the Federation of Women's Clubs, composed of 104 groups in our Fifth District. Every club took part, some on radio programs, others with talks or a quiz panel before their own organization, or when the Safety Council's speakers bureau provided them with a speaker.

Appraisal and Challenge

Several advantages are apparent after a

year of "Operation Home Safety" in Atlanta. The promotion is not confined to the period of each campaign, but it gains impetus and momentum during it and continues through several months afterward. The Safety Council confines the publicity on a particular phase to the stated period in which it is stressed, so it will not conflict with other programs, but the resulting interest and activities go on indefinitely.

Another advantage to the Safety Council is that its news stories are made more interesting and usable by highlighting the cooperating organizations and the people in them. Thus the credit is spread around and an avenue left open to the Council for publicizing other phases of safety without saturating the media with the same impersonal items.

And, of course, the invaluable situation of thousands of people promoting the cause and disseminating the "good word."

There is really no reason why the public can't be harnessed to the home accident prevention team, why home safety can't be as outstanding in the safety council family as *Industry, Fleet,* and Traffic are—except that John Q. hasn't been offered much opportunity to help, hasn't had the leadership, hasn't been shown the way.

Here is a *wonderful opportunity for any* safety council, if it fully accepts and meets the challenge which Home Safety offers. Reducing home accidents in our communities is a tough, demanding, often frustrating battle which can be won only if it's hard fought. So far we haven't done much more than give it lip service.

Public Health Department Opportunities in Home Accident Prevention

(A special forum for state and local public health personnel arranged in cooperation with U. S. Public Health Service, Chicago Regional Office.)

Presiding: E. R. Krumbiegel, M.D., Commissioner of Health, Milwaukee, Wis.

(Summary of Discussion)

Dr. Krumbiegel opened the discussion by stating that the following basic assumptions could be made:

1. Death, sickness, and permanent disability resulting from home accidents constitute an important public health problem.

2. Public Health Departments have a moral responsibility to help reduce these accidents.

3. It is possible to reduce the incidence of home accidents.

These points were accepted as correct by general consensus of the group.

The following questions were posed and discussed as summarized below:

1. *What resources do public health departments have that they can devote to home safety right now?* a. Epidemiology b. Public health nursing c. Statistical analysis d. Health education e. Mental health services f. Maternal and child health services g. Environmental sanitation.

There is in general a legal responsibility on the part of health departments for epidemiology, environmental sanitation, and vital statistics, as well as for other phases relating to communicable disease, but not necessarily for accident prevention.

It is difficult to release personnel for home safety because most of the appropriate divisions are already overworked, but perhaps some of the time of personnel in certain divisions could be more advantageously used for accident prevention than for present purposes which have become less serious.

2. *What percentage of these resources can be turned to home safety today?* The part of its resources which a health department can release for this work varies according to public interest in the problem. Therefore, the health department has to sell the public on the need.

3. *Are additional resources available? Where?* Maternal and Child Health funds are already authorized for accident prevention services, because home accidents are the most important cause of death among children from 1 to 14, and all accidents kill more children in that age group than the six most important nonaccidental causes combined. According to Dr. A. L. Chapman, Medical Director, Region III, USPHS, General PHS funds can also be used now for safety by health departments.

Public support for a long-range program of home accident prevention by a local health agency can be built up through:

a. Promotion of interest in the problem by the public health nurse among families she visits at home;

b. The advisory health council of the community:

c. Informing the local board of health;

d. Indoctrinating the entire health department staff, who in turn can educate the public.

Although it is wise to plan a comprehensive and continuous home safety program with funds allocated for the purpose, in most communities the health department must start with a diversion of personnel from other assignments before it can get additional money. One way to begin is its own complete demonstration campaign in a small section of the community, or a project in cooperation with some other organization.

4. *In which administrative section of the health department does the home safety program belong?* It was agreed that some official agency in a community must assume governmental responsibility for home accident prevention as we have in traffic and industrial safety. The only such agency which regularly goes into homes is the health department, but it has no enabling legislation with respect to the home accident problem, except possibly that which covers environmental sanitation. The problem must be met through education.

The environmental sanitation division can deal with accident exposure conditions, working with engineering and allied sciences. The mental hygienists, health educators, etc. can work on accident immunization and susceptibility in cooperation with the medical and psychiatric professions.

The safety council should assume the program promotion and organization community-wise, acting as a clearing house and getting behind the official agency for coordinated public support of its program. It should coordinate volunteer with official effort.

The administrative level for the health department's home safety program will depend on the size of the agency and contemplated scope of this program. In smaller departments the health officer will probably need to direct the program personally, but in larger ones it may be incorporated as an activity of the division of chronic diseases.

5. *What specifically can a health department do in home safety, effectively and economically?* In order to set up a program, the health department should first delineate the problem by:

a. Follow-up of death certificates to determine the extent and exact causes of home accident mortality locally.

b. Ascertain the morbidity from home accidents by getting case reports from hospitals and doctors. Other measures such as a sample survey of homes by public health nurses might be utilized if sufficient personnel time is available.

From these facts the most important problems to concentrate on can be established and forces and procedures of attack chosen.

It was suggested that in-service training in home safety for health educators and other groups in the comunity's so-called "health family" might be the next step. Mentioned for this training were public health nurses, sanitarians, health educators, public welfare workers, employees of voluntary service agencies who go into homes, insurance collectors, utility men, etc.

Our Children Can Have a Safe Community

(Joint Meeting—All Public Safety Delegates)

Presiding: NED H. DEARBORN, Pres., National Safety Council, Chicago

When the Educator Cooperates

By WAYNE O. REED

Assistant Commissioner for State and Local School Systems, U. S. Office of Education, Federal Security Agency, Washington, D. C.

Our children can have a safe community if the educator cooperates in helping them to learn to make it a safe community. Educators have placed great emphasis on this problem for the past thirty years or more and with such splendid results as to encourage us to redouble our efforts.

The educator will also help children have a safe community if he continues to cooperate with agencies and individuals in undertakings directed toward the reduction of accidents in the community. Serving on committees, helping to conduct surveys, keeping accurate accident records, establishing good traffic controls around the school, discussing matters with parents and civic groups—these are but a few of the many ways in which the educator can assume his responsibilities in community safety affairs.

There are many aspects of a safety education program, for safety education is a broad phase of the total educational program. Safety education involves many services such as the medical examination or observations and check-ups (screening) by the teacher and nurse. Through such services, we may find a child who has defective vision, or one who is weak or poorly coordinated, or one who is psychologically disturbed so that he is accident-prone.

By keeping accident records, the school can learn what the actual experiences of its own children are and thus point up the teaching.

There are first aid and emergency case services for children who do have accidents during school time. These services also include adjustments (physical and pedagogical) for children who have handicaps.

The Fire Drill is a real safety service. Often the local fire chief is consulted by the principal, teachers and representative children in setting up precautions to be taken in case of fire. Unfortunately, today we have also to provide for possible emergency conditions relating to Civil Defense. Here, too, we find school people and civil defense officials working together.

The school environment is involved in safety education. It includes everything from the way the scissors are handled in the first grade to the use of laboratory equipment in the science rooms of the high schools; from the custodian's storage of cleaning supplies and equipment, to the maintenance of the school bus. And of greater importance, is the necessity of teaching children how to use the facilities, equipment, and supplies safely and to cooperate in correcting conditions that are hazardous.

The organization and conduct of all school activities have safety implications. This involves such things as scheduling class activities, lunch, "activity" and recess periods; the regulations dealing with the riding of bicycles; classroom management, such as procedures involved when small children handle scissors and other sharp tools, or the way materials and other matters are stored and handled in the classroom—such things as the way science and shop equipment are set up and used, the way homemaking and physical education, athletic and recreation activities are carried on.

There is also a necessity for planned and guided learning experiences in safety—instruction, if you will. These learning activities range in scope and interest from helping the first grader find the safest route from home to school, to emphasizing the safe use of playground equipment for fourth graders, to special courses in first aid and driver education in the high school—with many other concepts, experiences, skills and attitudes necessary for all children in between.

In this broad program, many people have a responsibility. But most important, safety education is the responsibility of the teacher—not just the teacher who has some specific assignment for safety teaching but every teacher. Who is in a better position to favorably influence attitudes, to develop a safety consciousness, to impart knowledge, and to develop skills, than the teacher in his day to day intimate contact with boys and girls?

Children learn safety—absorb safety—in many ways. The most important way is by living safely throughout the school day and carrying over those safe ways of behaving into home and community life. When children help set up and understand certain regulations and safe procedures, and are encouraged to observe them—*that* is functional safety education.

There are thousands of examples: When children observe traffic in the halls, or handle their bicycles in the agreed-upon manner on the school grounds, or help keep the school grounds free of obstructions and debris, or light the ovens properly in the home economics class, or when they serve as a member of the school safety council or the safety patrol, they are *living* safety.

The attitudes children develop and the practices they follow in school carry over into the home and community. It is important for parents not only to encourage safe practices, but to follow them as well.

There can be learning through *dramatization*. This is not to say that all safety education must be so highly charged that inhibitions are built up. But safety can be taught in such a way that it is real and a part of life. There are times when interest is at "white heat." Then, of course, is the time to capitalize upon these incidents. I guess one reason why teaching seems so effective then is because the possibilities of unsafe behavior come closest to the person. One of the great hindrances to safety education is the common feeling that "it can't happen to me." Such incidents as these bring home forcefully the fact that perhaps it *could* happen to me.

Many—almost every—school experience involves some consideration of safety. *Wherever appropriate and natural*, the safety implications of any learning experience should be brought out. When the second graders visit the fire house, or the sixth graders go to the school camp, there are innumerable safety factors involved.

In the high school, who can better teach safety in relation to athletics, recreation and physical education activities than the physical education teacher? Or the safety in the home—who can teach it more appropriately than the home economics teacher? Is not science teaching replete with opportunities for getting across safety concepts? Surely this is true, and full capital should be made of these opportunities for correlation.

But then some of these experiences are so important that they must be a part of the education of *all pupils*. As an example, home economics reaches many but not all of the girls of the high school and few of the boys. Yet in the home it is the boys mainly who will operate the tools, fool with the electricity, or even wield the can openers these days. I suggest that we must look at our high school curriculum to make sure that all boys and girls have the privilege of profiting from certain basic and common experiences.

There is, then, *content in safety* education. Certain knowledges and skills to be learned. One must be in command of today's environment today. It is more than that. It is a way of thinking—so that one can also be in command of tomorrow's environment tomorrow.

The content in each school will vary with the needs and interests of the students, of course. But generally, for talking purposes, some of the more common learnings might be organized into these headings:

Home and Farm Safety: Safety in various parts of the home, the yard, in the barn, involving such things as the prevention of fires, burns, falls, poisoning, cuts, and asphyxiation, the handling of animals that as somebody put it "kick, bite, claw, scratch, buck, or gore."

Public Safety: Traffic: For elementary children—tricycles, bicycles, wagons, scooters, skates; for high school children—motor scooters, *hot rods, jeeps*, trucks, and the family car. For all of them—pedestrian practices, use of public carriers, buses, trains, taxi cabs, etc. Public Buildings: Using revolving doors, elevators, exits, fire escapes, etc.

Safety in Play and Recreation: Playing in the street and on playgrounds, using

equipment and supplies like kites, swings, seesaws. Water Safety: Swimming, boating, fishing. Safety Elements of Nature: The sun, wind, storms, insects, reptiles.

School Safety: Safety on the grounds, in the halls, in the classroom; Safety in gymnasiums, play areas, locker room; Safety in special areas such as the science room, home economics department, shop, school lunchroom, etc.

First Aid & Home Care of the Sick & Injured: Once again th... ited value unless ... individual and ... ways that w...

Study ... dent ... appr... fer... en...

d... t...

a...

p...

wh... thin...

Stu... to dete... and the a... ible with g...

Evaluate the ... teachers and other ... to note their influence o...

Survey the school, home and community for accident hazards and for other safety needs.

Use data available from the public health, police, highway, and other agencies.

Survey textbooks, courses of study, curriculum guides and other materials to determine what items are stressed; weight these items for appropriateness in the light of the needs of the particular children concerned.

These are just suggestive—there are many other evidences of children's needs.

State and Local Leadership

The broad program of safety education in the schools of a community needs someone especially concerned with pointing it up—someone to take a special interest to see that all of the educational opportunities are fully utilized, to help coordinate activities, to provide enlightened leadership so that school and community resources will be used to the fullest.

In a state or local school system, this is ultimately the responsibility of the administrator. But so are many other things—and so he must delegate. The manner in which leadership in safety education will be delegated must necessarily depend upon many ... The size of the community, the ... of pupils or students, their age and ..., preparation of the teachers, ...ources and many other factors ...

...ances the leadership might ...son especially employed as ...rdinator, or consultant in ... Or it may be a person ...tions described in those ...ction with a larger re... ...as director of health, ... education or assistant ... small organizations the ...one from a committee ...especially designated as ...mmittee. In other words, ...ion phase needs some one ... in the program, who has ...chnical background in the ...ho knows how to work with ...

... many States have someone in the ... Department of Education especially ...signated to coordinate the activities of the department that relate to safety education. Ten or more have such persons who give full time to the safety assignment.

There are counterparts of these school services on the national level. There is the National Commission on Safety Education of the National Education Association. In our own Office of Education we look mainly to our specialists in health and physical education for leadership in safety education. Each of those persons has had a wealth of experience and professional preparation in the field of safety. In addition, a number of our general elementary and secondary people are well versed in safety education and there are certain other specialists whose work deals in considerable extent with the safety aspects of education.

I hope I have conveyed to you my very strong personal feeling that we can make our community safe for our children *only* if every citizen accepts his responsibilities—the educator no less than any other person. The educator contributes in *two ways:* (1) by helping children and youth learn to live safely; (2) by contributing as a citizen of the community to those safety activities that lead to civic betterment.

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By C...
President, Kennecott Copper Corp., New York; Chairman, Board of Directors, NSC

Presented by D. E. MUMFORD
Supt. of Safety, New York Central System, New York

Today, industry accepts the fact that it has responsibilities to the community, and that the members of the community expect it to discharge properly these responsibilities. Increasingly, therefore, industry has been showing leadership in various community activities, sometimes corporately, and sometimes individually through its management personnel. Examples of this leadership are shown in community chest and hospital drives, and business-industry-education programs.

Industry's Interest in Accident Prevention

Logically, industry may assume leadership in still another field—community safety education, where it has so much experience and knowledge to contribute to public welfare and benefit. Industry has a two-fold interest in preventing accidents. First, there is the humanitarian interest—we don't want our employees to get hurt. Second, there is the dollars-and-cents interest—accidents cost money.

equipment and supplies like kites, swings, seesaws. Water Safety: Swimming, boating, fishing. Safety Elements of Nature: The sun, wind, storms, insects, reptiles.

School Safety: Safety on the grounds, in the halls, in the classroom; Safety in gymnasiums, play areas, locker room; Safety in special areas such as the science room, home economics department, shop, school lunchroom, etc.

First Aid & Home Care of the Sick & Injured: Once again this content is of limited value unless tied in specifically with individual and group needs. Some of the ways that we can help find those needs are:

Study and use medical, dental and accident records, the other health and safety appraisals, the recorded comments of conferences between teacher and nurse and parents and others.

Observe the safety practices of the children in the school, on the playground, during the lunch period, in the community.

Observe the child's ability to live with and compensate for his handicaps.

Evaluate the quality of relationships among pupils, with one another and with adults.

Learn what children do in their free time, what they talk about, how they feel about things.

Study the organization of the school day to determine whether the things that happen and the arrangement of the day are compatible with good safety practices.

Evaluate the philosophy and actions of teachers and other adults of the community to note their influence on safety attitudes.

Survey the school, home and community for accident hazards and for other safety needs.

Use data available from the public health, police, highway, and other agencies.

Survey textbooks, courses of study, curriculum guides and other materials to determine what items are stressed; weight these items for appropriateness in the light of the needs of the particular children concerned.

These are just suggestive—there are many other evidences of children's needs.

State and Local Leadership

The broad program of safety education in the schools of a community needs someone especially concerned with pointing it up—someone to take a special interest to see that all of the educational opportunities are fully utilized, to help coordinate activities, to provide enlightened leadership so that school and community resources will be used to the fullest.

In a state or local school system, this is ultimately the responsibility of the administrator. But so are many other things—and so he must delegate. The manner in which leadership in safety education will be delegated must necessarily depend upon many things. The size of the community, the number of pupils or students, their age and grade level, preparation of the teachers, available resources and many other factors are involved.

In some instances the leadership might come from a person especially employed as a supervisor, coordinator, or consultant in safety education. Or it may be a person who has the functions described in those titles, but in connection with a larger responsibility, such as director of health, physical and safety education or assistant superintendent. In small organizations the leadership might come from a committee with some one especially designated as chairman of the committee. In other words, the safety education phase needs some one who is interested in the program, who has an adequate technical background in the subject and who knows how to work with people.

Today many States have someone in the State Department of Education especially designated to coordinate the activities of the department that relate to safety education. Ten or more have such persons who give full time to the safety assignment.

There are counterparts of these school services on the national level. There is the National Commission on Safety Education of the National Education Association. In our own Office of Education we look mainly to our specialists in health and physical education for leadership in safety education. Each of those persons has had a wealth of experience and professional preparation in the field of safety. In addition, a number of our general elementary and secondary people are well versed in safety education and there are certain other specialists whose work deals in considerable extent with the safety aspects of education.

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Safe living goes on out of school—at home and on the highways; in plants and shops and on playgrounds. The community holds many people other than school people who are extremely interested in safety—the police, the firemen, the fire marshal, the insurance companies, the safety engineers, the automobile club, the highway engineers, the transportation people, the makers of dynamite caps, the parent-teachers association, the civic clubs, the medical profession, the public health people—these and many more. The school's part in this whole configuration is important and completely related. The schools not only stand to gain but cannot avoid working with community groups. Only when all of us plan, work, and evaluate together more closely can the best interests of children and youth be served.

Most of my comments have been related mainly to elementary and secondary schools. Trade schools, too, are concerned with many aspects of safety education. They do a particularly important job in stressing shop safety and the safe use of tools. In this respect they are of service to industry in training young people to be safe workers.

