MANAGEMENT OF THE WORK ENVIRONMENT

Part I: Safety and Health Instructional Topics and Selected Case Studies

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
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DISCLAIMER

The opinions and conclusions expressed herein are not necessarily those of the National Institute for Occupational Safety and Health, nor does mention of company names or products constitute endorsement by the National Institute for Occupational Safety and Health.

FOREWORD

Under the provisions of Section 21.(a) of the Occupational Safety and Health Act of 1970 (Public Law 91-596), the National Institute for Occupational Safety and Health (NIOSH) of the U.S. Department of Health and Human Services, has the mandate to conduct directly, or by grants or contracts, education programs to provide an adequate supply of qualified personnel to carry out the purposes of the Act. Three major approaches have been used by NIOSH to date to fulfill this mandate.

One approach is that of conducting an extensive training project grants program, through which colleges and universities may qualify for funds to provide training to occupational safety and health professionals (e.g., occupational physicians, occupational nurses, industrial hygienists and other occupational health scientists, and safety professionals). In place since 1971, this program has resulted in a strengthened infrastructure of colleges and universities that are prepared and qualified to educate personnel in the occupational safety and health sciences.

A second approach used by NIOSH to ensure an adequate supply of professional manpower to support the nation's occupational safety and health efforts is the Educational Resource Center (ERC) concept. The ERC program was launched in 1977, in response to a national need for occupational safety and health professionals, a need not totally met by the training project grants program described above. The Educational Resource Centers develop and offer degree programs in the disciplines of occupational medicine, nursing, safety and industrial hygiene. At present, 14 ERCs have been approved and funded. Continuing education/outreach is an important ERC function. ERC outreach programs involve providing assistance to other colleges and universities in the areas of industrial hygiene, medicine, nursing, and safety through full-term and part-term teaching, seminars, lectures, and similar types of support.

A third approach used by NIOSH to impact manpower in the occupational safety and health area is that of influencing the curricula of professionals who, while not classified as occupational safety and health professionals, nonetheless play a vital role in ensuring that occupational safety and health initiatives are successful at the company or corporate levels. These professionals include science teachers, industrial arts and vocational education instructors, and engineers. Recently, NIOSH, with the support of various safety and health organizations and representatives of Schools of Business, opted to follow a similar strategy to influence the curricula of the nation's schools of business management.

Project Minerva is based upon the premise that it is of limited value to provide more and better training in the recognition, evaluation and control of safety and health hazards in the workplace to occupational safety and health professionals, *unless managers responsible for the safety and health function and who make the major decisions on resource allocation also receive education and training in the managerial aspects of occupational safety and health.* Since management is the effective utilization of human and material resources to achieve an enterprise's objectives, managers must be aware of the adverse effects of safety and health problems, control strategies and of the resources that they have, or may need, to cope with safety and health issues and problems.

Advances in technology, a changing workforce, and increased legislation in the field of occupational safety and health have also placed new demands upon business managers. The knowledge and skills necessary to address these demands are extensive and generally exceed what is presently offered through courses in the traditional business curriculum.

In response to the need for addressing these demands, the National Institute for Occupational Safety and Health has developed occupational safety and health resource materials consisting of instructional modules and case studies, a book of readings, and candidate research topics. The material addresses some of the more pressing occupational safety and health management issues, and is being made available to schools of business administration in Project Minerva.

It is not the purpose of this occupational safety and health initiative to suggest a new curriculum, but rather to provide a source from which materials can be selected for integration into existing business courses commensurate with faculty interest, and institutional and/or departmental curriculum requirements.

REMARKS TO INSTRUCTORS

The following materials are intended to be used in business courses to introduce students to the problems of occupational safety and health and to behavior management methods as one means of controlling those problems.

The materials can be used in several different ways. The following are offered as suggestions. Copies of the text could be distributed as reading assignments. They could be studied and used as a lecture guide by the instructor. The indexing along the outside margins of the page can be used to identify particular passages for class discussions or they could be used by the instructor as a detailed outline for a lecture. The transparency masters at the end of the units can be removed, copied as transparencies and projected as visuals for lectures. The quiz questions could be done as an outside-of-class exercise. They could be used to help prepare students for class discussions, or they could be discussed in class. They could be copied and used as quizzes.

The principles of behavior often seem like common sense. Everyone can recognize the truth in the simple statements. Yet, people are rarely prepared for the extent to which the principles are involved in all human affairs. Expect your students to be surprised to find the many applications of the principles of behavior to safety and health and other problems.

