

1973

National Safety Congress Transactions

Pulp & Paper; Printing & Publishing

PLAINTIFF'S EXHIBIT

NSC-248



National Safety Council
425 North Michigan Ave.
Chicago, Illinois 60611

61st NATIONAL SAFETY CONGRESS

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Pulp & Paper Sessions

THIS IS THE DAY OF THE SAFETY DIRECTOR

By HAROLD MURTFELDT
President, Consolidated Papers, Inc., Wisconsin Rapids, Wis.

The effective control of accidents in an industrial society has never been more imperative nor more economically sound. Clearly, safety is good business.

Improving our accident control is a No. 1 priority for our company. We have, I believe, a commendable record, yet we are in agreement that our safety organization and performance is not sufficient to meet today's requirements.

Our primary business is paper manufacturing, yet we are in a multimillion dollar health care business through a comprehensive employee and family accident and health program funded by the company. Also, we are striving to fully comply with the new and more expensive requirements established by governmental agencies. Our union contracts are broader than ever before, covering all types and causes of illness. Wages and fringe benefits are at an all time high, so every hour of lost time is more expensive than ever before. Also, the capital requirements of our industry are escalating, and at the same time we are faced with the highest interest rates on record. Thus, the continuous and most efficient operation of production equipment is imperative, and this takes healthy, well motivated employees.

This all adds up to the simple fact that reduction of accidents is one of the most significant ways to reduce soaring medical costs, to gain maximum benefit from the operation of costly capital equipment, and to fully utilize expensive labor. These high accident and corporate liability costs make it necessary to update our risk identification and the cost of each risk to determine what risks, if any, can be properly accepted without correction. We have had two OSHA inspections, and we found them very thorough and fair. We're doing our best to comply with the standards established by this law. But we must constantly remind ourselves that our

primary job is to prevent accidents, not just comply with standards. During the past year we have probably spent disproportionate amounts of our safety time and effort in this area of compliance, which relates to only about 15 per cent of our accidents.

The corporate safety director today has an unusual opportunity to increase his stature and position with his company by making a substantial contribution to cost reduction. This is why I titled my remarks "This Is the Day of the Safety Director." I doubt if there has ever been a time when this profession has had such an opportunity to contribute and to personally gain from it.

All of this says nothing of the humanitarian aspects of safety. Of course, all of us firmly believe that every working man and woman in the nation is entitled to a safe and healthful place to work. The safety director is in an enviable position, to have a job in which he has the opportunity to make a real contribution in reducing costs and the same time be in position to reduce the human pain and suffering of his friends and associates that result from accidents.

Industry is making great strides in technology and mechanical engineering. I have little concern in our own company that satisfactory progress is being made in these areas aimed at increased productivity and improved product quality, but I am concerned that we are not doing enough in understanding and motivating our employees. I am also well aware that we know very little about the human mind and how to prevent unsafe acts of the individual. We all know the great majority of industrial accidents are not due to unsafe conditions of the plant, but rather unsafe acts on the part of the individual employee. We are trying to approach this type of accident from several viewpoints. As are many companies in the pulp and paper industry, we are continuing to battle the ine-

vitable impersonalization of a corporation of 5,000 people through improved means of communication, bringing people together, giving recognition wherever we can, and striving to build the interest and morale of our people, but much remains to be done.

We have recently inaugurated a behavioral-medical program headed by a full time professional and staff to care for the behavioral-medical problems of the employees, particularly in the area of alcoholism. Certainly we want to do everything we can to spot the alcoholic or drug user in the plants, as he is obviously a safety hazard to himself and his fellow workers. Yet, our program is aimed at rehabilitating these people, not eliminating them as employees. We believe the fact of the inauguration of the program and the limited initial success is showing the employees that we truly care about their health and safety, and hopefully will contribute to the employee's attitude toward his job and the company that will be commensurate with good safety practices.

An outside agency is now conducting a survey of all our employees, asking their evaluation of the corporate safety program and requesting their criticisms and suggestions for improvement with the aim of learning what we can do to improve the program and in turn achieve better accident control.

Until two years ago, my life was spent

largely in sales. I am sure all of the various techniques in the sales field are useful to my safety program. We must build a sense of urgency and a real excitement and dedication toward safe work habits. Any organization or corporation, no matter how large, is greatly aided by an employee group in which every employee is a salesman. A salesman for safety, a salesman for product quality and total excellence on the job, and a salesman for environmental protection. Certainly we all must be salesmen today in every phase of our lives. Doesn't every man need to be a salesman to have a happy marriage? Every employee needs to "sell" his boss, sell those he supervises, etc. We are looking forward to learning techniques during this Congress and applying them in our own situation to do a continually improved job in this important area of selling safety and keeping safety foremost in the minds of the employees.

"Take Time to Be Safe" is a great theme for the Congress. It is so difficult in this period of serious corporate problems and personal pressures and tensions to find the time for developing any kind of a program, and yet we must take time to be safe, and we are going to take time in our own company in giving top priority to our safety program and do everything we can to have it meet the unusual requirements of the present day.

ARTHUR HOYT SCOTT AWARD PRESENTATION

By JAMES F. GAYLORD
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This is the twentieth year Scott Paper has presented this Award. We initiated the Award in 1953 because we were convinced that there were some very special problems in conducting a meaningful safety program in a multi-plant company requiring, among other things, great corporate leadership. Up until that time, most of the safety contests and awards were based on single plant performances, and our Award was designed to fill that gap. We have only one regret, and that is that during this period we at Scott Paper have never won this Award, although we have come close a number of times. In 1972, our corporate safety manager thought we had a real chance of winning—but good as our overall performance was, we couldn't do better than sixth place. This in itself testifies to the marvelous job done by this year's winner, the United States Gypsum Company.

I would like to comment for a moment on the challenge I pointed out to this group at last year's presentation, when we reviewed briefly our industry's frequency rate. Those of you who were here will remember that I pointed out that the 1971 industry frequency rate was 8.53, which compared favorably with an all-industry average rate of 9.37. The problem discussed, however, was that the industry had not had a significant improvement in our industry frequency since 1954, when our industry had dropped to a 7.21 frequency from 9.54 in 1953. That year marked the end of constant improvement in our industry frequency and, in the intervening years, only on four occasions have we bested the 7.21 rate of 1954. Now we can look at 1972's record, and find that for last year our industry's frequency rate was up again to 8.91.