In the colleges we find a growing interest in the safety aspects of professional technical jobs—engineers, scientists, laboratory technicians, and others. Some few offer curricula in safety engineering and traffic safety control. Some offer general courses in safety education or safety units in personal and public health courses.

The colleges also have a major contribution to make in the preparation of the professional educator to assume his responsibilities for safety education. In the pre-service experience of elementary and secondary teachers or special teachers of safety, and in the post-graduate courses for school supervisors and administrators, there are many [illegible] in safety education that the colle[illegible], and in some cases, does provide. However, there is much room for improvement. For the most part, our teacher-education institutions need to improve their services so that the school person will come to the job better prepared in safety education. This will reduce the burden on State and local school systems and the colleges themselves for in-service education of personnel.

When the Industrialist Cooperates

By CHARLES R. COX
President, Kennecott Copper Corp., New York; Chairman, Board of Directors, NSC

Presented by D. E. MUMFORD
Supt. of Safety, New York Central System, New York

Today, industry accepts the fact that it has responsibilities to the community, and that the members of the community expect it to discharge properly these responsibilities. Increasingly, therefore, industry has been showing leadership in various community activities, sometimes corporately, and sometimes individually through its management personnel. Examples of this leadership are shown in community chest and hospital drives, and business-industry-education programs.

Industry's Interest in Accident Prevention

Logically, industry may assume leadership in still another field—community safety education, where it has so much experience and knowledge to contribute to public welfare and benefit. Industry has a two-fold interest in preventing accidents. First, there is the humanitarian interest—we don't want our employees to get hurt. Second, there is the dollars-and-cents interest—accidents cost money.

Industry takes its text for accident prevention from the Bible, Deuteronomy XXII—8, which reads, "When thou buildest a new house, then thou shalt make a battlement on the roof, that thou bring not blood upon thine house, if any man fall from thence." That ancient admonition still holds good. It applies to industry and individuals alike—we don't want "blood upon our house."

Industry is interested in all types of accidents. Accidents to employees on the job cost the most. To the employee they mean pain and suffering, medical expenses, and lost wages. To the employer they mean compensation expense, medical costs, damage to material and equipment, taxes for and contributions to hospitals, lowered efficiency and reduced production, and increased production costs, reduced markets and lower profits.

But accidents to employees away from the job are nearly as costly. The employee experiences the same costs whether he is injured at home or at work and the employer suffers lowered efficiency and reduced production, and increased production costs, reduced markets, and lower profits.

Then there are the accidents to members of employees' families. When an employee's wife falls and breaks her arm, the employee suffers medical costs and lost wages due to the necessity of his being away from the job as a result of the accident—and the employer sustains losses occasioned by the employee's absence from work and his worry and distraction while on the job.

Even accidents to others than employees and members of their families cost industry money through reduced markets and other factors. There is no kind of accident that does not affect industry unfavorably, either directly or indirectly.

What Industry is Doing About Plant Accidents

Industry has made great progress in reducing occupational accidents. It has spent millions of dollars for accident prevention devices, and additional millions for safety education. The number of occupational accidents per 100,000 population resulting in death has been cut in half, and a similar reduction has been effected in non-fatal accidents. Today the worker is safer on the job than he is off the job.

Industry can do much to reduce plant accidents still further. A great many companies have safety programs and full-time safety men, but more companies, especially the medium sized and smaller business concerns, should inaugurate safety programs. Moreover, the effectiveness of many existing plant safety programs should be improved and strengthened.

What Industry Can Do To Help Community Safety

The interest in off-the-job safety in certain states has been increased by the passage of legislation providing employee disability benfits for off-the-job injury as well as occupational accidents. However, in a recent survey of 400 representative organizations in the United States and Canada, only 43 were doing anything to reduce off-the-job accidents among their employees, and of these 43 only about 10 were really trying hard to educate their people in safety away from work, although all 400 companies had someone charged with the responsibility of employee safety.

Industry cannot afford off-the-job accidents and should begin to do more about them. In the case of companies having regular plant safety programs, the additional cost of incorporating off-the-job safety in the regular plant safety program would be small. Here are some of the things that could be done:

1. Keep records of off-the-job accidents in order to determine how, when, where and why.
2. Summarize off-the-job accidents and make the information available to all employees.
3. Compare the cost of off-the-job and on-the-job accident experience.
4. Show motion pictures, slide films and other visual aids relating to off-the-job safety at employee meetings.
5. Devote a proportion of safety publicity to the subject of off-the-job accidents.
6. Get employees to teach safety to members of their families.
7. Include first aid training in plant safety programs. (It is impossible to take one of the courses and not become safety conscious.)

Education to prevent non-occupational accidents will pay dividends in less absenteeism, lower labor turnover, better production, and higher employee morale. Off-the-job safety has an important by-product value—it not only brings down the number of accidents away from the plant, but it also helps to reduce the number of on-the-job accidents, by virtue of the fact that employees, when they become safety conscious away from the job, become more safety conscious while on the job.

In making off-the-job safety of employees a part of the general plant safety program, industry is contributing to the community safety program. But there are other ways in which industry can contribute more positively to community safety. One of the most important of these is in helping the community get the safety program set up on an efficient basis. Generally speaking, industry has had more experience with safety programs than communities have had, and its safety engineers can render invaluable assistance to the community in making the program effective.

Another important way in which industry can contribute to the community program is to make available its safety engineers to speak before the various community organizations, including church gatherings, parent-teacher's meetings, school groups, etc. The safety man should be ready and willing to talk safety on every occasion, wherever he happens to be.

Industrial safety equipment and materials, including motion pictures, slide films, safetygraphs, and other visual aids, are usually used only a small percentage of the time. By lending them to the various community safety groups, industry can enhance their usefulness and further contribute to the over-all community program.

What is Wrong with the Safety Movement in the U. S.

Forgetting for the moment what industry can do to help community safety, let us consider the safety movement in the United States and what is wrong with it. Real progress in accident prevention has been made. Since 1900 the "all accident" death rate per 100,000 population has been reduced about one-third. However, in 1950 over 35,000 Americans were killed in automobile accidents and 55,000 more in other kinds of accidents, totaling more than six times as many as have been killed in Korea since the beginning of the war there.

Consider these figures—in one year 90,000 dead and 9 million injured, at a total cost of $7,300,000,000 in money and an incalculable amount in suffering and mental anguish. Statistics are dry things—instead of the 90,000 dead, perhaps it would mean more if we think of the sorrow and deprivation in 90,000 homes resulting from the death of a member of the family, in many cases the breadwinner, due to an avoidable accident.

Despite the progress in accident prevention that has been made, we have not yet found a way to bring home to the individual the importance of safety to him personally. We have not been successful in making the individual sufficiently concerned about the accident "that has not yet happened."

There is a missing link somewhere, between our efforts to prevent accidents and the results we have thus far achieved. This missing link is really three links which are psychological, organizational, and financial in character.

What Can Be Done About It

The psychological missing link stems from the fact that safety involves more than putting up warning signs, safety guards on machines, and painting moving parts yellow. It involves men's minds. The steel industry, after notable progress in reducing accidents by the installation of millions of dollars of protective equipment and devices, found that no matter how many more dollars were spent, the accident rate held steady. The men themselves were no more safety conscious than they had ever been, and through neglect and misuse were circumventing the mechanical safeguards. Since the problem was mental and psychological, the solution was found in safety education. But substantial further progress will have to come from more fundamental safety education than can be given in industrial plants.

The safety movement in this country will not be fully effective until we accept the concept of safety as an important part of the American way of life, and this means that it must be taught in childhood in our homes and schools. In some manner the individual must be made to think safety—so that he will act safely at all times.

The organizational missing link is due to the comparatively small number of cities throughout the United States which have organized community safety programs in operation. There are more than 1200 cities

of over 10,000 population, but only about 200 of them have organized community safety programs. In 80 of these there are community safety organizations, which are affiliated as chapters with the National Safety Council and, generally speaking, the programs are effective and well run. In the remaining 120 cities which have organized community safety programs, the programs are less effective, often incomplete, haphazard, and part-time. This leaves 1,000 cities, most of which are between 10,000 and 25,000 population, with no organized safety programs.

The inauguration of many more community safety programs, and the improvement of existing programs, is essential if the effectiveness of the safety movement is to be increased materially. Safety programs must be carried down to the smaller communities of between 10,000 and 25,000 population, and even below.

Then there is the financial missing link. At present not one person in a thousand makes any direct contribution to safety, nor would he know how to go about doing so if he wanted to. People would be more conscious of the importance of the safety movement if they contributed to it financially. Getting the financial support of a substantial proportion of the rank and file of the citizens of this country is an important step toward making the safety movement more effective.

What Industry Can Do

What can industry do to help forge these missing links? In the first place industry can help persuade our people to think and act in accordance with the concept of safety as a fundamental of our American way of life, and it should urge that this concept be taught in our schools and homes. Industry can help further by assisting in the development of the school safety programs, by furnishing advice and assistance, and by lending safety equipment and materials for the presentation of the courses.

Industry can play an important part in organizing safety programs in those communities where none now exist, and improving those existing programs which are not effective. It can do this by virtue of its position in the community and through its industrial safety men, who are trained in safety and who are working at it constantly. Safety is their business, whereas others in the community, who are interested in safety, have other duties and responsibilities which have first call on their time. Industry can make no better contribution to community safety than by making available its safety engineers for helping set up community programs.

It should be the responsibility of the National Safety Council to get industry started in the inauguration of safety programs in communities not now having them. The Council should draw up a simple, easy-to-follow blueprint as a stimulus and guide. I feel that the professional safety engineers are the persons best qualified to organize community safety councils. They should work through business and community leaders, and obtain the people best qualified in the various phases of safety to make up the council's *membership*. The undertaking should have the blessing of the mayor, but care should be taken to keep the council free of politics.

An excellent example of a non-political safety council which has had notable success, is the one at Waterbury, Connecticut. None of the members receive pay for work on the council and all were chosen for their particular specialized knowledge and civic interest. The industrial members, I believe, are responsible for giving the council the spark which has brought its activities to its present high level of accomplishment. The council makes available to any interested group the services of speakers, material for speeches, films, slides, literature, statistics, etc. It holds regular meetings and receives good publicity from local press and radio. The council serves not only Waterbury, but a number of nearby towns and villages as well.

Achieving broader financial support of the safety movement is primarily the responsibility of the National Safety Council. One community that I know of that gives popular "grass roots" support for the safety movement is Cleveland, Ohio. Here the Greater Cleveland Safety Council once a year carries on a Green Cross dollar membership drive. It gets help from the police, the fire department, and the public schools, and raises a substantial portion of its budget in this way. Upwards of 70,000 members are enrolled, and, in addition, 100,000 school children get the Green Cross button for lesser contributions. The important thing about the Cleveland plan is not the amount of money that is raised but rather, the comparatively large number of people that become interested in safety as a result of their financial support.

I believe that some adaptation of the Cleveland plan can be found which can be applied on a national scale. In any event, when the council comes up with a way to attack the problem, industry will be able to lend substantial help through its plant safety programs and employee information channels.

Conclusion

In concluding my remarks on industry's part in community safety, I would like to point out that industry has been the pioneer in the safety movement in the United States. It has made large contributions to safety, and stands ready to increase its efforts in this field. But safety must be a joint effort of all of us if we are to succeed in reducing the tremendous losses that occur each year. There must be greater participation by educational institutions, local governments, business leaders, and individual citizens if we are to succeed in bringing to all our people the fundamental concept that safety is everybody's business.

The American people cannot afford to continue to pay the unnecessary annual toll of 90,000 dead and 9,000,000 injured. Such a loss is beyond the ability of even this country to bear, whether considered from the viewpoint of the amount of money involved, or the human suffering. Safety must be accepted by all our people as a fundamental of the American way of life.

Saving men's lives conforms to the ancient biblical concept that we are our brothers' keepers. Safety work should not be considered a chore which we of necessity must perform. Saving men's lives, and eliminating or reducing the pain and suffering resulting from unnecessary non-fatal accidents is a noble occupation, worthy of the best efforts of all of us.

When the Public Official Cooperates

By HON. SID MCMATH
Governor of the State of Arkansas, Little Rock

It seems to me that we have represented here the groups which can do the most about those reflections on our community integrity which we label "public accidents." When the industrialist, the educator, the safety council manager and the public official work together there is almost no limit to the good they can do. Conversely, no matter how hard each might work individually, unless their efforts are related and unified in purpose, results are problematical.

So it is gratifying to "team up" with an outstanding industrialist, an eminent educator and an able safety council manager, and with them to try to establish a few guideposts for our future effort.

The thesis of our discussion, that our children can have safer communities when all concerned cooperate, has been proved a great many times. Through the process of cooperation we have made some gains in my own state of Arkansas; but we haven't made *enough* gains. And I challenge you, my friends, that in your communities too, no matter how good your safety programs, you have realized only a fraction of the potential.

If we satisfy ourselves here today simply by agreeing on something we already believe, we are in danger of missing the point altogether. I submit to you that none of us is doing anywhere near enough cooperating.

First of all, let's examine this creature called "the public official." Contrary to what some might have told you, the average public official is a normal, decent american citizen; a human being. From some of the things you have been reading, you may doubt that; but it's true.

I say he is a human being. Perhaps his greatest fault is that he is *too* human. Human enough to believe he really should serve the expressed desires of the people who pay his salary. Human enough to listen the most to those who shout the loudest, though his conscience tell him the shout is a lie. Human enough to wonder why those who speak to him of high prin-

ciple also ask him to compromise that principle. And human enough to grow at least mildly cynical under the impact of what happens to him when he delivers what the public asks for, only to find that public missing, at home and silent, when the chips are down.

Is this an indictment of the public official's boss, the people? Is it just another way of saying that the people get the kind of government they want and tolerate?

What I am trying to say is that the public official is of the people. His vision frequently is the vision the people give him; his courage, often as not, is the courage they impart.

Here today we are talking about accidents. I think we should recognize that we could just as well be talking about some of the other things bothering our national conscience, because in doing so we would be talking about the same thing. We are by inference declaring that accidents in all these areas have their roots in the same soil.

For example, our fight against crime in our communities and in our states is the same as our fight against accidents. Whenever we find indifference to law enforcement, there we find in the shadows deplorable traffic records.

The prevention of crime is primarily a community and state responsibility. Organized crime can be eliminated for the most part by a vigorous and effective enforcement of state laws and municipal ordinances. The responsibility for enforcing these laws belongs to the elected public official.

By the same token, accident prevention is a community and state responsibility, and a vigorous enforcement of traffic laws and safety regulations will contribute greatly to accident prevention, and reduce the cost in lives and dollars that we are called on to pay each year.

Last year, 1950, for example, accidents in the home and on the highway resulted in 62,500 killed, 5,300,000 injured, and a $3,700,000,000 economic loss. This country cannot afford this drain on our finances and on our human resources. Our responsibility as a nation at this particular time in our history is such that this waste must be eliminated.

Most of the things we do today, and most of the things we fail to do, must be considered in he light of the great struggle in which we are engaged.

We need to husband our strength and conserve our national and human resources. America stands today, whether we like it or not, as the last clear hope of free men in the world.

We are engaged in a conflict with communism the outcome of which will determine not only the survival of our institutions and our way of life but will determine the future course of civilization as we know it. We find ourselves in the position of leading the free forces of the world in this struggle.

When we reflect upon it, it seems as though we have been engaged in this same struggle for the past thirty odd years.

You recall that we fought the first World War believing sincerely that we were making that great effort in order to preserve freedom in the world. We believed that this war would end all wars and bring peace to the world.

After the first war, however, we did not assume the position of leadership in the world that destiny had placed upon us. We decided that events in other sections of the world were no concern of ours. We withdrew into a shell of isolationism; refused to join the world court or the league of nations.

This negative attitude of ours contributed toward the second World War. We did not realize our mistake until Pearl Harbor. We were thrown into another world conflict and only after a great sacrifice did we emerge victorious.

But we finally learned our lesson. We matured, we realized after the second war that if we were to be secure in our freedom and if ever we were to have peace in the world, we must concern ourselves with the affairs of other nations; we must assume our position of leadership in the world.

Because of this attitude we have been able to check the advance of the communists, and thus far at least we have been able to avert a third World War.

But this struggle in which we are engaged will last for many years. We will no doubt have to fight many limited wars and be prepared at all times for an all-out conflict. To carry on this struggle costs American lives and billions of American dollars.

This is a fight that cannot be left just to the soldiers and sailors and marines. This is a fight in which every individual must participate. What greater contribution could you and I make than to eliminate the drain that negligence and indifference make upon our manpower and upon our treasury?

The saving of billions of dollars each year, the prevention of hundreds of thousands of casualties each year, by accident prevention, might conceivably make the difference in this "no quarter" conflict in which we are engaged. As educators, public officials and engineers; as citizens we are challenged to do a job that will not only save money and human suffering, but will contribute in large measure to our ultimate victory over our communist foes.

When we win this fight, and if we will continue our support of the United Nations, someday we will have peace in the world.

It is apparent that, though accident prevention may appear to be a routine and run of the mill job, the consequences of a successful safety program will be far reaching. So like good soldiers, let us meet the challenge and do the job.

It's Everybody's Business—Together

By JOSEPH M. KAPLAN
Mgr., Greater Los Angeles Chapter, National Safety Council

Can we have a safe community for our children? Of course we can if we ourselves come of age and fully assume the responsibility for making it so. The common denominator is found in the Biblical injunction about being your brother's keeper. The touchstone to success is in two key words—identification and participation. The catalyst is in the community safety council. Apropos is the old Chinese proverb that says "the longest journey begins with the first step." And that first step is a most important one. Not only the taking of it but the direction in which we strike out, the goal we strive for, the preparation and planning that go into making that goal attainable, and probably most essential, the dogged determination and stick-to-it-iveness that keeps us on the road until we get where we're going.

What is our objective—a safe community for our children. Is it possible of accomplishment? More important do you believe that it is? Quite a worthwhile objective, isn't it? The toll in young lives lost in accidents is far too compelling to ignore. The life of your youngster or mine alone is worth all the effort.

