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INTEGRATING ACCIDENT PREVENTION WITH PRODUCTION

By THOMAS A. SULLIVAN
A. O. Smith Corporation, Milwaukee, Wis.

We would like to offer the experience of our Granite City plant as a case study in the integration of accident prevention with production.

We have tried to present facts to you and not draw conclusions. If these facts can give you clues as to steps you can take in your own plants to tie accident prevention into your production processes this is the most that we believe can come from such a study. We would be the last to claim we have discovered any panacea for the complex subject of plant safety.

This case study is interesting because it was a new plant in a new area for A. O. Smith Corp. The exposure volume is significant, about 3,000,000 manhours per year.

From the beginning we had a safety director, who is still there. He is a staff man and must get all action through the operating people.

At the start-up of the plant two problems developed which complicated our problem immediately:

Certain automatic assembly equipment was not ready when product deliveries had to be made.

Our competitors were not ready to produce at all so we had to carry the entire requirements of our customer for the first few months of our operation.

As you might suspect, this required the hiring of green workers and green supervisors and made the training problem almost insurmountable at the beginning.

We have tried to put our whole story on this chart. It looks complicated but if you will follow along with me we will take it one step at a time.

The chart is divided into four areas:

The accident frequency data.

Production demands and union relationships.

Management action.

Safety and housekeeping.

Accident and frequency data show the number of lost time accidents per month since the plant began production in Sept. 1954. You will note that we have identified injuries to maintenance men separately from production people as the nature of their exposure is different and may be of some significance. For example, in 1959 and 1960 every other accident was in maintenance, although the hours of exposure of the production people is 10 times that of the maintenance men.

The frequency rate is a 12 month running average.

Production demands and union relationships are grouped together as things over which the management of the plant did not have complete control.

The start-up of new models in the summer of each year should have an adverse effect on safety because new equipment is present and men are back from a layoff of 4 to 6 weeks and presumably "out of practice." An examination of the chart does not disclose such a trend. Rather the accidents seem to bunch up in the later months when the heat is on to produce at peak efficiency. However, the data is not conclusive here either.

The effect of union activity on safety, while at first appearing adverse—after the union certification in 1955—does not show any discernable pattern. The accidents occurring after the major work stoppages in 1956 and 1957 do not seem to be related to the stoppage any more than to the model changes which occurred shortly thereafter.

In fact, it looks as though the formation of the Union-Management Safety Committee in 1959 had a major favorable effect on accident frequency. The frequency rate for the two year period since April 1959 is 0.78 per million manhours of exposure.

Management actions—There were four manufacturing superintendents during the period on the chart—identified as A, B, C and D. The frequency rate for each was: A—3.47; B—1.20; C—3.15 and D—1.53.

Making allowance for the start-up problem which seriously affected A's record, it looks like B had the best record and C the poorest. I would like to venture my opinion here that the attitude of the manufacturing superintendents toward housekeeping and safety had a major effect on the record of this plant.

There were three managers during the period on the chart. The frequency rate for each was: 1—3.08; 2—1.88, and 3—0.00.

The Monthly Management Plan of Action Meetings starting in February 1958 have had important results. The safety director presented safety projects to the manager and his entire staff and got their backing. A time table and plan of action was set up for each project and progress compared from meeting to meeting.

The need and approval for two engineering studies developed as a result of these staff meetings were safety of welding fixtures and a lighting survey—especially on the second shift. The welding fixture study not only corrected some serious safety hazards, but also resulted in a corporate-wide manual on "Engineering and Designing for Safety."

Safety and housekeeping—In 1956 the safety director began issuing safety procedures. These are tabulated in Exhibit I attached. They also are shown as P on the chart. It is to be noted that there was a flurry of them right after the Management Plan of Action Meetings started and again after the Union-Management Safety Committee started.

The two most significant procedures were: Eye protection, issued June, 1957, and Investigation of near injuries, issued April 1958.

The eye protection procedure eliminated policy confusion on border areas such as locker rooms, aisles, yards, etc., and signaled the beginning of a strict eye protection enforcement campaign.

The investigation procedure was an outcropping of the Management Plan of Action Meetings and became an effective communication device on hazardous conditions.

It is the belief of our safety director that good housekeeping is an important factor in developing a safe plant. This belief he demonstrates in a practical way by continually developing programs to improve housekeep-

ing practices. On the chart you will note that they started back in October 1954 and continue on a regular basis up into 1960. It will be interesting to look at Exhibit II which lists these programs. You will note how the operating supervision are tied into the program.

These, then, are the facts that seem to have some relation to the safety record of this plant which has twice earned the National Safety Council's Award of Merit and has twice earned the A. O. Smith Corp. President's Safety Award in competition with twenty other divisions of the company.

Perhaps by studying this data you can form your own conclusions and find some application to your own problems.

EXHIBIT I GRANITE CITY PLANT HEALTH AND SAFETY PROCEDURES

Description	Date of Original Issue
Plant and Fire Brigade.....	Feb. 1956
Sickness and on the Job Injuries.....	Jan. 1957
Receiving Plant Visitors.....	Mar. 1957
Cutting and Welding Permits.....	April 1957
Fire Safety and Prevention.....	April 1957
*Safety Eye Protection.....	June 1957
Gate and Bundle Passes.....	July 1957
Oxygen and Acetylene Cylinders.....	Nov. 1957
Press Repeat Control.....	Mar. 1958
Flammable Liquids.....	Mar. 1958
Safety Locks and Tags.....	Mar. 1958
*Investigation of Near Injuries.....	Apr. 1958
Power Truck Maintenance.....	Apr. 1959
Tornado Alert and Evacuation.....	Sept. 1959
Portable Grinding Wheels.....	Sept. 1959
Compressed Air.....	Oct. 1959
In-Plant Railroad Safety.....	Nov. 1959
L.P.G. Equipped Power Trucks.....	Jan. 1960

OTHER GENERAL BULLETINS

Basic Winter Driving Rules.....	Reissued annually
Heat Exhaustion.....	Reissued annually
Accident Costs.....	Issued as needed
Points of Safe Conduct.....	Issued as revised
*Key Programs	

EXHIBIT II GRANITE CITY PLANT HOUSEKEEPING

October 1954—

The first step toward orderly housekeeping was the establishment of safety lines to identify aislesways in the production areas of the plant.

November 1954—

Housekeeping conditions were reported by plant patrolmen on their Patrolman Watch Reports. These items were occasionally organized into a housekeeping action report by the safety supervisor and sent out to all supervisors.

October 1955—

A Housekeeping Committee was formed to make housekeeping inspections, and report their findings to the supervisors involved. This committee consisted of the safety supervisor, plant superintendent, plant engineer, and production control supervisor.

February 1956—

The activities were stepped scheduled and signed to serve

January 1957—

Housekeeping defined by the safety supervisor

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February 1956—

The activities of the housekeeping committee were stepped up. Regular meetings were scheduled and other staff members were assigned to serve on the committee.

January 1957—

Housekeeping responsibilities were clearly defined by the Granite City staff and the safety supervisor.

April 1958—

The Manufacturing Superintendent assigned housekeeping inspection to area foremen.

May 1958—

Our housekeeping program was intensified. Color slides of housekeeping conditions in

the plant were reviewed by the Granite City staff after each inspection and then by all manufacturing and maintenance supervisors.

January 1959—

Management concentrated on improving the switch board area, compressor rooms, the propane farm system, pumphouse, and other isolated areas.

January 1960—

Elimination of all homemade employee's conveniences such as benches, shelters, salamanders, etc.

July 1960—

Repainting all work areas and machinery. aisle lines and storage areas.

MODERN ROLE OF THE SAFETY SPECIALIST

By CHARLES A. CRAFT

George Fry and Associates, Management Consultants, Chicago

The subject of safety is not foreign to me or to virtually any layman. In fact, it has been pounded into us at every turn from the time we were able to walk and to understand. With all the exposure we have had, we should know all about safety. But, we certainly don't act like it! We're the ones (calling ourselves grown men and women), who are so "unsafety conscious" that we

—find ourselves in the middle of a busy intersection, after the light has turned to green without having looked either way.

—neglect to connect the ground wire on a power tool.

—drive at 70 miles an hour on a toll-road, two lengths behind the car in front of us.

Suddenly it all became clear! I realized what this five-day meeting and the 103-page program was about. It's a dire plot! Half spend their time plugging up the structural and mechanical weaknesses to make us complacent so that the other half can spend *their* time bombarding us with posters and slogans to overcome our complacency. It may not be modern, but it's a good "racket."

Seriously, I suspect this is one of your biggest problems. The better you do your job, the more complacent we become, and the more we take you for granted.

When we talk about something being "modern," we imply a change has taken

place. I am sure we will all agree that, in general, our lives and our environment have changed—so much, sometimes, that it is almost frightening. To determine his modern role, a safety specialist is primarily concerned with changes that have taken place within his own environment, with respect to the specific company for which he works and the people with whom he deals.

Since as an individual you are, or should be, most familiar with the changes that have taken place within your own specific environment, it may be presumptuous for me to talk to you on this subject. But, in case some of you have not recognized the changes, or have interpreted changes to be more far-reaching than they really are, I will proceed with my analysis.

Each company, of course, is different and because of time limitations, we can consider business and industry only in general.

It has been my experience that major changes have and are taking place in industry. For purposes of my presentation today, I have divided the changes into two categories.

As the first category, in general, business has become more sophisticated, larger in size, more diversified, more market oriented, more cost conscious.

The net results of these changes is that business is becoming more involved and

more complicated. More time and attention are required for areas directly related to the major objective of maintaining a profit for the stockholder. Consequently, there may be a tendency to spend less time in areas not as directly related to the end objective.

I am including safety as one of these areas. I am sure that there are many who are ready to challenge the assumption that safety is not an important factor in the ultimate profit goal and probably rightly so. But, remember, I said not as directly related as other areas. I am not necessarily defending this condition, but am merely stating it as a situation that at least is understandable — a situation to which you have contributed personally by the excellent progress in reducing the accident rate.

There has been a second category of change in business which is just as natural today as it was when the very small business first grew into long pants—when the owner was unable to maintain a close day-to-day contact with the individual worker because of the company's size.

To counteract the tendency to neglect those areas that may appear to be less directly related to the ultimate profit objectives and to better fulfill their objectives, management is doing more planning and organizing, developing or taking on more staff specialists, and establishing more controls.

Yes, we do find major changes have taken place, and are taking place in business in general. It is logical to presume that there have been and will be major changes in the role of the safety specialist—changes to make him more modern and more up-to-date with the modern business world.

I can cite several changes in the technical role of the safety specialist. For example:

1. In a company that has grown to a multiplant operation, the safety specialist may find himself in a different role, because he no longer has close contact with the production floor.

2. In some cases, the apparent large increase in the amount of claims has resulted in more time required of the safety specialist.

3. Also, in some cases, opportunities for reduction in insurance rates have become more apparent and the safety specialist is being used more in this respect.

4. Because of these changes, the location of the safety specialist in the organizational structure may have changed.

I am not going to dwell on changes of this type for several reasons:

First, they are not universally applicable.

Second, I don't know enough about your business to discuss them intelligently.

And, third, they are, to me, in themselves, relatively unimportant.

What I believe is substantially more important is that, regardless of the specific change in his role, the safety specialist must fully understand the ramifications of the change. While remembering his basic purpose, objectives, and goals, he must take intelligent and responsible action. For example, he must understand that because of growth, diversification, and more complication in general, it is not surprising that top management is paying less attention to his area of activity. If this is taking place, he must understand that the good job he and others have done to improve the safety record makes it even less surprising.

He must further understand the part he plays in the second category of overall change: better planning, better organizing, and more and better staff specialists. Top management is doing more of this because it is the logical way to make up for the lessening of specific attention caused by growth, diversification, and increased complications. The safety specialist, in this situation, must realize that as a staff specialist, he is expected to see that his function is properly and completely fulfilled: this is the reason for being a staff specialist.

Furthermore, if he does not feel that his function is receiving the proper relative attention in the over-all plan and organization he is expected to say so. To become effective, as in the case of any important function, the function of safety must have a proper definition in the organizational plan, and the related respon-

sibilities, and defined.

If this is a situation is to the safety specialist expected to "assume that" roughly analyze this is their because I have plans for and, believe it or not, percentage of the subject. I was not the

One danger change in his list, like anyone with the growth of sophistication is to forget the of his function changed, but purpose and one of them. diversification, tions in a machine in the same. Certainly faster, and so much human

Some of us, the organization with its effectiveness than with its objectives. Specifically to work safety specialist it be to engage the treasurer. The business sufficiently close the operations: contact or by to fulfill the would like to position in the

I am reasonable of most of you are common:

You, as a supervisor rather

Those in the given either is inferred, "the of the employ

sibilities, and authorities must be clearly defined.

If this is not the case, and the situation is to the detriment of results, the safety specialist, as a specialist, is expected to "speak his piece" and not to assume that top management has thoroughly analyzed the situation and that this is their last word. I dwell on this because I have seen some weak organization plans from the viewpoint of safety, and, believe it or not, a surprisingly high percentage with virtually no mention of the subject. I am sure, in most cases, this was not the intent of top management.

One danger connected with a major change in his role is that a safety specialist, like anyone else, may be so impressed with the growth, diversification, and sophistication surrounding him that he tends to forget the basic purpose and objective of his function. Many things have changed, but I am sure that the basic purpose and objective of safety is not one of them. Regardless of the size, diversification, sophistication, or complications in a business, the man and the machine in the shop remain basically the same. Certainly the elements are shinier, faster, and sharper, but I wonder how much human nature has changed?

Some of us, in considering our place in the organization, become more concerned with its effects on our place in the sun, than with its fulfillment of our primary objectives. I cannot generalize about specifically to whom in the organization a safety specialist should report. Whether it be to engineering, to personnel or to the treasurer is, in itself relatively irrelevant. The basic consideration is to be sufficiently close to the employee and to the operations affecting him, whether by contact or by influence, to be effective and to fulfill the basic purpose. However, I would like to talk about your general position in the company organization.

I am reasonably sure that in the case of most of you here today, two conditions are common:

You, as a safety specialist, are in a staff position rather than a line position.

Those in the line position have been given either in written form, verbally or inferred, "the responsibility for the safety of the employees reporting to them."

To a beginner in business, these two conditions appear to be at cross purposes and, unfortunately, many who have been in business for many years still fail to understand them. If you as an individual are having problems getting your messages across, this may be your trouble: possibly you have not given the subject enough thought or study.

To understand this condition, we must review some of the basic principles of organization. If you remember, I mentioned earlier that one of the changes that companies are making today to counteract the lessening of top management's attention to specific functions is to improve on and increase the number of staff specialists. This is one of the reasons for staff specialists, but there is a more basic reason.

There is, or should be, in your company, a direct line from the top production man down to the employee on the bench: a line of specialists in the field of producing a product. The man at the bench is the real production specialist and as we go up the line, the scope of supervision broadens as does the requirement to co-ordinate the actual production operation with other areas essential to safe, economical performance.

So, basically, we have a production line manned by individuals who are, in varying degrees, specialists in producing and in co-ordinating. These men are dealing directly, day in and day out, with equipment, materials, facilities and people for the fundamental purpose of producing products according to schedule. This is their forte, their specialty. And, in order to do their job effectively, they must have both responsibility and authority. Many would go even further and specify the need for full responsibility and authority.

Although most production line personnel have a working knowledge of supporting areas such as quality control, engineering, personnel, accounting, safety, etc., and some are at least semi-specialists in one or more of these areas, it would be impractical to expect them to be specialists in all of these areas, particularly with respect to the details. Nor could we expect them to have the time to perform the details involved.

The more basic reason for staff special-

ists is to supply specialized experience and time. How must they supply it? As a service to the line supervision! The line supervisors must retain the responsibility and authority, and too often, herein, lies the rub. Here communications and understanding often fail. Notice that I said "service" to the line supervision and not "servitude."

The staff specialist must function as a service to the over-all company as well. He must have an outlet through which he can recommend those changes important to the company as a whole without undermining the line organization—a large order, but a necessary and reasonable one if understanding, judgment, initiative, and ingenuity exist. In my opinion, at least half of the staff specialist's job is the same regardless of the specialty: namely "working effectively with people in a service capacity."

I have been discussing a fundamental and basic phase of business. I apologize to you who have found it repetitive, who already have a clear definition of line-staff relationships, and who have no major problems in this respect. To those of you who do have major problems concerning your dealings with the line organization, I suggest that you question your understanding of the relationship as it has been established and your related attitudes and actions.

I am not putting the entire onus on the safety specialist. The line supervisor has a definite share in the responsibility for making the relationship work, and the arrangement may be relatively ineffective if top management has not supplied the necessary education, clarification, and cooperation. But, I think it is significant that I have encountered a greater number of sub-standard performances among staff specialists which were caused by a failure to adjust to this relationship than those

sub-standard performances which were a result of lack of education, experience, or ability.

It was suggested that I also discuss "how the safety specialist can be of greatest value to management." I believe I have touched upon this subject throughout my talk so I am going to close with a summary of major points.

To be of the greatest value to management, I believe the safety specialist should:

1. Be a specialist! Study the field, learn the technical aspects, be creative, develop approaches, and trade ideas.
2. Analyze the current place of safety in his organization, determine the existence or lack of clearly defined responsibilities and authorities, and suggest necessary changes to management.
3. Re-define the basic purpose and objectives of his function. Consider his position in the organization *only* as to how the purpose and objectives of his function can best be fulfilled.
4. Keep management informed of the status of the accident records, of the related cost to the company, of the planned programs for cost reduction, and of the progress being made.
5. Study and thoroughly comprehend line-staff organizational relationship and the reasons for this relationship. Realize that to fulfill the basic purpose and objectives of his function, this relationship must be effective, and that a large portion of his job is to make it effective. To do so he must:
 - be a student of human nature.
 - be understanding of the responsibilities and problems of those with whom he deals.
 - be humble but responsible, and dedicated.
 - sell himself as well as his programs.

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THE PSYCHOLOGY OF ACCIDENTS

By JOHN MacIVER, M.D.

Asst. Medical Director, U. S. Steel Corp., Pittsburgh, Pa.

I should like to begin by locating what I have to say within a larger frame of reference. My overall philosophy of accident prevention is that it involves the whole person living within a total community within what has been called his "life-space." I would add the codicil that "no man is an island," that for the most part we do not live as individuals, but as groups, large and small, family groups, industrial groups, and all the rest. This total community—this life-space—may be quite safe, only relatively safe, or quite unsafe. No one would disagree with the assertion that we cannot be satisfied, despite our occasional triumphs, with the overall accident picture in our communities.

I am not concerned in this presentation with accidents in this total context. Rather, I want to "focus down" on one segment, the psychology and psychopathology of accident occurrence. Psychology I would roughly define as the study of behavior which is more or less normal or healthy or which "makes sense," as opposed to psychopathology, or the study of behavior which is more or less abnormal or unhealthy or which does not appear to "make sense."

It is in practice oftentimes difficult to separate behavior of the one sort from the other. In thus restricting myself I am eliminating vast areas of investigation and activity which have played a premier part in reducing the accident toll. This is the part played by engineers, chemists, hygienists, and public health workers in making our environments so much safer than they were in years past.

Let us imagine a community—and there are tens of thousands of them in this country—where great efforts and equally great sums of money have been directed towards the ultimate goal of a safe life for all—for child, and adult, and oldster; for housewife and workman alike. And still the accidents occur. Even though they occur less frequently than before, the toll stands out in clearer and more terrible relief within the framework of our healthier communities

—communities, where for example communicable disease mortality is virtually a thing of the past.

We might conclude that if our results do not quite measure up to our efforts, perhaps we have been neglecting one or more aspects of the problems we face. I do indeed think we have been neglecting the human animal—the fellow who gets into accidents despite all our work, energy, teaching, and admonition. I might add that just about all of the safety specialists I have talked with in recent years seem to agree on this point: we must in the future, and beginning now, endeavor to get a clearer understanding of the psychology and psychopathology of accidents, especially all those accidents that from an engineering and rules and regulation viewpoint have no business happening.

I am not in the position to set down the answers to this great problem. The answers lie first in the recognition of the psychological aspects of accidents and their prevention, and second in the recognition that a great deal of sophisticated and expensive individual and team research will be required. All that I should like to do is to suggest a few leads or possible directions for thought and discussion. A favorite word among researchers these days is "heuristic," which means, that a stated point of view is not given with finality, but in the hopes that it will lead to statements which are more precise and which have higher truth-values. The heuristic approach is, of course, as old as Socrates, and it is this approach which I am taking.

As a student of human behavior who is a psychiatrist, I might say a few words about mental illness and its relationship to accidents. I am not impressed by any overwhelming relationship between mental illness and accidents with the dual exception of alcoholism and mental illness among the elderly. By no means do I wish to deny some correlation between accidents and psychological disease of every type. However, and I want to underline the following as

a most important point, when a task is hazardous in small measure or large, people with psychological handicaps tend to be selected out of these tasks by either formal or informal procedures; and further, it is my impression that such psychologically handicapped individuals show some tendency to select themselves out of hazardous positions. Where superordinate or peer group or self-selection is for one reason or another only weakly operative, then, of course, the correlation between psychological handicap and accident occurrence becomes stronger in proportion to the complexity of the task and the hazards which the task presents.

If this has validity, another important point follows. If in fact there is a complex and in part hidden selection process which works in favor of minimizing the probability of accidents, why do accidents occur in this selected population?

I would suggest that accidents tend to take place when for any number of reasons, an individual who is usually a safe operator temporarily falls into the psychologically handicapped group, but continues at the same task. It behooves us, then, to bring to light temporary states of stress, to recognize them in ourselves and others, and to take appropriate steps to withdraw from the task until the stress is dissipated. This, I suggest, is what I believe more or less permanently psychologically handicapped individuals tend to do on their own.

And now, a few words on "accident-proneness," so called. Many people in the safety field who have investigated this concept—I think that I can include myself in this number—have recommended that the term be dropped, at least for research purposes or where terminological precision is required. There is little objection on the other hand to using the phrase casually in a descriptive sense. I can assure you that "accident-proneness" as a specific psychological entity becomes pretty elusive when one tries to pin down what it really means.

Some have suggested that the term "accident susceptibility" be substituted. "Accident susceptibility" takes into account all the factors, not just the psychological, which tend to predispose an individual to accidents or to protect him from them.

Let me proceed to what I think of as

a special difficulty we face in accident prevention in the light of normal human psychology. Human beings learn many things from repetition. There is a conditioning process; habits are formed; and we are thereby enabled to acquire multitudinous patterns of automatic behavior. This is behavior which we carry through, as we say, "without thinking." These habits are positively conditioned by actual repetition of the unit of behavior. There also exists a negative conditioning process. This is well illustrated in Mark Twain's witty saying that a cat that sits on a hot stove will never sit on a cold one. Let me make it clear that I do not want to minimize unduly the importance of relevance of negative conditioning by pain or minor accidents or admonition from any of a number of sanctioning sources.

Rarely an individual is born without pain receptors—that is, there is a neurologically-based inability to feel pain—and opportunities for negative conditioning from the environment are severely reduced. Such individuals are severely handicapped and accidental injuries become a serious problem.

There are, however, two great difficulties with negative conditioning in accidents. These are 1) Significant accidents—while in the aggregate they occur in great numbers—are quite infrequent in the life of the individual. And since there are so many things *not* to be done and to be avoided, even though the deleterious consequence, the accident, may be months or years away, the human psyche does not stay impressed by the negative sanction. 2) Negative conditioning is not nearly so conducive to psychological automation as is positive conditioning and the resultant active habit formation.

I can illustrate the dilemma by a fictitious colloquy between a harried mother and her probably male child. Mother: "Junior, don't do that." Junior: "Then what shall I do?" And Mother, her patience exhausted, counters with: "I don't care what you do, but don't do that." The mother in this dialogue, with whom we can all sympathize, has not provided a positive program for her young hopeful's self-assertive and exploratory drives.

Positive conditioning—*not* what *not* to do but what to do—allows for repetition and the development of patterns of healthy auto-

matic behavior toward gratification and approval a most important. As betw a knife into out an energy work on it," only far more generalization, more sense ps

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matic behavior, for the realization of inward gratification, and at times for reward and approval from one's fellows. This is a most important point for safety education. As between the precept "Never put a knife into a toaster" and "Always lock out an energy-producing device before you work on it," the second statement is not only far more powerful and susceptible to generalization, it is positive and makes far more sense psychologically.

This leads me to another point on human motivation and mastery. As humans we yearn to mastery, and at times we do not shrink from facing hazard, injury, or even death in challenging an at-times unforgiving foe—our environment, the world we live in. Perhaps this is seen most clearly in our recreational pursuits, but I believe the tendency goes far beyond recreation and sports. Man has had some of his very greatest moments while wilfully facing danger.

By the rule of opposites, safety is often thought of as dull, and safety procedures as unworthy. To invoke the little boy again, mother says, "Junior, be careful, don't do that," and the boy, with a touch of disdain born of healthy self-confidence, says, "I can do it," and does it. This is mastery. So with the mountain climber who challenges the mountain because "it is there," or the

experimental pilot and the spacemen. The drive for mastery, again.

What many lose sight of is that there is no one more safety conscious or conservative than the men who are engaged in what might be considered perilous enterprises. As Shakespeare has Hotspur say, "Out of this nettle, danger, we pluck this flower, safety." The result of the popular confusion between mastery and foolhardiness is the tremendous paradox that it may well be more hazardous to cross Times Square against the lights than to shoot off into space. Our challenge in safety education is to give free rein to the bent for mastery while at the same time to clearly distinguish between being the master and being the fool.

I have touched only superficially on a few points in this complex field of safety psychology. I would not ask you to agree with anything I have said; by the same token I would be immensely gratified if anything I have said perchance leads to further thought and discussion.

Let us give more and deeper thought to safety psychology. Our reward for giving this subject the attention it deserves, and applying what we learn, will be communities truly healthier to live in than any the world has yet seen.

COMMUNICATIONS FOR SAFETY—HOW CAN WE MAKE OUR SAFETY MESSAGES MORE EFFECTIVE?

By **LEE W. BAKER**

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Milwaukee, Wis.

Essentially, it seems to me, the National Safety Council and its auxiliary groups are among the most "communicatingest" organizations that I know of. They constitute a regular communicating machine, you could almost say, on the subject of safety.

On the general subject of communication, I want to mention some information I gleaned recently from the *Social Science Reporter*. An article in that publication dis-

cussed a University of Minnesota study of 100 companies regarding the pattern of "dropoff" in communication from the top down. This pattern was shown: vice presidents understand 67 per cent of what they hear from the board of directors and top management; at the general supervisor level, 56 per cent of the same information survives; by the time it reaches the plant manager, the level is down to 40 per cent;

among foremen, it dips to 30 per cent, and among individual workers, the level of understanding sinks to 20 per cent. In other words, one out of five messages from the top gets through to the men on the line.

What is the reason for this heavy loss in communication? And what can be done about it?

According to the Minnesota people, top management does not have a good understanding of the attitudes, opinions, ideas and suggestions of the people at the bottom of the whole business structure. Downward communication is only going to be raised significantly in its efficiency when top management acquires a better understanding of these factors.

One way to reduce the loss, it is suggested, is to cultivate good listening habits in everyone in the business—top management, general supervisors, plant managers, foremen and individual workers.

The article also pointed out that in verbal communication the mind moves faster than the voice. Most adults think four times as fast as they talk. The average American speaks at a rate of 125 words a minute among his family and friends, 100 words a minute in front of an audience. Yet most of us think at a "cruising speed" of 400 to 500 words a minute.

As a result, most speakers have trouble holding their audiences' attention. Most audiences "think circles" around speakers, and many get lost on tangents. Thus *learning from listening* operates at an average efficiency of only 25 per cent. Two days after a talk, you've forgotten three-fourths of what you heard. Well, there are some interesting facts for you to think about while you're cruising along at 400 to 500 words per minute ahead of my talking speed.

From those observations on general communication, let us move to the more specific subject—and my real topic—communication for safety.

Briefly, to start off, I'd like to say a word about our objective in this kind of communication. What are we trying to accomplish when we communicate for safety? Primarily I think you'll agree, this is the point of the subtitle: "How can we make our safety messages more effective?" Our real objective is to communicate effectively

with people—to communicate in a way that has an effect—that leads to a desired action or result.

This means that effective safety communication is that which has a result in people thinking more safely, in people acting more safely, in people living more safely. From the standpoint of industrial safety, and that is the concern of most of you, I think, your objective is to communicate so effectively that you see a really obvious and practical result through a reduction in severity and frequency rates.

If we accept this objective: let's think about how we are going to carry on effective safety communication to gain the objective.

There are a lot of ways to communicate. Media—we usually say, when talking of the various means of communication—are the way to get safety messages, and other messages, across to people. These media can be subdivided by the method of communication we use.

The first category I call environmental media. This is an unusual name—perhaps. Here I include such things as:

1. The absence of mechanical guards on machines—the lack of adequate warning signs—when needed.
2. Also—in the employee environment—careless, unsafe, behavior on the part of the supervisor.
3. These, of course, are negative aspects of environment communications. They can be turned around for the positive effect. Thus, the installation of all necessary mechanical safeguards and warning signs indicate the employee is working in an environment managed by people who believe in safety. Thus, also, the supervisor who acts in a careful and safe manner—avoiding for example, the temptation to temporarily forget safety in the interests of expediency when faced with a rush job—communicates the attitude of *safety minded management*.

The other media are less unusual and more commonplace. There are the visuals—the banners over plant gates or across large shop areas; films, both slide and movie; special exhibits and displays, preferably easily portable, so they may be moved from

one location to items to be w protectors.

The next m one—and cert munications o media, the use category are magazines and companies the folders, used : —letters to ex homes—special annual record of the past y accomplishments—visory manage

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one location to another; then there are the items to be worn—buttons, pins and pocket protectors.

The next media category is a very large one—and certainly widely used in communications on safety—it is the written media, the use of printed materials. In this category are employee publications — the magazines and newspapers issued by most companies these days — pamphlets and folders, used as employee handout material —letters to employees and mailed to their homes—special safety reports, such as an annual record of figures telling the story of the past year's accident trends and accomplishments—letters and reports to supervisory management.

Finally, there are the media of oral communications. These are the most common, occur more frequently than any other. And—if there can be a rating from the standpoint of importance — then I suggest that the oral media are the most important —can be the most effective.

There is more than one way I could substantiate this statement. One good reference source is a leading opinion research organization.

When *information* is the prime objective in employee communications, according to this report, printed media are best suited for the job . . . these are the employee publications, letters, bulletins and others referred to a moment ago. These media lend themselves to repetition, they can be easily distributed, contents can be controlled and adjusted to meet a specific situation.

But . . . when *motivation* is the objective, and certainly this is important in consideration of safety messages, the word of mouth communications better fills the bill. Person-to-person channels are adaptable to the individual employee's interests — and they meet his desire for participation . . . provide a direct feedback channel for the employee to express himself.

In the oral or person-to-person category are safety messages conveyed to employees in group meetings. These may be conducted by the supervisor or by a staff safety representative. The oral communications between the staff safety representative and the supervisor are important in conducting a total safety program. Uppermost in importance, however, is the supervisor—em-

ployee relationship. From the standpoint of safety messages this is the prime oral communication—it follows that the supervisor-employee communication is the No. 1 of any media.

All other communications are really a support program, to reinforce this personal safety communication with the supervisor.

Now two quick observations—one favorable to those of you who are interested in more effective safety communications, the other posing an obstacle.

On the favorable side, most managers rank safety a *must* in employee communications. This has been reported in a national opinion survey. In my own company, we conducted a communications seminar earlier this year. In advance of this, we sent questionnaires to plant managers on subjects pertinent to the seminar. One portion of the questionnaire asked the plant managers to look over a list of 23 topics for communications and rank them as very important, important, not very important. We found the entire group of managers ranked only three topics as very important for employee communications. One of these topics was safety. Management does want to talk safety.

Now—about the obstacle. Survey reports show that when employees are asked to state their information needs, the majority say, in effect, that they are well enough informed on safety. Yet there has to be constant communications with employees on safety—to keep the subject alive in employee minds. A recommended way to overcome this obstacle is to find ways to link safety with other subjects. Instead of straight safety reminders — such as, for example, "Work Safely" or "Drive Safely" —safety information can be linked with useful suggestions on handling materials, operating machine guards, good house-keeping—or with suggestions on how to improve driving skills, such as how to drive on icy roads, or who has the right of way in traffic circles.

In connection with the use of media I can't refrain from mentioning—and giving a high recommendation to—the extremely comprehensive "Everywhere . . . all the time!" program of the National Safety Council. This program—originally developed by Allis-Chalmers people following the

inspiration and urging of Mike Biancardi—demonstrates how to use a variety of media to make safety messages effective.

We would all like more dependable ways to weigh the effectiveness of the media we use. The search for testing effectiveness goes on constantly by people who work in every field of communication. We're somewhat in the position that John Wanamaker of department store fame was in . . . you know, he revolutionized merchandising through advertising, but he frequently said, "I know 50 per cent of my advertising budget is wasted, but I can never be sure which 50 per cent of it is."

Even though we can't be sure . . . we must always keep trying to find out. Comments and reactions of supervisors, employee feedbacks, studies and surveys—all can be helpful in determining the effectiveness of safety messages.

I have for your consideration what I've called—and not very originally, I'll admit—ten tips for effective safety communications.

The first of these ten tips is—

1. Know your safety communications objectives.

Your safety communications ought to be aimed at the main causes of accidents. These causes, I understand—stem from the human elements of the employee and supervisor—and from the working conditions.

Your objective should be to eliminate all lost-time accidents . . . to reach that magic "zero frequency" figure and hold it, through information, education, motivation and inspiration. The humanitarian aspects of this objective are obvious. The economic aspects, while not so obvious, are equally important . . . not only in the reduction in compensation costs, but also in the corollary point that a safe operation is generally a more efficient operation.

2. Establish your safety communications channels all the way from top management down to the individual employee.

Your safety communications must come from the top. This doesn't mean the president or board chairman must sign each piece of literature, but it does require an open endorsement by top management of the objectives espoused in your safety communications. Once you have this executive

endorsement, your superintendents and supervisors have some assurance that they can communicate with authority on safety matters, just as they can on other matters of management concern. Nothing undermines a foreman's safety efforts more than the uneasy feeling that his boss is going to "chew him out" for spending so much time on safety.

3. Encourage your supervisors to be safety supervisors.

A good portion of your safety communications should be directed at the line supervisor, to assure his alignment on the "safety team." In a well-run operation, the supervisor may be running a department which has a lost-time accident as infrequently as once a year or less. He may tend to take his employees' safety for granted in these circumstances. Actually, with this type of safety record, the supervisor knows a good deal about the principles of accident prevention. But he needs constant reminders to keep these principles in application. A good point for him to remember is that safety is a management obligation and he, the supervisor, is the first line of management. The Bell Telephone System uses a slogan which has become a way of life for employees . . . "No job is so important that we can not take the time to do it safely."

4. Remember, good safety communications is a two-way street.

Just as other forms of employee communications require some provision for registering employee reaction and comment, so do your safety communications. Nothing could hurt your accident prevention efforts more than a "so what?" attitude toward employee suggestions and complaints. The man on the job is often in a better spot to see and analyze hazards, and to recommend action before he or a fellow employee is injured. He must be convinced that his suggestions, his opinions are important safety communications.

5. Keep your safety communications flexible.

Naturally, any good communications program requires advance planning. And safety communications are usually timed to give vacation safety tips in June, winter driving suggestions in the fall, and so forth. But it would be a mistake to format an in-

flexible program justable to fit the rash of back injury should shift to dling, even though mitted to electricity scheduling. A safety communications for, when it becomes efforts are less they would be.