This offers the real challenge to you safety experts. In a day and age when we are guard-

ing our machines better and have better control of our process, we have an increasing accident rate. Of the 25 companies that competed for our Award this year, only seven had lower frequencies in 1972 compared to their five-year average frequency. This indicates that it is incumbent upon you experts to come up with, and develop, programs which will keep safety awareness foremost in the minds of employees.

Perhaps by looking at some of the elements we know about the safety program of this year's winners, we can learn something of value for everyone.

Before discussing U. S. Gypsum, I would like to pay tribute to the corporation which came in No. 2 this year—Olinakraft. The outstanding thing about their performance is that they have won this Award three times since 1965, placed third in 1971, and second this year. When you consider improvement is one of the keys to winning this Award, you can judge what an outstanding achievement this is. I am told that a key to Olinakraft's success is that their managers' bonuses are directly affected by their safety records. I am sure I wouldn't get any argument here that that is a wonderful way to get attention to any effort you are trying to achieve.

This year's winner—U. S. Gypsum—entered our contest with nine of their paper locations which had a combined frequency of 1.17 for 1972. When you remember that our industry average is 8.91, you can see what a leadership position this is.

U. S. Gypsum's corporate safety manager gives much of the credit for their success to top management's interest and involvement—with a long history of concern. This company was one of the companies who were charter members of the National Safety Council, joining in 1913. The corporation

has constantly pushed the philosophy that for every employee, safety is his No. 1 responsibility.

Two of their paper operations are big-city type plants near New York City and Houston, where they have lots of inexperienced people due to turnover and; therefore, they do a great deal of safety training. The five-year frequency for the plant near New York City is .63, and for the plant in Texas it is 1.81, which proves the value of this approach. I checked their records to-date in the Safety Council's monthly bulletin for the paper industry, and find that for both of these

plants the accident frequency through August of this year is zero.

Gypsum also places cost of accidents into their plants' performance for bonus calculations, so again we have testimony to the effectiveness of this technique for getting attention to a program by affecting someone's pocketbook.

On behalf of Scott Paper Company and the paper industry, I take pride in presenting U. S. Gypsum Company with this Arthur Hoyt Scott Award for outstanding safety achievement in the pulp and paper industry.

ACCIDENT PREVENTIVE DESIGN OF PAPER MAKING MACHINERY

By ROBERT G. CARLSON
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While today's paper making machines may not look much like those of 50 years ago, the same basic principles are used in the production of paper. Today's machines are much larger, more complex, and operate at ever increasing production rates. Changes in design have taken place more as a matter of evolution than of innovation. This is not to say that the designs are lacking in engineering expertise; quite the contrary is true: many of the latest engineering design techniques and tools are used to predict machine performance.

Paper machines are basically a custom designed product to meet customer specifications. It is probably fair to say that the general philosophy developed over the years has been one of "design for reliability and longevity." While reliability and safety share a limited commonality in purpose, a more reliable machine is not necessarily a safer one. It has always been difficult for the manufacturer to sell a safer product for safety's sake only. Safer paper making machines have evolved primarily through the integration of designs which both improved machine efficiency and lessened operating hazards.

Designers have had some problems in adjusting their philosophy to incorporate an appropriate safety discipline in their designs. It is difficult to objectively measure the safety in a design, particularly when the designer is also asked to design for maximum machine operating efficiency at the lowest possible cost. The most serious potential hazard on a paper making machine is the nip formed by two rotating rolls. This hazard presents itself in numerous locations throughout the machine. It seems quite inconceivable at this time that the machine can be designed without nip points. It therefore appears that the most logical way of preventing accidents is to

remove the operator from the hazard area. Considerable advancement toward this objective has been made in recent years through the use of remote control of machine adjustments, monitoring of machine performance with measuring devices, improved sheet threading methods, and improved design for operator accessibility.

Remote Machine Operation

Virtually all machine adjustments which must be made with the machine operating can now be done either automatically or with remote control. Extensive use is made of safety interlocks to prevent an operator from inadvertently performing control functions out of sequence. Interlocks are primarily designed to prevent accidental damage to equipment, but they also prevent consequential operator injury. Considerable care must be exercised in the design of control systems; the design must be such that a safe condition exists in the event of a malfunction, and they must be designed so they can be maintained.

Monitoring and Control Systems

These generally fall into two groups. Systems in the first group are generally used to measure the quality of the paper being produced; those in the second monitor or control the physical well being of the machine. Either group may indicate to an operator the existing conditions or, in many cases, can be designed to make corrective adjustments when abnormal conditions exist.

The first group would consist of moisture meters, basis weight gauges, hole detectors, and caliper gauges. The second group would consist of automatic paper, felt, or wire tensioning with or without overtravel limit indicators; sheet brake detectors; bearing failure detection; lubrication system failure;

drive overload condition.

Sheet Threading Methods

The objective is and has been for some time to design the machine so that it is self-threading. There is no completely satisfactory design at this time. Unfortunately, the characteristics of paper during production are not well enough understood to completely predict its behavior while threading. Hand threading has been, however, virtually eliminated through the use of air and rope threading systems: press section threading, calender threading devices, reel turn up devices, remote controlled tail cutters.

Machine Accessibility

While machines are now designed to prevent or minimize the operator's exposure to hazard areas, the machine must be inspected and maintained. Design improvements have reduced hazards through the use of foot-

walks, crosswalks, and access ladders to inspection points; modular framing design, which eliminates or minimizes roll removal for felt or wire changes; relocation of equipment to more convenient maintenance location; guarding of exposed rotating shafts, moving chains, etc.; signs designating hazard areas.

While it is a designer's responsibility to insure that safety is incorporated into the product on the drawing board, his designs are still aimed at fulfilling a customer's request. It is essential that he receive input from purchaser, operators, and maintenance personnel when establishing the design criteria. The utopian safety design would be fail-safe, maintenance-free, and cost nothing. More realistically, safer designs don't prevent accidents unless the customer is willing to pay for safety, the operators use the safety devices, and the systems are maintained.