Let us determine today, then, that we want a safe community for our children so badly that we will dedicate ourselves to eventually having it. Well, we have decided to take the first step—oh, we have all done that much many times before, in various ways and directions. But many lives are still being lost and many fine, healthy young bodies forever incapacitated, because you and I weren't really convinced an accident-free community could be achieved. So somewhere along the way, with too little faith, our steps began to falter, and finally, let's admit it, in too many cases came to a stop.

We must make up our minds here today that our long journey to safer communities has begun with the big step we are taking by having this meeting. Now then, with our common objective determined and the first advance made, our real problem is how to best reach that target and not be pushed back. If this seems rather elementary, I simply remind you that records in this business of accident prevention prove we have either strayed from the fundamental approach that ultimately brings success in any endeavor—or we have never really discovered the A which leads to the Z in stopping the criminal carnage that is our accident history.

So I want to search with you today for the touchstone on which we can stand and see a whole new vista in safety, with our reward at the end of the long winding road a safe community for our children, and the rest of us.

Key Principles and Some Ifs

The two key words or principles with which we must begin if we are to step out on the right foot, are identification and

participation—identification personally with the problem and participation or alliance personally in a never-wavering effort to solve it. All of us—as businessmen, industrialists, educators, governmental representatives, or just plain citizens—are inseparably and naturally linked with not just the phases of safety that affect us directly as individual groups (such as traffic, within-the-plant, fleet, home and school, farm, etc.) but also with entire, overall, community-wide safety. For the actual fact is that an accident, any accident, which could have been prevented has both a moral and practical implication affecting all of us in the community.

We have failed, each one of us personally and professionally—particularly those in the full-time business of promoting safety—every time a youngster is killed in a home accident, or when some father is taken from his family by a traffic or industrial accident. Any organization, agency, institution or group—as a member of our community—has failed if it does not participate with its services and/or finances in a community safety program. If your community, or mine, is unable because of lack of funds to support a complete public safety program that gets down to the grass roots, part of the responsibility for our appalling accident statistics should cause that community's non-participants some sleepless nights.

A community safety organization has failed if we have not sold the community generally on being identified with its accident problem to the extent of actually doing something about it collectively and individually. And we fail most miserably if we let ourselves become complacent, content to just hold the line, or if we do anything short of militantly seeking ways and means to prevent all accidents.

Let's look at traffic safety, for example. If you and your company or group still haven't accepted the thesis that calls on you to contribute to a traffic safety program which embraces the entire community, and are satisfied to work only within the bounds of your own organization, consider the practical side of the matter. Insurance rates on cars in your community are not based on the traffic safety record of your own employees or members, but on the record of the community as a whole. No matter how well you may instruct your own group in safe driving, it still costs you to replace one of your workers killed in a traffic accident by the employee of a firm where traffic safety education is non-existent, or by someone in a community where there's no such thing as an accident prevention program.

The Best Approach

How do we achieve this identification and participation which determine how safe our communities are? Can the police department do it? Can businessmen do it? The educator? Yes you can, partly. But how can we get the total *community* identification and participation essential to making our towns and our country safe for our children?

It is obtainable, I think, only through our *community* safety councils. The main function and service of such an organization is that of the catalyst, the unifying force to bring all phases of accident prevention closely together in a comprehensive, continuous program so they can help each other and jointly create a safety climate in the *community* as a whole. When you have an effective safety oragnization for the entire community—and it is your responsibility to make it so—one that is representative of all elements and interests there—you have a potential that properly employed can bring about the safe community that is our objective.

If we are reasonable in expecting a safe community for our children, we should expect it to be safe in every way through teamwork of all resources. The educator plays a part individually, as does the industrialist and the enforcement agency, but we cannot secure community safety in segments, only as a unit. If one side of the line falls down the whole team suffers.

How does a community safety council work toward this so-much-to-be-desired goal? First of all, it tries to unite all forces in the comunity which have a rightful responsibility to the public. When you, the industrialist, the educator, the public official, the private citizen, and group member really join up in this cause and in so doing, make a safety council possible, the prime step has been taken. This unified, active and potent force, in the community's name and because it is a community welfare effort, with no axe to grind but public safety, can accomplish the safe community we are seeking for our children. It can launch safety programs that will receive community support such as no single agency, commercial or civic organization might expect. As a specialized public service and educational association whose motives are above reproach, it can enlist financial backing and active cooperation for accident reduction impossible for more general and limited groups to accomplish. As the recognized voice of safety in a community and with the prestige of a national organization behind it, it can approach and utilize to the fullest extent the public information media which are indispensable in providing the promotional impact necessary to safety.

The things we do as community safety councils are so well known to most of you—like radio and television broadcasts; news releases, pictures, cartoons, editorials; industrial, fleet, home and school safety programs, contests, and so on—that I'm not going to take time here to enumerate further or discuss them specifically. However, all of us working together through such an organization can, I believe, reach any goal in accident prevention we set for ourselves. We are limited only by our imagination, ingenuity, capacity for work without let-up, and our ability to develop that long-sought-for formula which spells safety in such positive, acceptable and personal terms to the individual that he, at long last, takes heed and acts. In view of our past records, like almost a million traffic fatalities since the turn of the century, the holiday holocausts, the home and child accident toll year after year, we must surmount our limitations with all-out effort.

The Challenge and Answer

I'm afraid we've all been remiss—the community safety councils who have been either unable or lax to *sell* the need for such an organization to the business community, and the latter which in turn has not seen the need or realized the benefits to the community possible from an effective public safety program. So community safety went begging. This, ladies and gentlemen, can not continue, if we really mean it when we say we want a safe community for our children. And I believe it is squarely up to us—we here in this room this afternoon—to develop the selling campaign which has the biggest potential return imaginable—inestimable value in lives, happiness and dollars.

The problem and the answer are synonymous with the individual. But until we think constantly in terms of self-identification and self-participation we are going to continue scattering our shot and seldom, if ever, hitting the bulls-eye. If you and I are not first of all sold on the idea that we can make our communities safe for our children, then of course we never will. If we are not convinced that by all working together through a community safety organization of some description, we can accomplish any objective we establish for ourselves, then we will never do much more than hold the line. There can be no really safe communities as we envision them unless we have the faith that moves mountains, and also are willing to work unceasingly toward realization of the miracle. Do we have that faith, that determination? Until we have honestly examined ourselves and can answer emphatically and sincerely in the affirmative, we will not have safe communities for our children or anyone else. We cannot emphasize that point too strongly, because a first step half-heartedly taken is likely to result only in excuses about "irreducible minimums" behind which we can hide our inadequacies. The first step is to prepare the mind and dedicate the spirit.

Let me ask—do you as an individual believe that by being aware of the accident menace and taking proper preventive action you can reach your normal life expectancy before being wiped out or incapacitated by an accident? Yes, you say, I believe I can—but how about the other fellow? Well, are you willing as educators, public officials, business men, industrialists, professional safety men, and private citizens to assume the job of being your brother's keeper? Are we all ready to identify ourselves with and actively participate in solving the accident problem? Are we going to shoulder fully the responsibility involved in saying yes to these challenges—and how else in the name of humanity can they be answered? If so, we have taken several important first steps here together through this, the first national public safety meeting. We have set a common goal, we have identified ourselves with the problem individually and as groups and have decided to work together to solve it as communities, counties, states, and as a nation.

We are on the road to safe communities for our children, and we will get there when and if we fully and effectively employ the capacity that is ours. As delegates to this great 39th National Safety Congress, all participants in the national crusade to reduce accidents, we must pledge ourselves to return to our respective communities and intensify our search for the educational key to that all-important factor—the beginning and the end of our problem—the individual. What has been done already was effective, but it simply hasn't been near enough, or rather we have not invested enough in this cause to find the really effective approach to people themselves, who are the problem and its answer.

But the most important requisite is that we believe in our cause—for those who believe, achieve. Starting from that solid base, all working and working together by plan toward specific objectives, we can have safe communities for our children. It's up to us!

It's everybody's business—together!

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Current Safety Topics in

INDUSTRIAL NURSING

As presented in the Sessions of the Industrial Nursing Section at the 1951 National Safety Congress

Volume 14
Transactions
39th National Safety Congress

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In preparing these Transactions, the proceedings of the Congress have been condensed and edited for reference purposes. Complete original manuscripts, with any charts or illustrations which were used, are available in National Safety Council files. Views expressed at the Congress or in this record are those of the Congress participants and are not necessarily those of the National Safety Council.

THE INDUSTRIAL NURSING SECTION

This volume is a record of the sessions held at the 1951 National Safety Congress by the Industrial Nursing Section. The conduct of these Congress sessions each year is only one of the many cooperative activities which the Industrial Nursing Section carries on in behalf of its members, and for the benefit of accident prevention work in industrial nursing generally. The Section gives guidance in the preparation of a great variety of technical and educational material useful in the day-to-day safety programs of industrial nurses. The activities of the Section are under the direction of its Executive Committee, the members of which are listed at the close of this volume.

The Industrial Nurse's Role in Health and Safety

By MRS. JOAN TIMKE, R.N.
American Medical Assn., Chicago

Whenever an employee has an accident or feels ill, the person to whom he most frequently turns for help is the industrial nurse.

Statistics have shown us the truly vital part the nurse plays in the industrial health picture. They are impressive figures. We know that the nurse takes care of 90 per cent of all accidents and sickness which occur in the plant. We also know that the nurse is frequently the only one on duty to handle such cases. This is true because most of American industry is composed of small plants. There are about nine of these smaller plants for each big one. The small ones usually have one nurse, with a physician only on a part-time or emergency call basis at best.

Many companies still feel that once they have hired a capable nurse and installed her in a hospital-like room, they've got a first class medical program. But this program often is a glorified first aid room with the nurse sitting around waiting for an emergency to happen.

This is somewhat like a city which has beautiful clinics and hospitals but no stop-and-go lights to keep cars from crashing into each other. The victims are well cared for, but you don't cut down the accident rate.

Here is one of the biggest opportunities for the nurse. She can be one of the key individuals in the health and safety program.

In more and more plants every day, the nurse is taking this role. Plant managers, production men, and all other members of the safety team are welcoming her help.

The nurse is in a natural position to take the initiative and to aid in developing an over all program for health and safety in the plant. Through daily personal contacts with workers, she can encourage them to seek her help instead of letting small accidents or illnesses go unreported and untreated.

Because they turn to her in times of need, employees learn to trust and confide in the nurse about problems that are bothering them. She frequently must interpret to them the company policies on sick leave, group health insurance and retirement plans. She often can speed up case-finding and therapeutic work by encouraging employees to see a doctor for a check-up. Or she can help them with her knowledge of community services offered by the tuberculosis and cancer societies, the Red Cross, public and university clinics, and family service bureaus.

The nurse is both listening post and guiding hand for the employees. She may be able to spot faulty assignment of personnel. She might detect an accident-prone individual in a job that is inherently dangerous. She may get the first clue to emotional problems which might lead to the employee's breakdown. Or, she may learn of personal worries which preoccupy the worker so that he can not concentrate the way his own job-safety demands.

Because of her intimate relation to the employee, the nurse can note accident areas in the physical setup of the plant.

It is up to the nurse to make sure that she can and does play her maximum role in planning and carrying out the industrial health program. She must work constantly to keep the confidence and friendship of all the employees—a tremendous task in itself. She must continually be a super-salesman with management as well as labor, to insure that the health program keeps up with the plant's needs. This means that she must keep good personal public relations with everyone.

Every industrial nurse actually is in public relations work without trying. It may be good or bad, but it's there. So her public relations had better be good.

This means watching the little things as well as the bigger ones.

First, she should always have a friendly smile and a cheery greeting. Sure, she's human and has problems of her own. But, it's her business to help the others. So she can't become preoccupied with her own troubles and walk blindly through the plant.

She *must* see each person she passes and greet him sincerely.

Here are a few other suggestions for the industrial nurse. They are based on sound principles which have made men and women *well-liked for centuries back.*

The nurse should make an effort to know the name and face of each employee. This is one of the reasons *Franklin* D. Roosevelt was so popular. He recognized each person's inner desire to feel important and *to be called by name.*

She should compliment a worker on his appearance or on a good job he has done. It should be sincere, rather than mere flattery. Every one of us deeply wants to be appreciated when credit is due.

She should chat briefly about a mutual topic. Maybe they both bowl, or have dogs, or know someone who's *apartment* hunting. They needn't talk long.

She should inquire about a family problem, taking a real interest. Maybe the worker's daughter is in the hospital, or it looks like his wife may need an operation. Maybe she can help relieve his worries by explaining away some doubt in his mind about the case. Maybe his group insurance will cover a large part of the expense.

But, by all means, she should never give the impression of being nosey. That will undo all the careful work she may have done for months to gain the worker's confidence. And he might spread his distaste to his friends.

Here also, she should constantly remember to keep strictly to herself anything an employee has told her in confidence. Of course, it's hard sometimes when another employee starts to discuss his own gleanings about the case. Or, maybe she is not sure just how confidential the discussion really was. But, if she has any doubts at all, she should keep the information to herself until the employee concerned tells her otherwise.

That ties in with another important aspect of industrial nursing. Many plant executives have the impression the nurse should be a policewoman or truant officer. That is not true. The nurse should remember a confidence is just that—*whether* it comes from the manager or the stock boy. She must maintain trusting relations both with workers and executives, or she will defeat her chances of finding trouble spots in time to prevent the trouble.

She should, of course, investigate all cases where health is involved. And, try tactfully to learn the real reason so that she can work to solve the problems connected with it.

The nurse must constantly maintain her professional standing and qualifications. She should keep her house in order. Her first aid room should be spotless at all times. And that goes for her personal makeup, too. She should use her best manners for every visitor to her office, even if it's that irritating company gossip. She should put visitors at ease and give them her full attention. She should use good telephone manners. And, if she has occasion to write a letter, it should be warm and friendly as well as businesslike.

Knowledge of her good performance in these matters will first spread laterally among the workers and increase their cooperation with the medical program. Later on, management will hear of it too. And she will have a smoothly working health program to go with it.

There is an old expression among employees, particularly industrial workers. The expression is "Company Man." It is used with contempt. There are a few varying shades of meaning. But, in general, it is used to describe someone who thinks only of management and how the firm can keep expenses down or make money. This with total disregard for the welfare or interests of the employees generally.

The nurse should not let herself be put in this class in the minds of plant workers. Her function is responsibility to both. She should know how management thinks on safety issues so she can interpret them to the employee. She should not take the role of stool pigeon, to embarrass individuals. At the same time, however, she can keep management posted on potential trouble spots.

The industrial nurse belongs on the plant safety committee and planning councils along with representatives of management and workers, and the plant physician if there is one. But, maybe she it not included for some reason. That doesn't mean she can not contribute toward safety planning.

She can use the information at her fingertips to work up documented suggestions for action. Before long someone will suggest asking her advice or including her in the

next safety meeting. Why? Because they have suddenly realized that she has a pretty good knowledge of the things they need to discuss. And maybe she can be as helpful with this problem as she was in those suggestions she submitted last time.

Most companies have come to realize the value of job analysis from a personnel production standpoint. But the nurse must help them learn the equal value of job *accident* analysis.

Take the carpenter shop, for instance. The men must know the basic trade of carpentry. But, from management's standpoint, it is just as important to recognize the dangers of the carpenter's tools. In one plant, just recently, two carpenters were cut seriously by electric saws. There were ways this could have been prevented. These particular men needed ample work space around their table saw as well as instruction in working safely. There is also the problem of making sure that these preventive measures are used.

That's another place where the nurse can make a valuable contribution: Help the safety committee work out a plan to keep employees safety conscious. Try to get workers to feel that breaking a safety rule is just as bad as stealing, or assault and battery. It is not only that the lax worker might hurt himself. He might seriously injure another employee, or even cause a death.

The industrial nurse must also remember that executives and supervisors are human beings like other workers. They have their own worries and problems. They can get sick or they may have added problems from dealing with various personalities among their subordinates. Perhaps she can help in some way in these problems.

The worker of today is much better educated than he was a quarter of a century ago, and much more alert to world-wide events. Back 25 or 30 years ago, the average worker seldom had gone to high school, and may have only finished half the primary grades. Today's average workers nearly always have finished high school. More and more of them have taken a few college courses or earned a degree.

This means that they no longer passively accept everything they are told, no longer blindly follow orders. Today's average worker is able to analyze what he is told and therefore he wants to know the reasons behind it. He may not be able to do your work, but he is smart enough to notice some of your mistakes.

To keep ahead of this modern working force, the line supervisor, executive and professional employee must constantly analyze himself, and develop his own abilities and personality. The nurse must constantly keep this in mind while working with the safety and health programs for the plant. She can help satisfy this desire for knowledge by writing a column or some short items for the plant paper, by talking health and safety to employees and by helping distribute reliable health information pamphlets to them.

I know I have outlined a rather heavy program for the industrial nurse, but there is still another vital field of activity for her. That is in helping prevent off-the-job accidents which lose many hours or days from the job.

Getting safety consciousness into the home is one of the biggest problems of safety organizations such as the National Safety Council. A man's home is his refuge, and the ways of getting to him in the home are difficult.

The industrial nurse can start with the workers in her own plant by supplying them with information about home safety. She can join some of their clubs, or get club representatives together to help make these clubs safety conscious. In so doing, she will not only gain many more friends, but she will also get maximum satisfaction from doing a well-rounded job.

The Industrial Navy Looks to the Industrial Nurse

By WINNIE GIBSON
Captain (NC), USN; Director, Nurse Corps, U. S. Navy, Washington, D. C.

For its care of civilian personnel the Navy was not the first to employ a nurse. However, all of us in the Navy are vitally interested in the development of industrial nursing and keenly interested in its achievements. The first nurse employed in industrial nursing back in 1895 at the Vermont Marble Company was Ada Mayo Stewart. The Navy had a very strong attachment to her, as she was the daughter of a Navy chaplain who later became a rear admiral in our chaplain corps.

Certainly neither Miss Stewart nor her father could have foreseen the vast health programs for which the medical department is responsible today. To accomplish our mission, which is to keep as many men, at as many guns, as many days as possible, our Navy conducts two distinctly different programs. One is concerned with the military personnel and the other devoted primarily to the civilian industrial workers.

In our shipyards the program is aimed toward the prevention of occupational injury. On the battlefield it aims toward conservation of life through effective treatment. To a marked degree, much of the success of each of these programs is dependent upon the professional nurse.