6. Use sound a message again

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flexible program which would not be adjustable to fit the existing conditions. If a rash of back injuries occurs, the campaign should shift to lifting and material handling, even though it may have been committed to electrical hazards in your original scheduling. A shift in the use of various communications media may also be called for, when it becomes apparent that certain efforts are less effective than it was hoped they would be.

6. *Use sound approaches to tell the same message again and again.*

Repetition of sound safety principles is the key to making accident prevention a way of life for your employees. These messages may be carried in different ways, from time to time, for variety's sake or to cover a portion of your audience which does not seem to be "getting the message."

But it is not necessary to "spin your wheels" looking for completely new and different treatment of accepted safety messages. It is not necessary to disguise a safety message as something else to make it palatable. Variety of approach should be used only to broaden the coverage of a message, or to remind the employee of what you have already been telling him.

Incidentally, I think a word of caution might be in order on safety communications: We must guard against the clever approach which completely obscures the point we are trying to make. There have been examples of this in television commercials . . . notably the Piel's Beer commercials which were very cleverly done. The "Bert and Harry" commercials won numerous awards from art directors and TV critics, but they did not make an appreciable contribution to the sale of Piel's Beer. I think the same rule should apply to safety communications—our objective is to prevent accidents, not to impress employees with our cleverness.

One more point on this subject of cleverness: There probably isn't a safety director alive who doesn't dream of the day he'll coin a safety slogan with the impact and appeal of "The life you save may be your own." I'm sometimes inclined to think our safety efforts today are too wrapped up in slogans . . . that we're too dependent upon slogans as a substitute for a well-rounded, effective communications program.

7. *Tell the bad with the good.*

This, like most of the other points, I've listed, is a basic tenet of employee communications. We don't like to talk about fatalities; we don't like to show that our frequency or severity rates are on the rise. But we must face these facts of life and communicate with our employees about them. When employees are given a two-color four-page report of a decreasing frequency rate, *they're entitled to some form of communication when the rate takes a climb.*

Some people shy away from comparative listings of frequency and severity rates. They feel that this makes one plant or one department "look bad" if its rates are higher than those of other departments or plants. It's true, it makes one department look bad in comparison with others. But failure to use these listings is failure to give credit to those departments or plants which are doing better than your company-wide average. In order to give credence to the good, you must also publish the bad.

8. *Get employees into the act.*

Employees want to feel that they are a part of the company's safety promotion efforts. Poster contests, monthly quizzes, discussion meetings are all part of the employee participation program. At Allis-Chalmers we've distributed silver dollars to employees who could correctly identify the safety "theme of the month," with additional dollars for the employee's supervisor when a correct answer was given, and even dollars for the employees' wives if they correctly answered a telephone quiz on the same theme.

9. *Localize the message.*

An advantage of monthly safety themes in multi-plant safety promotion campaigns is the volume printing and the resultant lower cost-per-unit of handout materials, posters, etc. This is offset, however, by a big disadvantage—if your monthly theme is electrical safety, the message may be pretty well lost on employees whose work is primarily concerned with material handling, or machining or any number of non-electrical occupations.

To compensate for this flaw, we have gone to a "library" of employee handouts on a variety of subjects. Some are of a

general nature. Some are of a very specific nature, of interest only to specialists in certain phases of our operations. But the result is that our supervisors can order the handout folders *they* think will be of greatest value to them in a given month. They are not saddled with printed materials on electrical safety while trying to combat accidents resulting from poor housekeeping practices.

10. *Spend money on safety communications, but keep your program under a magnifying glass.*

Like any other staff function, the safety department is under scrutiny by line people where costs are concerned. An old-line general superintendent is not going to look too kindly on an apparently flossy safety

promotion campaign at a time when he is being asked to cut his department's costs.

On the other hand, it takes money to do an effective job of communicating . . . printed matter, motion pictures, banners and other promotional materials cost money. In addition, employees' time costs money, when it means taking people off the job to view a new movie, or to attend meetings and other presentations.

The best advice I can give you here is to forego the flashy materials and concentrate on good, tested communications devices—the employee publications, the posters, the handouts, and the other techniques, which your experience has shown to be effective communications. Be prepared to spend money when you have to, and to justify the expense if it becomes necessary.

SAFETY ENGINEERING—A MODERN CONCEPT

By JOHN J. AHERN

Dir. of Security, General Motors Corp., Detroit, Mich.

- I. You can't steal second with one foot on first
 - A. All progress involves risks
 - B. Engineering and scientific progress have raised our standard of living beyond fondest dreams of our forefathers
 - C. Each new conquest of nature's secrets accelerates industrial activity and adds to the burden of the safety profession
 - D. Few timid souls
 1. Governors on cars
 2. Restrictions on reactors
 - E. Safety engineering must be ready to meet the challenge
 1. Move forward—we can never stand still
 - F. This means a higher degree of technical competence
- II. Approach
 - A. How does safety engineering meet this challenge?
 1. Education
 2. Research
 3. Intelligent application of present knowledge
 - B. Education
 1. Great impetus by ASSE Committee on Cooperation with Engineering Colleges in early 1940's
 - a. Joe Stennett, chairman
 - 1) Suggested curriculum—graduate primarily
 - b. Conferences with engineering administrators
 - c. Schools
 - 1) Illinois Institute of Technology
 - 2) Texas A&M
 - 3) Georgia Tech
 2. Phenomenal progress—very few engineering schools today without some safety instruction
 3. Our goal—every graduating engineer safety oriented
 - C. Research
 1. Weakest part of our approach

2. Some hasn't
3. Equipn
 - a. Saf
 - b. Wi
 - c. Saf
4. Transp
 - a. Sea
 - b. Hig
 - c. Air
5. Industr
 - a. Ver trial
 - b. Exp
 - c. Exc
 - d. Aut activ
6. Accider on stati
 - a. How
 - b. Let's be a
 - c. Stat can
- D. Intelligent : edge
 1. First—
 2. *Heinric* in which son wit another sure of stances, tions, o person

Mgr.-Indus

With world ten today it may be our attention on

2. Some improvement but the surface hasn't been scratched
 3. Equipment
 - a. Safety shoes
 - b. Wire rope
 - c. Safety goggles
 4. Transportation
 - a. Seat belts
 - b. Highway construction
 - c. Aircraft crash
 5. Industrial
 - a. Very little on ordinary industrial accidents
 - b. Explosion features in ovens
 - c. Exotic fuels
 - d. Automatic Sprinkler Co. — fast acting sprinklers
 6. Accident analysis—lengthy reports on statistics
 - a. How many? — But why?
 - b. Let's not be record-keepers but be analysts
 - c. Statistics are only good if they can prevent future accidents
- D. Intelligent application of present knowledge
1. First—what is an accident?
 2. *Heinrich* "An accident is an event in which (a) the contact of a person with an object, substance or another person, or (b) the exposure of a person to objects, substances, other persons or conditions, or (c) the movement of a person causes personal injury or suggests the probability of such injury."
 3. *Webster*: "An event that takes place without one's foresight or expectation, esp. one of an afflictive or unfortunate character; a casualty..."
 4. Is this modern accident prevention?
 - a. Trim press—new job—old guard—fingers severed?
 - b. Is this an accident? Was it an unexpected event?
 - c. Only unexpected feature—timing!
 - d. Working on machine without locking-out. (same questions above)
 - 1) "Accident" masks our inability or reluctance to think through all the possibilities in an operation
 - 2) Better term: "predictable event"
 - e. Example: high pressure, airless spray guns
 - 1) Potential there from the beginning—good manufacturer — good development — no safety research
 5. Basically we are not doing as good an engineering job as we are capable of—nor are we communicating what we do know to the people who need the information
- III. This meeting is an opportunity to take stock and by improving our performance to enhance the stature of safety engineering.

DYNAMIC SAFETY CRITERIA— AN ENGINEERING APPROACH

By WILLIAM A. McADAMS

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Schenectady, N. Y.

With world tensions at the peak they are today it may be a little difficult to focus our attention on the dream world of the future. But that is what I would like to do. I would like to paint a picture—a picture which may seem more like a fantasy

than anything else—but a picture which I believe will be a reasonable facsimile of our world of the next generation.

Most of us will be in this picture—probably in retirement—and we will have some trouble recalling just how things were back in 1961, because our whole pattern of work and play will be completely changed.

Our homes will be masterpieces of convenience with replaceable walls, luminescent ceilings, wireless appliances and completely automatic temperature, humidity and ventilation control. We will wear disposable lounge and work clothes and use ultrasonics to wash our fancy clothes and dishes. We will have specially processed foods in concentrated forms which will be cooked in minutes by electronic ovens.

Our morning mail will contain letters written only moments before and transmitted electronically to a neighborhood message center. Guided missiles will provide us with almost instantaneous transport of packages and freight.

Guided missiles will also replace our jets for long distance passenger travel. We will solve our local transportation problems by personal land-sea-air vehicles that can be keyed to automatic routing systems by dialing the point of destination.

We will be well on the way to controlled climate. This will be accomplished through the development of methods for retaining or dispersing the heat of the sun. We will harness the winds, the waves, and the tides.

Atomic energy will become our chief source of energy and we will use it for all forms of transportation. We will have compact atomic power plants in our homes and factories. We will also develop new sources of energy and methods for direct conversion of one form of energy into another.

Advances in medical science will all but eliminate the major diseases such as cancer and heart disease. Better and more complete medical records plus data processing equipment will make it possible to diagnose and prescribe treatment for illnesses with greater accuracy and more effectiveness. New techniques for handling injuries will reduce fatality and permanent disability rates.

Our progress in plant chemistry and biology will be equally spectacular. New fer-

tilizers and growing techniques will permit us to harvest huge crops from small areas in shorter growing cycles, and with a variety of substitutes for soil. We may even find a practical biological or biochemical generator to produce energy, food, and raw materials simultaneously.

As we continue to use up our natural resources we will be faced with all kinds of shortages in materials. We will solve these problems by new synthetics and, eventually, by modern alchemy in which we change basic elements to others of our choice by transmutation.

Maybe these predictions of things to come seem like delusions, but almost all of them are known to be technically feasible right now, and many have already been demonstrated at least on a small scale. Maybe we won't accomplish it all in the next generation, but the chances are good that we will do this and more besides.

It would be nice to say this wonderful world of the future will be devoid of safety hazards. Much as we would like this to be true, it is not a very likely prospect. Nevertheless, if we make our safety criteria as dynamic as our technology, every year ahead will be safer than the previous one.

Now, what do we need to do to develop the kind of safety criteria that will enable us to keep abreast of these rapid changes in technology?

Few men in the past have had the sagacity to see the scientific and industrial growth that was immediately ahead of them. As a result, advance planning has rarely been adequate even for relatively short periods, and we have grown accustomed to a constant race to keep up with the times. In this respect the performance in safety has been no better than in any other field.

Therefore, we must be future-minded. We must know where science is leading us and we must understand the fundamental principles involved. It is obvious that none of us can become expert in all of the many scientific disciplines, but we can learn enough about the new developments to visualize their future applications.

Once we have a basic understanding of the new scientific developments we can then begin to recognize the potential hazards of the future. The world I have described will be full of new materials, strange phe-

nomena, and unknown hazards. There will be new noises, new and new traumas we have to identify, we have to know how to react to each of them before we establish criteria for safety. We must apprehend the hazards sooner we can prevent them.

Safety is no longer a proposition. We must turn our attention to hazards. Later on it will be necessary to seek out the hazards and ways to keep away from them by these hazard safety programs, personal protective programs, and safety facilities and equipment. There is no stalling. There is no engineering.

Now this situation. We have started to consider the atomic example. From scientists and engineers of ionizing radiation into account in a design did they design during operation, maintenance equipment as well. The disposal of waste and processing of by-products. This philosophy continued through atomic energy in many reason why radiation injuries.

Our rapid growth of tremendous "print" safety. I furnish us with techniques which we must as present become obsolete. systems of the future for built-in safety.

This trend to safety does not continue all of our

omena, and unnatural forces of all kinds. There will be new poisons, new irritants, new noises, new vibrations, new radiations and new traumatic hazards which we will have to identify and deal with. We will have to know how the human body will react to each of these changes in environment before we can prescribe the proper criteria for safety. The earlier we comprehend the hazards of the future; the sooner we can prepare for them.

Safety is no longer an "after the fact" proposition. We used to pay little attention to hazards until someone got hurt. Later on it became common practice to seek out the hazards and to find the best ways to keep people from being injured by these hazards. Under this kind of a safety program the emphasis was on personal protective equipment, safety training programs, and special devices added to facilities and equipment after they were installed. There was little real safety engineering.

Now this situation is beginning to change. We have started to "blueprint" our safety. Consider the atomic energy industry as an example. From the very beginning, the scientists and engineers recognized the hazard of ionizing radiations and took them into account in all of their plans. Not only did they design the reactors to be safe during operation, but they provided built-in maintenance equipment and emergency devices as well. They also planned for safe disposal of wastes and for safe handling and processing of the radioactive products and by-products removed from the reactors. This philosophy of engineered safety has continued throughout the expansion of the atomic energy industry and it is the primary reason why there have been so few radiation injuries in the industry.

Our rapid growth in technology will give us tremendous opportunities to have "blueprint" safety. The technology itself will furnish us with unlimited new safety techniques which we can exploit to the maximum as present facilities and equipment become obsolete. Furthermore, the automatic systems of the future will be ideally suited for built-in safety devices.

This trend toward blueprint, built-in, safety does not mean that we should discontinue all of our traditional safety meth-

ods. We have only to picture the U. S. astronauts, Alan Shepard and Virgil Grissom, to recognize that the best of built-in safety will not always be enough. Shepard and Grissom were provided with quite a collection of personal protective equipment and were given thorough training for every conceivable hazard they might encounter. There is no question that personal protective equipment and training will continue to be important parts of our safety programs, but they will become, more and more, a second line of defense.

As far as protective equipment is concerned, most of that in use today will have wide application for many years ahead. However, some items will have to be redesigned and made more efficient. For example, I can see quite a need for respiratory masks in the next generation, but they will undoubtedly have to be equipped with canisters for different kinds of dusts and poisons than we have now.

Also if we can believe our space researchers, face masks may have to be designed for beards, because spacemen may not be able to shave. According to the experts, shaving soaps will harm the bacterial digestion system of the space ship and whisker fragments from an electric razor will create a major dust problem. Of course, there is a good chance that our expanding technology will solve this problem with a way to keep whiskers from growing.

There is one great pitfall in all of this talk about the novel and unusual hazards of the future. If we are not very careful, we will become so involved with the glamorous new problems, that we will overlook the familiar hazards that have plagued us for generations.

For example, every year 18,000-20,000 persons in the United States are killed by falls. The frequency rate has declined slightly over the years but the total deaths from this cause is about the same as it was half a century ago. It is also interesting to note that, in the atomic energy industry which I discussed a moment ago, more people are injured by falls off ladders than by the radiation which has been given so much publicity.

Thousands of other people are killed each year as a result of burns, suffocation, drown-

ing, falling objects and other accidents common in everyday living and largely the responsibility of the individual. Life in the future may be more comfortable, but many of these same hazards will continue to exist. So in the technological growth ahead, let us be sure to give attention to the commonplace.

One of the most difficult problems in establishing safety criteria is the determination of acceptable risk. Some persons will insist that we are never justified in taking any risk which may result in loss of a single life, but it is obvious that a world predicated on this philosophy would not only be stagnant, but it would be less safe at the same time. On the other hand, we are not justified in taking a risk if there is a practical way of avoiding it. It requires considerable good judgment to decide what is practical, and time and cost are probably the most important factors involved.

Let us consider the hazards of electricity as an example. Every year about 1000 persons in the United States die as a result of electric shock—a death rate of about 0.5 per 100,000 population as compared to about 21 for automobiles, 10.5 for falls, 3.6 for drownings, 1.3 for firearms, and 0.6 for poison gases. This is truly a remarkable safety record when we consider the extent to which electricity is used in the United States.

But are we willing to accept this death rate as an acceptable risk for the use of electricity? The answer is not a simple yes or no. We are constantly eliminating electrical hazards but we are also constantly expanding the use of electricity with more applications, higher power levels, and greater distribution of electrical equipment. The death rate has been going down, but we may soon reach a point where a further reduction can be achieved only by a significant increase in cost of electrical products and services, or by a delay in promising new electrical advances. In this case, the public will consider the alternatives, and decide if the risk is worth taking.

In our pursuit of the invisible and the unknown, the determination of acceptable risk will become extremely complex. We will not always be able to perceive the hazards, and we may not even be sure that there are tangible benefits ahead. There

are bound to be disagreements as to whether risks in a particular situation are justifiable, but I think we must accept the fact that we will have to take some risks—even some blind risks—to make any substantial amount of progress. After all, our aspirations for the future lie in our investigations of the things we do not understand now.

I am not suggesting that we plunge ahead carelessly without any regard for hazards. I think it is rarely necessary to do that. The first nuclear reactors were built for military purposes at a time when the country was at war and at a time when there was a good chance the enemy might produce an atomic bomb before we could. This was a case where we had to be first—and we were. But we were first—and safe—at the same time.

I believe that we can achieve most of the wonders of the future with no more risk than we have taken in the atomic energy field, but there will be situations where it will not be possible to do this without intolerable delays. The promising world of the future will surely be a safer world and we can afford to take a few short cuts to get there.

Now I have described a fantastic world for the next generation and I am convinced that we have an excellent chance to make this amount of progress. Several years ago David Sarnoff, the well-known chairman of RCA, made the statement that our technological achievement during the last 100 years was greater than in all the thousands of years that preceded. Certainly we should expect an equivalent achievement in the next 20 or 30 years, for knowledge breeds more knowledge and growth in knowledge is a geometric progression or more.

In the face of this progress we must reappraise our whole safety effort. In the course of doing this we must be future-minded and comprehend the hazards of the future.

We must blueprint our safety, but in doing so, we must not abandon our old-style safety, and we must give attention to the commonplace.

Finally, throughout all of this we must develop a proper risk philosophy.

If we do these things, our safety criteria will become as dynamic as our technology and we will be able to survive our progress.

We do make war against industry. Take for example. It was right we first started scientists about annihilate an through pestilence the science progress. Yet, des today we are in only one area; vision sets.

I have been formation concerning Underwood Co believe you will

The accidents will all contain tion, but will be triggered by a t act, of an individual mind that substitute industrial accidents and about 11 per cent conditions mechanical hazards 11 per cent but into the 88 per acts.

For the purpose I would like to cident situations we will discuss accident, then, the set up and repair sion" accidents, the handling and finally "process c

Now, as we take mechanical accidents about guarding a many respects like "one best method background knowledge such thing as the method is the best one can be found unobtainable in the

MECHANICAL ACCIDENTS

By ROBERT P. BARROWS

Safety Dir., Underwood Corp., Hartford, Conn.

We do make progress in the ever-present war against industrial accidents, but slowly! Take for example the case of germ warfare. It was right after World War I when we first started hearing reports from the scientists about germ bombs which could annihilate an entire city's population through pestilence. With each passing year, the science prospered and the threat grew worse. Yet, despite all this progress, even today we are faced with germ warfare in only one area; on the screens of our television sets.

I have been able to develop some information concerning mechanical hazards at Underwood Corp. in Hartford which I believe you will find helpful.

The accidents we are going to talk about will all contain an unsafe mechanical condition, but will often be augmented, or even triggered by a thoughtless action, an unsafe act, of an individual. It is well to keep in mind that substantially 88 per cent of all industrial accidents arise from unsafe acts and about 11 per cent from unsafe mechanical conditions . . . By eliminating the mechanical hazard, we not only prevent the 11 per cent but make important inroads into the 88 per cent caused by improper acts.

For the purpose of our talk this morning, I would like to break down mechanical accident situations into five categories. First we will discuss the "point of operation" accident, then, those associated with machine set up and repair; next "power transmission" accidents, those arising from materials handling and storage operations, and finally "process control" injuries.

Now, as we talk about these five areas of mechanical accidents, we will be talking about guarding a great deal. Guarding is in many respects like the industrial engineer's "one best method." Those with an I.E. background know that there is really no such thing as the one best method. Any method is the best one only until a better one can be found. Omniscient perfection is unobtainable in methods work. The same is

true for mechanical guarding. There is no such thing as a perfect guard, nor is there any guard that cannot be improved upon.

In developing any guard, we first look over the work place, watch the operation, study the machine tool, look for the hazards and then determine mechanical means of minimizing them. But this is only the very first step. Improving that guard means calling on all of the talent available for improvement. The next man that comes along to look at your idea may have just enough of a different outlook to come up with a substantial improvement. So never become over-sold on the ultimate superiority of your own guards.

Now let's look at some examples of the five types of accidents and see if we can develop some general rules from the specific solutions offered.

Specific Examples

As I mentioned, the first examples will be concerned with "point of operation" accidents. Our first case deals with a drill press injury, more specifically, burr removal using free hand methods. In all metal working operations, it is generally necessary to remove the accumulation of flash or excess metal which builds up on the far side of a punched or drilled hole. Such de-burring jobs are usually very fast light operations where only a minimum of effort is required to break the burr. Often it becomes desirable to hand-hold the part as it is brushed against the working surface, rather than going to the cost of locating it in a fixture each time. In this particular injury, however, a common twist drill was being used as a burring tool. The part caught on the drill, tore out of the operator's hand, spun one revolution and struck the back of her hand.

Injury in this case resulted in lacerations and contusions to the middle and ring fingers of the left hand. Various solutions are available to prevent reoccurrence. Dial or automatic feeding of the parts or special fixturing of the part might be feasible

depending on production costs. The cheapest and easiest way would be to use a safer tool. Use of a sleeved drill, a burr, or a Weldon tool would maintain high production rates and yet protect the operator.

The next accident involves milling cutter guarding and two-hand controls. Actually there was no accident here but a "close call" incident was reported by a time-study observer. Here the operator was running a two-sided miller. The first piece was loaded on side A, the fixture jaws were closed mechanically and the milling cut started, thus automatically opening side B where the operation was repeated. Because of the single switch used to activate the machine, it was felt that greater safety was needed. As a result of the investigation, full enclosure guards were developed, and two-button control was substituted, requiring that both hands be out of the machine before it could be activated.

As a result of this change it was no longer felt necessary to stop the machine after each cut, and as a bonus for this improvement, an 1100-dollar per year savings in production cost was realized. The company fared well here in terms of a reduction in the cost of operations. The operator fared even better, inasmuch as this task was made less fatiguing and also considerably safer, thus reducing the level of tension.

The next example concerns non-standard operations of a power brake. This improvement came as a result, not of an accident, but of a potential accident turned up by an inspection committee. Here the operator was cutting steel strip stock to various predetermined lengths, using the single start button furnished by the manufacturer to activate the shear. Because of the varying nature of the stock in terms of width, thickness and length of cut, barrier guarding became very difficult. The guarding requirement was for relatively universal application, easy set-up and low cost. Such guarding requirements are not unusual.

Many safety directors find themselves faced with the proposition that 85 per cent of company profits are derived from about 15 per cent of the tooling. These tools are usually high performance multi-stage tools which can absorb relatively high costs for proper safeguarding without budgeting diffi-

culty. The problem arises with the much larger number of low production tools. Some of these tools may make a contribution to gross earnings of only five to fifty dollars per year. Yet they must be retained in the line because of customer demand, need within the product, or other reasons.

Here guarding becomes a more difficult problem from the financial standpoint. It is unprofitable to spend 250 dollars to guard a tool which possibly contributes only 25 cent to net profit. This is where the universal guard comes into play. Such a device would be permanently attached to a machine, not a tool. It can be rapidly readjusted as various tools are placed in the machine. A type of universal guard proved to be the answer to this power brake problem. Attaching a pull-out device to the lever arm of the brake, which was connected by wristlets to the operator's hands, it was possible to maintain an adequate degree of safety without a profit-cutting investment in hardware.

Machine Set-Up and Repair

Our next area of discussion is machine set-up and repair operations. Here we are getting away from the very repetitive easily guarded operations, but rather a collection of very unrelated tasks. However, by studying accident trends, we see that injuries here result from rather similar portions of activities. Take for example the screw driver that slips and causes a laceration of the hand. We see this injury cropping up time and time again. Generally, there is no injury or at least no serious injury. But each time, it happens because of the same two causes. First, the screw driver did not properly fit the slot. Secondly, the operator was not sufficiently aware of application of pressure and safe placement of his other hand or body part.

Preventions here can be obtained by:

- 1) Regular inspection of screw drivers for condition and training of screw driver users in proper fit, and
- 2) Development of risk awareness in the use of a screw driver.

The first goal could be much more easily attained if there were specific standards to work to, but unfortunately, although the screw driver is probably the most common hand tool in daily use by millions of our

citizens, there is at the present time screw slots or blades.

The next accident involves adjustable wrench while the operator was causing his finger to be caught in this case the wrench and contusion necessitating several solutions to the

First, special wrenches, rather than eliminate the multi-handled wrench, their place. The indoctrination of the worker and main second requirement use of tools, so the direction of force is from the

Power Transmission

Next we come to machine shafts, spindles, mitting hardware, the guard on drill presses. These machines are becoming more and more well guarded as machine tools are being new. Also require removal. Consequently, a involvement injury

I am happy to search of our injuries that they protect against. another possible injury, but we quite unpopular to maintain 100 find it is easier the Garden of Eden up a sign saying

The infrequent conveyors always unguarded. On removing cartons discovered, follow where a foot caught and drawn in under

citizens, there is not an accepted standard at the present time governing the width of screw slots or the dimension of screw driver blades.

The next accident concerns the use of an adjustable wrench. Here the wrench slipped while the operator was tightening a bolt, causing his finger to strike a sharp edge. In this case the result was a serious abrasion and contusion to the right little finger necessitating several days' lost time. The solutions to the problem are several.

First, special purpose tools, such as end wrenches, rather than adjustables would eliminate the mis-adjustment problem. However multi-purpose tools certainly have their place. The requirement is to properly indoctrinate the need for accurate adjustment and maintenance of condition. The second requirement is training in the proper use of tools, so that pressure is exerted in the direction of the shank rather than outwards from the jaws.

Power Transmission

Next we come into the area of guarding shafts, spindles and other power-transmitting hardware. The first example concerns the guarding of powered spindles on drill presses. Currently most of these machines are being built so that most revolving and reciprocating parts are pretty well guarded at the factory. But many machine tools in use today are far from being new. Also adaptations to special use require removal of the furnished guards. Consequently, a potential for hair and scalp involvement injury is developed.

I am happy to be able to say that a search of our records showed no recent injuries that the guard was designed to protect against. Hair nets, of course are another possible answer to this type of injury, but we have found that they are quite unpopular and therefore it is difficult to maintain 100 per cent enforcement. We find it is easier to remove the apple from the Garden of Eden, rather than to hang up a sign saying "Do Not Eat."

The infeeding end of power roll conveyors always poses potential hazard if unguarded. On a floor conveyor used for removing cartons of finished machines, we discovered, following installation, a point where a foot could be inadvertently placed and drawn in under the conveyor. Installing

a steel shield was quick and inexpensive. It did not interfere with operation in any way. Yet it meant the elimination of a potentially serious accident which could have occurred at any time.

Material Handling and Storage

Our first example in the area of material handling involves the loading of a trailer truck. Here gravity fed sections of a portable conveyor were set up inside the trailer to facilitate the loading of finished machines. The operation was safe in all but one instance. The regular dock board used to bridge the small space between the platform and the truck had been temporarily removed. A make-shift piece of boiler plate was obtained and used in its place.

After completing the loading, the operator forgot the makeshift condition. He backed out dragging the last section of conveyor with him. Since there was no curb on the boiler plate, he missed his footing and stepped off into air between the truck and the platform. The space was only about eight inches wide. His leg slid down its full length and the conveyor landed in his lap. He suffered from very painful strain to the groin and abrasions to the thigh and stomach. A more proper awareness of the danger of make-shifts would have made this trip unnecessary.

Storage of grinding wheels can become a delicate problem. At Underwood, many of our tool grinders like to maintain their own inventory of grits and shapes of wheels dressed to their own particular "feel" or taste. This is socially desirable, since it contributes to pride of workmanship. However, storage of these wheels at the workplace can constitute a problem. If they are not carefully protected against shock, cracks can develop which can cause a wheel to explode when it is started up.

Consequently, special storage racks were developed for each tool grinder so that safe storage could be maintained. These racks, of course, do not reduce in any way the need for the other grinding safe practices, such as the use of front guards, vision shields, safety goggles, and the need for "ringing out" a wheel with a wood mallet prior to each installation.

The third item under material handling concerns an operator who was checking out an overhead conveyor on a trial run, prior

to installation of the guarding. He moved under a descending section of conveyor to more closely inspect the action of one of the moving carriers. While thus preoccupied, the next carrier came along and struck this maintenance man lightly on top of the head, causing him to lose his balance, fall against the wall and onto the floor.

This was not a serious injury in itself. In fact it was hardly more than an incident. But it served to put everyone concerned on notice of the potential hazard of even temporarily unguarded conveyor.

Control-of-Process Type Operations

We next come to the area of process type operations, such as electro-plating and heat-treating.

The first case concerns the handling of highly corrosive acids in carboys. For many years, we have been purchasing our sulphuric and nitric acid in wooden cased glass carboys. No unusual incidents had been reported until one day we heard that a trucker, while setting a carboy down from his hand truck, heard the glass begin to crack. He stepped back away from the acid so that the only loss was from parts and equipment damaged by the acid and time spent in clean-up. However, a cursory investigation of alternate methods turned up a new piece of equipment which could prevent a repetition with more serious results: a polyethylene liner contained in a steel drum. This new type of carboy makes possible better handling methods and more efficient storage with no added cost and, most important, no potential breakage.

Conclusions

We have now seen the specific examples. What can we develop from these in the way of general rules? I would like to suggest the following, starting with the simplest possible rule, and proceeding to the more complex:

- A. Change the Operation
 - Eliminate the job
 - Alter the part design
 - Change the method of performance
 - Improve the job layout
- B. Improve the Tooling
 - Automatic parts feeding (vibration, air, etc.)

- Improved loading devices
- Better handles on fixtures
- Easier nesting
- Reduced cutting surface
- C. Keep the Operator's Hands Out
 - Remote feeding devices (dual, slide, chute, automatic)
 - Barrier guards (covers, duckboards, etc.)
 - Two hand controls
- D. When Guards are Necessary
 - 1. Make them simple and cheap. The fewer the parts, the fewer the failures. Obvious purpose discourages misuse.
 - 2. Let them help the operator. They should not make the job more difficult or awkward.
 - 3. Don't build in booby traps! Avoid additional pinch points such as machine part that closes on guard when cycled, or hole between truck and platform.
 - 4. Design them to be fail-safe. Plan for one in ten thousand or one in a million failures. Design guards so the operator is still safe when the failure occurs.
 - 5. Plan two independent mechanical or other devices. Require simultaneous failure of both to result in incident.
 - 6. Keep up the good work. Use the three "e's" of safety, engineering, education and enforcement. Once the guards are developed, (engineering) and the operators are taught their use (education), be sure to take advantage of the third "e" (enforcement).

Summary

Safety only starts in the safety office. Desirable follow-through requires effort on the part of everyone. Make sure that you are taking full advantage of all of your allies in the accomplishment of the safety effort. Some of your allies will be found in the line, for example the plant manager, the foreman, the set-up man or mechanic and most important, the operator himself.

Utilize fully the available staff organization. Such specialists as the time study or methods engineer, the tooling engineer, the

tool maker, an even the janitor gestions to im terms of bett twelve Disciple good safety coo to make operatic You can never attitude which :

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pool maker, and the machine repairman, even the janitor, can make invaluable suggestions to improve the safety effort in terms of better guarding. Just as the twelve Disciples were fishers of men, a good safety coordinator is a fisher of ideas to make operations safer.

You can never afford to have the superior attitude which say, "Joe, with his routine

job and low I.Q., sure can't tell me anything about doing this job." Maybe Joe, from his vantage point has made the one observation necessary to turn a good guard into an excellent one. Take the time to listen to the people that want to tell you something. It never hurts to give people recognition, and their advice will help you in avoiding the safety boondoggle.

REVIEW OF SIGNIFICANT ACCIDENT CASE HISTORIES, ELECTRICAL ACCIDENTS

By **HERBERT J. METZGER**

Safety Dir., Orange & Rockland Utilities, Inc., Nyack, N. Y.

Electrical accidents occur in many varieties, some of which are spectacular, most are not. This talk could have been made very interesting by describing and picturing spectacular high voltage accidents and their results. This type of accident and exposure is confined principally to a comparatively small part of our population, utility men and others who deal with these voltages.

We are here not to be shocked or entertained but to learn more about the business of preventing injury and death. We must therefore deal with the type of accidents most likely to occur to the greatest number of people. These are not spectacular but the results can be deadly.

The daily use of millions of appliances by practically every man, woman and child in the country produces a field of exposure greater than that of the automobile. It is a compliment to the built-in safety of these appliances that the death rate from all electrical accidents, including high voltage, is only about one-fortieth of that caused by automobiles.

In spite of this inherent safety, misuse of appliances and ignorance of the characteristics of electricity can be the cause of accidents.

As I do not know the extent of your familiarity with electrical behavior, I must assume that in an audience of this size, it will range from complete understanding to none at all.

I hope therefore that I may be given the liberty of departing from technical accuracy in order to try to make certain points clear.

Electricity is a form of energy and as such it will perform work, useful or destructive. A hammer will drive a nail or smash a finger, electricity will drive a motor or cause destructive effects in the human body. It is all a matter of control.

Unlike most other forms of energy, it is not perceptible to human senses at a safe distance so we must *assume* that certain equipment and wires possess an electrical charge or potential.

The earth is considered to be at ground potential and we can think of it as a receptacle for electricity, with unlimited capability to accept electrical current from any source of higher potential. We should consider any conductor of electrical energy to be at higher potential than the earth.

Electricity is kept within safe and useful bounds by insulation or isolation. When insulation fails or contact is made with another conductive body, that body becomes charged or raised to the potential of the conductor. If it is also connected to some body of a different potential, the earth for instance, a current will flow.

This is what happens when a fault occurs in an electrical appliance. The frame of the appliance becomes charged and a person holding it, and at the same

time in some manner electrically connected with the earth, as for example through plumbing will form a conductive path and receive a shock.

Let us look at a few such accidents. First, a case history taken from an insurance company file. The victim was engaged in installing sheet metal covering over the lagging on a pipe at a power station. He had been working from a wooden scaffold but had shifted to a sitting position on an eight-inch steel pipe. It was a hot day and it is probable that his clothing was damp from perspiration. An electric drill, one-quarter-inch capacity, was handed to him by another workman. He put it in place to drill and pulled the switch trigger. Sparks flew from the drill and the victim stiffened. A co-worker pulled out the extension cord and lifted the victim back to the scaffold. Artificial respiration was started at once but was ineffective.

Upon examination after the accident, evidence was found that the bushing which normally took the strain of the cord was broken and had been ineffectively repaired. The strain thus transferred to the binding screws probably pulled one of the power wires loose, causing it to make contact with the drill housing.

This drill was fitted with a three-wire cord with the green grounding wire properly attached to the case. After the accident, this wire was found to have broken off at its connection with the case. This probably occurred when the drill fell after the accident.

The three-wire cord was properly connected to a three-wire grounding type male plug. The three-wire fifty-five foot extension cord was equipped with a three-wire female receptacle at one end and a three-wire male plug at the other. It was plugged into a three-wire grounding receptacle.