MATHEMATICAL EVALUATIONS FOR CONTROLLING HAZARDS

By WILLIAM T. FINE

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The person responsible for safety in an organization usually knows of many hazardous situations within that organization at any one time. Since time and money are limited, it would be a great advantage for him to have a method to determine just how serious each hazard is and just what proportion of his time and effort should be devoted to each situation. In other words, he needs a priority system to allocate his own time and effort.

Another closely related problem deals with economics. We sometimes have to prove that safety is good business. When safety comes up with a proposed remedy for a hazard, it may be necessary to convince management that the cost of the corrective action is justified. Most budgets are limited. Unfortunately, in many cases the decision to undertake a costly project depends to a great extent on the salesmanship of safety personnel. As a result, due to a poor selling job, an important safety project may not be approved; or due to excellent selling by safety, a highly expensive project may get approval when the risk really does not justify it.

This report presents an easy way to "calculate the risk" due to a hazard. By means of a simple formula, the relative severity or importance of each hazard is evaluated. This quantitative evaluation establishes priorities for attention to hazards and guidance for safety personnel in deciding where to concentrate their efforts. A further formula gives a determination as to whether or not the cost of proposed corrective action is justified. Use of this justification formula will provide solid foundation for recommendations.

Risk Score Formula

The formula for calculating the seriousness of the risk due to a recognized hazard is called the "Risk Score Formula." A numerical evaluation is determined by considering three factors, the consequences of a possible accident due to the hazard, the exposure, and the probability that the consequences will occur.

The risk score formula is as follows:

$$\text{Risk Score} = \text{Consequences} \times \text{Exposure} \times \text{Probability}$$

The numerical ratings or weights assigned to each factor are arbitrarily assigned and flexible, based on the judgment and experience of the investigator making the calculation. Now let us review the elements of this formula.

The first element, consequences, is defined as the most probable results of an accident due to the hazard. We are concerned with (injuries and property damage). Numerical ratings are assigned for the most likely consequences of an accident, from 100 points for a catastrophe down through various degrees of severity to one point for a minor cut or bruise.

Severity of Consequences

Rating	Severity of Consequences
Catastrophe: numerous fatalities; extensive damage (over \$1,000,000); major disruption.....	100
Several fatalities; damage \$500,000 to \$1,000,000.....	50
Fatality; damage \$100,000 to \$500,000.....	25
Extremely serious injury; (amputation, permanent disability); damage \$1,000 to \$100,000.....	15
Disabling injuries; damage up to \$1,000	5
Minor cuts, bruises, bumps; minor damage.....	1

The next factor, exposure, is defined as the frequency of occurrence of the hazard-event, (the hazard-event being the first undesired event that could start the accident sequence). We rate the frequency at which the hazard-event occurs, from continuously with 10 points, through various lesser degrees down to 0.5 for extremely remote.

Hazard-Event Occurs	Rating
Continuously (or many times daily).....	10
Frequently (approximately once daily) ..	6
Occasionally (from once per week to once per month).....	3
Unusually (from once per month to once per year).....	2
Rarely (it has been known to occur) ..	1
Very Rarely (not known to have occurred, but considered remotely possible).....	0.5

The third factor, probability, is defined as the likelihood that, once the hazard-event occurs, the complete accident-sequence of events will follow with the necessary timing and coincidence to result in the accident and consequences. The ratings go from 10 points if the complete accident-sequence is most likely and expected, down to 0.1 for the "one in a million" or practically impossible chance.

The Accident-Sequence, Including the Consequences:

Is the most likely and expected result if the hazard-event takes place	Rating
Is quite possible, would not be unusual, has an even 50/50 chance of being an unusual sequence of coincidence.....	10
Would be a remotely possible coincidence (it has happened here) 1	6
Extremely remote but conceivably possible (has never happened after many years of exposure)	3
Practically impossible sequence or coincidence; a "one in a million" possibility (has never happened in spite of	0.5

exposure over many years) 0.1

Now, let us take a few examples. For demonstration, we have selected a variety of situations.

Example #1

Building No. 303 at the Naval Ordnance Laboratory contains a number of ovens which are used for environmental testing (heating) of explosive material, with up to five pounds of high explosive material in an oven. One side of the building is made of "blow-out panels" so that in case of an accident most of the blast will be expended out the blow-out panels rather than demolish the building. This type of oven has been known to heat excessively due to faulty heat controls and thereby cause the explosives in the oven to detonate. People walk past the outside of this building. The potential hazard considered here, for which we are calculating the risk, is the endangering of persons who occasionally walk near the building.

The first step in calculating the risk is to study the situation and list the most probable sequence of events for an accident. Here is our hypothetical accident sequence, step by step:

1. Several ovens are in use, each containing explosives. This is normal.
2. Persons are present in the area outside the building. This is a normal and accepted condition.
3. Now something goes wrong. The thermostat of one oven fails and the oven temperature rises above the proper operating range. (This is the hazard-event).
4. The secondary emergency shutoff control also fails to function.
5. The oven overheats.
6. The explosive detonates.
7. A passerby near the building is fatally injured by flying debris.

Now we consider the formula use:

$$\text{Risk Score} = \text{Consequences} \times \text{Exposure} \times \text{Probability}$$

Consequences. We decided that a fatality was most likely. On the rating chart, this has a rating of 25. Therefore Consequences = 25.

Exposure. The hazard-event is the failure of the thermostat. Investigation shows that this has happened before, but "very rarely." Therefore EXPOSURE = 1.

Probability. This has to be a careful opinion based on judgment and experience. We must decide on the likelihood that the complete accident-sequence will follow the hazard-event. Very briefly stated, we consider that all ovens have been equipped with secondary shutoff controls. Maintenance is very thorough and does ensure the proper functioning of the emergency shutoff controls. We would therefore consider that their failure at any time is quite unlikely. For a set of emergency shutoff controls to fail at the same time and on the same oven where a thermostat has happened to have failed, would be a remotely possible coincidence. It would also take somewhat of a further coincidence to place a person in a vulnerable position outside the building at the same time. Thus we arrive at an opinion that the net or total probability is remotely possible, (fourth item down the list). So Probability = 1.

Substituting in the formula:

$$\text{Risk Score} = 25 \times 1 \times 1 = 25$$

There is no particular significance to this risk score of 25 until we compute the risk scores for other hazards, using the exact same criteria and judgment, and have a basis for comparison.