The United States Navy is one of the largest employers of industrial workers in our country. Some half-million civilian workers are employed in shipyards, ordnance plants, supply depots and air stations. They furnish logistic support for our air arms and fleet. Without support by this industrial navy the military navy could not function. Without a sustained, active and realistic health program, neither could carry on to the fullest of its capacities or capabilities. In fact, neither could survive. The success in health conservation is largely dependent upon the nurses, whether military or civilian, and their ability to work with medical, dental and ancillary medical department personnel.

There is a difference in emphasis between military and industrial nursing services. The combat injuries and illnesses may be considered inevitable. The members of the Nurse Corps are charged with rendering the highest type of professional patient care, returning the men to duty as quickly as possible.

In performance of these duties, nurses are called upon to serve in hospitals, on board hospital ships and transports, and in the air evacuation of patient personnel from forward areas to installations behind the lines of combat. This is required in order that more extensive treatment may be given.

Our Nurse Corps is a large, far reaching organization which must be flexible and fluid. It must be capable of expansion at a moment's notice and it must be able to quickly move its personnel from place to place to meet the exigencies of the military services.

The industrial nursing service is one in which health and safety must predominate, where human life can and must be conserved, where the handicapped can find a place to work within the limits of their rehabilitation potentials.

In both of these programs the minimum qualifications of graduation from an accredited school of nursing and professional nurse registration can scarcely be considered sufficient to prepare adequately the nurse for the job demanded of her. For these reasons, every encouragement possible is given for advanced study.

In the military services, there is greater demand for nurses qualified in the various areas of clinical specialization and in supervision and administration. For the industrial positions, advanced preparation in public health or industrial nursing is essential.

In each instance, the nurse should be an active member of her local, state and national nursing organizations. She should wherever possible, attend seminars, symposia, and workshops to take advantage of the many opportunities available for promoting her own growth and development in her particular field.

I like McGrath's statement in her book, *Nursing in Commerce and Industry*, regarding industrial nursing. She states, "The kind of work the really good industrial nurse has done is work that cannot possibly be done by a woman lacking the professional nurse's training, but neither can it be done creditably by a professional nurse lacking either wits or compassion."

That statement defines every field of professional nursing. We need not only superior nurses, we need superior people. The value of the service depends on the quality of the nurse who renders it. In an organization whose mission is of such vital importance to the defense of the nation, we cannot afford to have less than the best on our health team.

The duty requirements of the Navy industrial nurse determine her objectives and guide her functions. I mentioned earlier the various types of shore establishments in which the industrial nurse of the Navy is employed. Because of the diversification of functions, not all activities demand that the nurse meet the same needs but the areas in which she works will be similar.

In certain activities steel construction will predominate, in others explosives, in still others clerical work. Many of these jobs are routine, monotonous tasks and make for real and imaginary illnesses which often assume proportions greater than they really are.

Wherever the nurse works her duties will be concerned with the physical examinations of personnel. Her daily tasks include the treatment of minor occupational injuries and occupational medical conditions and personal illness of patients immediately returnable to a working status. Much of her time will be spent in health education.

The doctor and nurse are an important liaison team between employee and employer from the time the man is hired until he is relieved of his job. Through her knowledge of job analysis and physical capacities appraisals the nurse assists the doctor in advising personnel management as to potentiality for employment, fitness for duty, or retirement.

With the extensive utilization of women in industry, with rehabilitation of the handicapped and with the upward age trend of workers to the point of bringing us into the field of geriatrics, the scope of industrial nursing has been broadened immeasurably.

Production speed-ups and the tensions of daily living impose demands upon us which we may be able to meet physically, but which require considerable mental adjustment. Such are the repetitious, monotonous, machine operations which are more demanding on the mind than on the body.

The nurse treats the minor occupational injuries but more important than that, she spots those early signs of human failings from which many tragic accidents result. Machines may be controlled and guarded. Work production assembly lines can be regulated, but the adjustment of the individual to these demands introduces these personal factors responsible for so many lost-time accidents.

The nurse is the pivotal point in the relationship of management, physician and production worker. Upon her rests the important function of assisting in the promotion of the health and safety of the employees through every possible means.

I'd like to end with one thought—the industrial nurse in civil defense. She plays an important part in the catastrophe program of the industrial plant in which she works. This role, on a small scale, is sufficiently similar to programs for national catastrophes to enable her to be used effectively in civil defense programs in times of national or local disaster.

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Psychoanalyzing Management

By C. F. SHOOK, M.D.
Medical Director, Owens-Illinois Glass Co., Toledo, Ohio

Industry is learning the hard way that both health and safety are of vast importance to the every day operation of business. Accordingly, my subject will be narrowed down to the health and safety program of management.

Why should top management be interested? Let's look at our last year's Industrial Accident Summary as reported by Thomas P. Swift in the May 6, 1951 edition of the *New York Times*. Fifteen thousand five hundred died from the results of industrial accidents and 84,900 employees were permanently disabled either partially or totally. Forty million man-days or one year's full employment for 134,000 workers were lost. The cost of all industrial accidents for 1950 has been estimated at $2,700,000,000.

Our problem in industrial medicine is becoming increasingly difficult and might well be compared to the early days of World War II when industry was hurriedly changing over from peace-time production to the manufacturing of essentials of war. Then, like now, the marginal worker entered the picture to augment the shortage of skilled manpower. The rising accident rate might well be traced to the return of women to industry, re-employment of older people and the temporary unfamiliarity with production tools.

With these distressing facts before us we wonder how long industry and its workers can stand these costs. You can replace machines or parts of machines as they wear out through time and service but you cannot replace the years of experience held by the operator. If you review the safety accomplishments of some of our leading industries you will find little excuse for the continuation of such losses by others. The size of the company is not the criterion for a good medical service.

I have seen large well established companies operating medical services in name only. I have one nationally known organization in mind as an example. This company has an excellent dispensary with a nursing service around the clock, but these nurses are limited to first aid only which is not enough to keep them comfortably occupied. The pre-employment physical examinations are done by a plant physician in his own office in town and the nurse makes no contact with the new employee until he is injured. She doesn't even know he exists until an emergency arises. I might add also that the plant physician is rarely seen at the plant. There is no semblance of health service to the people and yet management assured me they had an excellent setup and they were satisfied.

It is to management's interest to provide not merely a first aid room but an adequate up-to-date medical service. Such medical service should be supervised professionally by an interested industrial physician, not a busy surgeon who is interested in emergency cases alone. This physician if he is interested will be in attendance at regular periods in the plant. He will want to assure himself that good clean ethical service is being rendered locally by the nurse. He will acquaint himself with the plant proper to be able to properly make recommendations upon placement, hygiene, sanitation, and health.

The inertia begins at the top. If the company's top executives are not concerned with the health and safety of their people then the supervisors and foremen are likewise uninterested.

Why should management be interested in establishing an adequate medical service for their employees? First of all may I say it is just good business and secondly that good common sense shows that the operator of a machine needs repair and maintenance as much as the steel machine he operates. We are finding that production comes from people, not machines.

It has been proven that with an established, well operated plant medical service accident rates fall both in number and severity. This is a great financial saving to the employer as well as to the employee. There is less absenteeism and employee turnover and best of all there is an improvement in labor-management relations or human relations.

Business is supported by four main pillars —production, sales, finance, and human relations. No business man has ever questioned the first three, but not everyone has recognized the value of the fourth, human relations. It is a known fact that companies who have slighted human relations have usually had trouble which interfered with the success of the business.

Specifically, how does a company go about improving its human relations? One of the best ways is by increased intelligent attention to people. And one of the best ways of doing that is by increased attention to industrial health and safety.

Here is another group of reasons why a good medical service should pay dividends to management. The Council on Industrial Health of the American Medical Association has defined the scope of a good medical service in the following terms:

1. Regular appraisal of plant sanitation.
2. Periodic inspection for occupational disease hazards and recommendations of adequate control measures.
3. Provision for first aid and emergency services with prompt and early treatment for all illnesses resulting from occupational exposure.
4. Reference to the family physician of individuals needing attention; co-operating with the patient and physician in every practical way to remedy the condition.
5. Uniform recording of absenteeism due to all kinds of disability.
6. Important health appraisals of all workers.
7. Provision for rehabilitation services within industry.
8. The conduct of a beneficial health educational program.

Now let's see what the American College of Surgeons has to advise upon the same subject. Here are their four basic objectives as they see them. Industrial medicine should:

1. Ascertain, by examination, the physical and mental fitness of employees for work.
2. Maintain and improve the health and efficiency of those already employed.
3. Educate the worker in accident prevention and personal hygiene.
4. Reduce lost time and absenteeism from illness and injury.

What percentage of the above responsibilities are ever assumed by the average plant medical service? We are talking about the average, for many plants do have a good medical service backed up by both management and labor and are permitted to acquit themselves in a satisfactory manner. I am afraid they are very much in the minority. Even where a medical service exists it often times is limited in action to first aid and perhaps rudimentary physical examinations.

Although there are many activities that can exert a helpful influence on employee effectiveness, one of the most important is a well-planned program of industrial medical service. The medical service of an industrial organization is concerned not only with employee health but with many other phases of employer-employee relations as well. The personnel comprising the medical staff are in close daily contact with both employees and management, and are therefore in an excellent position to foster confidence and respect on the part of the employee and to encourage understanding and consideration on the part of the employer.

When the employee visits the dispensary without hesitation you can be sure that he has found the service to be helpful, courteous and efficient, and because of this you will have a healthier and happier worker. This is not a mere expression of wish fulfillment nor is there any intention to convey the idea that industrial medical service is an unselfish function. We know that many workers receive more and better health care through the medium of industrial medicine than would otherwise be available to them. The fact remains, however, that industry also benefits by any program which will help to keep the worker on the job and in top notch condition.

Most of the larger industries, I think, do have a fairly adequate understanding of what the medical profession can do for them, and their expectations measure up to its facilities. These industries have established health services in their plants, with physicians, nurses and other personnel, and these services have demonstrated their value from the standpoint both of human welfare and of dollar and cents return. Many industries are providing health service, but many more thousands have little or no such provision for their employees and have an utterly inadequate appreciation of what an organized health service can do for them.

Industrial efficiency requires the maximum production at the lowest cost per product unit. It is the goal of American enterprise and its attainment is dependent upon many economic factors beginning with the availability of raw materials and ending with marketability. No matter which factor or group of factors we may select for study or improvement, we find invariably that there is one element that cannot be eliminated from consideration. Regardless of how impersonal or subjective may be our analysis, sooner or later we will be obliged to recognize the individual as that indispensable ingredient.

It is logical, therefore, that in progressive industrial management, the efficiency of the individual should be of primary importance. Even with limited experience in the fields of industrial medicine and industrial relations I am convinced that we cannot hope for industrial efficiency without thinking of the individual as the basic contributor, and that when we consider him, we have taken the first step in the right direction.

Pursuing this theme further, we find that employee effectiveness is in itself a product of many factors which include among the most important, health, a sense of security for self and family, a feeling of accomplishment, and the existence of a mutual understanding and dependence between himself and management.

The pre-employment examination lays the groundwork for an industrial medical program. It initiates the employee's plant medical record; it rules out those with communicable disease or with certain specific conditions that will render them unfit for factory work. It permits accurate placement on a job commensurate with the applicant's physical capabilities. It permits the salvage of manpower through the employment of the handicapped individual. It lists pre-existing conditions to refute subsequent erroneous claims, and it discloses remediable defects, treatment of which will improve the health of the worker.

We in industrial medicine are more and more aware of the fact that the prevention of accidents is dependent as much upon physical and mental fitness of employees as upon mechanical safeguards and safety-first drives.

We believe that an individual's health, state of mind, nutrition and well-being are undoubtedly linked with his proper job placement and later performance.

Although the pre-employment examination furnishes basic medical knowledge about an employee, there is no assurance of its continued accuracy unless it is followed up with periodic examinations. Such periodic examinations are indicated especially for those employees who are subjected to toxic hazards on their jobs, so that it will be possible to detect the earliest indication of toxic effects and remove the man from such exposure.

Periodic examinations of the executive force and key personnel are also of particular value. Life insurance statistics have shown that periodic medical examinations actually can prolong the useful life of an employees by 25 per cent. If he is a key person in the organization, the value of repeated health checkups is obvious. Such examinations should be followed by recommendations for correction of remediable defects.

A medical program is a very powerful factor in developing either good or bad industrial relations. The healthy employee is of much greater value to management than is the ailing worker. A better medical program needs very little added effort to improve workers' health.

Management is coming more and more to recognize its moral responsibility for the welfare, the health and the happiness of those men and women whose working life is largely under its control. Medicine has much to contribute in this field. This conception of management's responsibility must be broadened and extended. In addition to this human responsibility, the industrial manager should understand the value of these services.

The values that will be derived from a good medical service are:

1. A fall in accident rates. Reduction in number and severity.
2. Decrease in compensation costs.
3. A favorable reduction in absenteeism.
4. Less labor turnover.
5. Higher employee morale.
6. Greater interest in the job.
7. Better labor-management relations.
8. Improved public and community relations.
9. Simple humanitarianism.
10. Securing and holding a better type of employee.
11. Full compliance with both the letter and spirit of existing legislation.
12. Earlier treatment—less complication.

Experience has shown that a sound well-thought-out health program intelligently administered, once started, is rarely stopped. In fact the trend is always to extend it.

It may be assumed that industry seeks to keep as many men working at as many machines as many days as possible. Industry must learn that the medical profession can help attain that economic objective.

Growth and Development of the Nurse in Industry Through Membership in Her Professional Organization

By AGNES E. M. ANDERSON, R.N.
Assistant Executive Secretary, American Nurses Association, New York.

To be able to understand how the nurse in industry may continue to grow professionally through membership in her professional organization, we must first evaluate what that organization is, why it exists, where it exists, and how and when the nurse participates.

The American Nurses' Association is the recognized national professional nurses' association with a membership of more than 175,000 registered nurses. It now embraces the members of district and state associations in all 48 states, District of Columbia, Hawaii and Puerto Rico. The American Nurses' Association is a membership association wherein its members have certain rights and privileges, and wherein the expressed will of the majority of the members must determine its policies.

The American Nurses' Association is spearheading nationwide activities to enlist the support of the public in its program to alleviate some of the problems in nursing. So wide spread and so acute has this threat to America's health standards become that the American Nurses' Association's efforts can only succeed with the cooperation of the public.

The American Nurses' Association program is designed to achieve:

1. Adequate distribution of nurses through proper counseling and placement.
2. Adequate legal regulation of nursing.
3. Proper functions and relationships of nurses through research and studies.
4. Economic security of nurses.

A definite professional need brought the association into being in 1896. Its organization was a logical step forward on the part of the nurses of the day, a step that was and is still vital to the protection and growth of nursing and nursing standards as well as to the protection of the public through sound legislation regulating the practice of nursing.

Decisions in such matters as distribution, legal regulation, functions, and economic security are the right of nurses to decide, and is the responsibility of a democratic professional organization to guide and develop.

It is a well recognized fact that the professional nurse must not only be adequately prepared and licensed to practice, but to maintain her professional status she must constantly continue to read, study, observe, investigate and participate in projects relating to her field of endeavor.

Recognition of the need for a "continuation" of professional education by the American Nurses' Association has resulted in the publication of the official organ, the American Journal of Nursing. Rapid and revolutionary changes in science, especially those in medical science, have revolutionized many health, medical and nursing practices.

The American Journal of Nursing is one avenue by which these changes are made known to nurses. An individual nurse would find it impossible to solve the problems created by these changes, but a well organized association of professional nurses, is using

all its resources in an effort to attain satisfactory solutions for the profession and the public it serves.

Today, as perhaps never before, nurses must grasp every opportunity to prepare themselves for the ever mounting tasks, and at the same time conserve themselves for the particular functions for which they have been prepared. Nurses are all aware that inconsistent demands create extreme pressures and frustrations. To maintain a degree of stability in the profession, it is essential that each *individual nurse*, as Dr. Jean Spencer Felton, Oak Ridge National Laboratory, has said, "should secure for herself that inner contentment which results from better understanding of her own motivations and goals, an understanding arriving only with *insight*.

"There should be a constant intellectual growth which derives solely from the seeking of answers to *questions stemming from* one's work, one's living, one's thinking."

The individual nurse cannot find solutions to all the present day demands. However, collectively, through the professional organization, answers can be ascertained by research, studies and evaluations on a regional or national basis. Recently, the American Nurses' Association has launched a five year program, "Studies of Nursing Functions." As you know this project is financed wholly by nurses on a voluntary basis.

'The purpose of this program is threefold:

1. To determine what should be the functions and relationships of institutional nursing personnel of all types — professional nurses, practical nurses, and auxiliary workers—in order to improve nursing care and to utilize nursing personnel most effectively and economically.

2. To determine what proportion of nursing time should be provided by each group in various situations.

3. To develop techniques for fulfilling the first two purposes, which can be used nationally in all types of hospitals and so benefit all nurses and the entire profession, as well as the people they serve.

The promulgation of an economic security program for nurses has been a major activity of the American Nurses' Association in an endeavor to alleviate the critical nurse shortage, to stabilize nursing service over statewide areas and in community agencies, and to provide more and better nursing care.

We are all only too well aware of the fact that economics and working conditions directly affect the quality and quantity of *nursing service* the profession can give.

It is through her professional organization membership that the nurse can participate in helping to solve her own *socio-economic* problems, help other nurses to improve their employment standards, and help keep the professional nurse in the field of nursing.

State and district nurses' associations are membership associations in the American Nurses' Association. Specific sections for various categories of nurses are provided in order that nurses practicing in similar fields of nursing may have an opportunity to meet together to discuss and express their opinions. Facilities within the state and district association are also available whereby all nurses may come together to discuss and solve problems affecting nursing and nurses within the jurisdiction of the state and/or the more far reaching national or international influences.

Thus, one can readily see that the many programs and activities promulgated by the American Nurses' Association stem from the desires and will of the nurses in the sections of the district and state associations.

To provide health and safety protection for the American people, the American Nurses' Association is ever mindful of the great value of nurses participating actively with allied health and safety groups to meet the needs of the country, and particularly the needs for nursing care. In essence, this statement is the very first plank of the platform for the American Nurses' Association.