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UNIT I

LEGAL ASPECTS OF OCCUPATIONAL SAFETY AND HEALTH

Professor Ellen R. Pierce
University of North Carolina

METHODS: Lecture, class participation, case write-up. LENGTH: 2 Hours

PURPOSE: To clarify for participants what it means in the eyes of the law to comply with the Occupational Safety and Health Act.

OBJECTIVES: To familiarize the participant with:
1. The necessity for compliance with OSHA
2. The advantages to compliance with OSHA
3. The employer's right and duties under OSHA
4. How to be in compliance with OSHA

SPECIAL TERMS:
1. The General Duty Clause
2. Recordkeeping
3. The Log
4. Exposure Records
5. Inspections
6. Citations
7. Penalties
8. Variances

INSTRUCTOR:
Lesson plan
Overhead transparency, projector, screen
Chalkboard/chalk
Case study

TRAINEE MATERIALS: Participant outlines and supplementary materials

UNIT I

LEGAL ASPECTS OF OCCUPATIONAL SAFETY AND HEALTH

INTRODUCTION PURPOSE AND SCOPE OF OSHA

OSHA was the result of a growing recognition on the part of Congress that industrial accidents and health hazards were taking a heavy toll on American workers. In considering the need for a comprehensive job safety and health act, Congress was presented with a number of startling statistics. According to the testimony of former Labor Secretary Shultz, an estimated 14,500 people were killed annually in industrial accidents. Furthermore, 2.2 million workers, at the very least, were disabled on the job each year. These figures accounted for the loss of 250 million employee work days. Congress also heard testimony that there were 390,000 new incidences of occupational disease each year. The economic consequences of such industrial accident and illnesses were overwhelming: over $1.5 billion was wasted annually in lost wages and over $8 billion was lost to the Nation's gross national product. It was estimated that new and potentially toxic chemicals were being introduced into the workplaces at a rate of one every twenty minutes. Confronted with these statistics, Congress set out to draft legislation which had as its purpose "to assure so far as possible every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources." This legislation is known as The Occupational Safety and Health Act of 1970 (OSHA) and can be found in Title 29 of the United States Code. Accompanying the Act are regulations which can be found in Title 29 of the Code of Federal Regulations.

References

"OSHA" of "the Act" refers to the Occupational Safety and Health Act (or Administration when appropriate). "OSHRC" refers to the Occupational Safety and Health Review Commission; "NIOSH" to the National Institute for Occupational Safety and Health, and "Secretary" to the Secretary of Labor. All section references are to Title 29 of the United States Codes.

ADVANTAGES TO COMPLIANCE

Because OSHA requires employers to self-regulate safety in the workplace, it is extremely important for employers to comply with the Act's regulations. Compliance with OSHA regulations becomes less burdensome when the employer realizes the benefits such compliance can bring. These are numerous and a few should be mentioned before discussing compliance under the Act so that students have an appreciation for the value compliance brings. First, managers should recognize that OSHA compliance will result in overall increased efficiency in the operation of the business. This increased efficiency is represented in reduced workdays lost due to occupational illness or injury and in dollar savings realized in reduction of the number of worker compensation claims filed. Both of these can represent substantial savings to an employer who establishes a safety program which satisfies OSHA regulations. Another important benefit of OSHA com-

pliance is the trust and good relations that management will have with their employees and union representatives. Employees are fundamentally concerned with safety and appreciate knowing that their employer is equally concerned with their welfare. Not only compliance with OSHA, but establishment of a safety program by an employer establishes his good faith concern for his employees' well-being. This will result in improved morale among employees as well as a reduction in labor turnover.

Compliance with OSHA then produces not only savings in dollar terms but improvement in labor-management relations.

HOW OSHA FUNCTIONS

The enforcement functions of the Act rest with the Occupational Safety and Health Administration of the Department of Labor. A separate organization, the National Institute for Occupational Safety and Health (NIOSH), is responsible for conducting studies and research to develop recommended safety and health standards. NIOSH is actually a part of the Department of Health and Human Services and was not created by OSHA.

Compliance Officers

OSHA Compliance officers (CO's) are given the power under the Act to inspect any workplace covered by the Act. The CO is required, upon arriving at the workplace, to present credentials to management in charge before being allowed to conduct an inspection tour. The employer and an employee representative have the right to accompany the CO on his tour. After the inspection is completed, the CO meets with management to discuss the safety and health conditions in the plant and to identify any possible violations. Typically, a CO must confer with the OSHA area director before issuing a citation. Thus, once the CO files his report, it is up to the area director to issue a citation or not and to determine any penalty or assessment of a fine. He further sets the date by which the employer must remedy the violation. If a citation is to be issued, it must be mailed within six months of the violation. Citations must be in writing and must clearly describe the violations alleged with reference to the appropriate standards and regulations.