Example #2

Six compressed oxygen cylinders are standing unsupported on a pallet in the shop next to a busy aisle; caps are on securely. In this case, we consider that there are two hazards: (1) a cylinder could topple and cause a foot injury; (2) a cylinder could topple, rupture, and become a missile.

Since there are two hazards, each one is evaluated separately and their risk scores added. Evaluating risk score for Hazard No. 1, the foot injury hazard, the accident sequence is:

1. Condition as stated above.
2. Shop trucks, carts and pedestrians pass close by many times daily, often brushing against cylinders. This is the hazard-event.
3. A person bumps a cylinder hard enough to cause it to topple over.

4. Cylinder falls on the man's foot.

5. A disabling injury results: fractured bones in the foot.

We now apply the formula:

Consequences are a disabling injury, 5 points on the rating chart.

For the exposure or the frequency of the hazard-event: persons brushing against or bumping a cylinder occurs many times per day. On the rating chart exposure = 10.

For probability, we estimate the likelihood, step by step, of all events occurring to include the fractured foot. Our reasoning follows: once a cylinder has been bumped, it is quite possible that one will topple over. It is also possible, but slightly unusual that it would land on a man's foot. But if it did land on his foot, a fracture is most likely. Putting these together, we consider the net likelihood of this series of events occurring as being "quite possible," but somewhat "unusual." Therefore, we interpolate and say $P = 4$.

Now we substitute in the formula. The calculation for the risk score for the oxygen cylinders, foot hazard is:

$$\text{Risk Score} = 5 \times 10 \times 4 = 200$$

Next we evaluate the risk score for Hazard No. 2, the missile hazard.

Accident sequence:

1. Condition is as stated above.
2. Shop trucks, carts and pedestrians pass close by many times daily, often brushing against cylinders. That is the hazard-event.
3. A person bumps a cylinder and it topples over.

4. A cylinder ruptures or the valve is broken off; escaping compressed gas causes missile action.

5. Very serious injury occurs.

We now apply the formula:

First consider the consequences. We would expect a very serious injury, $C = 15$.

Next, the exposure. This is the same as for the foot hazard: the hazard-event, bumping a cylinder, occurs several times daily. $E = 10$.

Next, consider the probability that a missile and very serious injury will result. Toppling over is quite possible, but a topple should not ordinarily cause a rupture, and cylinders have protective caps. So the tank rupturing is remotely possible. But in the

event of a rupture, missile action and a very serious injury could easily follow. Therefore we consider the net probability that the serious injury will occur is "remotely possible," $P = 1$.

Substituting in the formula:

$$\text{Risk Score} = 15 \times 10 \times 1 = 150$$

Adding the risk scores of the two hazards,
Total Risk Score = $200 + 150 = 350$.

Example #3

A 12,000 gallon propane storage tank is located close to operations involving ultra-highly compressed air lines and equipment: air and nitrogen at 15,000 psi. A high pressure pipeline explosion could result from a malfunctioning safety valve, a human error in operating the equipment, or damage to a pipeline. Blast or flying debris could then strike the propane storage tank, rupture it, and cause it to explode, with the consequences of several fatalities and building damage up to \$500,000.

Sequence of events:

1. Normal activities involve operation of equipment and pressurizing of pipelines in the vicinity of the propane storage tank.
2. A 3,000 psi pipeline 30 feet away from the storage tank becomes damaged and unnoticed. (This is the hazard-event.)
3. The pipeline bursts.
4. Metal debris from the blast strikes the propane tank with such force that the tank is ruptured.
5. Propane leaks out of the tank.
6. A spark ignites the propane fumes.
7. The propane and air mixture explodes.
8. Building damage is \$500,000 and two men are killed.

Next we determine values and substitute in the formula.

Consequences: two fatalities and damage loss of \$500,000. $C = 50$.

Exposure: High pressure air lines have been known to have been neglected or damaged. Frequency of such occurrences is "unusual." Therefore, $E = 2$.

Probability: Now we estimate the likelihood that a damaged pipeline will explode and the explosion will occur close enough and with enough blast to throw debris and strike the propane tank with such force as to

complete the accident sequence. Several pipeline bursts have occurred in past years, but none have damaged the propane tank. Just a few of the pipelines are considered close enough to endanger the tank. After careful observation, the complete accident sequence is considered very remotely possible, and the rating is placed at $P = 0.5$.

Substituting into the formula:

$$R = 50 \times 2 \times 0.5 = 50$$

Summarizing Risk Scores.

In the same manner as demonstrated, the risk scores for other hazardous situations have been calculated. These cases are now listed in order of their risk scores, or we can say, in order of the relative seriousness of their risks, on a "Risk Score Summary and Action Sheet." Two horizontal lines are drawn on the right side of the chart, dividing the chart into "action areas." Above the upper horizontal line are the hazards with the highest risk scores, down to a risk score of 200. The line was drawn here because it was adjudged that for these risks, corrective action was required immediately, and any operation must be stopped until the score was lowered. The middle-section of the chart (risk scores between 90-200) contains the hazards considered somewhat less urgent but still requiring attention as soon as possible. The hazards listed below the lower horizontal line (risk score below 90) are lesser ordinary hazards that should be eliminated without undue delay, but not as emergency situations.

The Risk Score Summary and Action Sheet is now a very useful device. It:

1. Establishes priorities for attention by both safety and management, since hazards are listed in order of their importance. The position on the list of any item can be lowered by corrective action which will decrease any one of the factors: consequences, exposure, or probability.
2. Provides guidance to indicate urgency of newly discovered hazards. For each new hazardous situation, compute the risk score. Its urgency is indicated by the action area in which its risk score falls. For example, when a highly hazardous situation is noted in a highly essential operation, the location on the chart would serve as backing if it is felt

that the operation must be stopped until the hazard is reduced.

3. Can become a valid method of evaluating a safety program, more realistic than using accident statistics. At any given time the complete chart for a plant represents the actual status of safety, i.e., let us say the chart shows seven "immediate actions" or emergency items, six items in the "urgent" category, and 12 "minor" hazards. Accomplishment of the safety program over a period of time will then be demonstrated by reducing risk scores and moving items downward on the chart, from the high risk categories into lower risk areas. For example, it would be progress to reduce our "emergency action" items from seven to two, and our "urgent" items from six to four, or to lower the overall average risk score from 92 to 74, etc.