At this point, as industrial nurses, you might well ask the question, what can the nurse in industry hope to secure for herself and her company by being a member of her professional organization? The following are but a few of the more tangible benefits that may be enjoyed as the experiences and participation continue in professional organization activities:

1. She is provided with recent or up-to-date information regarding nursing and health practices.

2. She has an opportunity to exchange ideas with other nurses.

3. She participates in solving problems with others having similar problems.

4. An opportunity to develop the art of self expression by word of mouth, or through the written word is accorded her.

5. She acquires knowledge and techniques which she can employ in her particular situation, i.e. safety and health education programs.

6. Through group action, she acquires an assurance and endorsement which lends moral support when difficult situations arise.

Management can be assured of a sound, progressive, and up-to-date safety and health program conducted by a truly professional nurse who has acquired a better understanding of her own professional objectives and has developed an ability to interpret them.

The professional nurse in industry having attained greater knowledge and skills through membership in her professional organization enhances a safety and health program for the industry. By accepting responsibilities in her professional organizations, she develops qualities of leadership which give her a degree of recognition which reflects credit to her employer. Likewise, as a leader she becomes a valuable asset in the community as a participant in planning for the safety and health of the people in the community, many of whom are employees in the plant in which the nurse is employed.

Nursing in industry, like nursing in all other areas, is no longer confined to the plant and the community; its influences are and must be global if we are "to help one's fellow man in his completion of the world's work, and aid him in reaching the security that will render him economically solvent, more adjusted emotionally, more physically fit, more personally effective, and more serviceable to society."[1]

[1]*Emotional Factors in Atomic Age Nursing*—Jean Spencer Felton, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

[1]*Studies Nursing Functions*. By Miss Elizabeth LaPerle. American Journal of Nursing. Vol. 51, August 1951.

A Good Health Program for the White Collar Worker

By KATHERINE H. SMITH, R.N.,
Coast Federal Savings & Loan Association, Los Angeles, Calif.

Industrial nurses are concerned in the health care of employed groups.

Under the supervision and direction of the medical director or plant physician, the nurse cares for industrial and non-industrial injuries and minor illnesses. She maintains the department, orders supplies and equipment and supervises the cleaning and maintenance of the department. She assists the physician with physical examinations on applicants and the periodic re-examinations done on employees and does the laboratory tests as ordered by the physician.

She does the follow-up for correction of defects that are revealed by the examinations and this includes a conference with the patient to encourage him to see his family physician or to refer him to one of the community resources for aid and care if he is financially unable to seek care from a private physician.

She promotes health programs through the use of bulletin boards, plant house organs, through cooperation with the family physician as well as employee groups such as labor unions and welfare organizations; and by personal interview with the employee when they come to her with a specific problem, medical or otherwise. She does an intensive program on improved nutrition. In many instances the nurse supervises the plant cafeteria and assists with the menus.

She is a member of the plant safety team and frequently serves as secretary for the safety committee. She aids in the promotion of safety by use of educational material such as films, posters and other literature. She assists with first aid training. She assists in the use and care of protective equipment such as respirators, goggles, gloves, aprons and safety shoes.

She assists with plant sanitation by making frequent surveys of drinking water, facilities for dispensing food, general housekeeping, lighting, rest rooms, locker rooms, washing and toilet facilities and ventilation. She participates in plant welfare programs by counseling with employees regarding group

health policies, hospital and medical plans and other group activities maintained by the plant. Last but most certainly not least, she maintains adequate records.

I list these activities that make up the day of the industrial nurse to point up the fact that she is no longer on duty just to render first aid to the injured but has long since proved her value as a member of the industrial health and safety team.

The need for extending industrial medical services is apparent and in many departments expansion is in progress. Leonard S. Scheele, Surgeon General, U. S. Public Health Service, wrote as follows in the June 1951 issue of the Industrial Health Monthly: "The horizon of the field of industrial health has expanded in recent years from a circumscribed interest in the control of industrial health hazards to a comprehensive approach to the total health needs of the employed population. This expanded concept has resulted from a growing recognization by management, labor and health professions of the great opportunities that the extension of all industrial health work offers for the prevention and early detection of illness, for the improvement of efficiency and productivity, and for the reduction of losses caused by absenteeism for medical reasons."

In order to institute a program to meet the total health needs of an employed group the medical department personnel must keep adequate records and determine from a study of their experience what programs will be of the greatest benefit.

That part of the industrial team we call top management will lend a sympathetic ear if they are approached for approval on an expanded program if the facts are written and the need explained in a memorandum that can be left with them to digest after the interview. Each nurse knows her organization and can select the best time to make the approach to management. Present your recommendations when you know top management has the time to lend you that sympathetic ear.

This is a good time to review the physical set-up and the personnel of your department. Obviously one nurse already operating at peak production cannot contemplate expansion of departmental activities without additional help.

The plant that has a medical department but does not provide in-plant service of a qualified physician is limiting the scope of activity of the department and the nurse and by-passing an excellent opportunity to make a very valuable contribution to good human relations within the organization. Nurses are trained and licensed to practice nursing and for obvious reasons cannot practice medicine and I would urge every nurse to make very sure her every act is within the nurse practice laws of her state.

A program of greater range may require more space and equipment. Determine the goals you wish to reach and then go to work. Remember your department is the maintenance department for men and women in industry who represent a dollar and cents investment to management, not forgetting your moral and legal responsibility for their welfare and well-being.

In discussing specifically a health program for the white collar worker, may I say the need for a health program here does not differ from the need of any other type of worker. It seems to me the only difference is simply this: because working in an office presents few if any hazards, the nurses' time is not taken up with the care of industrial injuries and she has time to devote to the keeping of adequate records, reviewing the experience of her group and developing health programs. Any industrial medical department can do likewise if there is a staff large enough to handle both the routine duties including the care of injuries and a health program.

There is a noticeable pay differential between the production-line worker and the office employee. It is no secret that the white collar worker is caught in the middle of the higher and higher prices and the mediocre income. If those of us in an office industry are to maintain a high level of health for our employees, thereby improving efficiency and production and reduce losses caused by absenteeism for medical reasons, we must expand our services and when necessary use community resources for aid and assistance.

The pre-placement examination is given to determine the physical condition of the applicant in order that recommendations can be made to management as to what can be expected of him in work performance, and not necessarily to deny him employment. The applicant has been screened in personnel as to his training and experience suitable

to the opening for which he is being considered before submitting to the physical examination. The reports from our department are in the form of a recommendation and not an order. We find that keeping our service to management on an advisory level makes a very fine working relationship. The final decision as to whether or not an applicant is hired is exactly where it belongs and that is the responsibility of management.

Last year the employees participated in the mass x-ray survey that was done in Los Angeles County by the several health agencies. This year employees will be offered a chest x-ray and serology as a part of the annual periodic examination. Pre-placement examinations are compulsory; periodic examinations are voluntary. Our department is just a little more than a year old so that last year we did what was equivalent to a periodic examination on present employees on a voluntary basis with 98 per cent participation.

The medical department was offered to employees as an additional service and as such was immediately and wholeheartedly accepted. I suspect had management issued a directive requiring all employees to submit to a physical examination it would have met with considerable resistance and it would have taken years to accomplish what we have been able to do in our first year.

The findings on this first round of physical examinations gave us the material for our first health program. Mathematically speaking, about 68 per cent of our employees had a hemoglobin below 80 per cent. Medical complaints of fatigue, various and sundry pains and illnesses, high incidence of upper respiratory infections and in some instances reduced enthusiasm in meeting the new day led us to believe that not only something could be but should be done.

Armed with diet sheets and a supply of enteric coated ferrous sulphate tablets we were on our way. Employees were called back for interview. We explained what we would try to do for them and the response and benefit they could anticipate. With but one exception every patient we called back joined the "secondary anemia party." The one patient did not believe in medicine because of her religious training but did study and follow the diet sheet and brought her hemoglobin to within normal limits. To the rest we dispensed the "iron pills."

Patients were listed on a control sheet and were called back every thirty days for a check-up. A few patients who did not respond to this therapy were put on a hematinic with good results. When complete blood counts are indicated, the doctor takes the blood sample and it is sent to a private laboratory for examination.

We have established an industrial rate for our employees for all referred laboratory examinations. This program was a real "conversation piece" and the employees who did not require treatment were very busy trying to find a complaint for which they too could carry a little bottle of pills and take one after each meal.

This program accomplished much more than to raise the health level of our group in respect to hemoglobin. Every one immediately became diet conscious and questions came pouring into our office by the dozens. Confidentially, the nurse had to quickly refresh her memory on dietetics in order to be able to answer the queries. Employees with problems in underweight and overweight became interested in their problem and came to us for assistance.

Actually the way was opened to do a magnificent educational program on nutrition which, I am sure, not only benefitted the employee but his entire family. The department enjoys the confidence and respect of the entire organization which serves as a real inspiration to be of greater service.

Vitamins are prescribed by individual patients and only when the physician believes there is a deficiency. We encourage all patients to eat a well balanced diet and supply their minimum daily requirements from food.

Counseling is an important part of our activities. It has been my experience that counseling is about 90 per cent listening and 10 per cent guidance and assistance. The employer who issues an order to the nurse that she is on duty to care for the industrial injuries and thereby reduce insurance rates and not to take care of the "troubles" of the employees is surely uninformed. I understand there are still a few employers who feel the employee should check his parcel of problems at the gate when he reports for work and pick up the same unsolved package at the gate at the end of the day.

Unfortunately, we aren't so constructed and that problem, however large or small, can

well be reflected in the production line in the way of reduced production, costly errors, industrial injuries and even influence co-workers.

Some one has said, "Give me the courage to accept that which cannot be changed, the courage to change that which can and the ability to know the difference." I believe these few words can be very helpful in attempting to guide others in the direction of solution to a personal problem. Every problem is unique unto itself and its owner. Therefore each one must receive individual consideration and a solution that will apply to one will not necessarily apply to a like one.

Each nurse must recognize when a problem is beyond her realm of experience and training and this knowledge coupled with a thorough understanding of available community resources will be invaluable in obtaining help for any source of worry and tension experienced by an employee.

We are very fortunate in Los Angeles to have community resources available for almost any type of referral all the way from heart studies to marital problems and we use them all. However, as you all know, many problems can be solved right in the medical department and will never need to be referred out.

It is not necessary to point up the value of a blood bank. The American Red Cross has done such a fine educational program that laymen and professional workers are equally well informed. We have established a blood bank for our group but in those areas where the American Red Cross Blood Bank facilities are not available, the medical department can act as the recruitment center for donors in time of need. A card file can be set up for all employees who have been typed and then it will be a simple procedure to get donors of a specific blood type when transfusions are required.

For as long as we have women working in industry we shall have the problem of dysmenorrhea. We have attempted to develop good mental hygiene and improvement in general health practices along with the use of an excellent brochure. Patients who do not respond to this treatment are referred to a gynecologist. All of our women employees have been taught self-breast examination for the early detection of tumors or masses.

With the stepped-up tempo of civil defense planning came increased attention to improved public health measures including advisability of immunization against certain specific diseases. We went into conference with top management and received approval to offer immunization for smallpox, typhoid-paratyphoid and tetanus on a voluntary basis.

Since many people seem to have a hearty dislike for "shots" we expected that about 50 per cent of our employees would take advantage of the program. You can't imagine how pleased we were when the last shot was given and the totals added to find that more than 90 per cent of our employees had received the series.

The vaccines were given on company time and at company expense. Supplies were purchased directly from the manufacturer and a minimum of time taken for giving the shots. Smallpox vaccinations were done at the rate of two per minute and shots were given at the rate of four per minute.

It has been our experience that every one is interested in maintaining a high level of health and will do so to the limit of their finances. As do most industries, we have hospital and surgical group plans and disability insurance.

We have established industrial rates for the purchase of vitamins and prescriptions. Employees who can pay for private eye care are referred to a private doctor for refraction, the prescription is filled through our office and the employee receives an industrial discount.

When the patient is unable to pay for private care, he is referred to the eye clinic where refraction and glasses are provided at cost. In many industries there is no need for this service but in an office industry it is certainly indicated.

We can't discuss industrial medical department activities without some discussion of safety and accident prevention. Industrial nurses can and do make a valuable contribution to safety by assisting in the middle "E" of the trinity of safety, i.e., education.

Nurses should not assume nor accept the responsibility for safety engineering and enforcement. They can no more be safety engineers than the safety engineer can be the industrial nurse. They are each a very special field of endeavor and even if one person were trained in both fields there are not enough hours in the day to assume the responsibility of both.

However, industrial nurses more than ever need definite knowledge in all phases of safety in order to assist in the great educational program being spearheaded by the National Safety Council. I am convinced nurses working in industry and public health nurses working with families in the home if properly informed can lend valuable assistance to accident prevention beyond any expectations.

In Los Angeles, we as industrial nurses were aware of and concerned about the great number of non-occupational injuries we were caring for in our departments, many of them disabling. We sat around telling each other we ought to do something about it. But what? A review of our knowledge revealed we had a speaking acquaintance at least with industrial safety but what about home safety, traffic safety and all the other safety programs? We knew them all by name but there our information ended. It was apparent if we were ever going to assist others we would first need to educate ourselves. So with all the soap boxes worn thin, we decided the time had come to go into action.

A group of twelve industrial nurses from Los Angeles County met and formed a committee to study the problem. Think straight regardless of where that thinking takes you and our thinking took us straight to the Greater Los Angeles Chapter of the National Safety Council. As a result, in September of last year the Industrial Nurse Section within the structure of the Greater Los Angeles Chapter by authority of the officers and executive committee of the Chapter was activated.

The purpose of the section as stated in the Constitution and By-Laws is as follows: "The purpose of the Industrial Nurse Section, Greater Los Angeles Chapter, National Safety Council is to attain a high standard in Industrial Nursing and through participation in programs of broader range to encourage the development of Industrial Nursing as a profession.

We recognize that through meetings and discussions we can better prepare ourselves to assist in educating the employee to protect his own well-being and the health and safety of his family. We also recognize that with more definite knowledge of all phases of the safety movement we shall be better equipped to assist in correlating health and safety programs in the plant and community. Cooperation with the National Safety Council and other organizations seeking to promote health and safety shall be a paramount consideration.

Our aim is to work in harmony with all groups with but one goal in mind; that is health and safety for all—at home, at work, in traffic and at play." All medical and legal aspects of industrial nursing are discussed in meetings sponsored by the professional nursing organizations. The Chapter Section is for the purpose of acquiring an education in all phases of safety. Last year we discussed in detail home and traffic safety.

To be sure, we have barely scratched the surface but have already found the information invaluable in our daily contact with employees. If we are to succeed in our efforts to reduce the astronomical number of deaths every year due to accidents we must educate the individual to make safe living a part of his every act. We might well start by encouraging the employee to apply the rules of industrial safety to his conduct and that of his family at home.

The Industrial Nurse Section in Los Angeles is lending their assistance to the Chapter, Harry F. Dietrick, M.D., and Children's Hospital to do a survey among 50,000 industrial workers to ascertain and compile information relative to injuries suffered by children in the home. It is hoped this survey will enable us to develop a safety program for children. Cannot you see the great and valuable assistance that lies within the power of each and every industrial nurse to give to safety if she so wills? As co-workers in health and safety, let us resolve to search for the greater horizons in industrial medicine and to put our shoulder to the Green Cross and carry our share of the load.

The Therapeutic Use of Oxygen in Industrial Medicine

By J. C. CARTER
Supervisor, Oxygen Therapy Dept., Linde Air Products Co., Div. of Union Carbide & Carbon Corp., Chicago

Oxygen is not an easy medicine to give to the patient. Oxygen itself comes in bulky packages, unlike the simple ampule which contains a substantial dose of penicillin. The equipment for administering oxygen is likewise bigger and more involved, than the simple syringe with which penicillin is administered. Finally, its administration must be continuous, in contrast to the quick insertion of a needle and consequent deposition of penicillin into subcutaneous tissues. With penicillin, and other similar medicaments, the host will accommodate it and use the drug gradually over many hours.

We do not have this convenience with oxygen as the human body has no provision for its storage. Therefore, for oxygen to be effective as a therapeutic agent, elevated concentrations must be taken into the lungs with each inhalation. This applies through any period of oxygen administration, whether it be for a few moments as in certain emergencies, or for a long period of perhaps several weeks as is often common with cardiac patients.

There are three primary applications of oxygen therapy for you, as industrial nurses to consider.

1. In an emergency.
2. In your dispensary.
3. For the patient in the hospital or at home.

An emergency is inherently a sudden occurrence and the maintenance of life perhaps depends upon moments. Oxygen may often prove to be the deciding factor in sustaining a thread of life immediately following the emergency. These emergencies may be touched off by accidents. They may be the result of strictly medical conditions—the coronary occlusion, heat prostration, or just plain fatigue which brings about collapse. All fit into the non-accident category. Accidents themselves, of course, can result in an unlimited number of injuries which seriously jeopardize life.

Regardless of the cause of the emergency, you will probably want to treat the patient at the scene before trying to move him or while waiting for the arrival of the physician. Obviously if oxygen is to be applied, you must have some type of readily portable oxygen apparatus. The essential elements are a small cylinder of oxygen, a reducing valve, a piece of hose, and a face mask. Mechanical resuscitators are good and can be used not only for resuscitation but for straight oxygen as well. However, they are not as light or as readily portable as the simple emergency oxygen unit.

The equipment should be kept in readily accessible but protected locations and several people in each section of the plant should be familiar with its use. It should be completely assembled at all times—don't just have a cylinder sitting in a corner and a regulator on a shelf, or a cylinder with regulator attached and a mask in a drawer some place—keep the entire rig ready to go at a moment's notice.

Inspect the outfit weekly, and in particular, check the contents of the cylinder making sure it is full. These small cylinders hold enough oxygen to treat the average patient for about an hour. Don't keep a part-full cylinder on hand. The small loss involved in exchanging a partly used cylinder for a full one is not worth the risk of running out of oxygen during an emergency treatment.

As soon as you get to the victim and start administering oxygen, dispatch someone to arrange for additional oxygen. If it is likely that you will treat the patient where he is for an indefinite period, have someone bring a large cylinder to the scene. The regulator on the small cylinder may fit a big cylinder if you use a commercial type valve on your small cylinders. Usually, however, the small cylinders are equipped with a medical or yoke type valve and you will have to get another regulator for the large cylinder. You will probably have one in your dispensary. If not, have a regulator such as the type used on gas welding and cutting equipment brought to the scene.