Notice of Contest

Once the citation is received, the employer (or an employee) has 15 working days in which to file a notice of contest. If the employer does not protest the violation, abatement date, or proposed penalty within this time period, the citation becomes final and is not subject thereafter to appeal or review by any court or agency.

The Secretary of Labor is required to forward immediately to the Occupational Safety and Health Review Commission any notice of contest. It is the OSHRC which will hear the employer's protest. The OSHRC is comprised of three commissioners, appointed by the President, who serve staggered six year terms. It is a quasi-judicial, independent administrative agency.

Review of the Case

When a case comes before the Commission, the Secretary of Labor is typically called the "Complainant" and the employer is the "Respondent." It is the Complainant's burden to prove the employer committed a violation of OSHA. The Commission does not actually hear the case; an administrative law judge (ALJ) hears the case and gives a decision which either affirms, modifies or vacates the citation, penalty or abatement date. It is this decision by the ALJ which is reviewed by the OSHRC. The Commission has 30 days in which to review the decision. The Commission may decide to consider the evidence and issue a new decision or may simply approve the ALJ's decision in which case it becomes final.

Appeal

If the employer wants to appeal the OSHRC decision, he may do so within 60 days of the final order before the United States Court of Appeals in whose jurisdiction the violation allegedly occurred.

WHO IS COVERED BY OSHA

OSHA covers employment in every state, the District of Columbia and Puerto Rico, an estimated 5 million workplaces and 75 million employees. Although employers must be involved in interstate commerce in order to be covered by the Act, the Secretary of Labor has consistently given broad application to jurisdictional coverage. To do this however, the Secretary must present substantial evidence of an employer's effect on commerce to substantiate issuance of a citation.

Who is an Employer

Virtually every employer is covered by the Act; however, the United States, the fifty states and political subdivisions of the states are specifically exempted from coverage. The term employer is construed loosely and includes joint-ventures and those hiring independent contractors as well as the traditional types of employers such as corporations, partnerships, professionals and agricultural employers.

Case: Griffin v. Brand of McAllen, Inc. 6 OSHC 1702 (1978). A company which received an OSHA citation for a violation argued that it was not the employer of migrant workers because their crewleader was an independent contractor. The Commission in reviewing the decision adopted an 'economic realities' test which identified the following factors in defining an employer:

1. Who do the workers consider their employer?
2. Who pays the workers' wages?
3. Who has the responsibility to control the workers?
4. Does the alleged employer have power to control the workers?
5. Does the alleged employer have the power to hire, fire, or modify the employment conditions of the workers?
6. Does the ability of the workers to increase their income depend on efficiency rather than on initiative, judgment and foresight?
7. How are the workers wages established?

Furthermore, it has been held that an employer is engaged in a business affecting interstate commerce if it does business with other employers that are engaged in interstate commerce.

EMPLOYER DUTIES AND RIGHTS

To be in compliance with OSHA, business managers must be aware of their duties under the Act. There are two major requirements for the employer which form the basis of his responsibility under the Act. First, an employer is required under the General Duty Clause to "furnish to his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees." (654(a)(1)). Second, an employer has the responsibility to comply with all applicable health and safety standards promulgated by OSHA (654(a)(2)). OSHA has promulgated standards for four broad industry categories:

Industry Categories

1. General industry
2. Construction
3. Maritime and longshoring
4. Agriculture

Copies of these standards may be obtained from Title 29 of the Code of Federal Regulations, Part 1910.

VOLUNTARY COMPLIANCE

OSHA is based on the concept of voluntary compliance in that the Act requires the employer to monitor safety in his business *before* the employer is inspected by any federal officials. To illustrate the importance of voluntary compliance is the contrast in the number of inspections held versus the number of businesses in existence during the first ten years of regulation: OSHA conducted approximately 600,000 inspections but the number of workplaces covered by the Act numbered 5 million. As can be seen, the only way to afford immediate protection to the approximately 75 million workers against work-related injuries and illnesses is to require compliance with the Act before an inspection. Two judges have aptly stated the purpose of the Act in separate opinions: "to prevent the first accident;" "the keystone of the Act is in short, preventability."

To understand what this all means to employers, we need to examine the nature of the employers' duty under the 'general duty clause' and in connection with OSHA standards compliance.