Formula to Determine Justification for Recommended Corrective Action

An addition to the risk score formula provides a method of determining whether the cost of corrective action to alleviate a hazard is justified. Once a hazard has been recognized, appropriate corrective action must be tentatively decided upon and its cost estimated. Now a formula is used to determine whether the estimated cost is justified. The formula is as follows:

$$\text{Justification} = \frac{\text{Consequences} \times \text{Exposure}}{\times \text{Probability}} \times \frac{\text{Cost Factor} \times \text{Degree of Correction}}{\text{Correction}}$$

The elements of the numerator of this formula are the same as in the risk score formula. We have simply added a denominator made up of two additional elements: cost factor (CF) and degree of correction (DC).

Cost factor is a measure of the estimated dollar cost of the proposed corrective action. Ratings are as follows:

Cost	Rating
Over \$50,000	10
\$25,000 to \$50,000	6
\$10,000 to \$25,000	4
\$1,000 to \$10,000	3
\$100 to \$1,000	2

\$25 to \$100	1
Under \$25	0.5

Degree of Correction is an estimate of the degree to which the proposed corrective action will eliminate or alleviate the hazard. Its ratings are as follows:

Description	Rating
Hazard positively eliminated (100%)	1
Hazard reduced at least 75%	2
Hazard reduced 50 - 75%	3
Hazard reduced 25 - 50%	4
Slight effect on hazard (less than 25%)	6

Criteria for Justification. To use the formula, values are substituted into the formula to determine the numerical value for justification. This will usually come out between 2 and 30. The critical justification rating has been arbitrarily set at 10. For any rating over 10, the expenditure will be considered justified. For a score less than 10, the cost of the contemplated corrective action is not justified.

Examples. For demonstration, we will continue the same examples already discussed.

1. Example of the hazard to persons near a building in which explosives are processed. The corrective action that was proposed was the construction of a barricade along the outside of the building to protect passersby in event of an explosion within. The estimated cost was \$5,000. Using the "J" formula:

(a) The consequences, exposure, and probability as already discussed were evaluated at 25, 1, and 1 respectively.

(b) Estimated cost is \$5,000.00. Therefore, based on the cost factor rating chart, CF = 3.

(c) Degree of correction. The effectiveness of the barricade to protect passersby is considered to be over 75 per cent. Therefore DC = 2.

$$J = \frac{25 \times 1 \times 1}{3 \times 2} \times \frac{25}{6} = 4.20$$

The expenditure of \$5,000 to construct a barricade to protect passersby is well below 10, and therefore is not justified.

Since the risk score is 25, this situation still requires attention. Review of this problem

revealed that other steps could be taken to lower the risk. The probability of the complete accident sequence occurring was considered to be remote, but it could be made much more remote (and the risk score halved) by administrative controls such as portable barriers and warning signs, to reduce or even eliminate the presence of passersby in the danger zone.

2. For the next example, consider the hazardous location of the 12,000 gallon propane storage tank. The proposed corrective action was to relocate the tank underground in a place where it would be less likely to be damaged by any external source, at an estimated cost of \$28,000.

Determine the values for elements of the formula:

(a) $\text{Consequences} \times \text{Exposure} \times \text{Probability}$ were already determined to be $50 \times 2 \times 0.5$, or 50. We must now divide this by the Cost Factor $\times$ the Degree of Correction.

(b) Cost of relocation is \$28,000; therefore $\text{CF} = 6$.

(c) *Degree of correction.* In the underground location there is considered no possibility of damage to the tank. Therefore, $\text{DC} = 1$.

Substituting in the formula:

$$J = \frac{50 \times 2 \times 0.5}{6 \times 1} = \frac{50}{6} = 8.3$$

The justification rating is lower than ten. Based on the established criteria, the cost of relocation of the tank is not justified. But the rating of 8.3 is close, so we re-examine all factors carefully.

It is emphasized that we do not say that the hazard is of little or no significance. The risk score is 50, and this is of appreciable concern. We must endeavor to reduce the risk by devising other, less costly, corrective action, or by reducing either the exposure or the probability. In this case, other possible actions were considered. It was decided that a steel plate barrier could be erected to protect the tank from the compressed air activities at a cost under \$1,000. This brings the cost factor down to 2. But since this action does not completely eliminate the hazard, the degree of correction is 2. Now we com-

pute the justification with these values:

$$J = \frac{50 \times 2 \times 0.5}{2 \times 2} = \frac{50}{4} = 12.5$$

The cost of this engineering action is considered justified.

With the steel plate barrier installed, the risk score is recalculated. Consequences and exposure remain the same, but probability is reduced to a "practically impossible" or "one in a million" chance, for a rating of 0.1. Therefore, the risk score = $50 \times 2 \times 0.1$ or 10.0, a risk that is in the negligible area.

It should be noted here that the use of this system in this case resulted in disapproval of an expenditure of \$28,000, and approval of measures costing \$1,000 that reduced the risk to the negligible area.

One tremendous benefit of the use of this formula must now be apparent, and that is in how it can really save money. For example, immediately after a very serious accident occurs, let us say a very bad explosion with a fatality, there is sometimes a tendency to over-react, to go to extremes in favor of safety. Judgment may become somewhat biased in favor of excessive safety measures. The safety profession does not need to get things approved that way. Such action really hurts safety's image in the long run, because when situations cool down and people again become rational and reasonable, the poor judgment of such projects is apparent. Therefore, under excitable circumstances when costly projects are being considered and may be too hastily approved, the justification formula can show whether or not the measures are justified, logically and simply. This formula can be used as a simple and positive management tool to enable management to make a proper decision.

Conclusions

The hazard evaluation systems presented herein can be used effectively by anyone who has sound judgment and experience in safety, with nominal training and guidance.

The risk score formula is used to calculate the relative severity of hazard. This process establishes priorities for attention to hazards

by both safety and management. The Risk Score Summary and Action Chart gives a quick reading or evaluation of the safety status of the organization at any time, it can show safety progress over a period of time, and it gives guidance to safety in determining where to concentrate its efforts.