Opening the valve slightly on this type of regulator will supply enough oxygen (one pound per square inch pressure equals approximately ½ liters per minute with the average industrial regulator). You can check the oxygen flow better by watching the breathing bag of the face mask. It should rise and fall as the patient breathes.

There are available, devices known as liter flow adaptors. This device converts a welding regulator to oxygen therapy use quickly and simply. The directions inscribed on the device tell how to adjust the setting on the regulator to get the correct flow in liters per minute. It would be desirable to have one of these devices in your emergency rig.

Try not to use all the oxygen in your small cylinder as it will probably be necessary to continue oxygen administration while the patient is being moved. This is important. The value of oxygen is greatest during the period of transportation. Therefore, you must arrange for someone to walk alongside the litter with the small cylinder of oxygen and to keep an eye on the mask to make sure that it does not become displaced.

Make sure that the ambulance service which you use is equipped to give oxygen en route. If no such service is regularly available, or at least not at the time of the specific emergency, make arrangements to have your portable oxygen equipment go with the patient.

If the patient is to be hospitalized, have someone call the hospital to have oxygen ready on your arrival. This will eliminate any unnecessary waiting for oxygen to be set up when you arrive. In addition, you will have impressed the hospital with the need for oxygen immediately. Again, this period of transferring the patient from ambulance to hospital bed is often critical, and oxygen may perform its most valuable service right here in supporting a thinly ticking life.

Let's take a quick look at oxygen in your dispensary. You need a large cylinder of oxygen, preferably on a four wheel carrier, a regulator, tubing, and a face mask. These should be kept assembled at all times. Keep the regulator attached to the cylinder, and the mask attached to the regulator. The mask can be wrapped in a clean towel. It is desirable to have two masks available, so that you can clean one should you have another patient requiring oxygen. A good disposable mask has just been made available, and you might wish to consider utilizing masks of this type.

A large cylinder holds 244 cu. ft. or 7,000 liters of oxygen. At 10 liters per minute, this will give about 12 hours continuous service. At 6 liters per minute it will give about 20 hours continuous service. This cylinder regulator mask set-up should be located near a cot. The people you treat in a dispensary will probably be conscious and co-operative. It is desirable to have them place the mask on their own face. You can secure the head strap. This is an intimate piece of apparel and is like eye glasses. The patient can best find the most comfortable adjustment of the mask to his face. Also by doing this he shares in the procedure and any apprehension which he might have concerning the treatment is thereby reduced.

Tell him to relax and breathe normally. This is important, as the tendency when putting a face mask on is for the patient to hyper-ventilate. This will make him dizzy and increase his discomfort, as it would do to anyone whether breathing oxygen or not. Thus, with the patient breathing normally you can adjust the oxygen flow so that the reservoir bag of the mask rises and falls with the respirations. The bag should not collapse completely at the depth of the inspiration. Usually, your doctor will ask you to use high concentrations of oxygen to your dispensary patients and this technique will accomplish the therapy required.

The major safety precaution to observe concerns smoking. You must tell each oxygen patient that he cannot smoke while taking oxygen. Also, there should be a "No Smoking" sign prominently displayed. A good place for it is right over the cylinder valve. Also, do not use any electrical equipment on the patient while he is getting oxygen. Don't try to combine diathermy with oxygen, don't take an X-Ray while he is actually breathing oxygen, and don't use a scope of any kind (it would be possible with this nasal mask for instance, to look down his throat while oxygen was being given).

The batteries and bulb used for illumination could be a possible source of ignition in a high oxygen concentration. Ordinarily, oxygen use is not a highly hazardous procedure, particularly if treated with just plain common sense and observing the precautions mentioned here.

Hospitals are almost universally equipped to give oxygen. Expense-wise this is included today in practically all group health insurance benefits on an unlimited basis. Private insurance company policies generally provide a specific sum of from $50.00 to $100.00 for oxygen treatment in each illness.

Of the various methods for giving oxygen, the tent is the most expensive, and the catheter and mask methods the least expensive. Catheters and masks involve about half the expense of the usual tent therapy. This applies to the cost to the hospital as well as charges to the patient. However, there are times when a tent is distinctly the method of choice.

The use of oxygen therapy in the home is increasing rapidly, particularly for chronic cases such as cardiacs, asthmatics, migraine sufferers, and others. Most cities have one or more oxygen therapy rental services who have good equipment and trained technicians on 24 hour call. They are prepared to make arrangements with industrial companies for the care of employees who might need oxygen at home according to a physician's prescription. Many of them will make contractual arrangements at favorable rates.

In the rural areas or smaller cities, there is always a distributor of oxygen (he usually handles welding and cutting products) and you will find that he also has oxygen therapy apparatus. He will be glad to sit down with you and tell you what arrangements can be made for supplying oxygen and apparatus to your employees, on physician's orders, for use in their homes.

We have done considerable thinking and work on the matter of oxygen in the event of disasters such as, atomic raids, severe plant explosions, and train or plane accidents and we have come up with a few practical ideas. By cutting a small hole in the crown of a hat and inserting a piece of tube, it can be placed over a face and oxygen can be given. A paper bag usually obtained for carrying groceries can be adapted in the same manner.

You can take a regular cardboard carton and, with a few alterations, improvise a temporary oxygen tent or Burgess box as they are sometimes called. These masks can be cut from a simple templet and made from cardboard, old X-Ray film, or any other similar material which is handy. Devices such as these plus oxygen which can be commandeered from any industrial plant, will provide oxygen therapy in the minutes and hours when it means the most.

The important thing is to realize that there are usually substantial sources of oxygen in locations near to you, and that with with ingenuity you can improvise equipment which will perhaps be of major value in the case of catastrophes such as those mentioned here.

Off the Job Accidents

By COLONEL WILL L. TUBBS
U.S.A.F., Assistant for Ground Safety, Headquarters,
U.S. Air Force, Washington, D. C.

The safety of airmen and civilians alike, while working on Air Force installations, is of vital concern to the Air Force. Through the USAF ground safety program every effort is made to provide a safe working environment, proper equipment and adequate supervision and guidance to prevent needless personal injury and loss from accidents.

According to records maintained in my office, we are having reasonable success in preventing accidents on the job, and we are constantly working for even better results. But the prevention of on-duty accidents is only a part of the safety problem which confronts the Air Force.

Accidents occurring to airmen in their off-duty and off-base activities constitute a serious hindrance to the efficiency and economy of operations. The prevention of these accidents is an essential phase of the ground safety program for several important reasons. When an airman is accidently injured, regardless of where, when or how, he is hospitalized at government expense and continues to receive full pay.

If the airman dies from his injuries, the government pays insurance benefits, pensions, gratuities and even burial expenses. A fixed charge, which was derived from a careful study of these costs, is assessed for each injury and fatality to provide a measure of the economic loss from these accidents. These charges are used in the Air Force accident cost accounting system enabling losses from off-duty accidents to be evaluated on a dollars and cents basis.

It cannot be denied that the injury and death payments assured by the government are essentially due to the nature of the military service, but by preventing accidents and needless injury and death these costs can be kept to a minimum. Besides economy, a most important reason for preventing off-duty accidents is the conservation of manpower. Under the present emergency the Air Force must conserve and efficiently utilize the manpower assigned for its mission. Through the continued application of control measures at all echelons, off-duty accidents are being reduced. Much indirect assistance is being given by civil and community agencies which are gradually taking a more active part in promoting all-round safety in their municipalities.

The reasons I have given for preventing off-duty accidents in the Air Force are applicable, in a limited sense, to off-the-job accidents in private industry. Some of you in industry do pay hospitalization, insurance and other costs for employees injured or killed away from the job. However, production losses result when the services of a skilled worker are lost regardless of the circumstances of his injury and industry, like the military services, has a large responsibility in manpower conservation during the present emergency.

With the labor market becoming shorter every day, manpower losses of any kind will hinder our national industrial efforts. It should be the responsibility of the safety director to evaluate the effects of off-the-job accidents on economy of production and to keep management informed. Of course, industry can exercise practically no jurisdiction over its employees when they are off-the-job, and necessary facts concerning off-duty accidents to employees would have to be obtained from employees on a voluntary basis. Similarly, controls can be applied only indirectly by suggestion, persuasion and encouragement.

In terms of economic management and good human relations, industry may consider it advisable to take a more active role in the off-the-job safety of employees in the future. Only a very small percentage are taking an active interest in off-the-job employee safety today. Labor organizations undoubtedly have a parallel responsibility in this respect. The possibilities of off-the-job safety cannot be ignored as a potential instrument for more efficient production.

In the Air Force, about twice as many accidents occur to airmen off-duty as occur to them on duty, and off-duty accidents cause about seven times more fatalities. The majority of all off-duty fatalities and about one half of all off-duty injuries are sustained in the operation of private motor vehicles. Sports and recreational activities are responsible for the second greatest number of off-duty accidents. Swimming stands out in this group as the source of many fatalities through drowning and hunting is second involving deaths resulting from mishandling weapons. The third source of off-duty accidents are domestic activities around barracks and other living quarters.

These approximate comparisons point out that off-duty accidents account for more than two-thirds of the Air Force accident experience, in a numerical sense at least. The situation in private industry is similar. Recent figures I have seen indicate that for each employee accidently killed on-the-job, two are killed by accidents away from the job. Off-the-job injuries undoubtedly run to at least several times the number of on-the-job injuries. The company which takes an active interest in the off-the-job safety of its employees will realize a certain amount of economic profit and enjoy better human relations and public approval.

Engineering and supervisory measures for off-the-job accident prevention are necessarily weak due to lack of employer jurisdiction over the personal activities of personnel. The key to preventing off-duty accidents is the proper use of educational media and publicity devices. By employing these means in the Air Force it is possible to convey knowledge and develop attitudes which will help condition the airman to behave and act safely.

Through the USAF Ground Safety Program, all available educational and publicity media are used to indoctrinate airmen in the

principles of thinking and acting safely. By Air Force directive, an accident report must be submitted by the supervisor of the injured individual for each off-duty accident in which an airman is injured.

On the basis of statistical studies of these reports, it is possible to isolate to areas of highest accident potential, and plan and direct corrective measures accordingly. As private motor vehicle operation is the most serious source of accidents, greatest emphasis is placed on education and publicity encouraging safe operation. At each Air Force installation suitable movies are shown, appropriate posters are displayed, base and local newspapers print articles, columns, stories and even pictures related to safe driving, and lectures and demonstrations concerning driving are given as needed. In addition to these measures, other devices are used at the discretion of the commanding officer.

For example, at some installations, privately owned vehicles must pass a mechanical inspection and be properly insured before they are allowed on the base. Where flagrant driving violations occur leading to an accident, disciplinary action is often taken to act as a deterrent to other vehicle operators. Character guidance activities of chaplains and supervisors are periodically directed at accident prevention. These and similar measures are applied in the prevention of accidents occuring in sports and recreation.

At many installations, efforts are made to provide the best possible recreational facilities on the base as an inducement to airmen to remain in the controlled military environment. Special measures are now being taken with respect to drownings, and the program for this purpose is outlined by Air Force directive. The other sources of accidents receive corresponding attention. The final objective of all measures is to help our airmen to be better, safer citizens, for their own good as well as for the good of the Air Force. A valuable source of assistance in the application not only of educational measures but of engineering and supervisory controls in particular is the local community.

Through cooperation with the local police, American Red Cross, automobile clubs, Chamber of Commerce and similar organizations, excellent results are being obtained at many Air Force installations in providing a safer environment for airmen.

In private industry, control measures directed at off-the-job accidents certainly could not be as extensive as those used in the Air Force for obvious reasons. The statistical information, necessary for program planning, relating to off-the-job accidents to employees could not be obtained on a mandatory basis as in the Air Force but would have to be procured on a voluntary basis. The first step in such a program would be to stimulate the employee's interest in his own safety by showing him how he will profit personally.

Cooperative action between industry and community agencies, labor organizations and state and federal safety authorities would be essential. Through the cooperative activities of these organizations and by the distribution of suitable indoctrination materials on safe driving, accident prevention in the home and in recreational activities, an effective start could be made on the control of off-the-job accidents. Ultimate results would depend on the ingenuity of industrial safety personnel and the quality of management backing.

In the interests of economy and human welfare, off-duty accident prevention in the Air Force is essential. The industrial situation may be different in degree but not in kind in this respect. It is likely that in each industry, the need for preventing off-the-job accidents would have to be evaluated, first on an economic basis, from the management point of view, and then on its broader merits. Possibly the greatest value in industrial participation in the prevention of off-the-job accidents would not be the profit to a particular industry or individual but the improvement which might be made in the national accident toll.

Children and youths are getting more and more accident prevention education each day in the schools of the nation, but it is difficult to reach and educate the adult population. Community, state and federal agencies are working more and more toward accident prevention and private safety organizations and insurance companies have been working on the improvement of national safety for years. Perhaps the answer to real results in reducing the national accident toll rests in the widespread participation of management in off-the-job safety.

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Current Safety Topics in INDUSTRIAL SAFETY

As presented in the Subject Sessions of the 1951 National Safety Congress. Sponsored by the American Society of Safety Engineers

(Continued on next page)

Volume 15
Transactions
39th National Safety Congress

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Current Topics in Industrial Safety

(Continued from cover)

New Ideas . . .

If safety is to keep pace with today's rapidly advancing technology, we must continually have "new ideas."

Each year, at the National Safety Congress, the ideas and experiences of many of the nation's top safety men are presented in the various sessions. Many of these ideas, devices and methods, first presented at a Congress session, later become generally accepted within their fields.

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Safety directors everywhere have found the Congress Transactions a useful aid in their accident prevention programs. In industry, for example, their judicious distribution to key personnel in management and supervision has proved to be of invaluable service.

In preparing these Transactions, the proceedings of the Congress have been condensed and edited for reference purposes. Complete original manuscripts, with any charts or illustrations which were used, are available in National Safety Council files. Views expressed at the Congress or in this record are those of the Congress participants and are not necessarily those of the National Safety Council.

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This volume is a record of the subject sessions sponsored by the American Society of Safety Engineers at *1951 National Safety Congress*. The conduct of these Congress sessions each year is only one of the many cooperative activities which the ASSE carries on in behalf of its members, and for the benefit of accident prevention work in industry generally.

American Society of Safety Engineers

An Introduction to the Effects of Atomic Weapons

By LT. ALLEN W. KENNEY, MSC, USN
Bureau of Medicine & Surgery, Dept. of the Navy, Washington, D. C.

(The opinions or assertions contained herein are the private ones of the speaker and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.)

In order that previously talked about radiation hazards and effects of atomic weapons that instilled fear for the unknown may be dispelled by newer knowledge, recently gained through progressive research, we have some information that we want to share with you.

It is quite natural that earlier concepts of hazards of radiation would be changed through our new experiences with this state of matter.

You will not be given the complete story —time does not permit but a small, small part of an introduction to the subject of radiological safety and the effects of atomic weapons. This must be repeated—over and over again to dispel the fears that have been magnified in our minds, in our reasoning of something new — strange and unknown.

This fear is quite natural; not understanding this newer science our minds may have conjured pictures of situations that could leave no other impression than that of helplessness. This is *not* true—you are *not* helpless—there is *much* you can do.

The very fact that the populations of Hiroshima and Nagasaki knew nothing of the effects of an atomic explosion spelled doom for thousands. The knowledge that we have now, and that you may learn, may save your life!

What do we now know about atomic explosions? What is this science of nuclear physics that has, in our lifetime, changed the concepts of survival of civilization, of the creation of energy?

The first concept men had of radiation was in an ore discovered in 1896 by Becquerel, a Frenchman. Forty-six years later in 1942, at the University of Chicago, the first "chain-reaction" was scientifically demonstrated. In 1945 the first atomic bomb was exploded.

Think, then, from this meager description of the passage of time, when in 1896 radiation was first discovered, to 1945 when this form of energy was converted into a mass that created an explosion.

Let us review these atomic bomb drops. First explosion: Alamogordo, New Mexico, July 16, 1945, the bomb was hung on a tower near the ground and detonated. This was a "ground burst." That was the first "test" atomic explosion. Less than a month later on August 6, 1945, an air burst about 2000 feet over the city of Hiroshima, Japan. Our second air burst over land followed in three days, August 9, 1945, at Nagasaki.

We waited a year then to further our knowledge of this new weapon and the first Bikini, "Test Able," over-water explosion was made on July 1, 1946. This was followed on the 25th of July 1946 with the first under-water burst, "Test Baker."

Until the results of these explosions had been thoroughly evaluated by our scientists, our physicists, no one knew, but many had predicted the results of the explosion of the atom.

Blast is the most important aspect of atomic explosion. Let's go to the three types of atomic bursts: 1. An air burst over land; 2. An underground burst; and 3. An underwater burst.

We are going to review these atomic explosions, and because the *"air burst"* over land is the most destructive, the type of an explosion that might be encountered, let's

use that for our first description. Its effects are: Blast, Intense Heat, and Radiation.

The blast effect of the atomic bomb is like a giant blow in a matter of one second with a rise in pressure--two seconds later a giant suction with a lowering of pressure and then creation of a vacuum by the wind coming back or going in the opposite direction. Later, a matter of five seconds from the time of the explosion of the air burst, our atmospheric pressure has returned to normal.

Our blast wave velocity (or force) at ground—zero—(the ground center under the explosion) of the bomb is 800 miles per hour. The velocity of our blast one mile from ground zero is about 200 miles per hour, and this force diminishes to about 50 miles per hour two and one-half miles from ground zero.

Now we must emphasize *this—the decreasing destruction*—with *increasing distance* from ground zero.

Our air burst has heat like that from the sun and can be described as a ball of fire.

For one ten-thousandth part of a second, the fireball temperature will be more than one million degrees Fahrenheit. The thermal energy released at this point will equal eight million kilowatt hours—enough energy to supply power and light for a city of 55,000 people for twenty-two days.

The ball of fire extends over an area of about 45 feet. The heat that was described lasts for a matter of seconds.

We have one more factor—RADIATION—to consider. Our ball of fire at ground zero contains certain rays which are emitted. The emission of these rays is called radiation, and these rays are scattered and absorbed.