Why then did this accident occur? Closer examination of the extension cord revealed that it had been lengthened by splicing twenty-nine feet of two-wire cord into its middle, leaving the green grounding wire open for that distance. Had this grounding wire been continuous the potential on the faulted drill case would have been reduced to a safe level and the

circuit fuse would have blown, cutting off the current.

It was a clear case of safe and proper equipment being made deadly by poor maintenance and makeshift alterations.

Case number two, from a newspaper clipping. A young man was electrocuted while operating an electric drill in a church under construction. He was standing on the top rung of a ladder, supporting himself by hooking his arm over a small metal I-beam and brought the drill close to his arm. His employer, standing on the floor, said he saw a blue flash and heard the youth scream. He pulled the plug of the drill and the victim fell off the ladder into his arms.

The coroner said that the self grounding device on the drill may have been circumvented by the way the victim was holding it. He also said the tool worked perfectly on later examination.

I mention the coroner's remarks as typical of uninformed investigation. This tool must have been faulted, and could not have been properly grounded, which is frequently the case on construction jobs. Further, a faulted drill, isolated from the ground, may still operate perfectly. I wonder if this drill is still in use, waiting for another victim.

Here is a somewhat similar case. A man was doing some alteration work on his house, in the course of which he was installing a four inch sheet metal duct in an attic room. His wife on the lower floor heard his electric drill running and became curious after several minutes as to why the drill should be running so long without any sound of other movement. She investigated and found her husband stretched across the attic beams, the running drill still in his hand. She pulled the plug and called for help but her husband was dead.

This accident may be reconstructed from the evidence found.

On test, the drill was found to have a very high resistance fault from the windings in the case. There was no third, or ground wire, attached to the frame. It is not known how long this fault had existed as the tool could have been used indefinitely in this condition so long as the case and the user remained isolated

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from ground. Working in the attic on a wooden floor, he might have been considered reasonably safe even with the faulted condition of the tool.

There was a slight burn on the tip of the drill and another on the duct, which was grounded. This would indicate that he had attempted to drill a hole in the duct and a small flash occurred causing him to pull the drill back quickly. Being in a kneeling position, he was thrown off balance and grasped the duct for support, forming an electrical path from the drill case to the grounded duct. It was hot in the attic and his perspiration lowered his skin resistance to a minimum. He had a small second degree burn on the palm of his right hand.

The exact nature of the fault in the drill was not determined but could have been from a loose strand of wire, insulation breakdown or even a drop of perspiration in the right place.

Another clipping relates that a woman using an electric massager in a bathroom was found dead on the floor near the sink. Another faulted appliance and a grounded victim.

Illustrative of a fairly common type of accident is this description. The victim was found in the bathtub. The coroner said that she had probably plugged in an electric razor and was holding it in her hand when she leaned over to feel the temperature of the bathwater. The force of the resultant shock caused her to fall into the bathtub. She apparently then dropped the razor into the tub and was electrocuted.

We hear once in a while of a person being electrocuted when an electric appliance such as a heater or a small radio falls into the bathwater. You may perhaps wonder how this can happen when the water is already grounded. The truth is that a bathtub is a glass-lined vessel and therefore is insulated. The only grounds are the drain and plumbing fixtures. An appliance dropped into one end of the tub charges the water, causing a flow of current to the drain fitting at the other end. If there is a person in that water, part of the current will flow through his body, perhaps enough to be deadly.

I have one more clipping, this one associated with higher voltage. Two accidents, resulting in three fatalities were reported in this article. Both were crane contacts. In the one case "authorities reported that both men were tossed from the cab by 2400 volts of electricity." I find this hard to believe as it is rarely that the man on the crane is injured unless he tries to get off.

The resistance of the machine, upon which the man is riding, is usually so low as to form a protective bridge around him. If he tries to get off, he will probably become a conductor between the charged machine and the earth. Even if he jumps off, which is the safest way to leave, there is the possibility, in some cases, of receiving a shock from two points of contact on the earth itself. In the other case, police said DeBouno jumped into a length of sewer pipe being lowered into an excavation and grabbed a steel cable attached to the crane.

"The crane came in contact with an overhead power line and the electric current passed through DeBouno."

The information given here is very sketchy and an accurate analysis is not possible. We can only know that all three men in some manner became conductors between the charged cranes and the earth.

Important lessons can be learned from a study of these accidents.

A very small current, as low as fifty milliamperes, may kill.

Practically the entire electrical resistance of the body is in the outer layer of skin. This resistance is very high when the skin is dry and cold and very low when it is warm and moist.

Under conditions of low skin resistance, and good contact, a potential as low as fifty volts could cause death. Low voltage contacts resulting in a small current through the heart muscles may result in ventricular fibrillation and almost certain death.

The belief that electricity takes only the path of least resistance can be deadly. Electricity will follow all conductive paths from one potential to another in direct relation to the conductivity of each.

A properly connected protective ground-

ing conductor can reduce the potential of a faulted appliance to a safe level and may cut off the current by blowing a fuse.

What protective measures can we take? All electrical equipment should be kept in top condition by frequent inspection and skilled maintenance. Extension cords and makeshift portable lights should receive particular attention. Makeshift wiring and repairs should be avoided not only because of the danger of shock, but also because of the fire hazard involved. All non-current carrying parts of fixed electrical equipment should be grounded through a low resistance grounding conductor.

All portable tools and appliances, particularly if used in damp locations, should be equipped with three-wire cords and a grounding-type plug.

Extension cords for use with such appliances should be three-wire, with ground-type plugs and receptacles. All new installations or replacements of receptacle outlets should be the grounding type. In locations where portable tools are likely to be used, such replacements

should be made at once. If necessary to use as an adapter to a two-wire receptacle, the grounding pigtail of the adapter should be firmly attached to a good ground.

Generally speaking, the bathroom is no place for electrical appliances. When used, bodily contact with plumbing fixtures should be avoided and no electrical appliances should be touched while in the tub. Some appliances such as electric razors cannot readily be grounded. These are usually encased with non conductive materials. This protection may be lost if the appliance becomes wet.

Isolating transformers with six or twelve volt output are available for portable lights in wet or otherwise hazardous locations and should be used where much work of this sort is done.

Never permit your body to make contact with two electrical conductors or with an electrical conductor and any conductive object connected with the earth.

Modern electrical appliances and tools are safe when properly used and maintained.

SAFETY IN MULTI-PLANT OPERATIONS

Presiding: LEWIS R. MORRISON, Corporate Mgr.-Safety, ACF Industries, Inc., New York City

MULTI-PLANT SAFETY ADMINISTRATION WORKSHOP

ROBERT H. ALBISSER, Safety Mgr., Merck Chemical Div., Merck & Co., Inc., Rahway, N. J.

FRANK R. BARNAKO, Mgr., Compensation & Safety Dept., Bethlehem Steel Co., Bethlehem, Pa.

JOHN A. O'DONNELL, Mgr.-Ground Safety, American Airlines, Inc., Flushing, N. Y.

DMITRO A. PATRICIAN, Administrator, Accident Prevention & Safety, Radio Corporation of America, Camden, N. J.

Morrison: The Multi-plant Program at the National Safety Congress started about 1954. This is either the seventh or eighth session. Don't be surprised at the infor-

mality—panel members sometimes ask their questions of the audience. Mr. Albisser will begin with a discussion of the problems of measurement.

Albisser: We performance to and how we are Mr. Albisser tu presented figure company's comp penses, includin loading, fire dan surance compan injury expense. industry average costs of safety added to one's on comparing to the

Barnako: A across the board department or o total result and have a plan of to size up the erations. Here : plan:

1. Safety me
2. Indoctrina
3. Personal c
4. Job safety
5. Personal j
6. Tools and
7. Accident i
8. Reports ar
9. Signs.
10. Inspection.
11. First aid t
12. Gas trainir
13. Safety cod
14. Safety lite
15. Equipment
16. Outside co
17. Off-the-jol
18. Forms.
19. Office safe

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Others use a i port. They sub what needs atten me to understan behind the frequ

O'Donnell: W employees from cc

Albisser: We must measure our safety performance to know how much to budget and how we are performing. (At this point Mr. Albisser turned to the blackboard and presented figures showing a hypothetical company's compensation and medical expenses, including the insurance company loading, fire damage (again showing the insurance company loading), and off-the-job injury expense. This he compared to the industry average. He pointed out that the costs of safety administration should be added to one's own company expenses before comparing to the all-industry average.

Barnako: A program that is effective across the board is what is wanted—one bad department or one good one can change the total result and distort the picture. We have a plan of evaluation which we use to size up the effectiveness of distant operations. Here are the main points of the plan:

1. Safety meetings.
2. Indoctrination of new employees.
3. Personal contact.
4. Job safety analyses.
5. Personal protective equipment.
6. Tools and equipment.
7. Accident investigation.
8. Reports and statistics.
9. Signs.
10. Inspection.
11. First aid training.
12. Gas training.
13. Safety codes.
14. Safety literature & posters.
15. Equipment & process developments.
16. Outside contractors.
17. Off-the-job.
18. Forms.
19. Office safety.

Some of our men who travel and rate plants use a chart which gives an arbitrary rating showing four grade levels from "good" to "poor."

Others use a more subjective type of report. They submit a verbal statement of what needs attention. These reports enable me to understand what is going on and get behind the frequency and severity figures.

O'Donnell: We have more than 23,000 employees from coast to coast who work in

a variety of types and sizes of operations. They all claim to be unique. However, we believe there is one thing they have in common—safety is a management function. I once heard a manager tell the supervisors under him that he had been refused a raise because his safety record was bad, so no raises were in prospect for the supervisors themselves until their record improved.

We use safety contests in the different operations in which the units either compete against their own previous record or on a point system.

We believe our main job is to supply technical assistance and a "needle." This is the best way to get local management to do its safety job.

Patrician: We sometimes have noticed a breakdown in communications. We have had this situation: a safety man complains that he has no support from management. The same management of which he complains asks "what more can we do?"

To bridge this gap we require a progress report prepared quarterly. This report shows:

1. Accident trends—a clear and accurate picture.
 2. Outstanding accident causes—it provides target areas and focuses attention where the attention will do the most good. Some reporters have a tendency to list too many causes as "outstanding."
 3. Include accident costs—let management know what accidents are costing.
 4. What is being done to control exposure.
 5. Obstacles preventing progress.
- We give these instructions to reporters on how their reports should be prepared:
1. Make it brief.
 2. Submit it periodically.
 3. Exclude irrelevant matter.
 4. Include exhibits.
 5. Summarize the contents.

QUESTIONS

Q. to O'Donnell: How is the pay raise withheld from a supervisor who has a bad record?

Answer: The manager considers the safety record as part of operating efficiency. This is not a company-wide policy. It is not formal.

This questioner then directed the same question to Mr. Albisser.

Albisser: Our company has incentives. Safety is a factor in the appraisal of performance, and this is a well known fact in the company.

Q. to Albisser: Are your costs allocated to the branch plant?

Answer: Yes.

Q. to Albisser: Is equipment (such as sprinklers, etc.) part of your safety administration expense?

Answer: No.

Q. to Albisser: Do you pay the entire cost of off-the-job accidents?

Answer: Some of our off-the-job accident victims get full pay and others get $\frac{2}{3}$ pay.

Q. to Entire Panel: What is being done to develop a serious injury index?

Barnako: We are using it.

Albisser: We are using it.

Patrician: Severity and frequency are meaningless to us. We have thrown out severity—it is a matter of luck. We concentrate on accident prevention, not lessening of injury. We use an "all-injury rate." We base it on injuries per 100 employees. An employee, for this purpose, is 40 hours of work a week. An employee, if he should work 60 hours in one week, would count as an employee-and-one-half.

Barnako: You can get into trouble with an all-injury rate. It can be overdone. There are infections that are reported late, and unreported accidents.

Morrison: Every injury that requires more than two calls to the dispensary is counted in our company.

O'Donnell: You need a firm measure in a scattered operation—it is hard to control otherwise.

Q. to Entire Panel: We had an accident that apparently had no cause and there was nothing to correct. A woman fell on a clear, unobstructed floor with good traction. How do we charge it? The woman was out for five weeks.

Albisser: As a disabling injury.

Q. to Barnako: Do your traveling central office men evaluate the safety men in the field?

Answer: We don't hire and fire them, but we can't help making personal judgments

about their efficiency. We judge what a man is trying to do. Sometimes local plant management can hold back the effectiveness of a potentially good program.

Q. to Entire Panel: I look upon extremely low frequencies with suspicion. Some of these plants can't possibly have such records if they experience rain and snow, use parking lots, and their people have to walk on floors. Do you believe the Z-16 has gone too far? Is the frequency rate reliable?

Patrician: One of our plants that had 17 million man-hours without disabling injury, after it went on an all-injury rate, went down near the bottom of the list.

Albisser: I'm happy about the present method, but we do need some emphasis on severity.

Q. to Entire Panel: How do you relate safety to production?

Volunteers from the audience answered:

"We relate it to feet of oil well drilled."

"The brewing industry relates it to barrels of beer."

"One company shows it in cents per share of stock."

Q. to Barnako: How long does it take your man from the central office to evaluate a plant of, say, 20,000 people?

Mr. Barnako called upon Mr. Nolan, who was in the audience, to answer the question since he had recently evaluated such a plant. Mr. Nolan replied that it took approximately 3 days the first time, and he now thinks he can do the job in one day.

Q. to Mr. Barnako: If the evaluation is unfavorable, what action does the plant manager take?

Answer: Evaluation is for the safety office; we talk to the plant manager, but don't show him the report.

Q. to Entire Panel: How is the best way to make use of the services of insurance company engineers?

Answer: (By member of the audience) Our insurance company engineer discusses problems with the plant managers, and gives us a copy of his report.

Q. to Patrician: If there is more than one major cause, how do you direct attention to the cure?

Answer: We attack the high-cost areas

first. There is no go overboard on We had a brok some pebbles in sum that was sp lot could better electrical hazards

Q. to Barnako search and devel

Answer: Very sit on committee on hazardous pr

Morrison: We expenditures to development is t

Barnako: The tip you off on this

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When an unsaf position with res of us in safety v will result. In th all of us are cor ent kinds of sa different kinds o need to be contr ever ways we can

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There is rarel "rule" to contr tions. The prop fumes contamin which our emplo

first. There is an unfortunate tendency to go overboard on isolated serious injuries. We had a broken leg caused by a fall on some pebbles in the parking lot. The large sum that was spent resurfacing the parking lot could better have been spent isolating electrical hazards.

Q. to Barnako: How close is safety to research and development?

Answer: Very close. We see reports, and sit on committees that give us information on hazardous projects about to be attempted.

Morrison: We ask for reports on capital expenditures to detect where research and development is beginning.

Barnako: The purchasing department can tip you off on this.

Albisser: In our company the safety department meets with the director of the development laboratory once a month.

Patrician: Plans are approved by the safety administrator and the plant engineer.

Q. to Both Panel and Members of the Audience: Should the safety man be an engineer?

Answer: 1. We will be here all week answering that one. 2. We must take a human approach—I am always pleased to see an author in the NATIONAL SAFETY NEWS advocate a human approach.

Albisser: 3. If you phrase the question with the word *should*, the answer is "no." If you phrase it with the word *can*, the answer is "yes."

ARE THERE TOO MANY SAFETY RULES?

By J. E. NICHOLS

Dir. of Safety, Reynolds Metals Co., Richmond, Va.

When an unsafe condition gets into proper position with respect to an unsafe act, most of us in safety work know that an accident will result. In the course of our daily work all of us are confronted with many different kinds of safety conditions and many different kinds of unsafe acts. All of them need to be controlled or eliminated in whatever ways we can devise.

The unsafe conditions are usually the physical conditions of plant and equipment. They are countless in number and may exist because they were created when the plant was designed and built or later remodeled, or they may have been created by the natural wear and tear on facilities which are in production. We usually find that it is easy to become aware of these unsafe physical conditions, through inspections, through information from others and from the occurrence of accidents which they have caused. They are usually not too difficult to correct and control by repair or maintenance, or by engineering revision.

There is rarely any thought of using a "rule" to control unsafe physical conditions. The proper control of dangerous fumes contaminating the atmosphere in which our employees may have to work is

not usually a "rule." It is engineering revision. Similarly, we do not think of a "rule" as being the best answer to a stairway with slippery treads.

Most of us learn early in our careers as safety engineers that people do not always do the expected thing under a given set of circumstances. How to control the unsafe acts of human beings is the question that keeps safety engineers on the payroll. There are many ways of accomplishing the necessary results in control of unsafe acts of people. One of these ways is by the use of rules.

The degree of success which a safety engineer achieves is largely measured by the degree to which he can control the unsafe acts of people under conditions which cannot always be predicted. There are safety programs which have been effective using a large number of "rules" and there are others which have been effective with very few rules. There must be some point in between at which the optimum of effectiveness is reached with just the right number of rules.

Just what is a safety rule and what does it do that cannot be done better by other means? Haven't we all been tempted at

times to devise rules for action which we thought would accomplish something for safety that couldn't be done by other means? And then we called this a "safety rule." Haven't we all sometimes wanted to fire or lay off an employee for a few days when he is caught violating some common sense safety practice? Haven't you felt sometimes that if only you could make a few more safety rules in your plant *and be sure of their complete enforcement*, it would be easy to produce a zero frequency rate every month?

Evidently some safety engineers have believed that rules were the answer to accident prevention. In one rule book, of several years ago, which I have in my office, and which came from one of our great corporations, here are two examples of safety "rules":

"Short cuts must not be taken over dangerous places where other ways are available."

And another example from the same course this being their rule No. 4007:

"Employees must look in each direction before stepping upon, crossing or standing too close to tracks."

This one, from one of our safety rule books originating in one of our plants several years ago, reads:

"Do not work with tacks in your shoes."

It is evident that the thinking about what a safety rule should do has varied quite a bit in the past. The need for rules is governed by different conditions under which accidents could occur. One of these conditions is the intelligence level of the employees with whom you are dealing. For example, a different approach is necessary for the staff of a laboratory doing research than for employees doing underground mining.

The degree and kind of hazard encountered will also affect the number and kind of safety rules that are used. For example, the manufacture of very fine metallic powders can usually be done with safety only when a complete and rigidly enforced set of specific rules of procedure is in effect. No such set of rules is necessary for general office employees, however.

We would all probably be happy to get along with safety instructions rather than safety rules, but sometimes just plain instructions, no matter how carefully given, do not seem to be quite enough to insure getting the idea across. So we make our instructions more forceful and perhaps call them "rules" and in addition, there is usually a penalty attached for their violation. It is the penalty, apparently, which makes a "rule" out of the instruction by making it painful or costly for the employee to forget or neglect it, all this of course, assuming that he can be caught if he does not obey the rule, and assuming that the penalty will actually be assessed.

It is these two "ifs" that really cause this entire subject to be discussed here at this safety congress. If we could always catch those who violate our safety rules and if they were always punished in accordance with the penalties prescribed in the rules, the problem would be greatly different, and so would the entire profession of safety engineering. Since this matter of enforcement is to be discussed in a later part of this program, I shall not touch on it now.

I would like to discuss further, however, the matter of safety rules and how they apply to human behavior. Have you ever violated a speed law or parked in a no parking zone? Have you ever smoked under a sign reading "No Smoking"? I shall not ask for a showing of hands—I merely ask that each of you examine your own conscience in this matter.

Our daily lives are circumscribed by such a mass of rules, laws and regulations, both written and unwritten, that it is doubtful if any of us can pursue our ways of ordinary daily existence without breaking some law everyday, either knowingly or unknowingly. It is said of one of our fifty states that there is a law on the books which was designed to prevent train wrecks where one set of tracks crosses another. When two trains meet at such a crossroad, the law prohibits either train from moving until the other shall have moved on!

We almost seem to be at such a crossroads and facing such a deadlock in some of the safety programs which are in effect today. With a large number of rules, trying to control human behavior, the inevitable result has occurred: We build up more and

more resentment put into effect, and a substitute for escape of disaster can without getting

In accident prevention many safety rules and a substitute for more ability and training. Teaching and selling of safety is the best known way the kinds of re-emergency arises, situation develops. is no good substitute that their own safety responsibility.

There are some which the needed emphasis and possibly be called attached. These are

ACHIEVING

There are many serious considerations being operated successfully. The achievement of safety is the result of these items of quality.

We in Westinghouse safety and well-being dependent upon prevention of a pursued. Success has an importance of our workers to on the job.

Among the many optimum safety improvements and applicable enforceable safety regulations that in a factory do not those imposed by

more resentment against rules as they are put into effect, and finally we try the natural escape of disregarding those which we can without getting caught.

In accident prevention, the use of too many safety rules is the use of a crutch and a substitute for something that takes more ability and ingenuity—instruction and training. Teaching, convincing, demonstrating and selling of safety to employees is as yet the best known way of securing from them the kinds of reactions wanted when the emergency arises, or when a non-routine situation develops. It is my belief that there is no good substitute for teaching employees that their own safety is largely their own responsibility.

There are some situations, of course, in which the needed instructions must be so emphatic and positive that they should probably be called rules and have penalties attached. These are few in number, probably

less than ten altogether and they apply mostly to special situations.

On the sturdy and reliable DC-3 airplane there are 15 items on the "check-list" which the pilot and co-pilot must check together before takeoff. On the new all-jet DC-8 there are 76 of these items! You may call them rules if you wish or just safety precautions, but few of us would want to see the list decreased in either airplane.

The real trick then comes in knowing how to make your program secure the results you want from it by the use of the fewest possible "rules" rather than by the opposite course of trying to formulate a new rule for each new hazard as it causes an accident or each newly found unsafe act of an employee. The safety engineer who is unable to make safety effective in his plant may be the same safety engineer who is relying too heavily on a long list of "don'ts"—with penalties.

ACHIEVING AND MAINTAINING RESPECT FOR COMPANY RULES

By JAMES F. VAN NAMEE

Administrator, Accident Prevention Services
Westinghouse Electric Corp., Pittsburgh, Pa.

There are many things which require serious consideration if a business is to be operated successfully. The management of safety is one of the most important of these items, along with cost and quality.

We in Westinghouse recognize that the safety and well-being of our employees is dependent upon the degree to which the prevention of accidents is aggressively pursued. Success in accomplishing this has an important effect upon the ability of our workers to perform efficiently while on the job.

Among the many features essential to optimum safety performance is the establishment and application of practical and enforceable safety rules. The rules and regulations that govern orderly conduct in a factory do not differ materially from those imposed by society in general. They

are merely adapted to the needs of a particular situation.

The word "rule"—as we use it in the term safety rule—is defined by Webster as "the usual method or way of doing something; as, it is the *rule* to rise at seven."

As stated previously, rules—safety and otherwise—are essential to the orderly conduct of business. Without them we would operate in a state of utter confusion. With them we have a roadmap that can be used to guide us down the highway of orderly and safe operating practices.

In order to generate respect for safety rules—it is essential to recognize that most Americans possess a basic resentment against rules and regulations. They feel that any regulatory mandate infringes too much upon their freedom to satisfy

their immediate motives. Secondly, it must be understood that many safety rules will be complied with on a voluntary basis—while others will require enforcement. Voluntary compliance usually results when the incentive for obeying is strong enough to overcome resistance. When voluntary compliance is not achieved enforcement must be resorted to—and enforcement carries with it a requirement of discipline.

We can see from this that there is a vast difference between rules that are respected and rules that are complied with only because of fear of the consequences that may befall as a result of failure to comply with them.

To state an extreme example of creating a state of fear—I would like to cite a recent article that outlined the penalties that are applied in Saudi Arabia as one means of controlling highway accidents. The article stated that any Arabian driver involved in a non-fatal accident goes to jail for one year, and has his driver's license revoked for life. Furthermore, one fatal accident is all that anyone in Saudi Arabia is allowed—woe unto the driver that survives a fatal accident—for he is promptly beheaded.

Here we have in a nutshell the reason why Arabians might say—"Drive carefully—for the life you save will be your own!" In the case of Arabian traffic rules and regulations—we can see that compliance stems from the fear of the consequences, and not out of true respect for the law.

Of course we do not advocate any such stringent measures in dealing with violators of our own "rules of the road"—although I'll wager that most of us in this room have experienced driving practices of others which might tempt us to momentarily wish for the existence of some such penalties.

Obviously, then, voluntary compliance with our safety rules is to be desired—and the chances of this will be enhanced when the benefits to be derived from compliance are clearly understood by the workers affected. Just as employees must be educated to be safety-minded, so must they be educated concerning the wisdom and necessity for the rules that are adopted. Hence, education becomes one

of the cornerstones upon which we build respect for our rules and regulations.

However, before we can educate we must backtrack and take a hard look at the rules themselves to determine whether they:

1. Are actually rules—or are statements of safe practices.
2. Can be adhered to.
3. Tend to arouse resentment.
4. Are really enforceable.

When making such a review it is desirable to sort the rules—and arrange them according to:

1. Those that apply to all employees, and those that apply only to employees in certain departments or on certain jobs.
2. The relative seriousness of their infractions.

The items applicable to everyone should comprise our general or basic rules. They are usually the "musts" and therefore are of major importance.

The remaining rules are more properly called safe work practices and therefore should be utilized in employee instruction or training.

The items that are truly "rules" should be reviewed again to decide if equal penalties should apply to all infractions. It is quickly obvious that this is not so. Some disciplinary action may be necessary in all instances, but it is obvious that the same type or degree of discipline is not necessary for every infraction. For instance, take the rule that says that an employee must never throw a switch to which is attached a "Danger" tag. Such a tag usually indicates that men are at work on some machine or piece of equipment and their lives would be endangered should the machine or equipment be started. There is no question about the major importance of such a rule. It is a "must"—and there can be no compromise with its enforcement.

On the other hand, we find an employee lifting a crate improperly. This represents an infraction that is entirely different from non-compliance with the "Danger" tag rule. Here a safe work practice—rather than a rule—is involved. Thus, it is quickly seen that an infraction of the "Danger" tag rule might justifiably result

in disciplinary of the safe lifting be immediately of instruction

This brings a difference between We may say that and work practices

Respect for when they can be applied with. One comparing some among them

"Never attempt upon, or over over facilities walk around

This particular of the safety rule to determine the cally located provided over the and warehouse difficult it would this rule if employee required to walk order to avoid

Let us also c "Do not clean, while the power is this rule violating controlling the is located at a the machine in switch also control or more other present. Often we for flagrant violations both from poor and pressure production which ruptured when the are also shutdown

These are but that are difficult barricades of out to obstruct the ance. Undoubtedly such similar plant's rules.

Likewise, rule are seldom a chance of being ample—take the

in disciplinary action, while an infraction of the safe lifting practice could properly be immediately adjusted by a brief bit of instruction on how to lift properly.

This brings us to the important difference between rules and work practices. We may say that rules are mandatory—and work practices are advisory.

Respect for rules is further enhanced when they can be readily and fairly complied with. One of our divisions was preparing some uniform safety rules—and among them was one that stated:

"Never attempt to step over, ride upon, or otherwise climb on conveyors. Always use the cross-over facilities provided or else walk around."

This particular rule held up the release of the safety rules until a check was made to determine that adequate and strategically located cross-over facilities were provided over the conveyors at each plant and warehouse. Can you imagine how difficult it would have been to enforce this rule if employees were unfairly required to walk a considerable distance in order to avoid climbing over a conveyor?

Let us also consider the rule that says, "Do not clean, oil, or adjust machinery while the power is on." How many times is this rule violated because the switch controlling the power for the equipment is located at a considerable distance from the machine in question—or maybe the switch also controls the power for one or more other pieces of production equipment. Often we find that the real reason for flagrant violation of this rule stems both from poorly engineered conditions—and pressure from the supervisor for production which might otherwise be disrupted when the other pieces of equipment are also shutdown.

These are but two examples of rules that are difficult to enforce because of barricades of our own making which tend to obstruct the orderly flow of compliance. Undoubtedly, you will find many such similar problems existing in your plant's rules.

Likewise, rules that arouse resentment are seldom respected—and have little chance of being complied with. For example—take the plant that decided to

institute a universal eye protection program. They established a rule that everyone must wear eye protection upon entering the plant premises. The truth of the matter was that the universal eye protection program was instituted for the sole purpose of assisting a few supervisors who were having a problem in enforcing the use of protective eyewear. In practice—there was no practical need for safety glasses in most areas of that particular plant. Is it any wonder—therefore—that the employees working in areas where no high hazard existed resented the new rule—and went to great lengths to violate it?

Furthermore, rules that no longer have meaning or application are not enforceable—and their mere existence on a posted order or list of rules tends to diminish the respect that workers have for all the other safety rules. For example—one plant that I visited had "No Smoking" orders posted in rooms where smoking was actually being permitted. Upon questioning the management of the plant concerning this situation, it developed that the room had been used for handling explosive materials during World War II—and after the operations were discontinued no one had bothered to remove the "No Smoking" orders.

Further checking of the plant revealed that employees were actually smoking in other areas where a bona fide hazard existed. Most of these workers had previously been assigned in the other area and just took it for granted that the rule wouldn't be enforced in their new work area. This example illustrates how failure to keep old rules current can be an indirect cause of non-compliance with rules—even though a real need for them exists. In other words—failure to rescind rules that no longer apply can be another basic reason why workers disrespect essential and applicable rules.

Last—but certainly not least—the manner in which management itself complies with safety rules can contribute to respect—or lack of respect—tendered to safety regulations. For example—whenever a rule calls for the use of protective eyewear, then supervision and management must set the example by wearing protective eyewear. For when leaders fail to

follow rules, it is impractical to expect that workers will comply.

Generally speaking—any rule that can withstand an honest appraisal of its worth is enforceable and is worthy of respect. The comments made concerning some of the shortcomings of safety rules are intended to point up some of the general areas of fault that contribute to workers having a lack of respect for them. Consequently, if you are finding a general disregard for your plant's rules—may I suggest that you take a hard look at them to see if you find similar symptoms of weakness.

Another important thing is to acquaint employees with the nature of the rules they are required to observe, in short, these guides to action must be sufficiently publicized to make them part of the "working knowledge" of every employee.

While the educational approach will lead to the observance by a large segment of the work force, unfortunately, there is always a small minority that will insist upon violating rules. Thus, where education fails, supervision must be prepared to take proper disciplinary action.

I believe that the following statement—made by Emile F. du Pont of the Du Pont Company—sums up the whole story concerning enforcement of safety rules.

"We believe strongly in the philosophy of preventive safety rather than after-the-fact correction. We place great stress upon safety violations rather than upon injuries as such. We are tough toward wilful violators, as we are more interested in eliminating the chance for injury by working safely without violations of good practice than in setting records. Where we are reasonable but firm on violations, a safety consciousness is gradually developed among the entire work force."

This brings us to the all important problem of enforcement and discipline. If rules are to be enforced they must—as has been said before—be clear and known by the employees. They must be fair and undiscriminatory—and they must be uniformly applied—otherwise you may find them contested by union representatives.

The need for acceptance of safety rules by union representatives is mentioned because under the terms of some labor-management contracts a company may find that improper rules can become a basis for the

filing of a grievance—or even arbitration. Two examples will illustrate this point.

A union local in Trenton, New Jersey, filed a grievance against management's newly inaugurated rule which required 100 per cent compliance with an eye protection program. The following statement is taken directly from a report that the union local made to its membership concerning the outcome of action taken on the grievance:

"The 100% eye protection program—the union argued that many areas in the plant did not require safety glasses. Management has agreed and have modified their program accordingly. The areas and jobs not required to wear glasses are—purchased parts cribs, receiving docks, salvage building, main stock cribs, overhead crane operators, steel bay area, yard area, parts checker, tool room aisles, waste material disposal operations, car washing activity and drivers not working in production areas."

"Management's unilateral promulgation of a safety rule presents an arbitrable grievance."

On a question brought against a company by the Oil, Chemical and Atomic Workers Union an arbitrator said, "The company had issued a regulation, which the union challenged, requiring all employees to wear hard hats and toe guards. The company argued that it had the unquestioned unilateral right to establish reasonable safety regulations—such as those being challenged. The union contended that safety regulations involving special protective devices, which employees were required to wear, constituted conditions of employment for which the union had been recognized as the sole and exclusive bargaining agent. The union held that these were matters for joint consultation between the parties in the first instance and subject to review in the grievance procedure in the event that a job was described and classified in a manner with which the union did not agree. The arbitrator held that although the employer ordinarily has the right to determine for itself rules for protection of employees, there are circumstances in which the union may challenge the imposition of certain types of rules as well as the reasonableness of particular rules and that the union's protest in these cases presented an arbitrable grievance under a contract which defined a grievance as any disagreement between the company and union involving interpretation or alleged violation of contract."

While I do not wish to invade the subject of discipline, there are a few precepts concerning discipline that also may have a bearing on the respect tendered to safety rules. Briefly they are:

First: Disciplinary action under some labor-management contracts may be subject to arbitration. When such is the case—remember that an arbitrator may determine whether there was just cause for the discipline, and also whether it was overly severe.

Second: The burden is usually yours to prove that your rulings are proper—and that the penalty given wasn't too severe.

Third: Disciplinary matters. (the answers to employee know "Was his violation previous violation")

Fourth: Disciplinary bargaining and

From the four principles emerge creating and new rules. They are

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Second, let's look at concepts: punishment. They have no meaning if they are not running operating business are attempting to perform their duty of their ability hazard to them

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Third: Discipline and discharge are serious matters. Consequently, be sure to have the answers to such questions as: "Did the employee know he was violating a rule?"—"Was his violation intentional?" and "Were previous violations condoned?"

Fourth: Discipline must be the same for bargaining and non-bargaining employees.

From the foregoing discussion, three basic principles emerge as being the basis for creating and maintaining respect for safety rules. They are:

1. The rules themselves must not be at fault.

2. Employees must be educated concerning the needs for the rules—and the benefits to

be derived from compliance with them.

3. When all else fails, enforcement and discipline must be resorted to, but on an equitable basis.

In summarizing this discussion, I would like to stress that:

First—Safety rules are essential to the attainment of both production and safety objectives.

Second—Ways must be found to make employees want to abide by safety rules.

Third—The rules must not be unreasonable or improper—for if they are they won't be respected or accepted by the workers—and without acceptance they are doomed to failure.

THE CONSTRUCTIVE USE OF DISCIPLINE IN SAFETY VIOLATIONS

By STANDISH C. RIDDLE

Senior Safety Eng., Cleveland Foundry & Engine Plants
Ford Motor Co., Cleveland, Ohio

On of the too many things aggravating the world situation today is the different interpretations applied to identical words by various persons or cultures. I want to consider the term, "constructive discipline," with a common and single interpretation of its meaning and implication.

First, let's look to Webster, who says,

"Construct (verb) 1. To put together the parts of something. To build. 2. To set in order mentally, to arrange.

"Discipline—1. Training (to train). 2. Punishment—(to punish). 3. Orderly Conduct. Synonyms are—'educate, teach, chastise and correct.'"

Second, let's toss out these words and concepts: *punishment, to punish and chastise*. They have no place in our philosophy. We are not running penal institutions! We are operating business organizations where we are attempting to *instruct* our employees to perform their assigned duties to the best of their ability and with the least possible hazard to themselves and their co-workers.

Third, now, let's look at what we have left from Webster's definitions:

1. To put together the parts of something. To build.

2. To set in order mentally.

3. To arrange.

4. To train.

5. Orderly conduct.

6. Educate, teach and correct.

Fourth, from these concepts, let's construct our definition of "Constructive discipline"—*to arrange by educating and correcting to motivate our employees to conduct themselves in an orderly fashion, both mentally and physically.*

What this means is that we must strive to reach the minds of our employees and move them to conform to the standards of conduct as represented in the Ford Motor Co. safe practices rule books. This is not always an easy matter, for a man is not a simple organism, like some of the lower animals. A man can be very complex.