The justification formula provides both safety and management with guidance in deciding whether the cost of a proposed safety project is justified. This formula gives a solid

foundation upon which safety may base its recommendations for corrective action. Its use will assure management that safety projects which actually are not justified will not be recommended. It will therefore cause management to place greater faith in safety and to give greater support to safety. It will help to establish that safety is a good profitable business.

MOTIVATING THE LINE SUPERVISOR

By K. P. KEARCHER
Manufacturing Mgr., Brown Co., Kalamazoo, Mich.

We are two different kinds of people here today. Two of the motives for your attendance here today may be:

1. Line—to seek ways to motivate subordinate supervisors or if low man on the totem pole—to self motivate or check yourself.
2. Staff or (non-line by definition) to seek a way to stimulate the proper amount of interest on the part of the line manager to be as successful in his safety performance as he is in his production performance, quality performance, cost performance, etc.

This is the way a staff person sees the safety-motivated supervisor, matter-of-fact—the way all line supervisors see themselves—a straight, upright, moving ahead kind of a guy with a purpose.

On the other hand, the unmotivated supervisor, whether he be president or foreman, appears to be the "Neanderthal" type in the eyes of the aware, sharp safety expert. He lacks motivation because he lacks awareness. Whether you are a higher-up line manager or a safety expert, your challenge is to have all supervisors willing to accept accident prevention responsibility—with a purpose.

We need to cause the supervisor to rally around a flag—and we had best have the generals motivated before we can expect to motivate the sergeants.

The motivated person too often thinks to motivate is a simple, straightforward problem solving experience. Now if you think this, you are absolute right. The path to achieve such a goal is straight, but there are a number of obstacles to overcome.

Example: Which is more important in the eyes of the line supervisor—production, waste, costs, safety or labor relations? (Whichever the boss impresses at any given time.) No one is more important all of the time. The line supervisor probably feels he must exercise his skills in cost control and production control most of the time; waste and labor relations a great deal of the time; and accident prevention when he prepares an accident report or gives a five-minute, stand-up safety talk.

This is the stone age attitude we have given our "Neanderthal" supervisors.

Our problem is to overcome the "let the personnel department do it—I have more important things to do" attitude we have caused—to get our "Neanderthal" man to straighten up and fly right.

If you, upper line manager and safety expert, will accept the premise that you caused this attitude, we can then be on the right road to cause our supervisor to have a broader view. Point out his job and then we can help him find a straight road to improved accident prevention.

To motivate the line supervisor to be effectively interested in accident prevention, he must have a purpose that will create in him the will to spend the time it takes to correct unsafe conditions and stop unsafe acts.

Your turned-on man has a purpose, the support of his superiors and his viewpoint has been changed. He must be trained to solve safety problems, he must actively participate in safety promotions and programs. I and my fellow supervisors are convinced—Safety Pays.

Printing & Publishing Sessions

SAFETY COMMITTEES AND MOTIVATION

By PAUL V. MC GUIRE
Corporate Dir. of Safety,
Meredith Printing Corp., Des Moines, Iowa

If you were to visit Meredith Printing at 2:00 A.M. or so in the morning, you might well find the plant manager poking around through the various departments with his entourage of employee inspectors. He might be pointing his finger at a department manager. Everybody at Meredith Printing is now in the act. How was this done, and why did we choose the committee system to activate a safety program?

First, let me say that initiating any kind of programmed safety isn't easy. Second, we implemented a participative safety committee to spearhead the safety program as a last resort. Theoretically, safety committees should be used only after extensive supervisory training in any plant that is in trouble from a safety viewpoint. Committees generally are un-wieldy, time-consuming and, in many cases, duplicative. Quite frankly, I am opposed to them for most plants that have a well-structured management organization with efficient channels of authority and communication. However, in today's society, there are employee forces which are demanding a part of the planned safety and health programs. Consequently, instead of seeing less, as I would personally choose, you may be forced to indulge in participative type safety planning for your respective plants or job shops sooner than you anticipate.

Please don't leaf through the available manuals and choose one of the pre-fabricated plans available. Your particular plant is unique and the design of your committee should reflect the qualities of your plant or shop.

In this presentation, you will note some basic organizational forms which should be present in all plans, but that is where the common characteristics should end. Use your creativity and design a plan which fits your

people and their needs. Regardless of your personal choice, you may be forced to organize a functioning safety committee operation for your particular plant. The Oil, Chemical, and Atomic Workers union has successfully negotiated safety and health clauses with major oil companies. The recent Chrysler strike was the result of a major difference of opinion on the safety and health problem as one of the major issues. The emphasis all major unions are putting on health and safety issues is impressive. In this issue, I look upon them as an ally. I do think that we can get our plants and shops in shape; however, any help from whatever source, should be accepted in its proper context rather than to harangue with the offer because of his historical position as an opponent.

As committee members, we have found also that the employees are quite reasonable in their observations. They are the first to criticize an employee who attempts to settle a personal grievance by an alleged safety hazard. Finally, for Meredith Printing, this safety committee programming has made an equally important impact on management ability. Because of the pressures exerted, the supervisory personnel are more cognizant of the workplace safety conditions. They manage more prudently and wisely.

Today, our printing plant safety committees are on-going, dynamic vehicles, and our people are stimulated and motivated toward producing safety more today than from anything we have tried in the past. Our accident trends have dramatically declined. We feel that the decline is permanent. It has not been without its problems. One of the major difficulties encountered was in getting the foreman and middle management to accept this barrage of input from the committees' activity. This was solved by the continuing

emphasis by top plant management. In addition, the chief executive officer of the corporation made it crystal clear to all members of printing management that safety is an integral part of the production function.

We have our problems in administering the program. It requires a whole lot of paper work. Our priorities have to be revised frequently to fit in with the maintenance manpower requirements. We hear grumbling about the great deal of money we are spending. Sometimes our work orders get lost or fouled up. We have had to devise many different forms to conform to the requirements of the committees. And there are a myriad of other things which help to make our day full, to say the least.