Alpha and Beta radiations are minute *particles* traveling at high speeds. Gamma, another constituent of this radiation, is a ray of energy (or force) rather than a particle of matter. I shall talk to you later about these radiation exposure measurements.

Here again is a description of destruction—by area in feet:

At ground zero, within a circle of 2000 feet, total destruction. From 2000 feet on, roughly one-half mile to about two miles, heavily framed steel and concrete buildings will remain standing, but without any windows, and none capable of continued occupancy until surveyed by competent engineers. At a distance of about two and one-half miles, wind blasts of about 50 miles per hour, and practically no danger from heat or radiation. A burn may be suffered at this distance similar to that of sunburn, which most of us at one time or another have experienced.

In our air burst—at two thousand feet from ground zero we will find many injured survivors. We find our heat flash has been deadly to a distance of one-half mile. Our gamma rays will be deadly for those *totally exposed*, to a distance of about 3000 feet. From a distance of about one-half mile from ground zero our survivors will be injured by the effects of the blast, by burns from the heat of the fireball and a few from radiation.

The heat flash will be a serious consideration up to a distance of about two miles, and of minor consideration from that point to about two and one-half miles.

There are two other types of atomic bombs for us to consider. The underground burst and the under water burst.

If our bomb were exploded on the surface there would be a crater in the earth 800 feet in diameter and 100 feet deep. There would be much more residue, or lasting, radiation, much less prompt or immediate radiation, and the blast and heat effects would be concentrated in a much smaller area.

In the "over-water" burst, we find the formation of a wave—or wall of water. This is the immediate start of the "fall-out," and shows the complete formation of the "plume."

In this type of explosion there is almost no immediate or prompt radiation; and considerably or more residual or lasting radiation than in the ground burst. Blast effects have been concentrated in a much smaller area, and practically no fires or heat effects.

In the water burst atomic bomb we find our area of destruction reduced to less than ¾ of a mile—versus ⅝ of a mile for our air burst. Three-quarters of a mile accounts for our heavy damage of buildings, beyond repair. From three-quarters of a mile to about a mile and one-eighth *major* damage, and from that point to about one mile and seven-eighths, relatively minor damage. Almost negligible damage beyond this point.

However, our radiation hazard presents a different picture. If we draw an elliptical circle superimposed over our city, this "egg-shaped circle" represents the "fall-out"—the residual or lasting effects of the underwater burst.

We find a wall of water forming at the epicenter at a height of about 100 feet; diminishing to a height of about 10 feet at two and one-half miles. There are *no tidal waves*—the maximum wave will be about 100 feet at zero point, and 10 feet at about two and one-half miles.

You will note that in the *air type of burst* (within a half-mile of ground zero)—all buildings are destroyed. Everything combustible is on fire. There are no transportation facilities. Communication is all gone. Shock is as severe as it can be measured.

From an atomic bomb *ground burst*—the effects are only one-half as great as an air burst.

From an atomic bomb *water burst*—a few buildings (about one-fourth as many) are destroyed. There are no fires. Transportation facilities are not affected. Communication facilities, unless a cable has been destroyed, are not affected. But the same *shock* damage may be expected—this is not measured—it may be none, or it may be as much as from the air burst; up to a distance of one-half mile.

We can now progress with this lecture to the point of discussing the effects or types of injuries our population will suffer.

We find mechanical injuries caused by flying debris. Heat will cause our burns and resulting fires. Our radiation injuries will be caused by the release of rays and particles contained in radiation; these are composed of Alpha, Beta, and Gamma.

Alpha particles can be stopped with as little protection as a thick sheet of paper, ordinary clothing, or our skin.

Beta particles can be stopped by about 1/16 inch thickness of metal or of any material or substance providing the like or equal amount of substance thickness of 1/16 inch of metal.

Gamma radiation, however, is not particulate matter. Gamma is ray, like a beam of light; this radiation can neither be heard, felt, seen, tasted, smelled or in any other manner become perceptible to any known human faculty.

At ground zero, Gamma rays can pass through more than one foot of concrete or *three* feet of earth; 4000 feet from ground zero, however, the same amount of concrete or earthen thickness will effectively shield from Gamma ray penetration.

What about our calculated injuries?

Within a half-mile of air burst, 85 per cent of the persons would have blast and burn injuries; of these persons injured there would be 15 per cent who would suffer from the effects of *Gamma* radiation.

This radiation would be of the *prompt* type and after initial blast (for a period of 90 seconds), the hazard of radiation would be passed.

In a ground burst our blast and burn casualties would be those immediately within ground zero. The *prompt* (or immediate) radiation would be decreased but the residual radiation would be increased because of the radiation particulate exposure.

In a water burst, burns would be absent, blast effect decreased; prompt radiation absent, but residual radiation increased.

Here are the effects of radiation:

Twenty-five *R* minimum exposure—no symptoms.

At about 200 *R*—which may be termed the minimum symptomatic dose, the symptoms would not appear until about 19 to 60 days. At about 400 to 450 *Rs* would be a lethal (deadly) dose for about 50 per cent of the persons and the symptoms would appear in eleven or twelve days.

At about 700 *Rs* the fatalities would be about 100 per cent. The symptoms of this amount of radiation exposure would appear in two to four days.

It must be pointed out that these effects would require that a person be "totally" exposed for the full ninety seconds that radiation is a hazard in our air-burst. Total exposure to the entire body, not just some anatomical part.

Now what about treatment?

The materials required to treat one burn case suffering a 40 per cent of body surface burn are: Forty-two tanks of oxygen; Thirty-six pints of plasma; Forty pints of blood; One hundred pints of other fluids; An un-

determined amount of antibiotics; Twenty-seven miles of gauze; Three nurses; and Two physicians.

NOW, The most important part of this lecture: *What to do to protect yourself!*

There are elaborate systems of air defense—or air attack warning stations currently being developed.

In Event of No Warning!

Immediate action means the difference between life and death.

1. Drop to the floor. Keep your back to the window; curl up in as small a ball as possible. If time permits, crawl behind or beneath a table, desk, etc.

2. Keep close to interior partitions and supporting columns. Keep *away* from the center of the room.

3. Cover your face, your eyes with your arms.

4. Curl up—shield your bare flesh with any kind of covering, with another clothed body.

5. After the blast:

Remain under shelter until falling debris has settled down. Remember, by the time the debris settles and blast effects have passed, there can be no further radiation effect.

6. Assist the injured near you. Apply the first aid measures you have learned.

7. Follow instructions of authorities.

8. Report to the assembly area as outlined by your supervisor if *at work*. Following the blast, a block warden will give instructions if blast has occurred while at home.

9. When the services of the health department become available, check your health with your doctor.

10. Do not spread *rumors*—remain calm, cool and collected.

What to Do When You Have a Warning Period of Impending Atomic Attack

1. Remain calm and obey authorities.

2. Pull down window shades, venetian blinds; tie these down securely. This may provide some protection from flying glass.

3. Take shelter in a basement, under a table, or lie next to walls away from windows. Secure gas, fires, light, furnaces.

4. Do not take refuge in upper floors.

5. If you are outside—get away from buildings—stay away from trees. Lie down in a ditch, any kind of a depression or behind a wall. Protect all bare parts of your body; cover your face with your arms; protect your face from the blinding flash that follows the explosion of the bomb. Remain under shelter for a few minutes after the blast so you can be sure you will not be injured by falling debris.

6. Try and help those near you *who may* have been injured. Your help is important —it is important that *you learn first aid.*

7. Follow the procedure outlined for you by Civil Defense authorities. If you have a military billet; report immediately to your assigned task.

In Case of an Underwater or Overwater Blast

(These conditions may be termed *contaminated* blasts.)

1. Your first steps are to cover yourself, and if outside, you must protect yourself from the radiation contaminations that will pour out of the "air cloud"—this "air cloud" may be water or dust. You should have a raincoat or newspapers.

2. Remain under cover until the rain, if any, *from* the blast has stopped falling. Remain where you are under cover for at least twenty minutes, if possible. This will permit the intensity of the radiation to subside.

3. We must work under the assumption that radiological safety monitors will be present to guide you to any rescue work that will be attempted within the contaminated area.

4. You will be needed to help in this rescue work, which will include evacuation of the wounded, fire fighting and other emergency work.

5. Unless a radiological safety defense worker announces the area safe from contamination, leave this area after the immediate first aid evacuation work has been completed. Continue to wear such protective clothing as you may have on until you have left the contaminated area.

6. Do not pick up souvenirs, plunder or loot. These articles, if contaminated, may cost you your life.

7. After rescue work, and when clear of the contaminated area, take a thorough shower. Scrub yourself completely three or four times paying particular attention to hair, hands and fingernails. Check with a radiological defense advisor or a doctor, if possible.

8. Do not eat, drink or use as smoking material, anything in (or taken from) the contaminated area.

In summation of what you have been told:

An atomic bomb and its explosion effect is just about the same as any other high-explosive type of bomb, except for the area of destruction. The atomic explosion covers a larger area and is accompanied by heat and radiation.

Within a half a mile away from ground zero your chances for survival are about one in ten with no warning; and immediately and rapidly from this point out, your chances for survival increase.

Doubling the bomb's power does not mean doubling the damage area. It will not even double the present value in destructive power.

In an atomic explosion, blast and heat are most dangerous. Blast will cause *mechanical* injuries from falling glass, buildings, wall, plaster, debris of all types. Heat will cause more burns because more people will be *exposed* to a greater heat than has ever been demonstrated by any force.

By lying down in a shielded spot from direct exposure to the "light" from the bomb's explosion, protection can be afforded against burn, and by distance or proper shielding against radiation.

Flash burns will be the most serious of our injured survivors' immediate treatment requirements. 85 per cent of our casualties will have blast and/or burn injuries. Of this 85 per cent, 65 per cent will have burns and some mechanical injuries—the remainder —fractures, lacerations, etc.—mechanical injuries of concussion. Only 15 per cent of casualties will have radiation exposures.

Any solid material will protect from flash burns. Loose white clothing will protect. Cloth with colored designs on white backgrounds has been known to permit burning of skin in the pattern of the design. Loose, white clothing will protect the skin from flash burns.

The radiation—the radioactivity is the principal difference from ordinary high explosive bombs. This is not new—this is not mysterious. Detection by monitors of radioactivity does not *always* mean danger; it is the type of radioactivity that determines its dangerous properties.

Even suffering radiation exposure to gamma rays up to 100 Rs is probably not fatal. We permit workmen to work at one-twentieth of one R per day—day after day. The common X-ray may give you as much as two Rs per picture.

Twenty-five Rs is the minimal single dose, that can be tolerated without any symptoms of radiation disease or injury. Up to 200 Rs—in a minimal single dose, symptoms will appear in 19 to 60 days and these can be treated.

From 200 to 400 Rs, fatalities will occur in 50 per cent of the injuries. These symptoms will appear in 11 to 12 days. Over 700 Rs, the fatalities will be 100 per cent. Symptoms will appear within 2 to 14 days.

Not much can be done to protect a home from blast damage. It is better to take cover in the cellar or basement than in an upper floor. Basements will offer protection against blast, heat and radioactivity.

An air burst will give only little, if any, lingering radioactivity. This lingering activity will come from an underwater or ground burst.

Air bursts do not create "doomed areas."

Specialists, monitors, radiological safety engineers will determine *hot* areas, if any.

Associations and Their Safety Programs

Introductory Remarks

By H. F. REINHARD

Mgr., Safety Codes Dept., Union Carbide & Carbon Corp., New York City; Chairman, Small Business and Associations Committee, Industrial Conference, N.S.C.

I know, that most of you represent associations in an executive capacity and association executives are very busy men who, if they give several hours of a working day to a meeting, expect to secure something worthwhile in return. We believe that we do have a program from which you will get much worthwhile data and other information on why associations should and how they can be helpful to their members in accident prevention.

We know from the statistics compiled by the National Safety Council and other reliable bodies that there are an average of about 16,000 occupational fatalities and 2,000,000 disabling occupational injuries each year and that the annual cost of these on-the-job injuries is about two and two-third billion dollars. Association members pay most of these accident costs because they represent a large portion of American industry.

Data compiled by the U. S. Department of Commerce and the National Safety Council shows that plants employing less than 100 workers have an accident frequency rate of about 18.4 disabling injuries per million man hours worked whereas the accident frequency rate for plants employing 1,000 or more workers is 10.5 disabling injuries per million man hours worked. In other words, those plants employing less than 100 workers have an accident frequency rate almost double that of the larger plants. Let us also bear in mind that 90 per cent of all manufacturing plants employ less than 100 workers.

This great loss of life, great number of injuries and staggering cost certainly justifies any effort that anyone can put forth to reduce them. The facts with reference to the accident frequency rates of the smaller businesses suggest that any successful effort to promote a better industry accident frequency rate with a resultant reduction of accident costs would require that special attention be given to the smaller businesses. These can best be reached by the association representing the industry to which most smaller businesses belong.

The papers which follow define what an association can accomplish for its members in the field of accident prevention; what this will mean to the members not only in human values but in dollars and cents; how one outstanding association went about interesting its executive board in an accident prevention activity; and an explanation of the National Safety Council's new program for smaller businesses and associations, including where associations can receive help.

What Our Association has Accomplished Through a Group Safety Program

By IVAN F. LE GORE

Mgr., Accident Prevention Bureau, Portland Cement Assn., Chicago

Safety work is a common interest of yours and mine even though I have spent more than 20 years at work on the problem representing an association that has had an accident prevention program for more than 30 years, whereas some of you may have

thought little about the subject and your associations may not have a program.

As members we have cooperated with the National Safety Council since its inception, finding its services invaluable to our safety progress. We are looking forward to continued relationships that should be mutually beneficial. We recommend membership in the National Safety Council to our members, and many units of the cement industry have held active Council memberships for 30 years or more.

I shall give you some of the highlights of what the safety program of the Portland Cement Association has accomplished, summarize the concepts on which that program is based, and explain what a valuable service it is to our members. Please let it be understood that this information is presented factually and objectively and without any thought of boasting. We know our shortcomings well and we are hard at work to improve them. Long experience has taught us that the only way to prevent accidents is to keep everlastingly at it.

Our plant operations like those in the steel and glass industries are in the heavy manufacturing class and might be called hazardous. The grey powder which is portland cement results from some 80-odd operations in a continuous flow manufacturing process. The principal ingredient, limestone, is blasted down in quarries and mines, hundreds of thousands of tons of stone requiring the use of thousands of tons of high explosives to throw it down and break it up. Limestone boulders, some of them the size of pianos, go through a grinding process in some of the largest moving machines in industry—giant crushers, hammer mills, ball and tube mills. The resulting finely pulverized stone is mixed with clay and other materials so that the chemical balance is right and is then burned in enormous revolving kilns at a temperature of about 2,700 degrees Fahrenheit. The white-hot pellets that come from this calcining are called clinker, and are so hard that they will cut glass. This tough material must be ground and reground and mixed with a small percentage of gypsum to retard the rate of setting up of finished portland cement.

High explosives, quarrying and mining operations, grinding and conveying, burning, regrinding and shipping present special dangers. A cement plant is highly conveyorized, equipped with belt conveyors, pan conveyors, screw conveyors. Power transmission equipment adds to the machine hazards. The work is done at many levels throughout the quarries and mills, presenting the hazards of falls of men and falling materials. High voltage electricity is a factor, as is the handling of railroad equipment and trucks involved in haulage of raw materials and railroad cars used in shipping the product.

Portland cement manufacturing plants cannot be considered small plants in the sense of the definition of a small plant as one comprising 100 employees or less. Average employment in our plants is approximately 225. Only a dozen of 142 member cement operations have less than 100 employees. The two largest have about 1,300 and 900 employees, respectively.

Only about three dozen years ago industrial managements and employees alike accepted a certain amount of suffering and loss of life as part of the price of industrial progress. But officials of the member companies of our association decided that injuries and fatalities were unnecessary. They believed that nothing is of greater importance to an organization than the people who do its work, and that nothing is more important to those employees than freedom from injuries which, like illness and disease, bring suffering and deprivation, shatter hopes and wreck futures.

Since production comes from people, there is even greater need for a program to develop and extend the competence of manpower than for a program to insure the maximum efficiency and useful life of machine power. Without competent employees, protected against mechanical dangers and on guard against unsafe acts, the equipment which management selects and installs with great care cannot be operated or maintained. It is a tragic waste when the services of persons who have been trained to perform important work are lost because of death, injury or impaired health.

It would be a calamity to entertain the notion that accidents are bound to happen when the plain fact is that accidents have been almost completely stamped out in most of our member cement plants. The necessary interest has been shown and the necessary steps have been taken, and as a result

thousands of our workers' lives and limbs have been saved.

As a result of our program, we know that there are no jobs in cement plants that cannot be done safely. We know that reasonably intelligent men can do a competent day's work without hurting themselves or anybody else, if they are trained and stimulated to do so.

Danger can be foreseen, and the day is past when an accident can be regarded as a glorified misfortune. With few exceptions, the person who hurts himself must realize that he has done something that is not much to his credit. An accident reflects on: the know-how of the worker who disables himself trying to perform useful work; the know-how of the injured's supervisor, who is responsible for prescribing the way work is done and for assuring satisfactory performance by making safety directions a part of every instruction, explanation and order given; the know-how of the supervisor's superiors, whose activities differ from those of the direct supervisor chiefly in degree. If the boss doesn't take safety matters seriously, his men could hardly be expected to do so. In our industry, safety is considered to be an integral part of production, an essential to competent workmanship, an inseparable part of any successful undertaking.

Portland Cement Association Program

We have found that three principal elements in effective safety work are: first, the collection of accurate statistics for the purpose of ascertaining true accident causes and measuring progress in eliminating them; second, the establishment of a program of competition to stimulate and maintain interest in safety; and third, effective education and training among those directly concerned.

Our accident prevention program is sponsored by our Accident Prevention Committee, which is one of the two standing committees of our Association appointed by the chairman of our board of directors and responsible to the board. Often referred to as the industry's board of strategy on plant accident control, the Committee consists at present of 32 men representing directly the management of 110 of the 142 cement manufacturing plants operated by Association members in the United States and Canada. In the extent and quality of their experience, these men represent an excellent cross section of the safety thinking within our membership.