He is what he has lived. He is what his ancestors have been.

Keeping this in mind, we must consider that, just as no two individuals have identi-

cal fingerprints, so too, no two individuals have identical thinking processes. Because this is true, we must remain very flexible in handling this matter or discipline.

We must keep in mind that the old days when a "straw boss" kept order in his crew by developing the hardest knuckles, the biggest biceps and the loudest mouth, are long gone. Possibly a few cases of straw bosses also developing the widest toothless grins might have had something to do with this. Seriously, though, we do not believe that physical or severe mental or emotional force has any real place in today's application of corrective discipline to industrial employees.

The concept of discipline at the Ford Motor Co. is that it must be *corrective*. This concept also dictates that *only* as much corrective action be applied as is necessary to result in the desired correction. In other words, it is the expressed philosophy that all personal feelings be divorced from the case and only the *facts* are to be considered. This is what we mean by the term, "constructive discipline." Discipline that is *constructive* through reasonable and fair *correction*.

We do not mean to imply by what we have said up to this point that we do not want our supervisors to maintain control over their employees. To the contrary, it is insisted that they do. It is insisted that they be firm. Point No. 6 of the 14-point Ford Motor Co. Safety Program states, "Maintain firm plant discipline." Please distinguish between firm and harsh. These two words are poles apart in our philosophy.

As a matter of fact, if you think of it in the right light, being firm and insisting on strict adherence to the requirements of safety rules is actually being kind to an employee. Being kind to him to the extent that you force him to avoid having an accident. He may not appreciate your kindness in applying corrective discipline when it is merited. It is, nevertheless, kindness of the first water.

Speaking of the 14-point Ford Safety Program, points No. 4 and 5 are also worthy of note here. "Sell safety to the new employee," and "Re-sell safety repeatedly." It might appear that there is a discrepancy of terms here. Is there really a conflict

between "selling" an idea and using "discipline?" We think not. Remember what Webster says? Discipline is education. Selling, too, is education. Therefore, Selling is a form of discipline.

Regardless of what we call it, or how we define it, it means nothing unless it is applied.

I am reminded of a story I read some time ago in a magazine. The story told of a rather large company that had been experiencing numerous serious accidents and injuries to employees with an ever-increasing frequency. According to the story, this went on for several years. (Hard to believe, but that is the story.) Numerous meetings to find causes and remedies were held but always wound up with someone saying that they hoped the "bad luck" would make a turn for the good, soon.

Finally it got to the point that someone at the top decided to bring the thing to a head. He called the managers of the various departments together and told them that it was up to them to find ways of controlling the situation or he would find someone who could. Rather drastic but a very effective form of discipline.

It turned out to be very constructive, as well. The top man's ultimatum finally made them realize that, far from their running the organization, the organization had actually been running them! Finally jolted out of their false sense of job security, each manager passed the jolt on to his subordinate supervisors. Each man was told to tender his resignation right then if he didn't think he could stop his employees from injuring themselves.

"Wow! The bosses are really mad now," they all thought, as they started scratching heads in search of ideas. It didn't take much scratching to come up with the idea of opening the safety rule books that for so many years had laid unopened in the desk drawers. One after another got the bright idea of starting to insist that the rules must be adhered to.

There were no changes in normal work procedures, no supervisors lost their jobs. The supervisors just started to supervise within the framework which already existed in the organization. The foreman started to be the "boss" and exercised his almost forgotten responsibility to discipline

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employees who violated the rules. Accidents all off sharply and other benefits were also realized. Morale was strikingly improved, absenteeism decreased and not too surprisingly, there was also a significant increase in productivity.

Let's go back again to Webster. Remember—he says that discipline also means “to teach.” Ford Motor Co. accepts this meaning wholeheartedly and considers the teaching and training of its employees to be one of its most important functions. Sure, we realize that our prime function and reason for existence is to serve our customers with a top quality product at a price they are willing to pay.

But, to do this we must have a *trained, disciplined* work force, at all levels of the organization. For the purpose of this discussion, however, we are considering only how this policy affects our program to prevent accidents, with particular emphasis on the enforcement of safety rules.

In order for established safety rules to have any meaning, it is a prerequisite that the persons to whom they are to apply, have a thorough knowledge of their context and meaning. This is accomplished through a very thorough system of training for both supervisors and hourly employees.

These training techniques take many forms, and include:

1. A six months training period for new supervisors.
2. One-hour weekly training meetings with required attendance by all supervisors.
3. Frequent contacts between supervisors and plant safety engineers.
4. Wide distribution of safety rule booklets, to both supervisors and hourly employees.
5. Requirement that all supervisors of hourly employees hold weekly safety talks with their employees.
6. Indoctrination program for new employees which requires that the supervisor go over pertinent safety rules with the new man to insure he understands them. A check sheet and card which the employee signs must be returned to the safety office for each new employee.

But that is enough of detail. I think

you have the idea that the Ford Motor Co. has an excellent training program and does a good job of educating its employees on how to do a good job safely. We have given our employees the knowledge, now we must see to it that they use that knowledge to the best advantage—to the advantage that employees will not suffer accidents and injury from someone's disregard of safe practices established and spelled out in the rule books.

Let us take a quick look at how “constructive discipline” of a progressive nature works in cases which demonstrate the principles we have been discussing.

First, consider a simple theoretical case. Suppose that one of the plant safety engineers observed an employee working at a machine while he was not wearing his safety glasses, as is required of all Ford Motor Co. employees. The safety engineer contacted the employee's foreman and verbally informed him that the employee was exposing himself to the hazard of a potential eye injury.

Thereupon the foreman, knowing the employee has just returned from lunch and merely has forgotten to put safety glasses back on, approached the man and reminded him to do so. The man, being a cooperative individual, did so, with thanks to the foreman for reminding him. (*This man knows which side of his bread has the butter*).

This man required very little correction since he realized that the eye protection rule was for *his* benefit. Just a word of caution was all the discipline (motivating education and correction) that was needed in this case and that was all that was applied. Mission accomplished!

Let us now consider a little more complicated and still theoretical case. Again, the plant safety engineer reported a worker, not wearing the prescribed eye protection, to his foreman. This individual was resentful and expressed himself fluently, indicating he did not want to comply with the rule requiring him to wear safety glasses.

In this case the foreman realized that positive action was needed to change this individual's thinking. The foreman, therefore, called the man into the department office and, explained to the employee that the Ford Motor Co. safety rule requiring all employees to wear approved types of

eye protection was established to prevent serious eye injuries, himself included.

The man was then informed that because his record did not show any previous citation for rule violations the disciplinary action report resulting from this case would show that he had merely been given a reprimand and warning without the loss of any time. The warning indicated that he had been informed that any subsequent violations of the rules might result in increased corrective action on a progressive scale.

Here again, the case was dispositioned with only enough "constructive discipline" to arrive at the desired correction of the employee's attitude and performance.

This program of scaled action to fit the case is carried out through the whole range of cases which might occur. Each succeeding time that it is necessary to apply disciplinary action to an individual employee, his previous record is taken into consideration. In those cases where it is clearly evident that the previous actions have not resulted in the expected improvement in the employee's attitude and behavior, additional motivation is applied, each step being progressively more severe.

In a few very serious cases, the end result may finally be a discharge. I am glad to be able to say that very few cases go to this extreme. The lack of extreme cases indicates that the system of progressive actions takes hold and does the job somewhere along the line before the final stage is reached.

Since a disciplinary penalty is imposed solely to obtain improvement of future behavior, follow-up is important in determining whether it has been effective, or whether further action is necessary.

Up to the present time we have dwelt extensively on the techniques utilized in the "constructive use of discipline in safety violations." Now, let's give a little consideration to the end results of such actions. This is the meat on the menu. This is the payoff. While we do not, by any means, give our company program of "constructive discipline" the whole credit, we are sure that it played a very important part of the recent accomplishment of the Cleveland foundry of the Ford Motor Co. in establishing a new all-time National Gray Iron

Foundry Best Record of 3,421,133 man-hours of exposure without a disabling injury.

We also are sure that this technique of using discipline for *corrective* purposes played an important part in the record of our two Cleveland engine plants. These two plants have, within the span of less than ten years, posted periods of over 3,000,000 man-hours of exposure without disabling injury on *seven* separate occasions.

The use of "constructive discipline" can never be the answer to all problems. It can, however, help in the efforts to create a *safety awareness* in our employees which we all are striving for. Safety awareness? Now there is a term I like! Turn that over on the tongue of your mind for a minute! Get the taste of it? Let me give you an example.

Recently, while I was walking through an aisle in our foundry at Cleveland, an hourly man walking in the same direction but some distance ahead, noticed a small length of pipe lying in the aisle where it had apparently fallen from a passing scrap truck. The man, with scarcely a pause, stooped down, picked up the pipe and tossed it into another scrap truck and continued on his way. It was done in such a casual manner it appeared to be an act of habit.

That is what we want! We want safety so ingrained in our employees that they exhibit similar thoughtfulness in all their actions. Thoughtfulness that is a *habit*! And there is no contradiction of terms in *this* instance.

Here was living proof of the "safety awareness" we are striving for. Here was evidence of one of the factors which helped the foundry set a new record, helped the foundry exceed the old record, which had stood for five years, by a margin of well over 500,000 hours. Here was evidence that, properly motivated, employees can be moved to consider the "other fellow's" welfare as well as their own.

This man's action may well have prevented the next man coming along from taking a bad spill. Such patterns of thought can cause a man who, in the past, had been guilty of leaving a guard off a machine, to now pause to replace it upon completion of his job. Development of such *safe* work habits can truly make a man become, almost unconsciously, his "brother's keeper."

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We do not know whether this man had ever had occasion to have "constructive discipline" applied to him. We have no way of determining since the man was not identified. We like to think, however, that this is the sort of attitude which can be developed by the technique of applying discipline in a corrective sense, rather than in a punitive sense.

You all know what happens when you push a pendulum. You give it a push and it swings right back at you. If you give a man a push he also has the same reaction: he has a tendency to take a swing at you in return, in one way or another. It is our thinking at Ford that much more can be accomplished by *leading* a man onto the right road by *correcting* his errors in a constructive manner. This leading, nevertheless, must be firm to avoid being misunderstood as weakness.

Someone says, "Nuts! There are some guys you can't reach with anything but a big club and a size 14 boot." There may be some truth in this statement, but, (and that is a *big* but) these cases are few and far between and we should not fall into the trap of accepting this as a *dump* for all of our problem children. It costs money, a *lot* of money, to train employees to perform today's complex jobs. It costs money, a *lot* of money, to have our employees suffer industrial injuries.

It is our job to save our employers from the unnecessary expense of discharging errant employees. It is *also* our job to save our employers from the unnecessary expense

of accidental injury. It is even more our job to discharge our moral responsibility of preventing the human misery to the employee and his family which invariably results when the bread-winner is laid low because he or his fellow-employee failed to heed the safety rules.

In nearing the conclusion of this discussion, let us remember that the old days of the woodshed as a symbol of discipline are gone and past. More enlightened thinking and the teaching of experience has opened a better door. A wider portal with broader vistas: "constructive discipline," based on correction, not punishment.

It is a prime tenet of psychology that the human animal has a greater tendency to remember pleasure than pain. How many of you can remember the occasions on which your Ma or Pa beat the bejabbers out of your little hind-end? I'll bet not one of you can, or, at most very faintly. On the other hand, I'll also wager that many of you can still clearly remember the old swimming hole, how much fun you used to have at the County Fair or many other pleasures of your childhood.

Not that we mean to imply that applying even "constructive discipline" to our employees will be a pleasure to them. Rather, we should attempt to remove as much of the pain as possible from our corrective action to lessen the tendency to forget unpleasant experiences. *Educate, teach, correct*, that's the ticket. Punishment for punishment's sake belongs to the Dark Ages.

SAFE APPLICATION OF ELECTRIC CONTROLS ON MACHINE TOOLS

By F. C. PEREGOY

Supervisor of Safety, Westinghouse Electric Corp., Baltimore, Md.

By definition, machine tools include all power-driven equipment performing cold-working of metal by progressively removing metal in the form of chips. The National Association of Machine Tool Builders has classified some 200 types of machine tools under five basic functions—turning, boring, milling, planing and grinding.

Authorities agree that injuries from machine operation are likely to be more severe than injuries from other causes; and more likely to result in permanent disability. For example, Accident Facts shows machinery to be the source of 10 per cent of all injuries, but the source of 19 per cent of permanent disabilities.

Material in reference books emphasizes that although many machine injuries result from lack of proper guards, the majority have their sources in unsafe practices; and that, therefore, is the area requiring concentrated attention.

Safe working procedures—operation, adjustment and repair of machines only by trained personnel, and supervisory responsibility for enforcement of established policies—are the weighted important factors in such reviews.

Other literature, stressing the soundness of correcting unsafe conditions first, provides lists of safeguards, such as drill vises, spring-loaded chuck wrenches, chip shields, tool guards, stock tubes, enclosed tanks for cutting-compounds, pinch-point guards, enclosures and ventilation.

However, it is most difficult to find informative material on the subject of providing protection against machine-tool injuries through use of adequate electrical controls. Although progress has been made through the years in the development of machine tool safety, the incidence of high severity in injuries dictates the need for closer examination of the problem. Perhaps there is no better place to start than to consider the feasibility of applying electrical controls for more efficiency and greater safety.

To prepare this article, many technical publications were reviewed. Although they covered the techniques of manufacturing without mentioning safety, safety is inherent in their operation because the operator is removed from the danger point. While safety handbooks serve their purpose adequately, there is an ancillary field ready to be explored: the field of technical publications on programming for machine control.

However, certain control methods developed in recent years mark beginnings in this direction. One of these is programming and control of machine tools by means of magnetic tapes.

Manual control of a machine tool means that both the tool and the operator are subject to physical limitations and to human

error—in interpretation of prints, in setup, in process of operation, in misjudgment of distances, in adjustment to light changes; and to other variables. Such problems repeat themselves for each run.

However, with the use of tape controls, decisions and checks are made at the time the tape is prepared. And so, errors and scrap go down; there is no fatigue problem; lead time is reduced; tooling is simplified; manufacturing time is cut. Such control permits infinitely repeatable precise machine operation, besides providing the optimum in personal safety. Manufacturing cost savings more than pay for the system: even one-shot parts are accurately and economically produced with such controls.

Additional accomplishments include the introduction of contactors to replace switches; the use of volt-meters and indicator lights for machine control; load meters and overload devices.

There is still a problem, that of a high incidence of permanent disabilities. Much effort has been devoted to mechanical guarding and safe procedures. Striving to improve machine tool safety, we must realize the limits of the past approach and the room for human error.

In an age when hospitals can wire patients to record pulse, respiration, blood pressure, temperature and heart action, cannot the individual safety engineer and organized safety groups probe more deeply into modern technology and demand a wider application to machine tool control?

References

Material was developed for the foregoing article by reference to such volumes as the National Safety Council Accident Prevention Manual and Accident Facts; Joint Industry Conference Electrical Standards; Machinery (Monthly magazine of engineering and production); the National Electrical Code and its companion Handbook. Also, manufacturers' descriptive literature including: Westinghouse Prodac and Cypak Controls; Tricop Company catalog of safety switches; Security Controls, Inc. bulletin 500.

Acknowledged is the cooperation of W. R. Blewett and E. Roberts, Safety and Manufacturing Engineering and Tooling Departments, Air Arm Division, Westinghouse Electric Corporation.

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Shortly after Bureau of Labor Statistics Bulletin 276, "Accident Statistics," was adopted at a 1926. The American Engineering Council, which is a revision by the A section on it were national associations as well as international including insurance groups, steel companies of labor various department, as well industrial group.

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THE ASA DISABLING INJURY FREQUENCY RATE IS A GOOD MEASURE OF SAFETY PERFORMANCE

By E. R. WALLACE

Sr. Safety Engineer, Eastman Kodak Company, Rochester, N. Y.

Shortly after World War I, the U. S. Bureau of Labor Statistics published Bulletin 276, "Standardization of Industrial Accident Statistics." A revision of this bulletin was requested by a resolution adopted at a National Conference on Industrial Accident Prevention in Washington in 1926. The resolution requested that the American Engineering Standards Committee, which is now the ASA, undertake this revision by means of a sectional committee. A sectional committee was organized and on it were representatives of the various national associations concerned with safety, as well as representatives of many other international and national organizations, including insurance companies, petroleum groups, steel groups, metal groups, departments of labor, accident commissions and various departments of the U. S. Government, as well as many state agencies. Other industrial groups were represented as well.

As a result of the work of this committee, the ASA Standard Z-16 was developed and was originally approved in 1941.

Prior to this time, there were many suggested methods of compiling accident statistics for use by the safety engineer. The one common denominator that has held true through the years is the method for calculating frequency of industrial accidents which, even though we all know it well, I am going to quote for you:

"Frequency is the number of disabling injuries times a million divided by the employee hours of exposure."

There is hardly a safety engineer, inspector or even neophyte who cannot quote the formula for frequency.

Since the establishment of the ASA Standard Z-16, many other methods of compiling accident statistics have been developed by one company or another. Most of us in safety have tried to evaluate these

other methods in an attempt to determine values from them which might better serve our needs in accident prevention work. However, we have found that our comparisons are made to the established standard with which we are all so thoroughly familiar.

The main point of confusion and the main point of discussion in any appraisal of accident statistics in relation to the Z-16 code are that of the determination of what a disabling injury is.

"A disabling injury is a work injury which results in death, permanent disability, permanent partial disability, or temporary total disability." (The definitions of disability are found in Section 1.2, Page 6, Z-16.1)

If one is to use accident statistics as a basis for winning contests, for creating a pseudo-safe atmosphere among the employees and management, or to prove on paper that their organization has a better safety program than someone else, it might be possible to interpret the ASA Z-16 code definition of disabling injury in such a way as to give a frequency rate which can accomplish all the previously-mentioned points.

However, if the Z-16 code is used as a good measure of safety performance by an industry and the safety organization, and if the evaluations of their injuries are made on a basis which, I am sure, the original ASA Committee felt was just and honest, the Z-16 code could become an effective tool in accident prevention work.

There are many safety engineers who feel that, because they have been associated with their industry and the accidents therein for a number of years, they can make an instant appraisal of those places where the greatest effort in safety should be placed. This may be true; however, I recall sitting with a safety engineer of a large chemical industry not too long ago who, with a certain degree

of amazement, asked, "How come in a chemical industry we have more finger injuries than we have chemical injuries?"

If this question is an indication of what is going on in the minds of many safety engineers, it appears that some of us are not using our statistical analysis to its best advantage.

The beauty of a standard such as Z-16 is that comparisons can be made by the segments of an industry, even though those segments may vary in employee population from four or five men to units of several thousand. This type of comparison can be shown on a chart.

Such a chart, for departments of a large industry which vary in size from approximately 30 men to approximately 2500 might show department "C" as having a very high frequency rate in the year 1959 and an extremely low frequency rate in the year 1960-61, the other departments having slight variations over a three-year period.

As an example of the effectiveness of the Z-16 code as a measure of safety performance, I am going to tell you something about department "C."

It is a chemical manufacturing area of a little over 200 employees. It makes proprietary mixes of both dry and liquid chemicals; it fills, packages, blends, mixes, receives, ships and does everything else a normal manufacturing plant does, including its own maintenance. In 1959, the frequency rate took a bounce upward; the severity rate traveled up as well. As a result of the statistical analysis made in accordance with the ASA Code, it was readily determined that this area was one in which concentrated efforts should be put by the safety engineer responsible for the area. Such concentrated effort was put to use within the department, using the statistical information as a criteria for discussion with top management. It was established that economically, as well as from a humanitarian standpoint, increased safety emphasis must be placed.

In previous years when the frequency rate had risen, attempts had been made to sell management on the fact that increased emphasis should be placed on safety; however, because we did not have the statistical backing to be able to show economic justification, because we were unable to prove

production loss, because we were unable to show the potential of increased production with an adequate safety program, we had no more than token safety emphasis within the department.

Today, however, the picture is completely reversed. The management is aware of their accident record; they are jealous of that record; they are not using the record in any other way than to increase the morale of the employees within the department; they are concerned with the maintenance of the record on the basis on which it was established. They know that disabling injuries included in their frequency rates are evaluated on the true and honest basis as established by the ASA Code; they know that lost time is calculated as established with the Z-16 code and so do the employees; and, this is an important point. In order to use effectively the statistical information of a code such as the Z-16, it is important that the personnel within the department or industry be advised as to what the statistics mean.

Department "D" is a department of approximately the same number of employees. This department, over a period of six years, has maintained a notoriously bad accident record.

It follows without saying that, under conditions such as these, this is the next place where greater emphasis shall be placed on safety performance, philosophy, safety engineering, and last, but not least, accident prevention.

To set an entire safety program on the compiling of statistical information alone and to feel that job is done is a rare, ineffective way of preventing accidents; however, in order to utilize the Z-16 code as a measure of performance, one must evaluate the criteria for determining disabling injuries — must evaluate with the greatest degree of honesty and then, following the analysis, must establish an accident prevention program in keeping with the facts which can be found. In doing this, a safety engineer cannot only utilize his current figures, but he can also pull from his records his accident reports of years past, evaluate these on the same standard basis, and show by a chart, by graph, or by any other known statistical means, the trends over a period of years. If this is done, and

the standard be a tool, then performance is measured well.

In two departments where Standards over easy to see the changes in safe engineering were in changes in safe personnel are at the hands of a measure of safe performance. I engineer in the management for within his industry safety performance that we give the of compensation already too far our effectiveness management team of accident criteria for report day, week-to-week, progress in the past ASA Codes, of long since been management as their position facturing business types of materials, the purchase miscellaneous products.

It seems logical management in stand and know the basis of long have stood the test.

There are three to maintain act show improvement employees, that our methods of statistics. This cases; however, a standard statistical a false sense of confusion on the management as permanent gain.

Some years ago I am very familiar procedure for

the standard becomes established as a useful tool, then performance can be measured and measured well.

In two departments where the records have been maintained according to ASA Standards over a period of six years, it is easy to see those places where safety programs were instituted, where safety engineering was effectively utilized; where changes in safety philosophy on the part of personnel are apparent. Such information in the hands of your boss can be a second measure of safety performance—your safety performance. I am sure that every safety engineer in this room is responsible to management for the reduction of accidents within his industry. Management measures safety performance on the basis of the facts that we give them as well as on the basis of compensation costs with which they are already too familiar. In order to establish our effectiveness as a member of the management team doing our job in the prevention of accidents, we must have established criteria for reporting to them our day-to-day, week-to-week, and year-to-year progress in the prevention of accidents. The ASA Codes, of which there are many, have long since been established in the minds of management as the basis for evaluation of their position with others in the manufacturing business or the evaluation of types of material on procedures and practices, the purchase of supplies, and other miscellaneous parts of the business world.

It seems logical to have to present to management in language that they understand and know, reports of performance on the basis of long-established standards which have stood the test of time.

There are those who feel that in order to maintain active interests or, in order to show improvement to management or to their employees, that it is necessary to change our methods of recording and compiling statistics. This may be necessary in some cases; however, change or modification of a standard statistical system can result in a false sense of security perhaps, in confusion on the part of the employees, and management as well and can result in no permanent gain.

Some years ago, an industry with which I am very familiar, established a statistical procedure for reporting injury experience

which was somewhat different from the ASA Standard. This method used weighting factors for average number of employees, for types of injuries, for practically everything under the sun. The reports were somewhat unwieldy to prepare; the interpretation of those reports was practically impossible for anyone less than a statistician. Because in each case, in order to obtain full evaluation of the statistical evidence, one would constantly be required to refer to the weighting factors. The employees could not understand the new system; however, they were favorably impressed in the first months or so because the charts prepared from this statistical evidence with those weighting factors were able to show an improving line on the graph almost constantly. The accident reports of this industry were analyzed according to the basis of the ASA Z-16 Code, and some startling information resulted. It showed that, by eliminating the factors, both frequency and severity fluctuated greatly over the period checked. It showed that their record was not the constantly improving record, and it showed that there was need of more than a new system chart to improve the safety of that industry.

Arthur P. Johnson, Vice President in charge of Engineering, American Mutual Liability and Insurance Company, in the May, 1961 issue of "Standards Magazine," published by ASA very appropriately summarizes my comments:

"Statistically, the total picture is much improved; however, fatalities and serious injuries are continuing as a result of accidents in which physical factors have not been brought up to a safe standard. This is of serious concern to employers as well as to employees. More and more, third-party suits for very high damages, alleging negligence by failure to make the operation safe, are being filed following industrial injuries. In these cases, evidence of failure to comply with codes and standards can be very damaging. Accident prevention, it should be remembered, is a process of management aimed to prevent recurrence of accidents. It is urged that management use standards, especially American Safety Standards, as criteria for the safe control of work environment and operations."

The ASA Disabling Frequency Rate is

a good measure of safety performance; the employees can understand it; management can understand it because it is the kind of information with which they are most familiar; the safety engineer can understand it because it establishes standards and limitations which, if used properly, can be the greatest assistance to him in his accident prevention work.

In order to play the game "according to Hoyle," we must have these standards. Deviation from the standard makes a new game.

Z-16.1 is no longer a research project. It is a regular code for day-to-day safety evaluation—for active safety engineers.

REFERENCES

ASA Z-16-1—1954
ASA Z-16-2—1941, Parts I and II
Bulletin 1149—U. S. Department of Labor
Injury Rates—New York State Industries
Industrial Accident Prevention—Helmreich, 1941
Accident Prevention Manual, 4th Edition—1969
Standards Magazine—May, 1961
Accident Facts—National Safety Council, 1961

A MORE DYNAMIC APPROACH TO THE PREVENTION OF BACK INJURIES IN AN INDUSTRIAL ENVIRONMENT

By C. F. MARTIN, M.D.

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Lexington, Ky.

Under this "wastebasket" term—the sore back—fall many common medical diagnoses and fancy National Safety Council classifications. Mark Twain's remark that, "Everybody talks about the weather and nobody does anything about it," might seem to apply to this sore back problem. However, as we know, this is not entirely true. In the field of medicine there is not a single large medical meeting presented anywhere without at least one discussion centering around the mechanisms and treatment of back complaints.

It is safe to say that almost everyone in this room has had a sore back. For reasons of understanding, let us define some terms so that we will be better able to understand each other. First, the disabilities in the back—with concern to safety people—can most simply be divided into two classes:

- (1) Those due to injury.
- (2) Those not due to injury.

Those conditions due to injury we speak of as *sprains*, *strains*, bruises of ligaments, muscles, and joints. Those not due to injury can be wear and tear of age, or perhaps inflammation of muscles or tendons, best known as rheumatism.

From a safety man's standpoint, I think

it would be important to classify back complaint, emphasizing four points:

1. There should be some accident or some unforeseen event which suddenly occurs or produces a definite sprain, strain, or other recognizable injury. For example, a bruise.
2. Such an accident should lead to an immediate, or almost immediate interruption of the ability of the back to perform its usual work.
3. A thorough examination of the back would reveal some sign, or demonstrate some functional disturbance.
4. This disturbance should bear a logical connection to the accident or event as reported.

The term *strain* indicates stress greater than that which the supporting elements of the back are normally able to withstand. The fleshy tissues of the back are endowed with strength, elasticity, and vigor according to the development of each individual. When an abnormal stress is applied, whether suddenly or slowly, and the tissues are stretched beyond their normal resistance, this gives rise to pain, soreness, and disability.

Again, from a safety man's standpoint, occupational back strain as a result of fatigue is not usually classified as an injury.

However, as frequently seen

When we see that an abnormal pair of the sprain is a suddenly become ligaments are torn or separate condition and finally and finally longer.

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Most medical back condition—that is, to self. This is use of the back port.

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2. Second ment collecte Department c back accident

However, as a medical entity, it is frequently seen and recognized.

When we refer to *chronic strain* we mean that an abnormal state has existed longer than the time estimated for the usual repair of the damage to the back. The word sprain is a term applied when a joint has suddenly been twisted or wrenched and the ligaments around this joint have become torn or separated. Sprains are a more serious condition than strains, and the disability and time for improvement are much longer.

One of the most popular diagnoses made today is the rupture or protrusion of the intervertebral disc. This simply means that for some reason the padding between the bodies of the vertebra is pushed out of its normal position, causing some pressure upon the nerve roots. When this happens, there is pain, muscle spasm, and notable disability. Treatment for this condition is long-termed and quite involved.

Another perplexing term that we come upon in the medical discussion of the back is the *lumbosacral instability*, which in most practical terms means that there is a weakness in the cornerstone and/or the cement of the cornerstone of the base of the back. This leads to chronic soreness, weakness, and subsequent disability.

Most medical forms of treatment for back conditions are directed toward one end—that is, to allow the body to repair itself. This is done by restriction of the use of the back, medication, rest, and support.

In our location, our experience can be divided into three phases:

1. First, we were offered an unprecedented opportunity, by the building and opening of a new plant, to observe, examine, and collect data on the physical work required for a perplexing variety of jobs. Not only the physical work required for the job, but, more importantly, how the man on the job was actually performing this work. Observation such as this can be made only one way, and that is to see it firsthand; not once for two minutes, but repeatedly at varying intervals.

2. Second phase: the Medical Department collected patients, while the Safety Department collected the case histories of back accidents. Our data and observation

were sorted and studied. Engineering methods were used to devise improvements in the mechanics of the job. Patients with back complaints were instructed individually on proper back care and advised to tell others of their painful experiences.

These first two phases are completed, and we have learned much from working through them.

In a third phase, prevention, strong emphasis must be placed on education and group participation; the effects of which will reach beyond the plant and work situation.

In an attempt to bring all the medical information and experience into focus under one study, the medical department did what was called "*The Statistical Evaluation of 235 Back Cases in the Medical Department; Oct. 1957—April 1960.*"

TABLE I

Total number industrial cases.....	130
Total number non-industrial cases.....	105
55 per cent industrial back injury	
44 per cent non-industrial back injury	
61 cases filed for Workmen's Compensation	

We see of the 235 people followed, approximately half were industrial injuries; the remainder occurred outside work. Of the 130 people who reported that they injured their back while at work, 61 (or less than half) were filed on through Workmen's Compensation.

It is important to remember, we were able to take care of more than half of the industrial injuries in the first aid area, using simple treatment measures. We will say a great deal more about the fact that half of our number of cases were injured *outside the plant*.

By listing the 10 departments having the largest number of cases, a finger is pointed to sore spots.

TABLE II

Ten Departments Having Greatest Number of Cases	
1. Dept. 166	11 (Assembly)
2. Dept. 265	10 (Machining)
3. Dept. 720	9 (Machining)
4. Dept. 093	8 (Machining)
5. Dept. 175	7 (Assembly)
6. Dept. 145	6 (Assembly)
7. Dept. 006	5 (Machining)
8. Dept. 010	5 (Machining)
9. Dept. 026	5 (Machining)
10. Dept. 323	5 (Assembly)
<i>Totals</i>	
Assembly	29
Machining	42
	71

In our pre-employment examination we ask the question in writing, and then again during the examination, "Have you ever experienced a sore back?" If the answer is yes, we ask, "Has this been severe enough to restrict your work activities?" Regardless of the answer, these people have been hired.

More recently, we have been asked these questions: Do people who have told you, at the time of pre-employment examination, that they have already experienced back trouble often have recurrences? How severe will their recurrences be? Will they demand jobs that are of a restrictive nature?

TABLE III

Comparison of employees who gave history of back trouble prior to employment as compared with those now having permanent physical (Class II) restrictions.

235 cases = 26 permanently restricted (Class II)	
Previous history	57
Permanently restricted	10

When we compare the employees who gave us a history of back trouble with the total number who have permanent physical restrictions, we see that out of the 235 cases, 26 people are permanently restricted Class II.

Of these 235 cases, 57 people said that they had had back trouble. Of this 57 people, 10 people are permanently restricted (Class II)—that is 1 in 5.

TABLE IV

Comparison between those having previous history of back trouble prior to employment as compared with workmen's compensation cases.

Previous history	57
Total number compensation cases due to back complaint	61
Previous history and compensation	13 (21 per cent)

In this table, if we compare those having a previous history of back trouble, prior to employment, with workmen's compensation cases, we note: Those giving previous history were 57. Total number of compensation cases was 61. Those giving a previous history and becoming compensation cases later in employment were 13 (or 21 per cent).

I think it is logical to say that people with past history did substantially contribute: (1) to permanent restrictions—1 in 5, (2) to compensation cases—1 in 4.

TABLE V

How Long For Common Conditions

Average length of treatment for muscle strain	11.6 days
Average length of treatment for lumbosacral strain	21.9 days
Average length of treatment for disc (surgical)	106.6 days
Average length of treatment for disc (medical)	56.5 days

In this table you will see the average length of treatment of muscle strain, of lumbosacral strain, of disc disease that demanded surgery, and of disc disease treated medically.

A disc that will require surgery can return to some type of productive labor in three months, providing rehabilitation happens to be popular in your plant. If the disc seems to respond to conservative measures (that is, without surgery), you can get him back in two months.

TABLE VI

Warning of a Pitfall

Time for recovery of workmen's compensation cases cannot be compared with industrial back injuries not compensated, nor with non-industrial back injuries, because of the factor of severity. Those patients having the most severe, complicated, and protracted back injuries are filed on under Workmen's Compensation. The more simple, uncomplicated back injuries receive routine supportive treatment in the plant first aids and are not filed on. No comparison should be attempted.

At first glance, I thought we could compare workmen's compensation cases with home injuries, and draw some conclusions. Safety people, management people, and now medical people must be concerned with the amount of money spent on compensation cases, and the time required for recovery of compensation cases. The time for recovery for workmen's compensation cases cannot be compared with industrial back injuries not compensation, nor with non-industrial back injuries, because of the factors of severity.

Earlier, in the tables, we called your attention to the fact that we filed on less than half of those people who had industrial back injuries—that is, we filed on the severe ones. We took care of the ones that were not severe and would clear up in a logical time anyway. So, those patients having the most severe, complicated, and protracted back injuries were filed on under Workmen's Compensation. The more simple, uncomplicated back injuries received routine supportive treatment in the plant

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TABLE VII
Average Length of Treatment of Compensation Cases

Muscle strain	21.6 days
Disc	75.3 days
Lumbosacral strain	31.6 days
Average Length of Treatment of Industrial Back Injuries Not Compensation	
Muscle strain	7.1 days
Disc	5.8 days
Lumbosacral strain	10.9 days

This table we present as a composite of facts (another warning of a pitfall) and not as a comparison: The length of treatment of compensation cases varies for muscle strain, disc, and lumbosacral strain, also for the average length of treatment for industrial back injuries *not* compensated. This may give us a picture, or perhaps an index of severity.

TABLE VIII
Back Cases 1960 Recurrent

Industrial	15	19
Compensation filed	4	
No compensation filed		28
Non-industrial		47

Now to be up-to-date, let us briefly review our experiences of 1960. Recurrent refers to some of our old buddies who have been re-injured and need further treatment at our gentle hands. Please note that industrial is now 19 and non-industrial 28.

From experience and from analysis, I have come to believe very firmly in the

TABLE IX New (Acute) Cases		
Industrial	29	49
Compensation filed ..	20	
No compensation		36
Non-industrial		85
Total cases 1960		
Industrial	68	132
Non-industrial	64	

third phase. You can see from this presentation that half of our back injuries happened in the plant and half away from work. So if we set about and spent all our time correcting all of the conditions in the plant that might cause any back trouble, and if perfection were reached, we would be able to show only 50 per cent improvement. Certainly we should—and we have—through individual training and through improved engineering techniques on the job, attempt to help this 50 per cent.