We were not surprised to see the employees accept this type of activity. We believed that the employees were most conscious of their work environment and would willingly participate in a program by which they could help solve these problems. This was borne out by the fact that we have a long waiting list of employees who would like to participate. Currently, in place of a two-man safety department, we feel that we have a 60-man department. These 60 safety engineers inspect our plant, make recommendations, follow up on those recommendations, and generally monitor the progress of safety activity of our 1,600 employee plant.

Additionally, we have many technical people and maintenance people who respond to the activity of our committees. These technical people solve our engineering problems. Our maintenance people make the necessary revisions.

Three years ago, I addressed the Congress and discussed our then-current programming. Our methods were different at that time, and we were successful. We did reduce accidents, and we did win an Award of Merit from the National Safety Council. Our strategy at that time was to chip away at the more acute problems and to lay the groundwork for a more enduring type of loss prevention control. In 1972, our accident rates moved in a continuing upward trend. It was not difficult to understand the cause. We had management changes! We had some management which was not sold on either our

programming or our methods. This is not to criticize the opposition unfairly. They were sincere in their beliefs. The point I would like to make is that disunity in a management group can destroy a safety program more effectively than a 10 megaton bomb. Quite frankly, our differences had to be resolved in a dramatic fashion to gain the greatest impact. The Meredith Printing Safety Committee program was the answer.

I am amazed at those companies who go on year after year in sweetness and light. Everybody seems to agree with everything, and all is harmony and bliss. I have never been that fortunate in being with a company operating under these beautiful arrangements. My experience has been that the workplace is not much different from a jungle. It takes eternal vigilance to keep from being swallowed up by a sharp-toothed tiger with a voracious appetite as he moves up the corporate ladder. Yes, dear friends, my ulcers cry out in pain quite frequently. I believe it was Hegel who stated that laws are necessary to preclude man from destroying himself in a manner somewhat similar to the tigers in the "Little Black Sambo" fable.

Historically, safety has not been in a position of strength in the printing industry. Consequently, we safety professionals in this industry have had many more problems than our brothers in more safety-oriented industries.

I think that Meredith Printing would have participative safety even if we had been utopian with perfect management accord. This was our ultimate plan; however, we put our plan into effect quicker than we would have had we had stabilized conditions. Quite frankly, at the time of its implementation, Meredith Printing supervision was still not educated to the point that safety was accepted as an integral part of the production function. I would have liked to have had more training time for supervision in the fundamentals of safety responsibility. As a result, top printing management has had to use, on occasion, some pretty heavy clubs to bring line management into line.

Many safety professionals view safety committees as just so much extraneous, irrelevant junk which insurance companies force them

gramming has its characteristics to fill the needs of its unique qualities.

In a small job shop, it is perfectly acceptable and desirable for the management to conduct its safety activities in a one-on-one fashion. As the plants grow larger, this personal supervision by top plant management becomes impossible. And this reluctance to accept the somewhat impersonal systematized safety is the prime reason for management's refusal to adopt participative safety in many large plants. Be aware of that, if you represent a large plant and if you attempt to organize a similar program.

I think management likes to think that, if given the facts, management can personally solve anything. This is an erroneous belief. The manager of a large printing plant cannot solve the literally hundreds of safety problems encountered in a week's time. It takes a system.

to accept. When viewed in this context I fully agree. Safety committees can be a potent and viable vehicle to instruct and educate all strata of both management and work groups. And this is what we hope we have at Meredith Printing.

As a result of our committee activity, we know that Meredith people are more responsive to safety responsibilities than they have ever been in the past. I was quite pleased the other day when a committee member walked up to the plant manager and told him that action had not been taken on an approved recommendation and he wanted something done about it.

We are in the process of devising a participative program for our Lynchburg, Virginia, rotogravure plant. That particular plant is a plant of 350 non-union employees. It has unique characteristics. Consequently, the plan will be tailor-made to complement those characteristics—just as our Des Moines pro-

AN OSHA INSPECTION

By CHARLES CHEVIRON

Exec. Vice Pres, Danner Press, N. Canton, Ohio

On March 23, 1972, at about 10:00 o'clock in the morning, we received that rap on the door that everyone has heard about. Quite frankly, we were surprised when the federal compliance officer did arrive, because we had experienced the same exposure that all of you had, in the two or three years prior to this event. We had heard of the possibility of being inspected, and we were advised by Printing Industries of America and other organizations, to become acquainted with what might happen when an inspector arrives.

The printing industry was picked to be in the second group of target industries. Fortunately, we did a few things to overcome some deficiencies, after an alert was sent out by PIA and other organizations. Also, we started working much more closely with the State of Ohio, in setting up safety programs. In addition, we designated one individual in our organization who would have the prime responsibility for complying with OSHA Regulations and the other safety programs. In this instance, it happened to be our Personnel Director. He is very diligent at keeping records, and from what we had heard earlier in the game, this was one of the prime responsibilities for complying with OSHA. And this has proved to be true.

The Inspector presented his identification and read the charge that had been levied against the Danner Press Corporation. The charge was made by one of our employees, stating that employees were recently hospitalized due to dust in our baling operation. As with most charges, it was unfounded. Yet, under the law, if a charge is filed, it will result in a mandatory inspection. The inspector asked to see the record keeping. We showed him the reports - the 100, the 101 and the 102. They are all recaps of injuries, illnesses, etc. Earlier, we were contacted by federal government representatives, and were cooperating by working on a supplementary

form on a voluntary basis, for them. We showed the Inspector recaps of our industrial compensation claims.

The record keeping inspection took about 45 minutes. At that time, the Inspector asked if we had established an OSHA Safety Committee, and if the employees had representation.

We have two unions - International Printing Pressmen and the Bindery Workers. The employees had selected the presidents of these two unions to be their representatives on our Safety Committee. The Inspector invited these two representatives to speak with him. We asked our Director of Manufacturing and our Plant Superintendent to join the group, which the compliance officer readily agreed to.

In the baling area the masks and respirators provided for the operator were not being used, and there was a fair amount of dust in the area. The Inspector looked at the operation, and asked how we were gathering the paper for the baling operation. We replied that we had a vacuum system that pulled it all into a cyclone that is roof-mounted. By gravity, it is fed into a horizontal baler. Now, we do inject moisture into the system in an attempt to eliminate the dust. If we inject too much moisture, we manufacture papier mache, which blocks the system.