Two Committee members are presidents of their companies. Others are vice presidents, secretaries and treasurers, general managers, general superintendents and works managers, safety directors, industrial relations and personnel managers, plant managers and superintendents.

The safety program is developed and administered in accordance with the Committee's wishes by the Accident Prevention Bureau of the Association. The staff consists of the bureau manager and assistant, two office safety engineers and two field safety engineers.

Policies and plans in regard to insurance protection are handled by the individual member companies and not by the Association. Risks are experience-rated and it is felt that if the accident hazards are well controlled by means of the pooled knowledge and experience of the membership, the accident costs will be kept to low levels. Many of our companies are self-insurers at savings made possible by favorable accident experience.

The safety program is based upon the facts revealed in the studies of disabling injuries reported by the member plants on forms provided. By means of the statistical system, the staff keeps informed of safety characteristics, trends and requirements, focuses attention on the principal accident problems, and proposes protective measures as indicated by experience and judgment. The comparative effectiveness of the safety programs of individual organizations is determined and the efficiency of the membership's program in relation to the experience of other industries is approximated. The reporting system is based on the American Standard methods for compiling industrial injury rates and causes used universally, making our industry's accident experience comparable with that of other industries.

Publications and materials transmit the benefits of accident analysis, impart accident prevention technology tailored to the needs of the plants and popularize safety work at all levels in member organizations.

Accident reports from all plants, together with analyses and comments, are published without identification in the monthly Accident Round Table for discussion by company and plant leaders and safety committees. An issue of the quarterly Accident Prevention Magazine summarizes the annual accident experience; other issues report the results of the annual safety trophy competition and publicize outstanding safety performances, safeguards and devices. Twice monthly, circular letters are addressed to operating officials, plant heads and safety officers conveying timely information about accident hazards and trends and basic technology.

Special *bulletins on safety* subjects are prepared and published and the safety papers presented at the general sessions of Association meetings are printed in pamphlet form for ready reference use. Safety posters are prepared and sent in quantities for posting on plant bulletin boards. We invite the employees of member plants to send us their home-made *safety posters*, or their ideas for posters. Those that are acceptable we reproduce in quantities for posting on bulletin boards of all member plants, with full credit to the originator. Response has been excellent, the men in the mills being proud to have their efforts broadcast. A library of sound-slide and motion picture film programs and safetygraphs is maintained for lending to the plants.

Since 1923 we have sponsored a safety competition, awarding 7,000-lb. cast concrete safety trophies to plants operating a calendar year for the first time without a chargeable disabling injury. The trophy is reawarded for each calendar year that the perfect record is repeated, winners being authorized to have *the reaward* dates cut in the concrete base. In a quarter of a century our plants have operated a total of 834 calendar years safely, a record believed to be unparalleled in industry.

Our Thousand-Day Club is composed of member plants which have operated at least 1,000 consecutive days without a disabling injury. Award of the handsome Certificate of Merit in recognition of this achievement and in acknowledgment of the inspiring example it sets has to date been made to 71 plants. A gold lapel pin designed and supplied by our office is purchased by Thousand-Day Club plants for their employees.

A safe worker's badge and pledge card are supplied to all plants at cost for distribution to employees at the first of each year.

During the first five months of each year a series of regional safety conferences for company and plant leaders is held in strategically located cities throughout the country. In one-day meetings of 21 groups aggregating 1,000 persons, safety policies are examined, safety organizations and programs are appraised, safety leadership problems are discussed and plans are perfected for improved accident prevention work.

Assistance to plant leaders in regional groups is augmented by visits of Accident Prevention Bureau fieldmen to individual plants requiring special help with their programs. Fieldmen inspect for hazards to safety and health, investigate accidents, examine the plant safety program, make recommendations for improvement, and address safety meetings.

In general, a number of plants in one locality can be covered in one trip, the fieldman spending a day or two at each in a two-week tour. When special investigations are requested, several days are usually spent at the plant and conferences are held with company officials either at the plant or at their headquarters offices.

For over 20 years a summer safety campaign has been a feature, with special attention to the traditionally high-hazard months of June and August. Many of our specially prepared guides to streamlining and systematizing the year-round safety program have been developed and supplied during campaign periods.

Special safety programs are developed for adaptation by the plants at Thanksgiving and Christmas times. The holidays are periods of special appreciation of family friends and competent fellow workers, of dedication to complete living, of conscious personal gratefulness for the blessings of safety. They are especially appropriate times to rekindle the fire of enthusiasm with which workers and their leaders carry on the fight against hazards.

The Bureau staff assists the members in occupational health problems, providing information and advice. Medical and engineering studies have exonerated the cement industry as a provider of employment conditions capable of producing occupational diseases of a serious nature.

A great many requests from member companies and plants for advice and assistance are handled by correspondence, telephone and office conferences. When new men are given safety responsibilities in member organizations, by special arrangement they are sent to us to receive a short course of training in fundamentals.

Results of Program

In the last 25 years member companies of the Portland Cement Association have reduced the frequency of accidents about 80 per cent. The accident rate of nonmembers has been found to range from five to eleven times greater than the rate of our members.

This year is expected to be the seventh successive postwar year of safety improvement in our member operations. The alertness, resourcefulness and stamina of cement workers have been severely taxed by the excessive snow and cold of an unusual winter, the flood emergencies of an extraordinary summer, the influx of inexperienced employees due to the defense mobilization program, and greatly accelerated repair and construction programs. Nevertheless, production has increased steadily and in eight months of this year there were 10 per cent less accidents and 10 per cent lower injury severity charges than in the same period last year.

While three times as much portland cement is being produced today as seven years ago, the injury frequency and severity rates are 40 per cent lower than they were seven years ago. In the face of all postwar obstacles, the incidence of mishaps and the seriousness of injuries in our plants are less than they were in the five-year, prewar base period of 1935-1939. Where 25 years ago there were five accidents, today there is one.

Of the 142 plants participating in our safety work this year, 66 were accident-free at the end of eight months, six more than had operated without any disabilities in the same period last year. Six of the seven plants which started 1951 with records of more than 1,000 successive safe days have continued accident-free. One of two plants which achieved 1,000 consecutive safe days of operation this year has kept its record clear. Four more are in a position to reach the 1,000-day mark before the end of the year. All told, 71 plants have at one time or another achieved this distinction to become members of our PCA Thousand-Day Club.

One of our member plants, with a payroll of about 85 men, has not reported a chargeable disabling injury to any employee since February 20, 1937, more than 5,300 days ago. That record is continuing. A larger plant, with about 480 employees, established a record in excess of 5,333,000 safe man-hours in 1,921 days, but saw it terminated by an accident last year.

This experience indicates that our accident prevention program has been well organized and tailored to the operating needs of our members and that safety activities have been effectively pursued. Cooperation is splendid.

The soundness of experience-sharing and mutual aid in stopping accidents on an industry-wide basis is apparent in the considerable success we have had with it. Our time-tested pattern for the voluntary solution of safety problems is reflected in the National Safety Council's printed brochure, *Associations and Employee Safety*, which we helped prepare. The outline of our program is also in the printed *Proceedings of the President's Conference on Industrial Safety.*

Nothing takes the place of individual company effort in the prevention of accidents. However, coordination of the talent and experience of a group of organizations in the same field in an orderly approach to the solution of common safety problems will take them farther and faster along the road to control. There are many instances where individual companies acting on their own initiative have made a success of safety work, but no case of a whole industry achieving a low accident record except where there has been cooperative effort along these lines through its association.

The National Safety Council and the United States Bureau of Mines have said that the Portland Cement Association is outstanding among organizations having

proved that an entire industry is the logical unit for organized accident prevention work. Within an industry there is a similarity of personnel, practices, equipment and hazards which makes close interchange of experience and a united attack on common problems particularly valuable. Safety programs and activities that prove helpful to one company are usually beneficial to all.

From long experience with a realistic and successful safety and health program, members of the Portland Cement Association know that the means to prevent accidents are inseparably linked with productivity. The prevention of unexpected occurrences that would hinder production is sound industrial engineering. Safety activities contribute tremendously to orderly operations and help to cut costs. Preventive measures taken are not an expense but an investment that pays dividends.

Some company officials have said that Cement Association-stimulated safety work helped their organizations to save through reduced insurance costs more than the cost of their companies' association membership. One company reported that its insurance rate was reduced from $3.65 per $100 payroll to 85 cents per $100.

Some of the benefits of our accident prevention work are intangible and not easily determined. The measurement of safety benefits encounters the same "proof of performance" problems that are met by the company legal department in practicing preventive law and by the plant engineers in preventive maintenance work. We never know what the costs would have been if certain actions had not been taken.

We have been searching out good safety knowledge and practices in our member plants and we have been developing ways and means of obtaining wider and better use of that knowledge in all member plants to help stop accident waste.

We know that our program of safety education helps employees develop initiative and judgment in working out their own accident prevention problems and forwarding the common aims of their organizations. It encourages respect for every team-mate and the contribution he can make to the general good. Every person is expected to contribute to the extent of his ability, and his suggestions leading to safe, well equipped, convenient and pleasant working places are welcomed.

Our program helps supervisory employees to grow and develop into better all-round members of the management team. At our regional safety conferences, plant heads and foremen take part enthusiastically in practical discussions of what is expected of them in getting right results by effective use of manpower. Workers' abilities and mistake-free performances develop to the extent that their supervisors' skills and capacities grow.

Nobody can do the safety job for any operating team. The Association coordinates and gives leadership to the safety program of the member companies, but those organizations themselves must develop activities based on their own as well as others' experience. And that experience does not teach itself.

The demonstrated interest of top management is doubly important in a period when the need for conserving resources is so great. In the emergency confronting us we have no employees, no equipment and no time to waste. Accident prevention work offers the men who produce the foundation upon which is built understanding, confidence and cooperation. They need and should have every assistance that executives can give.

We believe that it is logical for an association to include in its activities an accident prevention program providing channels for getting across to company managements, supervisors and workers the vital importance of applying constantly the lessons of collective experience and judgment to the battle for human and material conservation. Safety concerns all the members of an association, not just a few. Safety is non-competitive. There is no place for "trade secrets." The fullest type of experience-sharing and mutual aid can be expected, and it is in this type of relationship that the association operates most effectively.

How to Get an Association Started on a Safety Program

By A. E. MURPHY
Executive Director, Folding Paper Box Association of America, Chicago

If you can think of this presentation in terms of "How we got our Association started on a safety program," we may have something of interest to offer because we are well on our way through such an experience. A great deal can be learned from the experience of others. As a matter of fact, we relied on the experiences of the National Safety Council and the Portland Cement Association in setting up our program.

The start of a program such as this, involving association funds, requires some careful planning, as most of you probably know. The need for the program has to be made apparent to the board. Facts must be carefully selected, and they must be pertinent. This information should be presented in a manner that is clearly understood; a short quick story in terms of dollars and cents. This presentation should be made at a special meeting, or made a part of the agenda of the regular meeting.

Our program had bounced around for about four years before actually becoming an association function. There was an interest on the part of a few members, but there was a lack of follow-up of the presentation of a suggested program at the annual meeting. Following this the labor relations staff representative took over the direction of an area program. This activity stimulated enough interest in the labor relations committee to have them accept the safety program as a national project.

Since dollars and cents were to be the basis of our need for a safety program, our first job was to see what accidents were costing the industry. We found the manual insurance rates for our industry excessively high when compared to a similar industry. For example the rates in Illinois for the folding paper box industry is $1.27 per $100.00 payroll as compared to $.45 per $100.00 of payroll for the printing industry.

When the insurance underwriters were approached about possible change in the rates it was found that there was a lack of accident statistics for the industry as such; the rates were based on paper and pulp experiences. Any hoped for benefits would have to wait for industry records.

A study of the available figures in the industry did show that our accident rate was higher (13.6) than the national all industry average of 10.14 in 1949. Moreover, our rate was much worse than those in the steel (4.96) or cement industry (5.18) both of which seem more hazardous than ours. This also indicated to us the need for a safety program with more and better records.

Somewhat to our surprise, one other reason for the need of this program was brought out; it was the lack of interest in accident prevention and the related cost on the part of top management. This condition may be the result of failure to take time to analyze reports and materials presented to them, or the information was not prepared and presented to them in a satisfactory manner.

Reviewing what transpired in determining the need for a safety program we find the following factors involved: 1. High insurance rates; 2. Lack of adequate records; 3. Industry rates higher than national average rates; 4. Small plant experience poor; and 5. Management's apparent lack of interest in accident costs. With the need fairly well established as far as we were concerned, objectives acceptable to members became rather important.

Bearing in mind that our plan was to use that tangible item; money saved, it was obvious that the objectives emphasized this factor.

Probably the most tangible thing to management in safety is the reduction of insurance rates, this is a saving they can actually measure. This was the talking point and no one was allowed to forget that reducing accidents would eventually reduce rates. This, of course, would mean adequate records would have to be kept.

We hope the effects of our program will not only attain our objectives, but will also be looked upon as a long range or permanent function of the association. We would like to see the members look upon the program as non-imposing, but rather a stimulant for sincere activity with the staff man a guide.

Careful thought has been given to the idea of holding to a minimum the individual consulting the staff man should do. Such activity would limit his services to the membership as a whole.

Along with adequate records for direction of future activities, it is hoped that these records will be suitable for classification of the industry in the annual reports of the National Safety Council and the Bureau of Labor Statistics.

Checking the sixth and final step, on effects, we covered the following: 1. Range of program; 2. Staff man's function; and 3. Records for classification as an industry.

A summary of the entire program will show it was based on factors which would not require a too elaborate presentation. We merely took into account the following: 1. Need; 2. Objectives; 3. How; 4. Aid; 5. Attitudes; and 6. Effects.

I would like to express our thanks to the National Safety Council staff for the time and materials made available to us during our organizational period. The services rendered were immeasurable.

We know by experience that there is a place for a safety program in an association and urge you to consider this as another valuable service function to members of your associations. If the program is the means of saving the eye, arm, hand or leg of only one employee in the industry each year, it will have more than paid for itself.

The National Safety Council's New Program for Small Business and Associations

By A. M. BALTZER

Dir., Small Business & Associations Program, National Safety Council, Chicago

This meeting is a *milestone* in the 39 years that the National Safety Council has been holding these Congresses. It is the first time that any real attempt was made to attract association executives to a national safety meeting, although in September 1950 a smaller meeting was held for association executives in the New York area. Roughly half of our audience today comprises association executives; the other half comprises government and insurance safety men together with general chairmen and association committee men from our industrial sections.

The importance of such a joint meeting can hardly be over-emphasized because for years safety men have been trying to find a better way to reach small business and to gain the attention of executives in both large and small business. One of the best ways to do this is through the association which has the ear of top management and which has the promotional and distribution facilities to economically reach top management with the safety message.

My own part in the Council's Small Business and Associations program, which was launched July 1, 1951, is to serve associations and other groups that are in a position to reach a small business. One means of doing this is through the large scale distribution of the booklet, *Safety Pays the Smaller Business*, which you received at *this meeting*. Currently, trade associations, insurance companies, safety equipment distributors and local safety councils are distributing this booklet to small business, but we are working toward even wider circulation.

The green flier, *Associations and Employee Safety*, which you also received, describes the Council's policy of cooperation and suggests typical safety activities for association headquarters and association members. Copies of the booklet, the green flier and our quarterly *Association Newsletter* have been sent to a complimentary mailing list of over 600 trade associations, state manufacturing associations, insurance groups, local safety councils and others. Many trade journals have given publicity to the program and already a number of associations have shown interest in an organized safety program as suggested in this material.

My assignment to this new program does not mean that the Council overlooked the importance of cooperation with associations in the past. For years we have had a special membership for associations and at present over 150 industrial associations are members. The safety engineers in our Industrial Department have assisted many associations in setting up and conducting safety programs, and a number of our 27 industrial sections have appointed one or more executive committee men for liaison work with associations in their industry. Moreover, associations are represented, both directly and indirectly on the governing committees of the Council and thereby help direct Council activities and policy.

The Council, insurance companies and other organizations always had a great deal of technical material suitable for small as well as large companies. In fact, they may even have been guilty of devoting too much time to preparing more material and talking more about the small business problem when they should have been planning how to get this material to them. The major effort now will be in the direction of encouraging the small companies to do something about accidents and promoting the use of the material.

The new program should result in more direct action because:

1. The program for small business and associations now can be well planned and coordinated with the efforts of the Industrial Sections, A.S.S.E. Chapters and local councils, etc.

2. We now have the necessary mechanism to carry out the wishes of the Small Business and Association Committee of our Industrial Conference. In other words, the staff is now specializing in a field in which our volunteer officers have given so much of their time. We now can work with some of the general groups such as state manufacturing associations and chambers of commerce not directly serviced by our staff engineers.

3. We now have the time and travel expenses to work with associations on their home grounds, giving them assistance where and when it is needed. We can meet with their committees in planning safety programs for their conventions or conferences.

The Portland Cement Association and Folding Paper Box Association programs have been described in detail, but there are many other associations who have adopted organized safety programs of one type or another. Some have full time staff personnel, some have a safety committee of volunteers from the industry, and others merely engage in limited safety activities or give publicity to the overall programs. Typical examples of association and National Safety Council cooperation are as follows:

1. The Milk Industry Foundation and the Council jointly sponsor a fleet and dairy safety contest in which the Council's Statistical Division takes care of all mechanical tabulating on a cost basis and the Foundation distributes and publicizes the bulletins. A safety certificate showing the names of both organizations is awarded to winners who may or may not be members of the Council. The Council staff also prepared a Safety Manual for the Foundation which took care of the printing and distribution.

2. The U. S. Brewers Foundation now has a well rounded program which resulted in more than a 50 per cent reduction in accident frequency in the past six years. The Council helped the Foundation in planning a long range program and supported it through its Food Section.

3. The American Meat Institute has given publicity to Council publications such as a special series of instruction cards and posters for the meat packing industry.

4. The Chicago Candy Association and the Council's Food Section recently joined together to organize the Safety Committee of the Midwest Manufacturing Confectioners. A specific example of their activity was the statistical questionnaire prepared by the Council and distributed to the Chicago Candy Association members. Incidentally, the returns from this questionnaire showed that the smallest candy companies had almost five times as many disabling injuries per million