To achieve real success in the saving of manpower and in the lessening of pain and morbidity, we must have a group collective action. We propose to do this through an educational program of lectures (both medical and safety) and through printed material sent out with the plant newspaper and through management conference. We must train these people in groups, teaching them the mechanism of their back and the care of this system, and doing this in such a way that they will carry it from work and into their lives at home.

This has been the problem, the analysis, and the proposed answer.

SAFETY'S ROLE IN PREVENTING BACK INJURY

By CHARLES W. BOGGS

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Lexington, Ky.

One of the fastest-growing clubs in America today is the "Aching Back Club," an organization with millions of reluctant members. Thousands of industrial workers join this club every week by trying to lift objects too heavy for them or by failing to lift properly. There's no waiting for membership. It takes no longer to qualify than it does to bend over and tie your shoe. Admission is free.

Many safety people are of the opinion that back injuries will occur regardless of what they do, so little is done to eliminate the cause of these injuries. There are causes, though, that can be eliminated. In tackling this problem at our plant, the first thing I did was to make a survey of all our compensable back injuries from January, 1957, through December, 1960. From this survey we found that our assembly

area accounted for the greatest number and that lifting typewriters from the work bench to the monorail conveyor or vice versa, was our leading cause. The next two leading causes, lifting pans of parts and handling machine fixtures, etc. occurred in our machining area. After reviewing all the facts and figures we decided to concentrate our efforts in these areas.

A typical work station on our assembly line has the work bench and roller conveyor the same height with a monorail conveyor directly above the roller conveyor. The carrier on the monorail is located 45" from the floor. When handling, the typewriter has to be held away from your body with the heavy part (motor area) away from you. There is a reason for this and it was one of the bad things about our original arrangement. To keep the typewriters in proper alignment the operator has to keep the keys away from him when handling.

This type of assembly line has been basically the same since 1956 when our plant was located in Kingston, N. Y. As a result of a study made there by the Liberty Mutual Insurance Co. we lowered the monorail conveyor 3 inches when we set up our new line at Lexington. We also became more conscious of the placement of people in regard to the location of female employees along the line.

You will recall that our leading cause of injury was lifting the typewriter to or from the monorail conveyor.

We found that the main reason for this was that employees were not following good lifting practices, such as waiting for the typewriter to be directly in front of them before removing it, and were not turning their feet, but only their bodies.

Realizing that as long as employees had to lift the typewriter we would continue to have injuries, we took our problem to plant engineering. In the fall of 1960 a "push along line" was installed into one of our three assembly lines. This initial installation was put in an area where most of our back injuries were occurring. We haven't had a compensable back injury in this area since the installation of the new line.

In January of 1960 we came out with a new model typewriter called the model C. We were soon having injuries at our cover

operation where the typewriter had to be lifted twice; once to put the cover on and then again to be put back on the pallet after the cover was installed. Because of the design of the new covers it was hard to get a firm grip on the typewriter when lifting it back on the pallet.

As a result of a suggestion submitted by an employee performing this operation the pallet used to transport the typewriter on the rolled conveyor was changed and locating stops were installed on the bench. This eliminated all the lifting, as the pallet is now pulled off the roller conveyor to the bench, cover installed, and pallet and typewriter are slid back in the conveyor.

Following the typewriter on through the line we realized that we had one more area that required a lot of lifting, our packing area. Here four people were required to lift all the typewriters that came down the assembly line. A change was made in the layout of this area whereby only one person was required to lift but this person had a lot more lifting to do as he had to lift each typewriter and place it in a carton.

We realized this was a problem at the time the layout change was made, so a temporary lifting device was installed. Now the operator would not have to lift the typewriter. This operation has been changed so that the operator now lifts only the carton (one pound) instead of lifting the typewriter, which weighs approximately 50 pounds. This device was designed by our engineering department and built by our apprentice toolmaking school.

The only other area in our assembly operations that had given us any trouble at all was a sub-assembly operation that required an employee to lift power frame baskets weighing approximately 40 pounds from a skid. Although these baskets aren't too heavy, they sometimes stick, and an employee lifting the top basket is lifting above his elbow height. One of the recommendations made by Liberty Mutual Insurance Co., in the survey mentioned earlier, was that a person should not have to lift repeatedly above their elbow height. (The range of elbow height is given as between 34 inches and 45 inches, the average being 40 inches.)

For this reason, the first thing we did was restrict the height of these baskets to

three feet high below his elbow height. The height of materials handled that equipment baskets. With the operator up to his bench, the parts are the parts and for the next parts on small line on the roller conveyor involved basket from moving the material can be moved to bench height.

Before we would like to Our plant engineering department is chairs, so that and most conditions.

In the machine material-handling, but we are manually in the from our side of trouble here. Although we weight (pan 75 pounds, which this was being weighed as in most cases but because of being used it to stay within

We had to naturally took result of an machining, so personnel, a put into use. container full not exceed the up less floor

Lifting problems have been so conveyors, and at

In one instance back pain because he had to a

three feet high. Now the employee lifts below his elbow height. After restricting the height of the baskets we went to our materials handling department and requested that equipment be purchased to handle these baskets. With the equipment now in use the operator moves the skid of three baskets to his bench, performs one operation while the parts are in the basket, then removes the parts and places them on his bench for the next operation. He then places the parts on small pallets to be moved up the line on the roller conveyor. The only lifting involved now is removing the empty basket from the top of the pile. After removing the empty top basket the equipment can be raised bringing the next basket to bench height.

Before we leave the assembly area, I would like to mention the chairs used here. Our plant engineering, medical, and safety department investigated several styles of chairs, so that we might select the safest and most comfortable chair for our operations.

In the machining area, we have the usual material-handling equipment used when lifting, but we still have to lift many articles manually in the course of a day. We found from our survey that the biggest source of trouble here involved the lifting of pans. Although we have a rule that the total weight (pan and parts) are not to exceed 75 pounds, we found some instances where this was being overlooked, and some pans weighed as much as 150 to 200 pounds. In most cases the rule was being followed, but because of the size of the container being used it could only be filled partly to stay within the 75-pound limit.

We had to use more containers, which naturally took up more floor space. As a result of an investigation carried out by machining, safety and material handling personnel, a smaller container has been put into use. Now we can fill the smaller container full, and with most parts it will not exceed the 75-pound limit. It also takes up less floor space.

Lifting problems in the machining area have been solved by the use of belt conveyors, and air lifts.

In one instance an employee developed back pain because of the awkward position he had to assume while performing his

operation. Investigation showed that he spent most of his time in a bent position. This was solved by raising the saw and table so he could work more comfortably.

Another source of help that may be overlooked is the purchasing department. Many purchased parts remain in their original container until the parts are used, so the container has to be handled somewhere along the line. By having the purchasing department notify vendors to ship parts in smaller containers, keeping the total weight around 75 pounds, it is possible to handle these containers without too much difficulty.

Here's an example of what I'm talking about. We used to receive main springs in cardboard barrels that weighed 300 pounds each. We now receive them in cardboard cartons, weighing 74 pounds. Each carton contains four smaller boxes weighing 18 pounds each. Although the cost of the springs were increased slightly, we eliminated many handling problems in the plant that more than overcame the increased cost.

In trying to solve our back injury problems we followed three basic steps:

1. Recognized that we had a problem.
2. Analyzed the problem for the how, when and where.
3. Used one of the E's of safety—Engineering.

Now we come to another E of safety and one I believe to be the most important—Education. As I pointed out in the beginning, people can become members of the "Aching Back Club" without too much difficulty. We can find out all the statistics, take care of all the engineering problems, and people will still hurt their backs if they don't understand the problem. Therefore we have to educate them, and this is what Dr. Martin and I have been working on. We have taken small groups of employees from the high-injury areas and, by using slides, we have discussed the basic structure of the back, how it works, and the importance of good posture when sitting at a work bench. We feel that if the employee has a chance to see how his back is constructed, and what it can and cannot do, they will be more conscious of good lifting habits.

Education must not stop at the plant gate. We know from experience that if we elimi-

nate all the problems in the plant we would still be left with 50 per cent of our problem because of the back injuries that occur off the job. Therefore it is important that we extend our education program into the home.

Even though many believe that the back problem is here to stay and there is nothing we can do about it, I hope I have been able to give you some idea of what can be done if you really want to lick the problem.

HUMAN ENGINEERING AND MATERIAL HANDLING SAFETY

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"Human Engineering" in its broadest meaning, or to use the modern term "Ergonomics," aims at the optimum use of the human being to serve the community and the individual in the best possible way. Ergonomics is the science which studies the "laws of work," emphasizing the capabilities and limitations of mankind, physically as well as mentally.

Technical developments are often so far advanced that the capabilities of the user, rather than the potentialities of his equipment, limit the performance of the two working together. Disregard for the human limitations results in an alarming number of fatalities and injuries caused by his own inventions. Because accident prevention is our goal, recognition of the pathological man-artificial environment relationship is paramount in order to undertake steps to cure the situation.

The industrial hygienist, safety engineer, physiologist, psychologist, industrial physician, traffic engineer, law maker, and gadgeteer, just to name a few, have in many instances devoted a lifetime to making the artificial environment a safe place in which to live. However, the magnitude of loss payments prove that much more ought to be done. The problem is basically simple: we have obviously a mismatch between man and environment and we must do something about it to improve the situation.

Ideally, we first must know man, machine, and environment before we can even try to

match them. The modern approach to this problem is basically to adjust the machine or the artificial environment to man and not man to the machine or environment. The latter approach may be acceptable to the armed forces where the human criteria, out of necessity, are different from peacetime standards.

The artificial environment and the machine are secondary to man. Disregard for this basic human requirement will create a health hazard. Research, as I see it, must and can contribute in a significant way by gaining knowledge necessary for the application of the principles of Ergonomics. Acceptance of the fact that better understanding of accident causation will result in better accident prevention, is of extreme importance to our society. *The ultimate goal of Ergonomics is the determination of work procedures, machine designs, and environmental controls that will result in loss prevention.*

It seems to me practical to concentrate safety research activities to a certain degree to those areas which have proven time after time to be significant accident producers. These areas can be selected simply by studying national accident figures, or our own statistics. A recent study made by our loss prevention department over a period of two years reveals e.g. that 23.8 per cent of all high cost workmen's compensation accidents are related to manual materials handling and are responsible for about 20 per cent of the total cost. These figures indicate

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the need for better understanding of causation of accidents as a result of pushing, pulling, lifting, bending, twisting, carrying, etc.

The plant physician, as well as the safety engineer, would be greatly helped if we could supply him with answers to numerous questions such as: How much can the average man lift? What is the maximum daily allowable energy expenditure of woman? Is pushing more efficient than pulling? What is the proper relationship between the slope of a ramp and the total weight of the hand truck and the load? Many of these questions can be answered today because the research procedures and tools are available.

It is my privilege to discuss and to demonstrate a method which has been proven to be of great importance in the study of some of the human factors in material handling and equipment design.

One of the favorite tools of the physiologist interest in ergonomics is his equipment to measure metabolism. Because of the importance of this equipment, I have spent a good deal of time and effort in developing an instrument which will measure work efficiency more satisfactorily than most commercially available equipment. I would like to discuss this new instrument, called the "Differential Flamoxymeter." It enables us to obtain an accurate, continuous determination of the oxygen concentration in gas mixtures, information basic to the evaluation of metabolism and human efficiency.

Description of the Differential Flamoxymeter

In considering the development of a method to determine oxygen quantitatively and qualitatively in gas mixtures, it seems logical to utilize chemical or physical characteristics of oxygen, which are in degree, or essentially, different from other gases. Therefore, the fast oxidation of combustible substances as it occurs in a flame seems especially appealing because this reaction does not take place without oxygen in the majority of circumstances. Furthermore, the physical phenomena which accompany combustion will provide us with a variety of choices for quantitative measurements. The instrument must be designed in such a way that the oxygen concentration

of the gas sample is correlated with the chemical or physical characteristics measured.

A priori we did not expect satisfactory results from a method in which the heat production of a flame would be affected by minor changes in the oxygen concentration in the environment of the flame. One may expect that the limiting factor for the combustion under these circumstances will be the rate of supply of combustible material rather than the concentration of oxygen in the sample.

To make oxygen the limiting factor in the combustion we simply can "reverse" the flame. Because combustion is a physico-chemical process in which the combustible component is as essential to the reaction as the oxygen, it makes no difference whether a combustible gas burns in an environment of oxygen or whether oxygen burns in an environment of combustible gas. Therefore, if we were living in an atmosphere of hydrogen, we would call oxygen a combustible gas and the gas company would supply our gas ranges with oxygen.

By utilizing a reversed flame for the determination of the oxygen content in gas samples, it will be possible to produce heat in direct proportion to the oxygen content of this sample. In order to obtain this direct relationship, one must provide an excess of the combustible gas in the environment and at the same time one must keep the flow of the sample gas toward the flame at a constant rate. Under these circumstances, the instrument is specifically sensitive to oxygen and not to other gases. Notwithstanding the simplicity of the principle of the reversed flame it was found to be extremely time consuming to develop an accurate, sensitive, and practical instrument for the determination of the oxygen content in gas samples.

A differential method, using two flames, was chosen because it had some advantages over the utilization of a single flame, as will be explained later.

As combustible gas, hydrogen was found to be the best environmental gas of the group tested and has been used without experiencing any difficulty. FIGURE 1 presents a sketch of the essential parts of the Differential Flamoxymeter. Chamber A is kept under a constant low vacuum by means

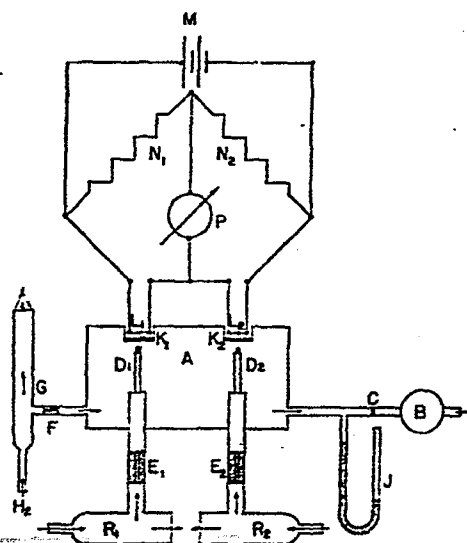


Figure 1—Schematic drawing of the "Differential Flamoxymeter." A, combustion chamber; B, vacuum pump; C, critical orifice; D₁, D₂, burners; E₁, E₂, capillary tubes for air samples; F, capillary tubing for hydrogen; G, pressure release tubing for hydrogen; J, manometer; K₁, K₂, quartz windows; L₁, L₂, thermistors; M, battery; N₁, N₂, resistors of Wheatstone bridge; P, galvanometer; R₁, R₂, pressure release tubes for air samples.

of vacuum pump B. The gas flow toward pump B is kept constant by utilizing a critical orifice C. D₁ and D₂ are the burners for the reversed flames.

The air flows toward the burners D₁ and D₂, is mainly a function of the atmospheric pressure P, the pressure within the combustion chamber A, and the resistance of the capillary tubing E₁ and E₂. A constant flow of hydrogen enters chamber A through the capillary tubing F. Because the instrument is very sensitive to variations in flow, the pressure of the incoming hydrogen and sample air at the entrance to the capillary tubes must be constant.

The hydrogen is taken from a tank of compressed gas. In order to supply this gas at a constant pressure to capillary tubing F, the gas is supplied to an open tubing G. The excess of hydrogen is simply burned at the end of this tubing. A small part of the hydrogen in tubing G is drawn through capillary F towards the combustion chamber A. The same method is used for the air samples supplied through R₁ and R₂ toward capillaries E₁ and E₂. The capillary tubes F,

E₁ and E₂, as well as the critical orifice C must be kept at a constant temperature to assure good flow control.

Opposite the two flames are two quartz windows K₁ and K₂ mounted in the wall of the combustion chamber A. The infrared energy radiated from the two flames is measured through the windows by means of two matched thermistors L₁ and L₂. The thermistors form two arms of a Wheatstone bridge.* A variation in the oxygen concentration between samples supplied to flame D₁ and D₂ will cause an unbalance of the Wheatstone bridge. The signal coming from the bridge is amplified and fed into a chart recorder.

Because the degree of unbalance of the bridge is related to the difference in oxygen concentration of the two samples, the magnitude of the signal coming from the bridge is an indication of the oxygen concentration of the gas fed into the "test" burner if the "reference" burner is supplied with a known gas mixture. For the "reference" gas mixture, we normally use outdoor air.

The analysis apparatus described is the most important component of an instrument designed to measure metabolism continuously. FIGURE 2 presents a schematic drawing of the various additional parts essential to this kind of measurement. A motor driven constant output pump draws outdoor air through tube A, via valve K to mask J. The plastic expansion bag I provides temporary room for extreme expirations. The valve K closes if the exhaled air exceeds the capacity of the pump. The dry and wet bulb thermometers E and F enable us to determine the partial water vapor pressure of the air passing through the mask. A calibrated flowmeter D measures this air flow. The valve X is used to make corrections in air flow during an experiment. An additional low capacity double piston pump P₁ and P₂ samples air dried by means of absorbers N₁ and N₂. The absorbers are connected with the open tubes O₁ and O₂. Thermistors V₁ and V₂ are exposed to the radiation from the two flames passing through the quartz windows.

The thermistors V₁ and V₂ are branches

*The variations in infrared radiation of the flames can be measured in many ways. At the present time, we are experimenting successfully with two matched lead sulfate cells, on which we project, by means of a single quartz lens, the images of the flames.

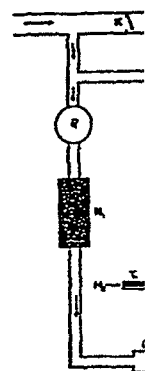


Figure 2—Schematic drawing of the various additional parts essential to this kind of measurement. A, motor driven constant output pump; B, vacuum pump; C, critical orifice; D₁, D₂, burners; E₁, E₂, capillary tubes for air samples; F, capillary tubing for hydrogen; G, pressure release tubing for hydrogen; J, manometer; K₁, K₂, quartz windows; L₁, L₂, thermistors; M, battery; N₁, N₂, resistors of Wheatstone bridge; P, galvanometer; R₁, R₂, pressure release tubes for air samples.

FIGURE 3—Schematic drawing of the various additional parts essential to this kind of measurement. A, motor driven constant output pump; B, vacuum pump; C, critical orifice; D₁, D₂, burners; E₁, E₂, capillary tubes for air samples; F, capillary tubing for hydrogen; G, pressure release tubing for hydrogen; J, manometer; K₁, K₂, quartz windows; L₁, L₂, thermistors; M, battery; N₁, N₂, resistors of Wheatstone bridge; P, galvanometer; R₁, R₂, pressure release tubes for air samples.

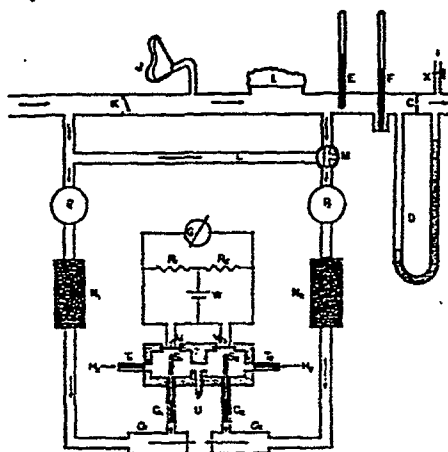


Figure 2—Schematic drawing of the "Differential Flamoxymeter" and additional equipment as used for the continuous determination of metabolism (see also text). A, inlet for outdoor air; K, valve to prevent back flow of respiratory air; J, face mask for test person; I, expansion bag; E, dry thermometer; F, wet thermometer; C, orifice; D, calibrated manometer-flow meter; X, flow adjusting valve; P₁, P₂, sample pumps; N₁, N₂, air sample dryers; O₁, O₂, pressure release tubes for air samples; S₁, S₂, burners for the "reversed" flames; T₁, T₂, capillary tubes for hydrogen; V₁, V₂, thermistors; R₁, R₂, variable resistors of Wheatstone bridge; W, battery; G, D.C. amplifier and recorder; M, "zero line-sample" valve; U, outlet to critical orifice and vacuum pump.

of the Wheatstone bridge schematically shown in Fig. 2. The indicating meter G is actually a D.C. amplifier and recorder. Resistors R₁ and R₂ may be varied which enables us to adjust the "zero line" of the recording meter. The amplifier is equipped with a four step-gain control in order to vary the sensitivity range of the analyzer. The valve M supplies the "test" burner S₂ with outdoor air or with sample air coming from mask J.

The "reference" flame S₁ receives dry outdoor air continuously from pump P₁. With the valve M in the position shown in Fig. 2, the difference in heat production of flame S₁ and S₂ is related to the oxygen consumption of the test person. Therefore, the current passing through meter G is proportional to the rate of metabolism of the subject breathing through mask J. The temperature, relative humidity, barometric pressure, and volume of the air passing through tube A are all factors playing a role in the final calculation of the metabolism.

The latest model of the Differential Flamoxymeter (FIGURE 3) which I am demonstrating today is especially designed for use outside our laboratory. It records the energy expenditure of the worker immediately and exactly, compensating semi-automatically for variations in the tempera-

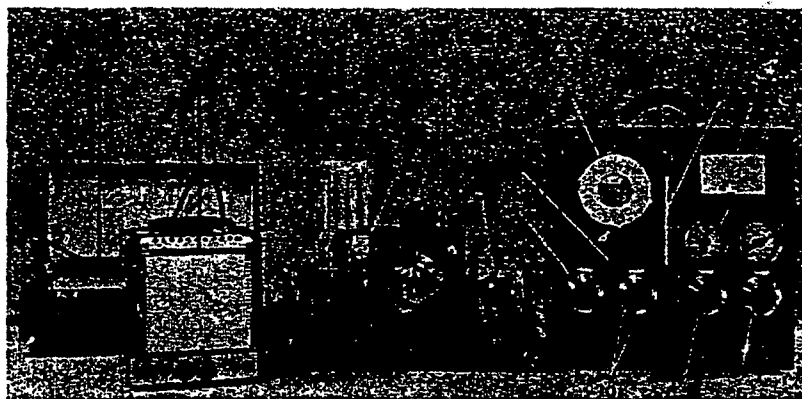


FIGURE 3—Equipment for the Measurement of Metabolism—The four basic components are as follows: A. Analogue computer, air pump, flowmeter, barometer, wet and dry thermometer, and timer. B. Oxy-combustion meter (air analyzer). C. Amplifier and recorder. D. Vacuum pump.

1—Barometer; 2—Bimetal wet thermometer;

3—Bimetal dry thermometer; 4, 5, 6—Manual setting of barometric pressure, wet and dry thermometer for analog computer (computer inputs); 7—Flow correction indicator (computer output); 8—Flowmeter; 9—Manual flow adjustment; 10—Timer and timer indicator; 11—Ignition coil for reversed flames; 12—Bridge balancing potentiometer; 13—Vacuum gauge for combustion chamber.

ture, pressure and humidity of the patient's air. This is accomplished by means of a simple analog-computer in which we feed manually three variables: (1) Barometric pressure, (2) Dry bulb temperature and (3) Wet bulb temperature. The meter reading of this computer indicates the air flow correction necessary to compensate for the deviations from "standard" conditions of the patient's air. (Dry air at a temperature of 0° C and 760 mm Hg). Under these circumstances the patient's air supply is the equivalent of e.g. 3000 liters of air per hour, at 0° C temperature and 760 mm Hg pressure.

The flamoxymeter indicates the percentage changes in oxygen in this standardized air flow, which now becomes an absolute measure of the volume of oxygen (under standard conditions) consumed by the test person per time-unit. Accepting a fixed respiratory quotient, which is permissible in metabolism determinations, based upon oxygen uptake, we now can express the difference in oxygen concentration of air going towards the patient and of air coming from the patient, in calories per unit of time.

This *a priori* correction of air flow makes time consuming calculations after the experiments are terminated, unnecessary and this is especially advantageous for field trials.

As I have mentioned earlier, I would like to demonstrate to you the importance of the evaluation of energy expenditure in the study of materials handling problems.

I have chosen, as an illustration, a very simple lifting experiment in which my associate will lift a box weighing 10 pounds every 4 seconds over a vertical distance of 1 foot. If he continues to do this work for 1 hour, his total work output will be $60 \times 15 \times 10 \times 1 = 9000$ ft./lbs. or about 2.9 Calories per hour.

We will see that his energy expenditure (to compare with "input") far exceeds this output value, because the human engine has a relatively low efficiency. The human efficiency, however, is not a fixed value and its magnitude depends upon a multitude of factors, some of which we will discuss today.

First we will "hook up" the test person with the Differential Flamoxymeter while he is in sitting position, and we will notice

that his "rest" metabolism is about 75 Calories per hour. This value is somewhat larger than his so-called "basal metabolism." The basal metabolism is to compare with the energy expenditure of an idling engine. It is more realistic to calculate the efficiency of work after the basal metabolism has been deducted from the measured energy expenditure values.

We are now ready to start with the actual lifting experiment. We will notice that our instrument shows an almost immediate increase in energy expenditure, but we also will notice that it will take some time before a steady state has been reached. The total energy expenditure reads now a constant value of about 120 calories per hour or about 45 Cal/hr after deductions of the rest metabolism. We previously calculated that the actual output is approximately 2.9 Calories per hours: An efficiency of only $\frac{2.9}{45} \times 100 = 6.4$ per cent.

We now will repeat this experiment, varying only one factor and see what will happen to the efficiency of this test person under these circumstances.

In the previous experiment, we placed the box on a table which is about 30" high. The lifting took place, therefore, between 30" and 42", as measured from the floor.

In the second demonstration, my assistant will lift the same box at the same frequency and over the same distance of 1 foot, but starting the lifting from the height of 18" from the floor. The external work is still as in the first experiment, 9000 ft./lbs. or about 2.9 Calories per hour. The Differential Flamoxymeter, however, indicates in the second test a higher energy expenditure and we read now a total metabolism of about 170 Cal. per hour. After subtracting the rest metabolism we find that the cost of this work is about 95 Cal. per hour. The efficiency is now reduced to $\frac{2.9}{95} \times 100 =$ about 3 per cent.

This simple demonstration reveals the importance of the area in which materials handling takes place. If time permitted also to vary the weight of the box, we could demonstrate that the efficiency of lifting could be made about 8½ per cent by increasing the weight of the box to about 40 pounds and by starting the lift at approxi-

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mately 4 feet from the floor. (Variables such as sex, age, body weight, height, etc., are purposely excluded from this table.)

This type of studies reveal that the human efficiency for many industrial activities has an optimal value if the circumstances are selected correctly.

This means that independent of the work output, certain design-environmental-or other factors influence the energy expenditure of men. One of our goals is to find situations in which man works at this top physiological

efficiency or, in other words, expends the least amount of energy for his daily industrial physical work. This approach will reduce fatigue and stress, and consequently, injuries related to fatigue and stress. Much work has to be done in this field before we will notice the full effect of Ergonomics on the reduction of losses.

It is my firm belief that ergonomics will be of great help to the army of safety experts in their battle against our mutual enemy—accidents.

SAFE HANDLING OF LOW LEVEL RADIOISOTOPES

By E. R. HARRIS

Safety Eng., Missiles & Vehicles Dept., General Electric Co.
Philadelphia, Pa.

Radioactive materials continue to find increasing application and acceptance in modern industry. If you presently do not have radioisotopes in your plant, there is a strong possibility that at sometime in the near future you will. We are going to talk about some of the problems you, as safety engineers, will be confronted with when that day arrives.

The problems of control of radioisotopes may be reduced to essentially three factors: removal, or reduction of the hazard to lowest practical levels, guarding the hazard, and protecting the worker. Any program to use radioisotopes should be reviewed with the intention of applying controls in the above order.

A recent news note in a nationally circulated magazine (*Life*, 9-22-61) best illustrates the need for an adequate control system. Alarming amounts of radioactive contamination were discovered in a dozen laboratories at a Canadian university. The contamination was accidentally discovered by a graduate student while attempting to calibrate geiger tubes in the university's old physics building. Lab after lab proved to be contaminated. University officials and a decontamination unit of the Canadian Army were rushed to the scene. Subsequent investigation disclosed that the labs had been used by Ernest Lord Ruth-

erford and his associates between 1899 and 1907.

Lord Rutherford conducted much early research in radioactivity and is considered to be the father of atomic physics. In those early days little was known of the harmful effects of radiation, and a more relaxed view of laboratory cleanliness and order was permitted than could possibly be tolerated today. The legacy of Lord Rutherford's work habits has suddenly been handed down to us; and it points out a condition which we will not be permitted to pass on to our grandchildren, even accidentally. The law and common sense now dictate that you maintain strict control over the use of radioactive materials.

Radioactive materials may appear in your plant virtually unannounced. Usually in micro-microcurie amounts incorporated in devices having little, if anything, to do with radiation work. Certain wave guide tubes used in radar installations are an example. Radium 226 is not covered by the Atomic Energy Act of 1954, and devices containing this material often only require registration with the proper state authority *after* being received. What control measures do you have which notify you when such materials are received? I am not implying that presence alone con-

stitutes a hazard, but rather that a lack of knowledge of intended uses of these devices; and more important, their ultimate disposition may indeed constitute a hazard.

Obviously the need for concern is greatest when you become involved in programs deliberately designed to utilize radioactive materials. These programs usually require licensing by the Atomic Energy Commission. Meeting the requirements of the A.E.C. at the time of application does not insure the elimination of problems after the actual work has started. The Commission, in Washington, can only act on what it reads, you must act on what you observe first hand. The forms in which radioactive materials will appear, and the uses to which they can be put are limited only by the imagination. The amount of control required may vary, but one thing is certain, a system must be established which will permit the required flexibility to do the job without sacrificing safety requirements.

Reams of material have been published documenting the potential hazards associated with the handling of radioactive materials. More reams of material—laws—have been published purporting to effectively control the use of radioisotopes and reduce hazards to acceptable levels. It is not my intention to discuss these laws, but rather to indicate how, within the framework of the law, an effective radiation control program can be administered.

An effective radiation control program requires the issuance of a policy statement of intention to control radiation. The statement should contain nothing which might later be subject to interpretation, and it should fix responsibility for control. Of uppermost consideration should be the health and welfare of employees and the public. All else is secondary.

Effective control of radiation begins in the design stages of the facility or equipment. A knowledge of the type and amount of radioisotopes to be used, and the effects that this will have on location, environmental restrictions, shielding and handling requirements is necessary. Here is the place to provide as much built-in safety as possible.

Selection of suitable personnel who will work directly with radioisotopes is of the utmost importance. Every effort must be made to provide for employment of individuals who are mentally and physically suited for this type of work. The medical department should establish standards for physicals at employment and determine the need for periodic re-examination. A positive system for reporting and clinically observing actual or suspected over-exposures to radiation is indicated.

Training programs and information courses are needed which will provide personnel with an understanding of the hazards associated with handling radioisotopes. All personnel should be trained in emergency procedures, including the use of radiation detection instruments. Emergency procedures should be clearly written and posted. To reduce the possibility of misunderstanding concerning the handling of radioisotopes a separate and distinct series of safety standards should be adopted and enforced. No one should be released for isotope work until he has demonstrated an understanding of the established safety requirements.

Documentation of all occupational radiation exposures is necessary. It is of utmost importance that these records be accurate and up to date. Individuals transferred from other companies should be required to supply documented previous radiation histories. An alternative to this is to assume that the individual has received the maximum allowable amount according to his age. The importance of always wearing personal monitoring devices cannot be over-emphasized.

Film badge programs are usually best administered by outside concerns who specialize in this field. They are usually prepared to provide rapid, accurate exposure records and, in addition, provide legal responsibility for their determinations.

Within the limits of whatever security restrictions you may have imposed upon you, it will be to your advantage to keep the appropriate civil authorities in your community posted. If the local fire company were to respond to an alarm unaware that it might have to deal with radioactive material, considerably more harm than good could be the result.

Constant supervision of general protection is especially pressure from done, you can worker to all principles of radi have as short exposure to anywhere near true facts in distorted before learned, or co

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Constant surveillance would finish the list of general requirements. If radiation protection is to be your responsibility, be especially alert in this area. Under pressure from all directions to get the job done, you can't depend on the individual worker to always adhere to the best principles of radiation safety. Few accidents have as short a reaction time as an over-exposure to radiation. Even fewer have anywhere near the publicity value. The true facts in the case can easily be lost or distorted before anything worthwhile is learned, or corrective measures taken.

Research laboratories usually have more complex radioisotope programs than straight industrial application users. I will describe the program of one such laboratory.

The Atomic Energy Act of 1954, Title 10 — Part 30, paragraph 30.24 requires among other things, that a committee be established "which will review and approve, in advance of purchase of radioisotopes, proposals for such uses and has appointed a radiological safety officer who will advise or be available for advice and assistance on radiological safety problems."

The committee's purpose is to establish and maintain accepted radiation safety and health standards. The committee must have absolute authority to pass on all matters concerning the safe use of radioisotopes, and to reject or modify any request for their use if, in their opinion, such use would jeopardize these standards. The committee does not sit in judgment of the relative merits of the work itself.

The plant physician, safety engineer, representatives of the various departments and a specialist in radiation protection are members of the committee. The medical doctor is responsible for establishing and maintaining a sound medical program and his presence on the committee insures adherence to strict medical consideration of all problems. The presence of the Safety Engineer prevents the sacrificing of sound safety principles as an expedient short-cut to a fast solution to a problem. This trick is not unique to the field of radiation as you well know. The representatives of the various departments often supply special knowledge which eliminates problems which otherwise would not have come to light until too late.

The work horse of a safety committee is the radiation safety specialist who should be someone technically qualified to give advice in this area. In addition, his duties will include most or all of the following:

1. Provide initial contact service for individuals wishing to use isotopes.
2. Discuss the overall program, evaluate the potential hazards, and provide necessary information to insure selection of proper isotopes by balancing radiation safety and health requirements against the job to be done.
3. Determine the background and training of the requester, with regard to previous isotope experience.
4. Provide for instruction as the case may indicate.
5. Examine the area in which the work is to be performed, and evaluate the potential hazard with regard to area personnel, equipment and environment.
6. Outline the personal protective equipment which will be necessary for the job.
7. Outline the work procedures insofar as radiation protection and waste disposal is concerned.
8. Supply necessary guidance for radiation requirements to be included in the formal request.
9. Arrange for full isotope group meeting to consider the problem, supply copies of request in advance of meeting for adequate consideration.
10. Record minutes of meetings.
11. Order radioactive materials. This is the only person authorized to do so.
12. Receive materials; again, the only person who can do so.
13. Store materials in a tamper-proof area. Test for leaks. Maintain inventory records.
14. Distribute radioactive materials as needed; label containers, areas, equipment.
15. Perform startup and regular surveys to insure proper procedures are being followed.
16. Dispose of radioactive waste through government-authorized channels.
17. Maintain correspondence with AEC and state boards.

18. Keep the full committee informed of all happenings of interest in this area.
19. Maintain radiation exposure records.
20. Conduct environmental surveys as indicated by the type of work performed.
21. Maintain professional contact with experts in the field.
22. Maintain contact with professional societies to insure knowledge of advancements in the field.

The committee's responsibilities cannot be overestimated. A decision to permit the use of isotopes is not lightly made, and cause for concern exists right up to the time that the material is finally disposed of.