After looking over the baling operation, the Inspector told us that we were in violation, because the operator was not wearing a mask. We replied that we had provided masks for the operator to use. The Inspector then interviewed the man on the baler and asked him where the mask was. To this question, the Inspector probably got an honest reply, which was - I don't know. I think that probably the operator inferred he did not care. The Inspector then asked him why he wouldn't wear a mask, and the operator replied saying that it was uncomfortable, it was

warm, it was this and that. At this point, much to our surprise, the compliance officer admonished the man, stating that he was there on a complaint about dust, which, perhaps, was a health hazard. He added that since safety equipment had been provided, the operator should at least be wearing it.

The Inspector chose to go into the bindery. He walked through and around each piece of equipment, he checked nip points, guarding, chains, and the action of the guillotine cutters. He asked numerous questions and made numerous notes, causing you to wonder if the inspection was going to turn out badly.

The Inspector then checked all of the electrical outlets to see if they were grounded, and looked at the electrical motors to see if the junction boxes were all covered. He made numerous comments about the electrical cords for fans, that were hanging down. Other instances involved questions relative to suspended lighting.

After the compliance officer left, we were anxious to get a summary report. We had a few good things going for us. One was that our record keeping was in good order, especially since the Inspector found no fault with it. Another was the fact that he was impressed with the OSHA posters on the bulletin boards. He did request that we put additional posters up, which we did later on.

The other area we were very much concerned about was in the First Aid room. After inspecting this room, the compliance officer stated that we did meet the minimum standards, but he was concerned about the fact that our records showed that in most cases, an injured employee was transferred to a local hospital. I think, perhaps, he was concerned about the severity of the injuries involved. We pointed out that our plant is located approximately three minutes from one hospital and six minutes from another. We also stated that we only maintained minimum first aid and that even if the injuries appeared to be minor, we thought it best to get the injured party off the premises and into the hands of professionals. We added that this seemed to satisfy the requirements of the Industrial Commission of Ohio.

By handling it this way, we felt we were giving better service to the employee and also

building our own protection. After discussing this at length, the Inspector agreed that we were above the minimum standards and it was acceptable to him.

On April 4th, we received a communication from the headquarters of the area director in Cleveland, Ohio. By law, we had to post the letter and citation of April 4th in conspicuous areas. We also had to post a copy of the citation near each area where we were cited for a violation. In this connection, we were cited for a violation in six different areas throughout the plant, and these were as follows:

The first violation was for failure to provide a hand saw with an electrical switch, within easy reach of the operators. Now, a hand saw was purchased many years ago and has been in use, from time to time, ever since. Yet, in the opinion of the Inspector, the switch should have been mounted so that the operator could readily reach it if something went away.

The second violation was failure to provide guard rails at the open ends of the work platform on folders 1 and 9, on two different web offset presses. What this boils down to is that if you have a ladder or a "monkey" pull at the end of the platform in order to gain access to the upper levels, it must be guarded with a gate. When you go up, you open the gate and then close the gate behind you. Without this gate, members of the crew are actually working on an open-ended platform, and I am sure that in our case, the citation for violation was warranted.

The third violation was failure to provide a non-slip base on a metal portable ladder which we often use at folder number 1, and which does not have access to upper areas of the press.

The fourth violation was failure to maintain the general requirement for portable fire extinguishers. It had nothing to do with the number or type of fire extinguisher that we have, but the fact that several fire extinguishers were sitting on the floor instead of being installed at a prescribed height and mounted on poles. Now, if a fire extinguisher is a floor-type, then that would not be considered a violation.

The fifth violation was our failure to main-

tain proper housekeeping in the pressroom. Now, we were somewhat chagrined at being charged with this violation, because we think we do a top-notch job of housekeeping. So, in digging a little deeper, we found that what it actually boiled down to was the fact that there were several barrels which are used for soiled rags that did not have an approved cover on them. The compliance officer also pointed out that we had a lot of things, such as skids, standing in the pressroom. We countered by stating that we needed the empty skids to put the signatures on, and that full skids were banded before they were moved. So, we may have scored a few points on defending our housekeeping, which we think is good.

The sixth violation, which I mentioned earlier, was failure to maintain and provide adequate respirator protection in the baler area.

We were fined \$30 for two different violations, or a total of \$60. This involved (1) improper placement of the portable extinguishers; and (2) masks for the baler operators. With respect to the other four violations, we were told to make changes so as to be in compliance. There were no financial penalties involved. I think you could say that we were very fortunate, and I agree we were, because the fines could have been much higher. In a conversation with the area director, I found that fines can be as much as \$1,000 a day if you do not comply. Had the compliance officer tested the noise levels, we would have been in violation of the prescribed acceptable levels. This would not be so today, because we now have initiated a rotating work force system where our employees are in different levels of exposure during a given period of time.

Although we continue to work toward full compliance, I am sure an inspector could still find some areas of violation. The law itself is so lengthy and difficult to interpret, that we

would be very fortunate, indeed, if we were not cited for violation of the law. We feel that our continued attempts to cooperate with the compliance agency in meeting the standards set, has put us in good stead. They have not been back since May 10th, which was actually two days after the compliance date of May 8th. In this connection, the provision of the law states that any employee in any department of a plant can, at any time, file a claim or ask for an inspection on a health or safety issue. Taking this into consideration, it is possible that we could be subjected to another inspection at any time.

The good ideas and thoughts that we received through the cooperation of the compliance officer have been helpful in shaping up to OSHA standards. We have made numerous changes such as: (1) changes in our exits; (2) changes in aisle markings; (3) changes in the lighting system; and (4) elimination of a lot of lengthy extension cords, replacing them with heavier ones. We were able to make these changes as a result of the notes our people took when they walked through the plant with the compliance officer.

If you should ever become involved in an inspection, I would encourage you to do the same. I would also suggest that you establish a team of employees, particularly your maintenance personnel, to accompany the compliance officer on his walk through your plant. Have your employees make notes of all the questions he asks. Do not assume that every question asked has reference to a violation, however, by the same token, it may have.

Frankly, I would say that we were quite surprised at how easy the inspection really was, after getting over the fear of it. I would add, however, that we are not looking forward to another one. But, if another inspection should occur, we will certainly cooperate to the fullest extent.

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