In every field of endeavor the problem of dealing with people is important. This is especially true where you start talking radiation. The individual requestor often feels that you are being unnecessarily restrictive; you're standing in the way of progress. His associates in adjacent areas feel that you're too liberal and aren't exercising sufficient control. The manager is concerned with increased costs. Everyone wonders why so strict medical requirements if everything is so darned safe. And finally, if the project gets big enough,

the community starts to wonder about all that radiation floating around.

The solution to the problem of radiation lies in strict control of all sources of radiation and their use, based on current laws, and an understanding of the presently accepted theories of effects of radiation.

References

A complete list of useful publications would fill a book; however, the following should prove useful to anyone about to become involved with the use of radioisotopes:

Federal Register (reprints) Title 10—Atomic Energy, Chapter 1, Parts 20, 30 & 31, USAEC, Washington 25, D. C.

Handbook 48: Control & Removal of Radioactive Contamination in Laboratories, National Bureau of Standards.

Handbook 51: Radiological Monitoring Methods and Instruments, National Bureau of Standards.

Handbook 59: Permissible Dose from External Sources of Ionizing Radiation, National Bureau of Standards.

Handbook 73: Protection Against Radiation From Sealed Gamma Sources, National Bureau of Standards.

Safe Handling of Radioisotopes. Safety Series No. 1 (1958), International Atomic Energy Agency, United Nations, New York, N. Y.

Safe Handling of Radioisotopes. Safety Series No. 2 (1960), International Atomic Energy Agency, United Nations, New York, N. Y.

Radiation Hygiene Handbook. Hanson Blatz, McGraw-Hill.

SAFETY RULE ENFORCEMENT—A KEY TO ACCIDENT PREVENTION

By RICHARD R. WILEY

Safety Eng., Bethlehem Plant, Bethlehem Steel Corp., Bethlehem, Pa.

In all of the many diversified activities of a large industrial organization like our Bethlehem Plant of the Bethlehem Steel Co., there are certain common basic principles. One of the most important is the principle that work should be done without injury to personnel. And one of the important elements in carrying out that principle is the development and enforcement of safety rules. The rules themselves are necessary, but unless they are followed—and followed consistently by everyone—they are simply a nice expensive collection of words.

Making sure the rules are followed is what is meant by "enforcement." By definition,

"enforcement" is "that which gives force, energy or effect; a putting into execution."

Our session is on "The Dynamics of Supervision." Again, by definition, "dynamics" is "the motive and controlling forces of any kind, and their mode of action."

My endeavor, therefore, will be to touch on some aspects of our program relating to modes of action, and those measures which give control, force, energy and effect to our safety rules and accident prevention program.

With this preface our stage is set, and the program begins. It must begin—I'm sure you will agree—with education, for education

is the impartation of discipline of character.

John Ruskin in his teaching people know. It means they do not believe in kindness, by way of acceptance and by example."

At this point everyone was not that stuff," because general concept. employees for visible? Specific operations, employee technique for proper personnel at make a few stages on the hope idea that all employees schooled in safety finally, we declare proclamation, "mark on your agree that our proved. That is

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the impartation of knowledge, skill and discipline of character.

John Rust-in had this to say about people and education . . . "Education does not mean teaching people to know what they do not know. It means teaching them to behave as they do not behave. It is a painful, continual and difficult work; to be done by kindness, by watching, by warning, by precept and by praise, but above all by example."

At this point I would be surprised if everyone was not thinking to himself—"old hat stuff," because we should all know this general concept. But is it equally true of our employees for whose safety we are responsible? Specifically, do we, in our respective operations, employ every possible practical technique for promoting enforcement among our personnel at all levels? Or do we simply make a few standard selling approaches and go on the hopeful, but woefully mistaken, idea that all employees have been adequately schooled in safety? Then, with unjustifiable finality, we dust off our hands with the proclamation, "Well, that's that!" Make a mark on your calendar on the day that we agree that our enforcement cannot be improved. That is the day we start slipping.

You can have as much safety as you care to be responsible for. You can have little or none if the consequences do not bother you. After an accident happens it is easy to say, "The man knew better." We all realize, I'm sure, that it more realistic to swallow our pride and accept the fact that the man would have known better had he been better instructed.

To dodge responsibility is easy; the difficult part is to dodge the consequences of dodging the responsibilities.

The thought of simply talking to you about safety—whether principles, modes of action, or whatever—reminded me of the college professor in English composition. He would refer to a certain bit of work as "an unfinished Indian arrow"—long, polished, lots of feathers, but no point! To avoid being guilty of that very thing, it seemed to me that a maximum of specific action techniques and a minimum of theoretical principles is best.

In order to better identify and better acquaint you with our Bethlehem operation, let me lay a little groundwork.

The plant attains a force of 22,000 employees working 43 million hours a year. The average disabling injury frequency for the past ten years has been 0.64.

A successful program in any plant, regardless of size or nature of work, can result only with the unlimited backing of top management and the acceptance of responsibility by all levels of supervision. Our program begins here.

At a regular time each month, a general manager's safety meeting is held. The general manager's staff meets with all superintendents and their assistants. For one hour we discuss and illustrate with pictures the overall safety experience of the plant, and superintendents who have had serious accidents in their departments give an explanation of these to the group. Projected pictures of the re-enacted incident add realism and interest, and promote understanding for the responsibility and necessary preventive measures.

Within the next three days, 38 departmental safety meetings are held according to a fixed schedule. The superintendents meet with all of their foremen and cover all of the material presented at the first meeting. The foremen in turn pass the pertinent information on down the line to the men. Here again, to be at all effective, the message must be presented with enthusiasm. It was Emerson who so rightly said that nothing great was ever accomplished without it.

In order to develop in the foreman a keener perception of his operations and the importance of his function of supervisor in preventing accidents to the men, the job safety analysis program was adopted. This three-column worksheet is a detailed study of an operation by the supervisor in consultation with the workers for the purpose of determining how it is now being done, what the associated hazards are and how the operation itself can be improved to eliminate, minimize or control the hazards. When an analysis has been completed and approved, it becomes a matter of record and is the only acceptable method for performing that particular job.

Rules and regulations are very necessary for safe conduct. We have 60 different booklets called safety codes. The green ones represent department codes. In addition, many workers are given other codes relating to

their specific jobs within the shop, such as crane operators, welders, and so forth. Violators of the provisions of the codes are subject to disciplinary measures up to and including discharge. Our supervisory safety code is designed intentionally on a broad basis as a guide for departmental safety programs and codes, and it outlines those things which should be covered by them in detail.

Certain other standards or guides are posted on bulletin boards. For example, an eye protection standard is designed to leave nothing to the imagination as regards the required eye protection. It specifies by picture the minimum type protection necessary when exposed to any conceivable job with eye hazard. It leaves no room for excuses for anyone.

All of us recognize the fact that the most effective way to sell any program is to offer constant reminders in the form of proof of the need and value of an item. We have been highly successful in stimulating interest through the dissemination of information on a variety of incidents.

A simple, letter-size "Safety News Bulletin" is promptly prepared on any incident of significance and interest, and run-off in quantities of about 1200 copies. These are sent out for complete plant coverage so that every foreman has a copy to use as material for his five-minute safety contact with his men. In order to insure that every man is aware of the incident, as well as being a follow-up reminder, copies are also posted on all bulletin boards.

The manual or mechanical handling of materials exacts a heavy toll in injuries to the fingers and hands and presents an infinitely more difficult problem than that of protecting the eyes. We do, however, provide hand hooks in great quantity and rigidly enforce their use when taking up, guiding, or setting down crane lifts of bars or similar materials subject to shifting. This program, although requiring constant education and enforcement, has been extremely successful.

An illustrated program on the subject of pinchpoints is presented at a safety meeting. We have developed a number of programs on a variety of subjects. The presentation consists of about 20 color slides and a prepared 15-minute commentary. In order to create realism, actual case histories are used. Visual aids, properly presented, are well re-

ceived and quite effective. It leaves an employee well informed and with no excuse for an unsafe act.

Supervision must recognize the fact that in order for a man to be safe around crane lifts there is considerably more to it than controlling his acts with respect to pinchpoints. The old adage, "A chain is no stronger than its weakest link," is a literal fact. In respect for this, we have an extensive chain maintenance program. All chains are sent to a centralized shop for periodic annealing, inspection and repair. In an average year about 8,000 chains are serviced and each one machine proof-tested before being returned to service. Each chain bears its own identification number and has a complete history file card. This chain servicing description is offered only as a typical example of a great number of rigidly enforced procedures employed to guarantee maximum safety.

In a typical year about 82,000 respirators are disassembled, washed, disinfected, dried, repaired, reassembled, packaged in cellophane bags, sorted and returned to the departments. The pick-up and return is done daily. A total of 17,000 pairs of goggles were similarly processed. The function of this central servicing is to encourage the willing use of this vital protective equipment.

Training of physically qualified men in symptom recognition, oxygen mask rescue and first aid for men exposed to gas is maintained at a high state of preparedness. Two scheduled two-hour classes per day, five days a week are held at either our central training school or under actual field conditions. Nearly 4,000 men participate in this training annually. Each trainee undergoes a refresher course every six months.

Any program, to be effective, must be policed. Therefore, every six months the school records are carefully reviewed and an appropriate form letter—either "satisfactory" or "unsatisfactory"—is prepared and submitted to each department superintendent advising the status of training.

The teaching of first aid is an essential part of our safety program. In addition to its general concept of providing emergency treatment and preparing the injured for transportation, it is also of intangible value by indirectly and subconsciously imparting thoughts of safety to both participants and casual observers as well.

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Our general plant minimum requirement is that 10 per cent of the shift personnel be qualified first aid trained men. This means certification by the U. S. Bureau of Mines for the successful completion of the 15-hour course. All foremen are also required to have this same training.

Here again, as in gas training, we continually check on the adequacy of the training. A supervisor from our central safety office conducts test drills at the rate of 28 per month among the departments. This means that every department is examined every other month.

When an employee is injured, no matter how slightly, we insist that he report to his foreman for referral to a dispensary. Four copies of the form shown are prepared, two of which accompany the injured to the dispensary. Three times daily all pink copies are collected by the Safety Department and immediately examined. This system keeps us currently informed of most incidents, and puts the departmental supervisors in a position whereby they must investigate the incident in order first, to prepare the report form, and second, to be able to provide additional information which is often requested.

A safety program is not any one thing or any one person. Rather, it is an aggregate of a great many things requiring the efforts of every person. This is to include a vast number of things, a few of which were touched on here—protective equipment, devices, controls, rules, regulations and procedures—and the enforcement of them to maintain effectiveness. Were it not for these techniques our personnel would, naturally, care far less about safety in general. Infractions do occur, however, and violators must be dealt with accordingly.

A typical discipline report for a safety violation is on the subject of hand hooks which were mentioned earlier. It reads "Man placed hand on lift of two and one-half-inch liners to guide same, while placing lift on buggy. Explained to man that we insist on safe practices being followed, as all of these are for his protection. Pointed out to man that he was holding hand hook in his left hand while guiding lift with his right hand. He had the proper tool but was not using same." Discipline: "Warning."

In an average year we have occasion to

impose 357 formal written safety disciplines against employees' records. Of these, 83—or about one-fourth of the total—include time-off penalty, which in the average case amounts to slightly less than 10 hours.

Common sense reasoning will convince most employees that a safety rule should be followed. There might always be the small minority who insist upon ignoring the rules. Experience indicates that with such people disciplinary action must be taken. If corrective action is not taken, the regulation soon ceases to exist. It is the constant training and correction which in the end becomes self-discipline.

If the man on the job fails for any reason to follow known safe practices, he is taking a chance. If we in management condone his unsafe practices, then we too are taking chances, the only difference being that our chances are more serious since by condoning bad practices we are actually teaching disrespect for regulations. Consequently, we cannot excuse a poor accident record by accepting unsafe acts if we have failed in our duty to enforce safe procedure.

We believe that the many standards and procedures in effect at the Bethlehem Plant, a few of which were presented here, all play a significant part in the difficult role of developing proper attitudes on the part of all employees, including supervision.

The problem is to impress indelibly, through enforcement, on the mind of the individual that there is an approved safe way to carry on most activities. The various modes of action are limited only by one's imagination and the unrelenting effort of enforcement to maintain liveliness.

The three essentials to safe practices—knowledge, skill and desire—can be developed through these media. The thorough preparation of the procedures can give us knowledge. The faithful application of them will develop skill. The rigid enforcement of their provisions will create desire. This last matter I associate with personal safety contact—those little five-minute discussions between the supervisor and the employee.

Personal safety contact in its conventional form is, to my mind, an artificial and unconvincing way to discuss safety unless the material is related to the daily doings of the supervisor or the worker. A supplemental approach to the general personal contact can

readily be based on an on-the-spot correction of something that an individual or group is doing incorrectly. This is dynamic enforcement. Simultaneously, to find a theme for a safety contact will be a challenge to the supervisor to detect a fault—and correct it!

To illustrate my point, I'll ask each of you to search your memory for an occasion when you listened to someone's remark or lecture on the subject of driving precautions on the highway. Can you recall such a session? If so, do you remember what was said? If not, I can assume that you were not impressed.

Now, another question. Have you ever been personally apprehended by the law? If so, can you ever forget what you did and what was said to you? I can now assume that you were impressed! A personal contact of this type is really personal and is most convincing. To the vast majority of individuals it creates a healthy respect for the law while creating a desire to abide by the rules and regulations.

The creation of a desire is commonly

known as "habit." Horace Mann, an American educator of a century ago, very aptly described it thus: "Habit is a cable. We weave a thread of it every day and soon it cannot be broken." This, in a nutshell, is what can be achieved through continuous enforcement of required practices.

We of Bethlehem wish to *exchange* ideas with our industrial compatriots. We hope to be helpful; we also hope that we can be helped. The problem of enforcement is a common one. Diversified action is the key. The task is simple, but not easy. There remains nothing but hard work.

In closing, I think it fitting to quote one of our superintendents who, in response to a general survey question on what more we could do to improve our plant safety program, said this: "Fundamentally, our program is complete. Perhaps what we need now is more backbone and less wishbone!"

This can be done in the very best American tradition: *enforce the rule, but never rule by force.*

DAMAGE CONTROL—A NEW HORIZON IN ACCIDENT PREVENTION

By FRANK E. BIRD, JR.

Supvr., Safety & Plant Protection, Lukens Steel Co., Coatesville, Pa.

The anticipated goals of the Accident Damage Control program at Lukens Steel Company in its planning stages five years ago were: first, a reduced injury rate and secondly, cost improvement. While both of these goals have exceeded all expectations, it is primarily the cost improvement aspects of the program that will be emphasized in this presentation.

While safety men can base the complete justification for their safety programming on the injury prevention potential, it is naive to underestimate the influence and role that sound economics can play in the further extension of safety efforts.

Cost improvement results were obtained last year at Lukens by the practical application of a very simple concept we have all ascribed to for many years—the fact that injuries can be prevented by controlling ac-

cidents. The larger portion of this presentation will reveal the programming methods involved.

Reference to our Company's Annual Report for 1960, that was sent to all stockholders and employees, reveals the economic highlights of plant operation. After all other distribution of the Lukens sales dollar was made, \$1,430,892.00 was made payable to stockholders in dividends and \$3,517,383.00 was retained to be reinvested in our business. Keep these two figures of one and a half million and three and a half million in mind in considering another small paragraph involved with this financial picture: "The first year's organized experience with a relatively new industrial safety approach to the area of accidental property damage was completed in 1960. The program's contribution to cost improvement

was estimated dollars."

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was estimated to be a half a million dollars."

To avoid confusion at this point, let me emphasize that the program required to produce this one year achievement took five years of careful planning and development. This planning and development began with the complete acceptance of the concept that engineering out all accidents, whether or not they involve personal injury, could only result in an improved injury performance at reduced operating costs.

The fact that a common denominator between personal injury and property damage exists is borne out by the accident relationship known as the Heindrick Theory. Statistics have indicated that for each disabling injury, 29 minor injuries occur; while 300 accidents (with no personal injury) that may or may not involve property damage have also resulted.

Suppose we consider a hypothetical accident case to show this relationship of property damage to personal injury—

1. A moment of decision (mule sitting down while hitched to vegetable cart).
2. The approach—an unsafe act (farmer striking mule).
3. Resulting in accident which may involve property damage (mule kicking wagon, vegetables and farmer into the air).
4. Personal injury or both (mule heehawing while farmer looks on wrapped in bandages).

To more effectively achieve our main objective of reduction in injuries to our employees, it was logical that greater emphasis be given to the control of all accidents. In addition to the humane aspects that had always been a vital concern, the economics involved with the anticipated all-accident approach indicated that any additional time and effort required would be more than justified. The four basic control methods to be described are:

- 1) Reporting;
- 2) Investigation;
- 3) Analysis;
- 4) Remedy.

Let's first explore the development of our reporting system in all accident control, since any accident prevention program is only as strong as its ability to discern the true nature of its problems. The first

method of reporting is through employee compliance with our revised general safety rules. In October 1956, a broad revision was made in our rules to include the reporting by all employees of any accident resulting in personal injury or property damage.

General safety rule No. 2 was rewritten to read: "Report immediately to your foreman or supervisor any condition or practice you think might cause injury to employees or damage to equipment."

The key to our whole program, general safety rule No. 5, was rewritten to read: "Whenever you or the equipment you operate is involved in any accident that results in personal injury or property damage, regardless of how minor, you must immediately report it to your foreman or supervisor. Get first aid promptly in a company dispensary."

In order to assure the success of the program, known violators of this rule have been equitably disciplined. Approximately six employees have been given time off from work for gross violations (since the adoption of this rule in 1956) while written and verbal warnings have been used more widely.

Fully recognizing the natural reluctance on the part of employees and supervisors to report the fact that they were involved in damaging company property, a simple report form maintained by the foreman of each repair shop serves as the same control to our accident damage program as dispensary records serve our injury prevention efforts. A damaged equipment repair tag was next introduced and required to be used by all employees whenever equipment was sent for replacement or repair as a "reporting" control to further pinpoint accident location, time, date and apparent cause.

One of the most effective methods of control is the investigation of each accident in order to determine corrective action and prevent recurrence. Mass collection of facts obtained from good accident investigations, properly correlated, formed patterns of common occurrence that were used effectively for further control. A new standard practice including personal injury and property damage was adopted as a tool to attain desired goals in proper accident investigation.

Essentially, the supervisor or foreman in whose area of responsibility the accident occurs is responsible for conducting a thorough investigation and submission of this official supervisor's accident report form. One form is used to cover personal injury, property damage or both. Since identical controls are used to prevent accidents whether they be personal injury or property damage, no conflict presents itself in the application of this two-purpose form and its broadening effect on the total accident control outlook of supervisory personnel.

Just as the disabling injury provides ammunition for drawing upon more extended management effort, so by standard practice any property damage accident of one thousand dollars or more is dealt with in the identical manner of a disabling injury. An immediate notice of serious property damage is delivered to all superintendents and managers. The superintendent concerned is required to hold a formal hearing of all persons involved in order to determine adequate remedial action. The results of this hearing are promptly forwarded to the manager, who then calls a final review meeting which includes the superintendent, key supervisors and myself.

This opportunity for top management to actively demonstrate its concern for accident prevention tends to keep everyone more aware of the accident problem and their individual responsibilities to maintain effective controls.

It might be useful to look at a few typical accidents in order to realize the importance of the remedial action resulting from these investigations. Accident No. 1 involved an ingot being lowered into No. 48 pit. The crane operator struck the front top of this pit with his ingot dog causing a key section to break off. The direct costs for brick replacement and repair were \$200. However, in order to make the necessary repairs this entire pit had to be shut down. Rehandling of the ingots that remained in the pit, reheating, rescheduling, and four hours of pit delay time added tremendous indirect costs.

Accident No. 2 involved our 206-inch Mill ingot buggy. The mechanical department personnel were changing rolls in our S & R Mill using a large "C" hook to grab the roll and pull it out. Electricians did

not tag the pulpit control that operates the ingot buggy. The operator sent the buggy down to service the 206 Mill (this buggy services both of our mills). Because of insufficient clearance between the buggy and the "C" hook assembly being used to remove the S & R Mill roll, a collision occurred that bent the main frame of the ingot buggy.

Three turns were required for temporary maintenance since permanent repairs would have required eight to 10 days of down time. The direct cost of temporary repair was \$1,250. It is interesting, however, that permanent repairs have still not been made because of the extended down time necessary. The maintenance bills for repair and replacement of wheels, axels, and collector shoes occurring as a result of the bent frame has continued for months, and is tremendous. On six occasions, two turns have been required to do this work.

Accident No. 3 involved an ingot dropping on our 206-inch steel yard crane scale. Although the replacement scale part cost \$175, it was necessary to ship the entire scale back to the factory for repair. During the week required for repair, all slabs formerly weighed on this scale had to be trucked to a scrap supplier's yard outside our plant and then returned for preheating. Delay time was estimated to have cost at least 40 times the direct costs of the accident.

Accident No. 4 involved a load dropping and destruction of a travograph machine. The old machine was originally purchased for \$6,000; however, a \$25,000 premature capital expenditure for the purchase of a new machine has been proposed.

Accident No. 5 involved a plate shears. The shear crew was trimming plates and allowed scrap to accumulate in the scrap trough. This caused the upper knife block to jam on the downward stroke and fracture the shear housing. Direct costs for repair were \$2,000.00. However, 15 turns of work were lost along with line slowdown and customer delays. The indirect costs were estimated at \$12,480.

These typical accidents that actually occurred point out the tremendous cost involved in accident damage as well as the importance of an organized preventative program.

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The more management is explicitly made aware that people will be hurt or property damaged through certain acts or conditions, the greater the possibility that action will be taken to prevent it. The *accident analysis phase* of our damage control program pinpoints specific items damaged repetitively and the agencies involved. Supervision concerned are thus equipped to place concerted effort on single specific objectives.

A detailed quarterly analysis is furnished to all key management personnel and includes a comparison of all accident damage costs this year to date to that of last year. It helps maintain a continued awareness of particular departments, agencies and items needing attention. A colorful barometer on the cover gives flash indication to busy management personnel on the degree of action necessary on the report contents.

Just as compensation is considered a direct injury cost, damaged equipment repair or replacement is considered our direct costs for property damage. In order to show the big potential of cost improvement, our total costs include indirect costs estimated at a four-to-one ratio of direct costs. The estimated total costs of accident property damage for 1960 exceeded one and one half million dollars.

A breakdown by the agency or act inflicting damage revealed crane involvement with well over 80 per cent of our property damage accidents. Four departments stood out as shareholders in the greater majority of all damage costs. Further analysis revealed the cost of accidents by items damaged. A severity rate in dollars per unit of hourly rated manhours of time is used in our plant to indicate trends in control performance. Accident damage severity is expressed as direct costs per million hourly rated manhours worked. (All cost figures used in the remainder of this presentation are rounded off to facilitate understanding and retention.)

The severity rate for 1959 was \$62,000 per million hourly rated manhours worked. For all program purposes this was our base year. The 1960 year end damage severity rate of \$45,000 was substantially below the previous year's rate.

To realize more fully the cost improvement aspects of this comparison, let's examine more closely the 1960 accident

rate of \$45,000 per million hourly rated manhours worked. This was an improvement of \$17,000 per million manhours worked over the 1959 performance. Recognizing these are direct costs we are using, let's translate this into total cost improvement for the calendar year. This improvement per million manhours worked multiplied by the millions of hourly rated manhours worked revealed the direct cost improvement for the year. The value of our total effort becomes more evident when we apply the four-to-one ratio to determine indirect costs. By adding both direct and indirect costs, the larger figure of one half million dollars becomes a total estimated cost improvement for 1960.

Here are some new program examples of accident repetition highlighted by the analysis phase of the program with action taken that helped to bring about this cost improvement:

1. One door was damaged ten times in less than one year. (The door has been widened; piling in the loading area inside the door more effectively controlled.)

2. One railroad gate was broken 30 times in 1960. (The gate has been relocated and has not been damaged since.)

3. Better than 75 per cent of all narrow gauge railroad rolling stock maintenance is due to accident damage. (Spuds and ingot dogs have been redesigned, numerous procedural changes made.)

4. The guard railing on the top of seven shears were struck and badly damaged by material handling devices 38 times in one year. (Using solid plate guards instead of pipe railings and rounding of railing corners has greatly reduced catch points at these locations, reducing damage at least 50 per cent.)

5. At least 80 per cent of all cable replacement in the melting department is due to accident. (Methods have been changed, guards placed on sheave wheels, practices altered and inspection methods improved.)

6. The glass panel in this door was broken seven times in 1960. (It is now standard practice to use plastic in place of glass in shop doors throughout the plant.)

7. One thousand six hundred spindles on hand grinders were replaced in 1960. Investigation revealed that at least 25 per

cent of this was due to the unsafe practice of striking the locking nut to loosen it in order to remove the wheel. (All grinders are now provided with a special band wrench; the knowledge gained through the accident investigations also brought about improvement in the spindle quality and design, which has also reduced breakage substantially.)

8. Two thousand one hundred and six incidents of staters on hand grinders required repair and replacement in 1960. Accident damage investigation revealed that a minimum of 50 per cent of these "burn outs" was due to an unsafe practice of the operator. When the wall fuse would blow because of a "heat up," the common practice was to pull out the hot plug and connect to a cold plug and continue to use the grinder until it burned out. (We are now supervising better, testing local heat warning devices and new grinders.)

9. Thirty two oil lines on various pieces of equipment were damaged severely in 1960. (Standard practice is now to place all these lines in hideaway locations.)

10. One water pipe in the pickling department was damaged four times in one year. (There has been no repetitive damage in six months since the relocation of the pipe.)

To motivate key management personnel even further, an accident damage control chart is posted in a most conspicuous position in our superintendents' conference room where the general manager points to weekly trends each Friday. A weekly publi-

cation called *Safety Facts* is distributed weekly to all supervisors in our plant. The lower left side of this report gives personal injury facts, the lower right side gives property damage facts. A *total safety performance* rating is given each department in the right hand margin. This rating includes an evaluation of housekeeping, protective equipment, communications, actual injury experience, personal injury and property damage investigation.

It is the opinion at Lukens that the addition of damage control to our injury prevention program more truly represents a positive program approach to total safety. A final reason for the justification of this approach is the fact that a company desiring to earn 5 per cent net profit after taxes would have to sell six and a quarter millions in additional annual sales volume to compensate for accidents costing \$6,000 in damage per week.

In closing, I can say with a great deal of pride that this tremendous economic drain on our company's pocket book from accident property damage is fast coming into control. Our safety personnel point with particular pride to the fact that ground will soon be broken for the construction of a new electric furnace.

In addition to the normal rewarding feeling that comes from any service to fellow man, they now realize how substantially their staff efforts contribute to the economic health and growth of their company through this new dimension in accident prevention—*total safety programming*.

TRAINING THE PLANT DEFENSE CORPS

By JOHN E. TWOMEY

Supt., Industrial Defense Planning
Western Electric Co., New York, N. Y.

With the threat of a nuclear attack, it became evident to the management of our company that a program would have to be established to provide for the protection of personnel, continuity of production and continuity of management.

Although all three are essential to an effective industrial defense planning program,

it was recognized that planning measures for the protection of personnel should receive primary consideration. This article will therefore focus on the personnel protection phase of our program with the main emphasis being given to emergency and disaster training.

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sponsibility on the part of the individual for his self-protection, it became clear that significant new dimensions in training employees in activities essential for their survival would be necessary. In organizing the training effort a three-pronged approach was decided on—expand existing protective forces—create new type protective forces—train employees in special action required to minimize blast and radiation injuries.

Before describing this three-phased personnel protection program in more detail, I would like to briefly describe our scope of business activities, as they greatly influenced the kind of training problems we were confronted with. Our primary function is the manufacturing and supply unit of the Bell System. We have manufacturing plants in fifteen metropolitan areas and thirty-three distributing houses located in or adjacent to major cities.

In addition our defense work on Nike, Titan, Dew Line, etc. further complicated our protection problems for employees based over a wide geographic area. Excluding our subsidiaries, we have approximately 140,000 employees. Because of the wide dispersion of our business operations, we realized that we had a more difficult job to develop appreciation for self-protection and to train workers in appropriate protective measures.

The first area of our personnel protection program on which we concentrated was the expansion of existing plant protective forces. Our major effort was to stimulate increased participation in first aid training and to form these people into teams with designated areas of responsibility. These teams were then set up to supplement the existing "cot" or "stretcher" crews that we use in normal emergencies.

Our objective was to train 10 per cent of our people in first aid. This objective has been generally obtained; as a matter of fact, some of our locations have more than 40 per cent of their people trained in this vital area of personnel protection. This is particularly gratifying to us because all of the training is given out of hours. The first aid teams devote several hours each year to practice exercises. These exercises, which are conducted during regular working hours, serve to train the employees to act as a team and also provide a more realistic test of their skills in a simulated emergency environment.

The fire crew was another protection group that was expanded. Where needed, fire auxiliaries were trained to supplement existing fire crews. In establishing a program of this nature it must be assumed that there will be no help from the local fire department, since the holocaust following a nuclear blast will be greater than anything ever before anticipated or experienced.

The second major phase of our personnel protection program was the creation of new types of protective forces. In this area rescue squads were established to remove the injured from the debris. With the help of the Civil Defense people a group of our employees received expert training at Olney, Md., in the techniques of removing the injured from buildings destroyed or damaged by natural or man-made disasters. These people returned to their locations and passed their training along to others who were then organized into rescue squads. Special equipment was assembled for training and other equipment normally used in maintenance work was designated for training and emergency use.

Under this second phase of our program, we also organized radiological monitoring and detection squads. In establishing our radiological training program, we brought together a small group of employees skilled in training techniques or with a technical background. These people reviewed the problem and prepared an Instructor's Guide and a Problem Book to facilitate training. A Radiological Monitoring and Detection Manual was also prepared for the squad members to be used as a guide and reference to aid them in performing their responsibilities.

Originally we purchased several sets of instruments and borrowed others from local Civil Defense units for training purposes. We recently completed the purchase of radiological instruments for each of our working locations. Each set of instruments, manufactured in accordance with Civil Defense specifications, consists of one geiger counter, one medium range survey meter, one high range survey meter, four dosimeters and one dosimeter charger. These instruments will be used to retrain our present monitors and train others as the need arises.

The third and final component of our personnel protection program is training our employees in the special action necessary to

minimize blast and radiation injuries. This includes such items as warnings, warden organization, shelter drills and shutdown procedures.

We receive our warning primarily by the bell and light system furnished by the local telephone companies. The warning is disseminated by various means—bells, horns, whistles, sirens and in some cases by public address systems—and is readily recognizable by the employees.

Our warden organization is generally made up of supervisors to whom people would normally look for direction. Our wardens are trained to see that employees move quickly to their assigned shelter areas, check to be sure that prescribed shutdown procedures have been carried out, and take any other steps necessary to minimize blast damage.

Shelter drills are conducted periodically. Drills of this nature are one of the best means of keeping our employees aware of the continuous need to prepare themselves to handle disasters effectively. Workers who are conditioned to shelter drills will show considerably more control when faced with a real disaster than those with little or no training.

While on the subject of shelter drills, a word about our shelter areas is in order. Specific areas in our building have been designated by our engineering organization as shelters and are well marked. Providing adequate fallout shelters poses a big problem and at the present time a survey is being made of our various buildings to determine the amount of protection that they will afford against radioactive fallout in the event of a nuclear attack on this country.

To aid us in this work, the Office of Civil and Defense Mobilization conducted a two-day fallout shelter survey workshop at their operational headquarters in Battle Creek, Mich., for 22 of our building engineers providing us with the necessary information, procedures and techniques for making such a study. These surveys, when analyzed, will enable us to determine the most suitable shelter areas for our employees. The important thing in any shelter program is that some positive action is better than none, as more people will be in areas outside the blast zone where fallout will be a major problem.

The fourth and last item of training employees in special protective action is the establishment of shutdown procedures. We have established detailed procedures for shutting down operations as quickly as possible when a warning is sounded and individuals with the responsibility for taking action have been trained in the necessary steps that are to be taken at that time. Where possible the actual shutdown of equipment takes place; however, if this is not feasible we conduct simulated shutdown procedures by tagging the equipment. These drills occur simultaneously with shelter drills for the rest of the employee population.

Although we have made progress in our personnel protection program, further work is necessary. We still need additional equipment for our various squads and the problem of providing refresher training in all phases of the job is a continuing one. We are presently reviewing the possibility of acquiring additional geiger counters to be used by our first aid squads in monitoring the injured, to be sure they are relatively free of radioactive particles, before being brought into the receiving area. Another item that is receiving close attention at this time is the creation of decontamination squads to remove radioactive fallout particles from our manufacturing areas, machinery, and equipment so that we can get back into production at the earliest opportunity.

One of the big problems in personnel protection training is to have the workers recognize their responsibility and participate in the training that is made available to them. This requires a continuous educational program of providing them with information on the threat and the steps that can be taken to counteract it. The recurrent international crises also have helped to maintain this interest; however, one of the big problems is to overcome the apathy that is still prevalent.

One of the best ways to be sure that the individual does what he should about civil defense while away from the job is for his employer to demonstrate the awareness of the peril and doing something about it at the work place. This is accomplished by conducting shelter drills and other defense activities in which the employees participate while on the job. There are also many excellent publications that can be passed out to the employees which detail the steps necessary for survival.

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istically face the problem of survival and cooperate in an active industrial defense program.

WHAT DO WE EXPECT OF THE SAFETY ENGINEERS?

By G. W. HARPER

Prof., School of Mechanical Engineering, University of Illinois, Urbana, Ill.

Before launching blindly into a detailed discussion, it seems to me that the third word in the title must be defined. Who is this "we" that is asking the question? To clarify this point I suggest that the "we" which we have in mind is that of top management. It might be both enlightening and valuable to discuss this subject from the standpoint of "we" being the safety man; in other words what do we expect from our fellow safety engineers. This might be very interesting indeed, and if carried to an extreme might even lead to bloodshed. However, I believe you will agree that we must approach this question keeping in mind that we had best understand what our bosses expect from us.

At this point, I could of course, refer you to several textbooks on industrial safety, and to the federal governments' *Dictionary of Occupational Titles* and quote what has been written on the subject during the past forty years. While this might be enlightening in a historical sense, I believe sincerely that it would fall short in providing an adequate and useful answer for us.

Without taking your time to read the detailed list of what I consider to be a well done summary of the duties and responsibilities of the safety director, as outlined in fourteen specific items in Chapter 2 of the *NSC Manual of Accident Prevention for Industrial Organizations*, I want to pick out the action words from this listing. In these fourteen points we find the following: formulating, administering, reporting, advising, recording, investigating, supervising, training, delegating, correlating, inspecting, contracting, complying, initiating, and last, but not least, directing.

Now you will note that I have, up to

this point, not given any of the objects along with the above words. There are two main reasons for this. In the first place there are several objectives which have been and can be attached to each activity. Let me explain what I mean. For example, take the word "recording"—recording of injury cases, recording of unsafe practices, and the recording of the minutes of supervisory safety meetings, are possibilities.

But we will return to this train of thought in a moment. The second reason for not including types of activities is that I should like to pursue another line of thought as a foundation of further discussion.

Before attempting to pin-point what is expected of the safety engineer in detail, I think it would be well to review the areas of knowledge, or the tools of the trade of safety engineering. A good many years ago, Joe Stennett, writing in the *National Safety News* had an article which was titled "The Double 'C' of Industrial Safety." In it he pointed out that the double "C" of industrial safety included the first "C," control of environment, and the second "C," control of behavior. Before a safety engineer can begin to do his job he must have knowledge of methods and procedures in both of these areas.

At this point I should like to refine and clarify these two items. For a number of years I have given a talk and a portion of it has been devoted to this phase of our present discussion. In it I have outlined some areas of information, study, and knowledge essential to accomplish the com-

¹The Double "C" of Industrial Safety by J. C. Stennett—*National Safety News*, December, 1939.

plete job of industrial safety engineering. The areas are defined in answer to the question, "What are the tools for the safety job?"

Item number one states that "A safe environment is obtained through engineering." A few of the tools with which we, as safety engineers, must have in our kit, include machine guarding, heating, light, ventilation, material handling, electricity, welding, materials processing, and a host of others. As you can see all of these areas concern the engineering background and tools essential to creating, maintaining, and controlling a safe environment.

Item number two covers a part of the second "C" and states "Safe acts and practices are obtained through training." Some of the tools in this kit are orientation or induction training, plant or general safety rules, job safety training, job safety rules, fire training, first-aid training, supervisory training and management conferences.

Item number three, in the talk I referred to previously concerns itself with a supplementary set to tools to reinforce the second "C." It states that "Safe attitudes are created and enhanced thru promotional activities." In this area in our kit of tools we find such items as posters and bulletin boards, contests, awards, certificates, stunts, campaigns, plant publications, signs, and suggestion systems. Let me be very explicit about this kit of tools. None of them ever directly prevented an injury but the whole kit contains supplementary and supporting activities. That "attitudes" are important is a fact that I am sure cannot be disputed.

It is evident in U. S. Steel's program, "knowing is not enough." Motivation is essential. May I insert at this point, that some safety programs, I have known about, are made up of such a high proportion of promotional elements, that the other two sets of tools are all but forgotten.

Now, let me summarize. Our top managements expect the safety engineer to have fundamental knowledge in the three basic tools of safety: engineering to make a safe environment; training, to eliminate unsafe practices; and promotion, to foster safer attitudes. The ways and means, of obtaining this knowledge through higher education, and as a continuing process, are the topics covered later in this program.

To quote a phrase already used, "knowing is not enough." The safety engineer is a doer. This fact was illustrated earlier by the list of action verbs. But this same listing covers such a diversity of activities that many safety engineers have jumped on their white chargers and galloped off in all directions. Many times to the detriment of their own jobs, and also to the safety movement in general. In all fairness, it must be said that these individuals have been few in number in recent years.

Let us now turn our attention to what management expects of us as safety administrators. In approaching this question I would for a moment or two like to dwell on the negative side; that is, a few of the things that they do not expect safety engineers to do.

I would like to direct your attention to a recent article in *Factory Magazine* titled "What's Wrong With Safety Management?"² Let me say at the outset that I hope all of you will read this article, and I am sure you will be as angry as I was. Why will you get mad? Because there is so much truth in the article. Let me make just a few quotations to show what I mean.

The responsibility for making safety work must rest with first-line supervision. Safety men must learn to live as staff specialist, nothing else.

The management approach needs fewer, but better safety men.

Awards are absolutely worthless.

Safety function has too often become a hiding place for 'kluks'—men who are neither managers nor experts.

Here's where the safety expert comes in—as a staff specialist.

There is food for thought in these articles and I trust that you will all read it. But now let us turn to the positive side of the picture.

Russ De Reamer, writing in the *A.S.S.E. Journal* highlights what has been said before. "In the past the industrial safety specialist has been the doer. In the future he will be the catalyst, the advisor, the teacher who precipitates safety action on the part of live managers."³

²What's Wrong With Safety Management—by Lawrence F. Mühlen, *Factory Magazine*, September, 1961.

³A.S.S.E. Must Prepare Today For Tomorrow—by Russell DeReamer, *Journal of the American Society of Safety Engineers*—January, 1960.

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⁴Safety Engineer John W. Gri-tion gress—1961.

⁵Get Safety out —R. G. D. An March, 1961.

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Along with this change in the type of activities we find a new challenge in the job that we must do. Just last Tuesday, Dr. John Grimaldi¹ called these to our attention when said—

First we must convey that safety is not a doctrine of risk avoidance. . . . It would be more appropriate instead, to emphasize that safety is controlled risk taking. In this concept the professional work of the safety specialist is implementing risk control so as to limit accidental harm to people, products and material. Prevention is not the key here, but limitation of hazards is. An effort to control hazards may produce their eradication, but not always.

There is much more that needs to be said on this subject, that I feel would be of help, but time does not permit. So in conclusion, I should like to summarize the major points I have made.

1. We must change our perspective and direct our energies toward a newer and higher goal—that of accident and hazard control—and stop becoming “follow-uppers.”

2. We must realize that we can be more effective if we accept our role as staff safety specialists—safety consultants, planners, etc.² and stay away from the firing line.

3. We must equip ourselves with the

¹Safety Engineering in a Changing World—by John W. Grimaldi—at National Safety Congress—1961.

²Get Safety out of the Personnel Department—R. G. D. Anderson, *Occupational Hazards*, March, 1961.

basic tools of our trade and know when and how to recommend their correct use in the control of hazards: i.e., in the control of environment, in the control of behavior, and in the motivation of safe attitudes.

4. We must emphasize the planning and control functions of our work. We must plan the safety programs, provide the necessary means to measure its application, be alert to the areas of weakness, provide assistance and technical information when and where needed and give leadership in safety work on the job and in other areas of our daily living.

Bibliography

1. Accident Control—Phase One Administration
by Francis T. McGowan, Safety Director,
The Borden Company.
Talk given before the National Safety Congress.
2. Can Safety Stand on its Own Feet?
by H. W. Heinrich
National Safety News, November, 1955.
3. Safety Man: Engineer or Educator
Symposium—350 Safety Men
Occupational Hazards, June, 1961.
4. Industrial Safety—A Presentation of Industrial Safety Procedures.
by Metropolitan Life Insurance Company
1940.
5. Engineering As a Foundation For Optimum Safety Success.
by William E. Tarrents
at National Safety Congress, 1960.
6. Safety Engineering and Production
by J. E. Trainer
at National Safety Congress, 1954.

DESIGN SPECIFICATIONS FOR A SAFETY ENGINEER

By T. H. ROCKWELL, Ph.D.

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With the growth of any profession there is always the need for that introspection called “soul searching.” In the rush to get the job done we need to pause and ask the most humbling of all questions, “Where are we going and how are we going to get there?”

Certainly before we spell out the necessary ingredients to concoct the ideal safety engineer we must agree upon the end product. Doubtless there are countless versions

of the role of the safety engineer in our society. These role images will vary depending upon the viewpoint taken. Management, labor and the safety engineer himself will have different concepts of safety engineering, just as they will view the safety function, itself differently.

For purposes of delineating this discussion and to pursue the main purpose of this address, namely the basic requirements of the safety engineer and suggestions for his ad-

vanced training, we shall stipulate the safety engineering role, "as the minimization of the losses associated with accidents and industrial hygiene hazards." To fulfill this role three prime skills—analysis, interpretation and communication—are required in the safety engineer.

While knowledge is essential as the backbone of any profession we must not confuse knowledge with understanding or the accumulation of facts with progress. Possession of knowledge is no guarantee of professional competence. Technical knowledge is indispensable to a scientific profession but at the same time detailed knowledge can be worthless without the skills to properly employ it or the ability to convince people that its fruits are worthwhile.

We don't want the modern safety engineer to be a walking encyclopedia—a roving handbook without the wisdom which must mediate knowledge. In fact, the exponential rate of growth in technology prevents anyone from being completely informed. This has led to specialization and subspecialization in engineering and still it is virtually impossible to keep abreast of a field.

The universal safety engineer—competent in all fields perhaps never existed even in early days of the safety movement. It is certain he does not exist today. Ionizing radiation, occupational noise, automation, the introduction of bizarre processes and exotic materials have forced the safety engineer to be concerned not with knowledge per se but with the problem of knowledge acquisition relative to a given problem.

The challenge of technology in the 60's has forced engineering educators to put less emphasis on technical details and more on skills, creative engineering and professional attitudes. While one has difficulty teaching an attitude he can imbue a student with the responsibilities of his profession and attempt to show him how he appears to others outside his discipline. The engineer must recognize that his assignments come from non-engineers and his results are used by "non-engineers." The safety engineer would do well to remember this in attacking accident problems.

In terms of knowledge requirements the safety specialist (at this point we should recognize that an engineering background is not the only preparation for success in acci-

dent control) must first know the process and operations for which he is responsible. This is just as important as the physical laws upon which engineering is founded. The safety specialist must also have knowledge of the vicissitudes of the accident phenomenon and the environments which precipitate accidents. He must be able to recognize the hazards in an operation before they result in accidents. He must be aware of pertinent safety codes and safety regulations.

Since he is a coordinator in many cases, the safety specialist must have some knowledge of cost accounting, compensation laws, union contracts, medical aspects of accident control, etc. These knowledge requirements are familiar to you all and as such the proceeding statements are not very profound. What I do think is often overlooked is the emphasis in analysis, interpretation and communication.

The problem solving skills of the safety specialists are demanded with every accident in the plant and, indeed, with every man-machine operation. Such analytic skills are also required each time a new process is introduced since the safety specialist must know how to anticipate problems before they occur.

There is an obvious parallel between the criminologist and the accident investigator. Each must attempt to reconstruct conditions before the occurrence of the crime or accident. *Proper accident investigation is not something anyone can do.* It requires a trained mind—an inquisitive nature and a student of human behavior. This last point is one in which more training is needed.

All of us consider ourselves dilettantes in the behavioral sciences. In understanding accident causation, however, this is not enough. Too long have we left the psychologist in the laboratory and limited his discipline to research. The 20th century safety specialist must be familiar with learning, motivation, emotion, attitude, fatigue, boredom as well as sensory and motor skill capacities. These are not erudite subjects for the university climate. They are aspects of human behavior which impinge on the accident phenomenon.

Consider how slow the recognition of human engineering has been in the safety field. How many accidents have been ascribed to

operator error the fact that have been described is inevitable. Driving a fo learned response rear wheel steering for the experienced driver situation when responses.

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operator error or carelessness instead of to the fact that certain kinds of equipment have been designed so that operator error is inevitable. Consider forklift accidents. Driving a forklift truck violates man's learned response from the automobile. With rear wheel steering, backing errors are common for the novice driver and even the experienced driver if he is in a stressful situation where he reverts to old learned responses.

A great per cent of the male population can't apply the forklift's brakes without striking the knee against the steering wheel unless braking is done with a slanting motion. I might add that present day autos have this same drawback. The auto industry has only in the last six to eight years begun to design cars for operator comfort and safety and I fear we have a long way to go. Thus, it is imperative that the safety specialist study the fruits of applied psychology if he really expects to properly analyze accidents.

The safety analyst must also recognize the danger signs of employees working in environmental stress. There is considerable evidence to suggest that sub-quality output, slight decreases in total output and a higher frequency of unscheduled breaks will occur during early stages of environmental stress such as heat, light, noise, airborne contamination, etc. This stage is followed by more direct quality errors by the operator and also increased susceptibility to accidents. Finally physiological damage and occupational diseases result with increased environmental stress.

Since safety is not a criterion in its own right but rather is intimately tied into production, the safety specialist must understand the principles of work design so that accident prevention complements production. In this regard, a safety specialist should be trained in methods improvement and work simplification. With very few exceptions, building safety into a job should increase output. None of the principles of motion economy, for example, contradict a principle of machine guarding. Indeed, the future of safety may depend on the justification of safety on the basis that it facilitates production *not* on the basis that accidents are costly.

It is precisely in the area of problem

analysis that the disciplinary training of engineering is useful. In safety, one must be able to organize facts, isolate the contributing factors, propose hypotheses and test them in the work environment. It is here that creative engineering is most pertinent. One must be forever curious in accident studies, for curiosity as Samuel Johnson put it, "is the permanent characteristic of a vigorous mind."

The fantastic complexity of the accident phenomenon obviates the application of simple homespun accident prevention remedies, such as the use of the ASA causal classification system. The safety specialist must be alert to new hazards, to new solutions, and to new ways to safeguard the operator. He can not afford to be straight-jacketed in this thinking.

Second to the analytic skill requirements of the safety specialist is his role as interpreter. He must be able to interpret the significance of accident findings to management and the worker. He must be able to interpret accident prevention measures in terms of company savings, better product and increased employee morale. He must be skilled at both descriptive and inferential statistics. The former will permit him to measure his progress and properly evaluate safety effectiveness in the firm. The latter will enable him to differentiate between real and chance changes in the safety level of the organization.

As a rule, safety specialists are mired in statistical averages and have little appreciation for the pitfalls that averages are prone to supply. How many safety specialists can perform or even interpret a statistical analysis of accident data; for example, the relationship between first aid and LTA accidents. Statistics are neither the work of the devil nor a panacea. They simply provide specialized interpretation of data.

An interpreter in the language sense is equally fluent in two or more languages. In safety, the specialist must be able to translate management policy into safety programs and translate accident data into management action. In addition, because of his unique position as coordinator in the firm, the specialist must be able to translate engineering into maintenance terms and vice versa. He must be able to translate medical recommendations into protection for the worker.

Moreover, the constraints as represented by safety codes must be related to the realities of production. Those interpretive skills must be mediated by wisdom and a sense of magnanimity, neither underplaying nor overplaying the function that safety must play in the company operations.

Finally, juxtaposed with interpretation is communication. Unless the safety specialist can make his findings and their interpretations known to management and the worker his efforts are wasted. To most safety directors this is the area of their prime concern, especially in their communication with management.

We often forget, however, that safety communication must be lateral, as well as vertical in the firm. Other staff functions are intimately bound to the safety functions since accident prevention measures are very likely to affect quality control, production control, methods and time study, sales, and accounting. Communication involves establishing channels and organizing the messages to be used in these channels.

Effective oral and written communicative skill is one of the real weaknesses in modern engineering education. Almost without exception our graduates complain that they wish they could have taken more English and speech courses while in college. To the safety specialist, communication is a constant challenge and a difficult art.

For example, he must convince his superiors that their support is indispensable and at the same time not inculcate the attitude that he does not have control of the situation. To the worker he must establish his authority and at the same time solicit from him assistance in combating accidents.

The safety specialists must above all else establish by means of the written and spoken word a sense of awareness and responsibility towards safety, from the hourly laborer to the plant manager. Unless the plant community considers safety a part of each individual job and is aware of accident producing situations it is questionable how much the most capable safety specialist can accomplish.

Up to this point we have outlined the general specifications for the ideal safety specialist. While none of us may ever reach perfection we can through self-education better equip ourselves for the challenges of

our work. Rather than emphasize more detailed knowledge I would like to suggest eight areas of advanced study which will assist the safety specialist in these functions of analysis, interpretation and communication. These areas of study might involve reading, safety seminars, advanced courses sponsored by local ASSE chapters and topics for ASSE national meetings.

I. *Work Simplification*—including work measurement, principles of motion economy, methods analysis and operational analysis. This ability to analyze elements of work is the foundation of job safety analysis.

II. *Human Factors Engineering*—The fundamentals of the design of man-machine systems for human use. This involves consideration of the cognitive, anthropometric, sensory and motor capabilities of man and their effect on equipment design.

III. *Descriptive Statistics*—The ability to organize data in meaningful ways and the subsequent ability to present accident data in clear and concise forms.

IV. *Inferential Statistics*—ability to draw proper inferences about statistical data. Of paramount concern here is the distinction between chance and real changes in accident statistics and the testing of hypotheses concerning accident causes and the relation between accident prevention efforts and changes in safety effectiveness.

V. *Environmental Stress and Its Effect on Worker Behavior*—included here are those environmental factors which not only accelerate accident producing situations but those which at the same time undermine quality output such as thermal stress, noise, lighting, airborne contaminants and toxic chemicals.

VI. *The Psychologically Safe Climate*—This is an area of psychology that has been abandoned in the past for emphasis on accident prone theory. Here we refer to motivational, learning and attitudinal factors which facilitate alertness and concern towards safety.

VII. *Creative Thinking*—one of the lost arts in engineering today. Because no two accident problems are the same we must develop ingenuity and unconventional solution methods. Creative thinking is a skill that can be developed as brainstorming sessions have demonstrated.

VIII. *Effective Communication*—The

ability to express our findings in the recommended terms which the stand.

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ability to express concisely and completely our findings in safety and to spell out clearly the recommended action to management in terms which they can appreciate and understand.

What is needed is the development of these topical areas by talented individuals within and outside of our society and the publication of this material so that it is available

to the individual safety specialist. Lastly it should be clear that knowledge and skill are no guarantees of success in accident prevention if we fail to be genuinely motivated in our concern for our fellow man. If we truly possess this concern, face up to our own inadequacies and continually strive for self improvement, we will be a credit to ourselves and to our profession.

PREPARING THE SAFETY ENGINEER AND UPGRADING PERFORMANCE

By D. A. WEAVER

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A hasty review of the literature reveals that we have been probing and discussing this subject for at least 10 years, and the question that first occurs to me is, "Why this recurring interest in this theme?" What are the needs that impel us to review and discuss this material and to seek new answers on frequent occasions in all of our professional meetings.

I believe there are four needs. Discussion of them will give us an opportunity to review some of the literature concerned with preparation of the safety engineer. In addition, I should like to present to you seven additional ideas concerned with preparing the safety engineer and upgrading performance. With this brief preview let us begin with the first need which motivates constant stirring and review of this question.

First, there is a need to clarify the question of whether a safety engineer must first be an engineer. I shall not discuss this issue, but merely refer to some of the literature, such as the 1956 item entitled "Preparing Tomorrow's Engineer and Safety Specialist"; or the 1958 item on the "Safety Engineering Profession"; or the fine paper by Heimrich, "Can Safety Stand On Its Own Feet"—a paper dating from 1955. At the 1955 Congress, there was a paper on "What Shall We Teach the Safety Engineer of Tomorrow"—in 1959 the question was discussed, "What Is A Safety Engineer?"—or the fine article in the current

issue of the Journal entitled "Engineering as a foundation for Optimum Safety Success."

One of our needs in our recurring discussion of this theme of education of safety personnel has been the need to clarify this question of the role of engineering training for safety engineers.

A second need has been to develop a university curriculum for preparing safety personnel. This has given us a fine paper at the congress in 1958 by Tom Rockwell, "Removing a Blind Spot in Safety Education." Or in 1955, a survey, entitled "The Safety Engineer in Industry." Or a paper from 1956, entitled "Recognition of Safety as a Profession." And dating all the way back to 1952, a fine booklet by Cutter and Elkow, entitled "Training For Industrial Accident Prevention," to which I shall return in a few moments.

I believe there is still a third reason why safety engineers find a need to consider and reconsider the kind of knowledge and training that goes into their job. I believe by such discussions we seek to avoid being swamped, being drowned, by the immensity of the knowledge and skills that seem to be unavoidably inherent in our job. We sense a need to know all things and yet we are aware of the fallacy of seeking to know all things, and are aware of the fallacy of creating an image of the safety engineer as a man who knows all things.

We have sought the core concepts around which to integrate our body of knowledge, to integrate our work, to integrate our safety personalities. The very vastness of the things we deal with, in chemistry, in physics, in engineering, in medicine, of plant layout, in industrial engineering procedures, in psychology, in teaching, in motivation, the very vastness of all this surrounds us with a chaos through which we seek guide posts.

This need gives us such papers as one in 1953, entitled "What The Safety Engineer Expects in the Safety Program"; or one in 1959 seeking guidance on policy, entitled "Safety Management Policy"; or in 1952, "The Place of Safety Engineering in Industry"; or in 1959, "What A Plant Manager Expects Of A Safety Engineer." We have sought guidance in the chaos of the knowledge and the skills of our job; we have sought to avoid being swamped by again and again asking ourselves what should be in our education and training.

Fourth, I believe there is another paradoxical need which motivates us to look at our training and background—the need to avoid being narrowed to the special aspects of our immediate job—to avoid becoming specialists in one plant, in one industry, or perhaps in just one department or phase of safety in a plant or industry.

On the one hand, we have the need to avoid intellectual chaos and on the other hand we have the need to avoid intellectual tunnel vision. This has given us such papers as the 1958 paper on "What is Wrong with Safety Engineers"; or in 1959 a paper entitled "Toward the Profession of Safety Program Management"; or in 1960, "Today's Safety Engineer"; or in 1960 again, "Our Society Must Prepare Today for Tomorrow."

These four thoughts provide a hasty review of some of the literature that exists on these topics. It may be comforting to you to know that whatever you are seeking here today and whatever you may acquire here today, can be augmented by the devoted efforts of many people extending back over many years. I believe we shall continue for many years to probe these questions, for by probing them we find personal guidance, personal integration, identification in our special role. We harness

ourselves and we harness concepts to the tasks of safety that surround us.

The American Society of Safety Engineers was the first organized group with an expressed belief that safety could be achieved by orderly application of principles. We still struggle to define ourselves and our body of knowledge. It is interesting to be aware of the fact that others deal in the same life-preserving and property-protecting tasks that we ourselves are in. But their identity has been different, their specialty has been different, the pattern of their thinking has been different.

Others have found it necessary to organize in groups and societies whose patterns of thinking are not satisfied in the things we have identified in the American Society of Safety Engineers. Just hastily there are the Fire Prevention Engineers, the Institute of Traffic Engineers, the Council of Safety Supervisors, the Campus Safety Association, the American Industrial Hygiene Association, and I am sure there are others.

I can perhaps close off this portion of my comments by referring again to the booklet by Dr. Cutter and Dr. Elkow, published in 1952 by the Center for Safety Education at New York University. In this 64 page booklet, Part I is entitled "The Industrial Accident Prevention Specialist and His Functions." Part II, "Training for Safety in Engineering and Technical Schools." Part III, "Training in Accident Prevention in Non-Engineering Colleges, Schools and Departments." Part IV, "Recommendations for Training in Industrial Accident Prevention." Those of us who seek for guidance in this field need not seek in vain.

Let us then consider some other aspects of preparing the safety engineer and upgrading performance. Let us consider it from the view of the practical safety engineer doing his job, perhaps aware of the need to avoid both intellectual chaos and intellectual tunnel vision, and desiring further education and guidance to upgrade performance. The following seven ideas may have some merit in your thinking:

1. *Build your self-improvement around the specific hazards of your operation.* Define what it is you need to do in order to do your job better and seek opportunities for that kind of education. Do you have lad-

ders or flammables, an outside or special hazards give self-directed

For example, is the trucking many industries, to be growing a skills and knowledge out and exert as your company perhaps spread rected by a sale cern is sales, and driving passenger little influence?

This is what your influence, around the special operation." This tale told to me received a photo in a chemistry lab he hastily thumb data sheets, and explain to the audience had happened, how to prevent carefully, for being the role of doing all things. Having role when but you seldom

The real point was prepared to his chemical laboratory engineer to know to be known a chemicals that industrial operation

I submit that the safety engineer baked chemist. I tion as a safety he contrives pro whenever a new potential is brought gives him the opportunity and preventive improvement can specific hazards

2. Through it available, a flow our desks from mention this point

ders or flammable materials, window washers, an outside construction crew, explosives, or special hazards to which you might well give self-directed educational endeavor?

For example, one frequently overlooked is the trucking operation, which exists in many industries, and which at present tends to be growing at a rather rapid rate. What skills and knowledge do you need to reach out and exert an influence over that? Does your company have a sales organization, perhaps spread over a very wide area, directed by a sales manager whose sole concern is sales, and all of whose salesmen are driving passenger cars over which you have little influence?

This is what I mean when I say, "Build your influence, build your self-improvement around the specific hazards of your own operation." This I think is illustrated in a tale told to me by a safety director, who received a phone call about an explosion in a chemistry lab. Before he rushed over, he hastily thumbed through some chemical data sheets, and upon arrival was able to explain to the amazed chemist exactly what had happened, why it had happened, and how to prevent it. He said all of this very ruefully, for he realized that he was playing the role of the safety engineer as knowing all things. He knew that this is a satisfying role when you can get away with it, but you seldom can.

The real point of the story is that he was prepared to deal with the hazards of his chemical labs. It would require a chemical engineer to know all the facets that need to be known about the wide variety of chemicals that exist in most any of our industrial operations.

I submit that it would be a fallacy for the safety engineer to seek to be a half-baked chemist. He performs his full function as a safety engineer, however, when he contrives procedures whereby he knows whenever a new chemical with unknown potential is brought into the plant. This gives him the opportunity to exert control and preventive measures. Self-directed improvement can usually be pointed by the specific hazards of our own operation.

2. Through the literature and standards available, a flow of materials should cross our desks from the standard sources. I mention this point because so frequently

a safety engineer mentions a problem, not knowing that a standard exists that would be helpful to him or that literature on it exists for pass-out materials for his supervisors. This again does not mean that we become all-knowing in studying all these things, but that we know what is available from the American Standards Association, from various insurance companies, from the National Fire Protection Association, National Safety Council, heating and ventilating engineers, industrial hygiene publications, chemical data sheets, and special publications pertinent to our industry, be it trucking, mining, petroleum, utilities, or whatever.

I believe it is a fair statement that you do not have a problem, you do not have any need for knowledge, that has not been reduced to writing and expressed in a pamphlet or a book somewhere. My point here is: keep your channels open to a flow of this material, learn to scan it hastily so that you know what is there, learn to read some of it and learn to study certain further choice items.

3. *Study your position and the position of safety in your organization.* This idea relates to the next one I am going to mention. My thought can be illustrated by this situation:

A safety man had been attached to the trucking department in an organization because that was their problem when they brought him in. He had, however, a sizable background in industrial safety, felt the need to extend his influences further throughout the organization, and found himself strategically in a very poor position to exert influence throughout the organization.

It is further illustrated in a company I consulted with, in which it became a question of some import as to just where and to whom a potential safety director should report. The standard academic answers were there, but for reasons that would be difficult to understand without knowing the internal workings of the company, it just would not work in this case.

The idea is illustrated in a situation in which the safety director just isn't attached anywhere. He literally reports to no one. The person who hired him changed to another position, the safety director literally

did not know whom he reported to, and no one understood him to be a subordinate. He was a free-floating safety engineer. He was the most advisory safety engineer I have ever seen, and also in a position of least influence.

Can you extend your influence throughout the organization? Can you make it reach the sales department, the high-powered brains in the research department, the driver on the highway, the outlying plant in the other city, or the boss's son? We need to understand our position and the position of safety in the organization, in its total functioning, in order to advance and exert our influence for good.

4. *The fourth point is an old cliché of safety, to fix safety as a line responsibility—where it belongs.* It has been my observation that management does not expect this; is quite confused as to the functions of safety, even when they define it in words; is often rather vague in its application and, most importantly, that it is a long and difficult task to really imbue a whole organization with the idea of line responsibility for safety. I believe the whole philosophy, theory, and practice is revealed in a little vignette of the safety director who described a scene in which he stood talking to the plant manager one morning when the assistant plant manager walked up. As the assistant approached, the plant manager nudged the safety director and pointed at the shoes of the approaching assistant and said, "Look! No safety shoes—give him hell!" The safety director calmly shrugged his shoulders and walked away with the comment, "He doesn't work for me."

I believe these last two thoughts—to study your position and the position of safety in your organization, and to fix line responsibility for safety, are important in the development of the safety engineer. Your success and your skill in dealing with these last two items, I believe, make the distinction between safety management and safety inspection for some other lesser expression of safety control.

5. *Make the safety post a stepping-stone upward.* I believe this point has overlooked implications. It applies to you—it applies to your subordinates—and in a large organization it has special meaning for safety supervisors assigned in the field. As it applies to

you, let me suggest these thoughts: I believe that a man who leaves safety work for some higher responsibility in his company is not lost to safety—he is rather in a position of doing more for safety.

His higher position, with his safety background, makes him highly receptive to the safety needs of the organization; and his higher position puts him in a more influential position to accomplish something in it. I do not believe the cause of safety suffers when a safety man moves to a higher responsibility in his company.

This idea of making safety a stepping-stone has a special pertinence in many organizations which have gone through a rugged phase—a phase of rapid growth, of immaturity and development, of acquisition of other companies, of difficulty in applying good management procedures and hence good safety procedures. I have seen such organizations influenced by strong, competent safety men, who did a terrific job in safety and inculcated throughout the organization a deep awareness of safety fundamentals.

The more successfully they accomplished this task, the less it needed a man of such high competence and salary. I have seen such men become, shall I say, the victims of management's awareness that their tasks, now so well integrated throughout the company, could be done by somebody at half the salary.

I have seen other men in this same situation, perhaps more fortunate, who used safety as a stepping-stone. As they did this tremendous job for safety they also developed around themselves a set of related tasks—tasks in claims, in insurance and compensation, in wage administration, in pension programs, in any number of related tasks which are a developing part of the efficiency of the organization. I talked to one such man this week, who recently gave up the title of safety director to take on a higher title that encompasses all the tasks that he developed while still safety director. He now has reporting to him a safety director at perhaps one-half or one-third of his salary.

Safety suffers when highly competent men, who have staked their prestige, their status in the company, on masterful safety performance, suddenly have the rug slid out from under them. On the other hand,

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This idea of self-reliance applies to your success as a man as you develop your company, or to another man; let work in your organization be organized as a stepping stone to the best abilities and performance.

A special version of the program for organizations who are not at the district level. Supervisors are not authorized. These municipal safety men are not a staff; they represent the organization.

In such position of two things: S competent hiding because he is not he seems to do th desk. Or sometin picture—a capable done a fine job i because he *has* do promotional oppo other men. It is and the function safety supervisors

These men are working of a w throughout it, to deal with all of wonderful opportu get better. safety safety supervisory nized that a post i for a step upward

6. Seek out opportunities to be acquainted with the able. Just thinking radius of Chicago courses, courses in plant hygiene, in industrial investigation, and more. Know the of the kind of need. This doesn't

Safety gains when that safety engineer advances himself, exerting a stronger influence throughout the whole company, including his influence on safety.

This idea of safety as a stepping-stone applies to your subordinates. You may lose a man as you develop him to another company, or to another department, but let him go; let work in safety be seen and recognized as a stepping-stone upward deserving the best abilities and the most aggressive performance.

A special version of this applies in large organizations where at the plant level, or at the district or division level, safety supervisors are assigned by the line authority. These men are not usually professional safety men as you and I know them, they are not a part of the central safety staff; they report directly to the line organization.

In such positions you are apt to find one of two things: Sometimes you find an incompetent hiding behind the desk, left there because he is not wanted anywhere else, and he seems to do the least harm at the safety desk. Or sometimes you find an opposite picture—a capable, aggressive man who has done a fine job in safety and is left there because he has done a good job, while other promotional opportunities are passed on to other men. It is well to review the role and the functions and the prospects of safety supervisors in these positions.

These men are in a position to study the working of a whole operation, to travel throughout it, to know all its people, to deal with all of its people. It is a most wonderful opportunity for growth. We will get better safety performance in these safety supervisory posts when it is recognized that a post in safety is an opportunity for a step upward in the organization.

6. *Seek out courses and training opportunities to fit your needs*; become acquainted with the variety of courses available. Just thinking out loud—in a 150-mile radius of Chicago there are supervisor courses, courses in safety fundamentals, courses in plant ventilation and in industrial hygiene, in industrial security, in arson investigation, and I am sure there are many more. Know the sources in your own area of the kind of further preparation you need. This doesn't mean that the precise

package you want is always available, but the opportunities for the precise preparation you desire are available somewhere.

7. I suggest that each ASSE chapter should sponsor a professional-level course. When I mentioned this to George Harper he suggested two courses: one for safety engineers and safety personnel and the other for front-line supervision. I agree with him. I shall, however, at the moment, speak only of courses for professional safety personnel. Each chapter should seek out and establish university contacts. You will eventually find someone or some university or some department of the university that can work with you in putting on a program that will be helpful to you and to your chapter.

Let me offer four suggestions from my own experience in organizing and putting on these courses: (a) Put them on for yourself; don't develop them as a noble service to some other beknighted soul who needs your help. Serve yourself. Serve your own chapter. Serve your own industry, and you are apt to find in the process that some other beknighted soul is interested in what you're doing and will attend in greater measure than if you aim at him specifically.

(b) Put on your courses at the highest professional level. In part, this is an expression of the previous point, in that the greatest need for safety education is in the numerous small plants who have no safety director, who have little awareness of safety as an organized activity, who think of safety in terms of 5-600 dollars a year as insurance premium. These people we need to reach, but if you try to reach them directly, they will not come. If you put on a high-level course deserving of your attention and your earnest participation and attendance, and then promote it among these lesser folks whom you wish to reach, you will reach a higher percentage of them. This has been our experience.

(c) Work in fundamentals, even though your program is at a high professional level, because you wish to serve some folks who have less experience than you. Fundamentals are really worked in by the definitions and instructions given to your teachers rather than by the selection of titles themselves. Regardless of title, safety fundamentals, with forethought, by instruction to your speakers, can be worked into the

highest professional course, and what's more, can be presented in a way which will absorb the interest of the highest professional group.

(d) Look for an adviser. Somewhere there is a man who will work with you, who knows people in our field, knows the cross-threads of ideas, knows who can help to develop a program or present topics. In my work I always had the guidance of the Indianapolis chapter of the American Society of Safety Engineers, and beyond that I had phone contact with our longtime friend J. C. Stennett, who is an encyclopedia of guidance and help, and who I called on frequently.

Education for safety personnel—preparation of the engineer—upgrading performance—I wish I could tell you exactly where you can acquire the educational background that fits your particular needs, your particular personality, your particular intellect, your particular company. I cannot do that nor will we ever be able to. We do need constantly to orient ourselves and to seek new directions, especially new directions in self-preparation.

Bibliography

Safety as a Profession, by A. C. Blackman, Managing Director, American Society of Safety Engineers, Chicago, Illinois. (1953 NSC Transactions, Vol. 12)

Is the Tail Wagging the Dog? by Karl Schulze, Senior Safety Engineer, Western Operations, Inc., Standard Oil Company, San Francisco, Calif. (1958 NSC Transactions, Vol. 8)

The Engineering Approach, by William E. Tarrants, Instructor and Research Associate, Center for Safety Education, New York University. (1960 NSC Transactions, Vol. 12)

What's Wrong with the Safety Engineer? by Alfred Lateiner, Mamaroneck, N. Y. (1960 NSC Transactions, Vol. 12, Sup. 9)

What the Safety Engineer Expects in the Safety Program, by Stanley F. Spence, Dir. of Safety and Fire Prevention, American Cyanamid Co., New York City. (1953 NSC Transactions, Vol. 31)

What Shall We Teach the Safety Engineer of Tomorrow? by William D. Renner, Safety Supvr., Schering Corp., Bloomfield, N. J. (1955 NSC Transactions, Vol. 13)

Recognition of Safety as a Profession—A Challenge to Colleges and Universities, by H. W. Heinrich, Chairman, The Uniform Boiler & Pressure Vessel Laws Society, Inc., New York City. (1956 NSC Transactions, Vol. 24)

The Safety Engineering Profession, by Joseph C. Stennett, Dir., Accident & Fire Prevention, National Association of Mutual Casualty Cos., Chicago, Illinois. (1958 NSC Transactions, Vol. 16)

Reports and Reporting Procedures, by D. T. Mould, Safety Director, General Motors Corporation, Detroit. (1958 NSC Transactions, Vol. 16)

The Safety Engineers' Major Problems, by Myron L. Miller, Supervisor of Safety, Westinghouse Electric Corp., East Pittsburgh, Pa. (1958 NSC Transactions, Vol. 16)

Problems of Administering Multi-Plant Safety Programs, by D. T. Mould, Safety Director, General Motors Corp., Detroit; Earl H. Stockdale, Accident Prevention Div., Gulf Oil Corp., Pittsburgh, Pa.; C. H. Hoopes, Supvr., Safety & Health Services, Continental Can Co., Inc., Chicago, Ill.; W. C. Mahlstet, Safety Eng., Continental Baking Co., Rye, N. Y.; L. R. Morrison, Safety Mgr., A. C. F. Industries, Inc., New York City; J. E. Nichols, Dir. of Safety, Reynolds Metals Co., Richmond, Va.; D. A. Patrician, Staff Administrator, Safety & Accident Prevention, Radio Corp. of America, Camden, N. J. (1958 NSC Transactions, Vol. 16)

The Safety Engineer's Responsibility with Management in the Far Reaching Aspects of Increasing Workmen's Compensation Benefits, by Albert L. Anthony, Service Representative, Loss Prevention Dept., Liberty Mutual Insurance Co., East Orange, N. J. (1959 NSC Transactions, Vol. 2)

American Society of Safety Engineers—Annual Meeting, Standards of Concern to the Safety Engineer, by Arthur S. Johnson, Vice Pres., Engineering American Mutual Liability Insurance Co., Boston. (1959 NSC Transactions, Vol. 13)

American Society of Safety Engineers: Annual Meeting, What is Ahead for Engineering, by John T. Bertallata, Pres., Illinois Institute of Technology, Chicago, Ill. (1955 NSC Transactions, Vol. 13)

Safety Is Basic in Human Relations, by C. G. Rousch, Mgr., Westinghouse Electric Corp., Kansas City, Mo., Vice-Pres., National Society of Professional Engineers. (1952 NSC Transactions, Vol. 15)

Are Your Efforts Effective? (A Symposium). So We Want a Better Job, by H. K. Lambie, Safety Consultant, Kaiser Aluminum and Chemical Corp., Oakland, Calif. (1954 NSC Transactions, Vol. 13)

Training for Industrial Accident Prevention, by Walter A. Cutter and J. Duke Elkow, (Center for Safety Education, Division of General Education New York University, in co-operation with The American Museum of Safety, New York, 1952).

A Safety Job—or Job Safety? by John W. Gurry, Safety Engineer, AVCO-Everett Research Laboratory, Boston, Mass. (National Safety News, May 1961)

Working in the Shadows, by Charles M. Brooks, Director of Industrial Relations, The Texas Company, New York, N. Y. (National Safety News, June, 1959)

The Men Who Will Follow Us, by William D. Renner, Safety Supervisor, Schering Corp., Bloomfield, N. J. (National Safety News, February, 1956)

Let's Not Sell The Safety Engineering Profession Short, by H. E. Packard, Regional Safety Officer, Dallas Regional Office, Post Office Department. (National Safety News, October, 1958)

What Is A Safety Engineer? by J. Robert McCullough, Supt. of Safety, Hunting Park Plant, Budd Company, Philadelphia, Pa. (National Safety News, February, 1959)

Safety Engineers' Leadbeater, Safety Corporation. (Supr.)

Dedication Plus Expects of a Safe Crosby, Director Operations, for ti santo Chemical Co. (National Safety 1)

Toward the Pro Management, by 1 Center for Safet University, and Ttor of Safety, I (National Safety 1)

Our Society Musi row, by C. Russel ager, Internationa tional Safety News

Safety Comes of Assistant Sales M facturing Co. (Nat ary, 1960)

Today's Safety i Business and Gove conl, Chairman, A Engineers, Special Services. (Nation 1960)

Can Safety Stan H. W. Heinrich, Engineering and Travelers Insura Conn. (National 1955)

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G. M. KINTZ, I
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Safety Engineering Comes of Age, by T. R. Laddbeater, Safety Director, Todd Shipyards Corporation. (Supervision, January, 1954)

Dedication Plus . . . What a Plant Manager Expects of a Safety Engineer, by Lincoln B. Crosby, Director of Manufacturing, Eastern Operations, for the Plastics Division, Monsanto Chemical Company, Springfield, Mass. (National Safety News, September, 1959)

Toward the Profession of Safety Program Management, by Walter A. Cutter, Director, Center for Safety Education, New York University, and Thomas H. Wilkenson, Director of Safety, Department of the Army. (National Safety News, October, 1959)

Our Society Must Prepare Today for Tomorrow, by C. Russell De Reamer, Safety Manager, International Business Machines. (National Safety News, May 1960)

Safety comes of Age, by John B. Dunne, Assistant Sales Manager, Bomgardner Manufacturing Co. (National Safety News, February, 1960)

Today's Safety Engineer . . . in Industry, Business and Government, by E. Peter Marconi, Chairman, American Society of Safety Engineers, Special Committee on Membership Services. (National Safety News, August, 1960)

Can Safety Stand on Its Own Feet? by H. W. Heinrich, Superintendent of the Engineering and Loss Control Division, Travelers Insurance Company, Hartford, Conn. (National Safety News, November, 1955)

Principles of Accident Prevention and Con-

trols, by George F. Nuernberger, Safety Engineer, A. B. Dick Company, Chicago. (National Safety News, November, 1956)

Canons of Ethics for Engineers, prepared by Engineers' Council for Professional Development and adopted by the Executive Committee, American Society of Safety Engineers. (National Safety News, August, 1956)

Management Safety Policies, Published by the National Safety Council. (National Safety News, November, 1959)

The Safety Engineer in Industry: A Survey, by Society for the Advancement of Management, 74 Fifth Avenue, New York 11, N. Y. (Management Review, August, 1955)

Preparing Tomorrow's Engineers and Safety Specialists, by H. H. Fawcett, Research Laboratory, General Electric Co., Schenectady, N. Y. (National Safety Council, Library, October, 1956)

The Place of Safety Engineering in Industry, by C. H. Weiser, President, American Society of Safety Engineers. (National Safety Council, Library, January, 1954) (1956 NSC Transactions, Vol. 24)

The Safety Engineer's Relationship With Management in Industry, by E. C. McFadden, Vice-President, Texas Employers Insurance Company. (Engineering for Safety, No. 232, June, 1954)

What is Wrong with Safety Engineers? by A. B. Pettit, Supervisor, Industrial Health and Safety, The Davidson Chemical Corporation, Baltimore, Md. (National Safety Council, Library, April, 1951)

THE KINTZ AND BROWNE FIRE AND STATIC ELECTRICITY DEMONSTRATION

By

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H. F. BROWNE, Supervisory Safety Eng., District G, Bureau of Mines, U. S. Dept. of the Interior, Dallas, Tex.

The presentations which are designated "Project Igniter" deal primarily with the subjects of:

- (a) fire and explosion, cause and prevention,
- (b) the control of flammable and toxic gases,
- (c) the hazards of static electricity,
- (d) safety hazards in electrical equipment.

One of the highlights of the presentations is a demonstration entitled the "Magic of Fire," which has been enthusiastically received by large audiences in Canada, U.S.A. and Mexico.

All of the undernoted lecture demonstrations are authoritative, lively, informative and enjoyable scientific shows utilizing a unique combination of specially designed equipment and lecture demonstrations. The general technique of presentation is to describe an occurrence, a theory, or operating procedure and then by use of specially designed equipment, to reproduce the occurrence or apply the theory and show the results.

The first demonstration deals with the chemistry of fire and dust explosions, the fire triangle (fuel, heat and oxygen), explosions due to pressures, the extinguishment of fire by removing individually, fuel,

oxygen and the heat legs of the fire triangle. The strengths, limitations of various types of fire fighting equipment are shown and techniques of use are demonstrated.

The lecture further deals with the special and hazardous characteristics of light hydrocarbons including natural gas and gasoline. Factors which act to convert an explosion into a detonation are demonstrated. The special effects of different concentrations of gases and oxygen on flammable limits and explosive pressures are seen as is the migration of gases according to specific gravity. Ignition temperatures and various methods of developing these ignition temperatures are demonstrated, as are dust explosions and the factors affecting them.

Special methods of control of fire and explosion in industry, and in the home are demonstrated at length. Particular attention is given to discussion of individual and local problems.

The next lecture demonstration deals with the flammability, toxicity and explosive limits of gases encountered in industry. Examination is made of the composition and qualities of normal air and the special effects of the differing specific gravity of gases as well as detailed consideration of the special qualities of oxygen, nitrogen, carbon dioxide, methane, propane, butane, gasoline, carbon monoxide, hydrogen sulphide, sulphur dioxide and mercury. Diffusion of gases is demonstrated and respiratory equipment and its choice is discussed and the affect of gas concentrations on living organisms is shown. Permissible limits and the meaning of permissible limits are described and demonstrated.

The next lecture demonstration explains and shows the nature of static electricity. Its various manifestations are dramatically presented and specific hazardous occurrences are discussed in detail and repro-

duced in miniature. Means of control of static electricity and means of preventing serious effects are demonstrated and discussed. It is shown that static electricity cannot ignite flammable materials unless three conditions exist simultaneously. Means of preventing fire and explosion from static causes are derived in demonstration from this observation.

The effects of discharges of static electricity in operations involving such common place substances as gasoline, anaesthetics, natural gas, paint, varnish and commercial alcohol are demonstrated in memorable fashion.

The final lecture demonstration is of special interest to persons who are concerned primarily with electrical problems in areas in which explosive vapours and gases may be contaminants and particularly in conduits, ducts, and underground structures. It is also of wide interest to many laymen, industrial managers, architects, contractors, supervisors, and workmen. The need for maintenance of explosion proof and permissible electrical equipment is explained and demonstrated.

Special devices are used to demonstrate the behavior of flammable gases in conduits, and enclosures. The provisions of the Electrical Code dealing with these matters are discussed, explained and demonstrated. Flame and explosions are generated and propagated by equipment which permits observation, and study of the phenomena. Comprehensive demonstration is made of the differing performances of various types of equipment in explosive and flammable atmospheres.

This series of lectures provides an unusual training opportunity for accident prevention personnel, supervisory staffs, safety committees in industry, teachers, training personnel, fire department workers, hospital workers, civil defense participants and others.

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Traffic accident cause of accident nation today. But that their principal off-the-job safety accidents. This is taken and the refinery in red traffic accidents. publication preparation organizations wish program.

For many years maintained a comprehensive safety program. of off-the-job loss their conviction 1 Safe Around the the-job program in-plant injuries.

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During the past considerable progress lost-time accident presented the first year to bring off-the-job control. It was disabling injuries every plant disabling were reduced from 1958. In 1959 we of accidents by year.

The problem with the total off-the-job reduced, no progress of traffic accident cent of our off-the-job traffic accidents since cent in 1959. As

BETTER DRIVING FOR THE WHOLE FAMILY

By WILLIAM F. SABOTA

Safety Advisor, Humble Oil & Refining Co., Linden, N. J.

Traffic accidents are the number one cause of accidental death and injury in the nation today. Bayway Refinery also learned that their principal problem in the area of off-the-job safety last year was traffic accidents. This is the story of the action taken and the results achieved by Bayway Refinery in reducing off-the-job lost-time traffic accidents. My talk is taken from our publication prepared as a guide to other organizations wishing to implement a similar program.

For many years Bayway Refinery has sustained a comprehensive and progressive safety program. They attacked the problem of off-the-job lost-time accidents because of their conviction that employees should "Be Safe Around the Clock" and that an off-the-job program contributes toward reducing in-plant injuries.

The success of the program was primarily attributed to the enthusiastic employee participation in the off-the-job safety activities. Some measure of its success was indicated by the fact that of the 1200 employees and members of their families who enrolled for the course, only 2½ per cent failed to attend all four sessions. The reductions in off-the-job traffic accidents, as a result of this program, indicate that it was very worth-while.

During the past five years, Bayway made considerable progress in reducing off-the-job lost-time accidents. The year 1956 represented the first year that action was taken to bring off-the-job disabling injuries under control. It was found that 20 off-the-job disabling injuries were taking place for every plant disabling injury. Our accidents were reduced from 263 in 1956 to 63 in 1958. In 1959 we reduced the total number of accidents by four from the preceding year.

The problem was found to be that while the total off-the-job disabling injuries were reduced, no progress was made in the area of traffic accidents. Accounting for 18 per cent of our off-the-job accidents in 1956, traffic accidents steadily increased to 34 per cent in 1959. As significant was the increase

in days lost to 54 per cent of the total due to off-the-job traffic accidents in 1959. These increases offset reductions in other areas, such as home and recreation accidents.

Program Development

STEP 1: Bayway Safety Division developed a defensive driving program based on needs, with the cooperation of the Esso Safety Foundation.

STEP 2: Defensive driving program was presented to Bayway Central Safety Committee for approval.

STEP 3: The cooperation of outside agencies was obtained to participate in the course, such as the New Jersey Division of Motor Vehicles and Division of State Police and the New Jersey Safety Council.

STEP 4: A pilot course was presented to a sample group to develop the final program format before it was offered to all Bayway employees and their families.

A letter from the Manager of Bayway Refinery accompanied by this flier was sent to employees' homes announcing the program.

A second letter from the manager of Bayway Refinery was sent to employees' homes accompanied by an information sheet and a kit of promotional materials, as follows:

Information and Instruction Sheet

Who is eligible?—All Bayway employees and members of their immediate families who drive. The initial program will be presented to the first 600 who register. Attendance tickets will be sent out for this program.

Place—Auditorium, Bayway Office Building.

Time—7:30 p.m. to 9:30 p.m.—4 sessions, 2 hours each.

Dinner—Starting at 6 p.m., a free dinner will be served in the Bayway Cafeteria to everyone attending the program.

Dates—Tuesdays or Thursdays through May.

This program will continue in future

months until everyone who registered has a chance to take part.

Registration and award card—Enclosed is a return address registration and award selection card. Please print your name, address and employee number. Check the box indicating that you will or will not attend. If you (the employee) plan to attend, look over the enclosed list of Employee Awards and mark the number of your selection in the box after your name on the card. To register members of your family who drive, print their names on the bottom of the card in the spaces provided. If you register family members, have them look over the enclosed list of Family Awards and mark the number of their selection in the box after their name on the card. If you (the employee) cannot attend, you may still register members of your family who drive.

If you prefer either Tuesday or Thursday sessions, please indicate your choice at the bottom of the card.

Driving skill rodeo prizes—A total of \$350 will be awarded to the three best men and women drivers of the Rodeo. Both employees and non-employees who attend all four sessions will be eligible for selection to compete in the Rodeo. The top 15 men and 15 women selected for the Rodeo will compete for the cash prizes.

Women Drivers		Men Drivers
\$100	First Prize	\$100
50	Second Prize	50
25	Third Prize	25

Employee and family awards—Employees and family members who attend all four sessions will be eligible to receive the award they selected from the two enclosed lists.

Certificates—Defensive Driving Certificates will be awarded to everyone who attends all four sessions.

Defensive Driving Pens will be given to all who attend.

DON'T DELAY—REGISTER TODAY

Program Coordination

Behind every smoothly run program is a hard-working staff with specific assignments. The coordinator for the course was William F. Sabota, Bayway Refinery Safety Division, who was responsible for all arrangements. This included publicity, enrollment,

scheduling guest instructors, resource people, visual aids and physical facilities. In addition, each session required the following staff assignments:

1. **One attendant at cafeteria door**—punch ticket stub of persons enrolled in course as dinner guests of management.
2. **One attendant at auditorium door**—collect tickets for attendance records.
3. **One guide at ground floor elevators**—direct people to the auditorium. Assist Motor Vehicle Inspectors during psycho-physical testing in cafeteria.
4. **One guide at first floor elevators**—same duties as item 3 above.
5. **Two microphone handlers**—assist in stopping distance demonstration. Assist Motor Vehicle Inspectors during psycho-physical testing in cafeteria. Usher. Handle traveling microphones during regular sessions.

Instructors included Dr. Herbert J. Stack, Department of Safety Education, New York University; Consultant, Esso Safety Foundation; Dr. Arthur Mahony, Education Supervisor, Fair Lawn Public Schools System; Dr. Nathaniel O. Schneider, Director, School and College Division, New Jersey State Safety Council; Richard Tossell, Assistant Director, Esso Safety Foundation.

Cooperating agency representatives included George Traver, Executive Vice President, New Jersey State Safety Council; Capt. Daniel Dunn, New Jersey State Safety Council; Gerald J. Driscoll, Chief, Bureau Traffic Safety, New Jersey Division of Motor Vehicles; William J. Ford, Budd Krayner, and Richard Stearn of the New Jersey Division of Motor Vehicles; Ensley Bennett, Traffic Engineer, New Jersey Division of Motor Vehicles; Col. Joseph D. Rutter, Superintendent, New Jersey Division of State Police; Lt. Peter Hausch, New Jersey Division of State Police, and Lt. Raymond Mockridge, New Jersey Division of Motor Vehicles.

Instructional Planning

Planning for the instructional program in off-the-job traffic safety was based on the purposes of driver education and on other practical objectives of the learning group. In determining details, instructors considered the needs and interests of the employees and their families and utilized every good resource available.

The limitation course required careful use of time in the Bayway range of driving. Many family groups enrolled in each course.

Inasmuch as the were at various levels and driving experience be structured to needs represented national objectives in the development of courses was the responsibility of the instructor working.

1. Develop the and "early recognition" conditions.
2. Develop the responsibility for 1
3. Develop criteria can measure their habits.
4. Develop the violations and the
5. Review effective collisions and near
6. Personally in "participation" in to course objectives

Method

Little attempt methods closely, leading to student new learning experiences. The methods selected placed learning and realistic setting the participants. following teaching

1. **Class discussion** for determining the and involving a through participation
2. **Instructors' personal background** students for planning Lectures were carefully organized in variety of audio-visual demonstrations suitable to create and maintain

The limitation of eight hours for the course required careful planning and judicious use of time. The participants attending the Bayway course represented a wide range of driving experience, age and income. Many family groups of two to five members enrolled in each class of nearly 300 people.

Inasmuch as the individuals in these groups were at various levels of learning readiness and driving experience, the course had to be structured to meet the more common needs represented. The following instructional objectives were established; however, the development of specific learning experiences was the responsibility of the qualified instructor working with the participants:

1. Develop the concept of "anticipation" and "early recognition" of hazardous traffic conditions.
2. Develop the concept of "personal responsibility" for preventing accidents.
3. Develop criteria by which participants can measure their own driving practices and habits.
4. Develop the relationship between traffic violations and the consequences of accidents.
5. Review effective evasive steps to avoid collisions and near misses.
6. Personally involve the individual through "participation" in learning experiences related to course objectives.

Methods of Instruction

Little attempt was made to standardize methods closely, since they may vary according to student needs, size of group, type of learning experience, teacher abilities, available facilities, and other local conditions. The methods selected for the Bayway course placed learning experience in meaningful and realistic settings which were familiar to the participants. The instructors used the following teaching methods and techniques:

1. *Class discussion* was an important means for determining the more common problems and involving a large number of people through participation.
2. *Instructors' presentations* provided essential background information and prepared students for planned learning experiences. Lectures were discouraged. Instructors skillfully organized their presentations using a variety of audio-visual materials and demonstrations suitable for large audiences to create and maintain a high level of interest.

3. *Visiting specialists and resource persons* (representatives from the State of New Jersey Division of Motor Vehicles, Division of State Police, and State Safety Council) backed up the instructor at each session by answering questions raised by individuals in the audience. The students also wrote their questions on the cards which were provided and collected at the end of the session. Questions not answered became the basis for the panel discussion during the final session. The panel members were representatives from each of the cooperating state agencies. State Motor Vehicle Division Inspectors also participated by administering the psychophysical tests and scoring participants in the Driving Skill Roadtest. Their participation gave the program an "official" atmosphere and improved the participants' understanding of the objectives of each of these agencies.

4. *Stopping distance demonstration*—a series of dramatic stopping trials were run over a roped-off area of asphalt pavement at the refinery parking lot. Two cars of the exact model and weight were matched against each other—one equipped with Atlas Bucron tires, the others were factory-equipped tires. The measured braking distances of the two vehicles at 40 mph on both dry and wet pavement impressed the audience with the fact that even with Bucron's added margin of safety—You Can't Stop on a Dime! Volunteers from the audience were invited to drive the vehicles at 20 mph and make emergency stops.

No attempt has been made to present a detailed course of study in this manual. The following outline and sequence was developed as a guide in organizing instructor presentations to achieve the course objectives.

Outline of Course

A.—First Session:

1. Informal greeting to group by top management.
2. Group orientation—purpose of the course and seriousness of the traffic accidents with particular emphasis on local problems; introduction of guests and instructor by coordinator.
3. Audience interviews to familiarize audience with discussion technique and use of microphones, by instructor, "mike" handlers, and audience volunteers.

4. Discussion on basic causes of traffic accidents and meaning of "defensive driving," namely, avoiding mistakes of others by anticipation and early recognition, using transparencies.

5. "Seven-tenths of a Second"—strip film with tape recording.

6. Development of proper seeing habits using transparencies and trapezoidal window demonstration.

7. "Smith System" a motion picture for developing driver alertness.

8. Discussion of film and question and answer period, conducted by instructor, audience, State Motor Vehicle and Police representatives.

9. "And Then There Were Four," a motion picture. (Note: Interest can be stimulated by *not* revealing the ending of the film until the next session.)

10. Summary and assignment (*You and Your Driving booklet*) by coordinator.

B. Second Session:

Prior to this session, the group met for a demonstration of stopping distances by the New Jersey Safety Council.

1. Summary of previous session and introduction of guests & instructor by coordinator.

2. Demonstration of psycho-physical testing and significance of tests by audience volunteers, using transparencies.

3. Tell Them the Truth—the alcohol story showing physiological function—no warning signs at time drinking becomes dangerous, using transparencies.

4. "And Then There Were Four" (if not completed prior session)—motion picture.

5. Discussion of film.

6. "To See Ourselves," a motion picture.

7. Discussion of film.

8. What Makes Us Tick, by Dr. Arthur Mahoney—discuss how emotions are related to attitude development and show how attitudes influence our actions in practical situations—using transparencies.

9. Questions and answer period—instructor, audience, State Motor Vehicle and Police representatives.

10. Summary and assignment (vehicle safety checks)—coordinator.

C. Third Session:

For 30 minutes previous to this and the fourth sessions, four sets of psycho-physical testing apparatus were operated by Motor Vehicle Division License Examiners and assistants.

1. Summary of previous session and introduction of guests and instructor—coordinator.

2. "Freeway Driving Is Different," a motion picture.

3. Discussion of film to emphasize important differences.

4. Discuss safe driving practices and specific steps in meeting the more common driving emergencies; show transparencies.

5. Improving perception in driving—discussion illustrated with color slides to provide practice in "early recognition" and "anticipation" principles, using color slides.

6. Question and answer period, conducted by instructor, audience, State Motor Vehicle and Police representatives.

7. Summarization and assignment (prepare and mail in questions on "what I want to know" for panel discussion).

D. Fourth Session:

1. Things I Would Like to Know—question and answer discussion around questions submitted on cards prior to or during the session, conducted by a panel: State Motor Vehicle Division, Police, Safety Council and Course Instructor. (Transparencies were utilized for illustration.)

2. Summarization of course by the instructor.

3. Objective Driver Knowledge Test (20 minutes).

4. "You and Your Driving," a motion picture.

5. Discussion of film.

6. Closing remarks by coordinator and management.

Instructional Materials

There are many audio-visual resources in driver education to aid the instructors to more fully motivate learning among his students. The following aids were used at Bayway for the purpose of illustration, stimulating discussion, and for holding the students' attention and interest:

a. Motion picture the course content

1. "Smith System" sound—Training seeing—Ford Motor

2. "And Then min. B&W, 16 mm showing faulty at Company.

3. "To See Our mm sound—Pro factors.—Aetna Company.

4. "Freeway D min. color 16 mm sing how to drive Automobile Assoc

5. "You and color 16 mm sour with a refreshing Safety Foundation

b. Transparency projector. Large at the rear of the a blackboard. All audience. Stimula dent participation.

1. "Driver Saf training transpart 10" overhead p traffic conditions.—Inc.

2. Transparency suit the needs of

c. Slides and s related to course sound recording a film.

1. "Seven-tenth mm color strip ration and music. collision in tenth-phone System.

2. Perception sl camera in color, s tions. Individual the screen for 3 recognition" of tr late discussion.—(tion, New York 1

3. Seeing habi taken from "Obse duPont De Nemot

a. *Motion pictures* especially related to course content.

1. "Smith System"—9 min. B&W, 16 mm sound—Training film on proper habits of seeing—Ford Motor Company.

2. "And Then There Were Four"—25 min. B&W, 16 mm sound—Inspirational film showing faulty attitudes—Socony Mobil Oil Company.

3. "To See Ourselves"—15 min. color 16 mm sound—Provocative film on personality factors—Aetna Casualty and Surety Company.

4. "Freeway Driving Is Different"—15 min. color 16 mm sound—Training film showing how to drive on freeways—American Automobile Association.

5. "You and Your Driving"—14 min. color 16 mm sound—Defensive driving film with a refreshing "positive" approach—Esso Safety Foundation.

b. *Transparencies* used with overhead projector. Large enough to be easily seen at the rear of the auditorium. Utilized like a blackboard. Allows instructor to face his audience. Stimulates greater degree of student participation.

1. "Driver Safety Education," 7" visual training transparencies suitable for 7" or 10" overhead projector. Shows specific traffic conditions—Porto-Clinic Instruments, Inc.

2. Transparencies may be made up to suit the needs of the instructor.

c. *Slides and strip film* were specifically related to course content. A synchronized sound recording also was used with a strip film.

1. "Seven-tenths of a Second"—4 min. 35 mm color strip film with tape-recorded narration and music. Shows the effects of a collision in tenth-second detail—Bell Telephone System.

2. Perception slides—taken with a 35 mm camera in color, showing local traffic situations. Individual scenes were flashed on the screen for 3 seconds to improve "early recognition" of traffic hazards and to stimulate discussion—Center for Safety Education, New York University.

3. Seeing habits—35 mm B&W slides taken from "Observation Perception"—E. I. duPont De Nemours & Co.

d. *Psycho-physical testing device* — each student was afforded the opportunity of being tested on a Porto-Clinic by a uniformed motor vehicle inspector on the following: visual acuity, depth perception, color vision, peripheral vision and stopping reflex. Each of the items were demonstrated and related to safe driving practices during a regular session—Porto Clinic Instruments, Inc.

e. *Reading material* — the Esso Safety Foundation *You and Your Driving* booklet and tests and the New Jersey Department of Law and Public Safety Driver's Manual were the basic reading materials. Other appropriate reading materials from various sources were distributed at each session.

f. *Trapezoidal window demonstration* — particularly effective demonstration to show how we do develop seeing habits that can produce errors in the interpretation of what we see on the road.

(Note: The materials used in the Bayway course are only representative of the many fine educational aids available in the field. Consult your state safety council or other traffic safety agency in your state for assistance in obtaining these aids.)

Driving Skill Roadeo

Eligibility of contestants in the men's and women's divisions was based on attendance at all four sessions of the Defensive Driving course and placement among the top 15 scores of the Driving Knowledge Test administered at the end of the course. Dr. Nathaniel Schneider, New Jersey State Safety Council, assisted by eight New Jersey State Motor Vehicle Inspectors, conducted the contest.

The score sheet for the Driving Skill Contest was based on New Jersey State Teen-age Road-e-o.

Program Evaluation

Approximately 1200 employees and members of their families who drive attended the Defensive Driving Program. Nearly 25 per cent of our employees were in this group. Those employees who did not attend were made aware of the course objectives by favorable newspaper coverage published by the refinery and local communities.

The reactions of employees and relatives participating have been gratifying. On a course evaluation questionnaire completed at the end of the last session, 99 per cent of

the participants rated the program "excellent" or "good" on its educational value and helpfulness. More than 85 per cent of those who attended voluntarily took the Driver Knowledge Test at the end of the course. Scores on the 50 questions based on course material averaged 82.5. This indicated the participants learned their lessons well.

The benefits derived from this program were not limited to the area of improved traffic accident performance. Bayway is now experiencing its lowest off-the-job and on-the-job disabling injury frequency rates ever recorded. These results support the belief of Bayway management that the course not only contributed toward making our employees safer drivers but also made safer workers.

Many other benefits were derived from the program which cannot be converted into frequency rates. The program added to the prestige of Esso in the community and impressed upon all employees and their families that management was sincere about reducing accidents. The program contributed toward improving employee relations by providing representatives of management and their families an opportunity to meet on an equal and continuing basis with wage and salary employees and members of their families. It also strengthened management and union relations by their working together to promote the program.

In addition, it reinforced the relationship between Esso and the state agencies that participated, such as the New Jersey Division of State Police, New Jersey Division of Motor Vehicles and the New Jersey State Safety Council.

One of the primary justifications for this program is the reduction in off-the-job accident costs as a result of a decrease in traffic accidents. It is anticipated that the savings represented by the reduction of traffic injuries will pay for the Defensive Driving Program in one year. Like any good investment, additional dividends are expected in the future.

Recommendations for Future Sessions

1. Continue the four, two-hour sessions, inasmuch as a large per cent of the partici-

pants reported that the length of the course was just right.

2. The course should be conducted during the spring, summer or early fall months due to the longer daylight hours and warmer weather for outdoor demonstrations, namely the stopping distance demonstration.

3. Early planning is essential with regard to obtaining speakers, resource persons, state agency cooperation, facilities and audio-visual aids.

4. Instructors should utilize practical examples familiar to the audience along with as many visual aids as feasible. Straight lectures should be discouraged.

5. Discussions around specific points with decisions (voting) or conclusions drawn is highly desirable. However, questions or comments from the audience of a "gripe" nature and personal experiences not of general interest or directly related to the discussion tend to waste time and add little to the "learning" process.

6. Written questions from the audience should be encouraged because they contribute to the sense of "individual participation." Cards for questions can be given to the participants as they arrive. A specific time should be allowed for answering these questions during each session.

7. Perhaps the most important recommendation is that only highly qualified and interesting speakers participate as instructors and panelists. It is essential that each session be made as interesting as possible in order to continue a high level of attendance.

8. In the Driving Skill Contest a car should be located at each of the test areas. This expedites the completion of the testing, thereby improving the efficiency of conducting the contest.

9. It is suggested that incentive awards be continued, as they were effective in motivating attendance.

(NOTE: Copies of the course manual may be obtained by writing to Safety Department, Esso Standard Division of Humble Oil and Refining Co., Bayway Refinery, P.O. Box 222, Linden, N. J.)

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GETTING PEOPLE TO UNDERSTAND LAW ENFORCEMENT

By FRANKLIN M. KREML

Dir., Transportation Center at Northwestern University, Evanston, Ill.

I am glad that the title of this talk asks for "understanding" instead of "liking." None of us really likes enforcement, especially if it is applied to us; but we all hope for acceptance of and support for enforcement.

Enforcement is, of course, an essential element of traffic safety—even as it is an essential element in industrial safety or, for that matter, in virtually every aspect of life, from the maintenance of an organized, effective military arm to the rearing of children. In bringing up children or maintaining an army we speak of enforcement as supervision or discipline, but it is still enforcement.

Naturally, the more self-discipline we have, the less need there is to impose enforcement. If people generally can be made to see this—in this light—then we will have come a long way in "getting people to understand enforcement."

In a word, enforcement is the discipline that is imposed when lack of self-discipline causes anyone to intrude upon or violate rights of others. To fail of enforcement under such circumstances, is to invite anarchy.

This would be the end of my speech if we were interested only in the philosophy of enforcement; but it isn't quite this simple in life and practice because public attitudes and misunderstandings create many difficulties. We are still quite immature, as a people, in our attitudes toward the enforcement of our own laws. Some people are truculent in their resentment of enforcement action, and with such people officers sometimes have difficulty in making even routine arrests.

There are many attempts to evade or beat the law, varying from the childish erasure of chalk marks on the tire of an overparked vehicle to the destructive device of having a child riding in the rear seat of a vehicle "look out for the cops." These unfortunate attitudes—this immaturity—

spring, in part, from our heritage of freedom; some come from widely held beliefs that are erroneous or from a lack of respect for the law and its officers. Let us look at these latter two for a moment.

One of the most common public misconceptions lies in the statement, "I have a right to drive!" People think that what they have is a licensed privilege and this concept may be too late to correct.

Another misconception is that "the use of radar, unmarked cars, concealed officers, etc. is 'unfair,' 'un-American,' and amounts to a speedtrap." Now the difference between the clearly illegal practice of entrapment and devices such as those just mentioned, which are commonly called "traps," is the difference between the securing of evidence of the violation by reliable though perhaps surreptitious means on the one hand and, on the other, actions on the part of an officer which induce the commission of an offense which might not otherwise have been committed, for the purpose of getting evidence thereof.

The means of securing evidence are unimportant so long as the devices are accurate and the officers honest. A change of method will not insure honesty. It would, of course, be extremely desirable to have a, far-ranging, all-seeing patrol to insure the proper enforcement of laws, but this is completely unfeasible from the standpoint of municipal and state finance.

We hear, too, that "policemen enjoy catching erring motorists." This may be true in a few isolated cases, but one of the problems in most traffic departments today is the difficulty of getting officers to enforce traffic laws with sufficient vigor.

These three misconceptions—along with others—lead to a fourth—an attitude which sets the law enforcement officer apart from the rest of society. This is dangerous, for the policeman must become a respected member of the community. We cannot overcome misconceptions about enforcement if

we do not have respect for the law and its officers.

There is some real basis, in my view, for the lack of respect for the law and its officers. Traffic law enforcement has not always been carried through with that integrity, reasonableness, and intelligence which the public has a right to expect. Let us look at each of these.

Integrity. The "fixing" of cases by police officers, prosecutors, clerks and judges, while greatly reduced over what it was a decade ago, is still widespread. The effect of this upon the confidence of the public is incalculable and positively dangerous—particularly among our younger citizens. This is a serious weakness in the moral fabric of our society, reflecting a lack of both devotion and courage on the part of the officers and a cynicism on the part of the public which has lost its capacity for *righteous indignation* wherever these conditions are tolerated.

Reasonableness. The use of radar to enforce speed laws to within two or three miles of the limit; traffic violation bureau fine schedules and the crowded courts which deny a hearing; the fixed limits in chemical testing for intoxication; and the "point system" for drivers' license revocation, while apparently "business-like and efficient" are substituting artificial standardization for judgment and reason and courage in law enforcement. This mechanization and efficiency are very handy for the politician, but the public has a deep sense of the unreasonableness of it all.

Intelligence. The aim of selective enforcement is to produce the safest possible con-

dition with the available resources. It is based upon accident investigation and good records—by time, place and type of violation. The public will understand and support such enforcement; but it is still not being done in even a majority of our cities and states; it requires the training of top people, both staff and line.

When the public knows that enforcement action truly reflects accident experience, then understanding and acceptance will follow.

What does all this add up to? We have seen that we must have enforcement; we cannot have enforcement without public understanding and support; the public will not support unless the enforcement is honest, reasonable and intelligent; and for such enforcement we need highly trained, well motivated, adequately supervised police, from top to bottom, to carry on a well-organized program which, in turn, is supported by an effective court program.

The initiative to achieve all this can come either from the official (court and/or police) or civic side (safety council, chamber of commerce), but initiative must be taken in the development of enforcement that meets these criteria.

Once the enforcement program has begun, then all of the citizenry must be informed by *every means available*, from the police officer writing a selective enforcement ticket, to the statements of the judge to the defendants, to the use of TV programs. This will be easier to do as the inevitable results of an effective traffic law enforcement program evidence themselves in a reduced accident experience; for in this, as in almost all human endeavors, nothing succeeds like success.

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