THE GENERAL DUTY CLAUSE

The General Duty Clause, Section 654(a)(1) of the Act, was created to address serious hazards in the workplace for which no standards have been promulgated. To understand the duties of the employer under this section, key terms in the clause need to be identified.

Definition of Terms

1) 'employees' — The general duty clause makes it clear that the obligation of the employer under this section is to the workers and is not satisfied simply by compliance with given standards created by OSHA.

2) 'employment and place of employment'—OSHA has defined these terms to mean that any workplace where at least one of the employer's workers is working qualifies as a place of employment. This is true even if the worksite is owned by a different employer. Care must be taken to safeguard all locations at the employment site, even those to which only a few employees have access.

3) 'free of recognized hazards.' This term limits the employer's liability to those hazards of which he has notice, or should be aware (constructive knowledge). A question presented in one case by this language was whether the term 'recognized hazard' meant that it had to be detectable only by the senses or whether it extended to those dangers only recognizable by instrumentation. In general the courts have held that "recognized hazards" refers to hazards that are common knowledge, detectable by the senses or by widely used methods in a given industry and discoverable under usual inspection practices, or to those hazards of which the employer had knowledge. Hazards may be recognized at the management level as well as the employer level. State and local laws, as well as industry standards and codes all have been used to show that a hazard was recognized by the employer's industry. Unpreventable hazards such as the carelessness of an employee are not the employer's responsibility.

4) 'causing or likely to cause death or serious physical harm.' Employers must also train employees satisfactorily for their jobs. Many OSHA standards require employers to equip machinery with safety devices, to provide personal protective equipment, and generally to provide employees with tools and equipment in a safe condition. For an employer to be found guilty of a violation under the general duty clause, the Secretary must "specify the particular steps a cited employer should have taken to avoid citation, and . . . demonstrate the feasibility and likely utility of those measures." The concept of feasibility

means economically and technologically capable of being done. In connection with the steps the employer took to abate a safety hazard, the question is whether a precaution is recognized by safety experts as feasible, not whether the precaution's use has become customary.

Furthermore, the Secretary must prove

a. that the employer failed to render its workplace free of a hazard which was
b. recognized and
c. causing or likely to cause death or serious physical harm
d. and the Secretary must specify the particular steps taken by the employer to avoid the alleged violation and to demonstrate the feasibility and likely utility of those measures.

Areas of Inquiry

Critical to OSHA's review of a possible violation. An inquiry into a number of areas is:

1. The employers' safety training program. Employers have a duty under OSHA to provide safety training to their employees. The responsibility of an employer, however, is limited to training employees concerning safety in the employee's regular assigned tasks, not in other operations when it is not foreseeable that the employee would face a hazard. Generally, the employer must instruct the employee in safety training rather than simply give him material to read at his option.

2. The adequacy of the employers supervision. A majority of supervision questions focus on whether, at the moment of an accident, better supervision could have prevented the hazardous occurrence. In general, courts will look at whether feasible precautions were taken in the hiring, training and supervising of employees. Even if a hazard is partially caused by employee's own conduct, the employer is responsible if he could have prevented it.

3. The overall safety practices of the employer. Overall safety practices will also be examined in determining a violation of the General Duty Clause of OSHA. OSHA must prove that the employer's practices were inadequate. Safety precautions include the use of safety equipment and work procedures.

COMPLIANCES WITH STANDARDS

The employer's second duty under OSHA is to comply with any standards for the employer's industry which OSHA creates. 654(a)(2). There are 4 groupings into which standards fall: general industry, construction, maritime and longshoring, and agricultural.

General Industry Standards

General industry standards apply to all covered employers. Within these standards are, however, certain special standards such as for bakery equipment, laundry machinery, sawmills, pulpwood logging, agriculture and pesticide operations which may apply only to special industries. A few examples of standards created by OSHA include: rules requiring eye goggles for employees operating saws, sanders and similar equipment; maximum levels of exposure to toxic substances such as lead and asbestos; and safety nets, scaffolds, temporary floors or other safety devices for employees working more than twenty-five feet above the ground.

Construction Standards

Construction standards apply to employers with employees "engaged in construction work" which is defined as "work for construction, alterations, and/or repair, including painting and decorating." Examples of cases where the Commission

found that an employer was engaged in the construction business are: when the employer was replacing an old utility pole with a new one; connecting telephone cable in a building under construction; erecting a gas furnace; revamping two towers of an oil refinery; and dismantling a crane. Employers have been found not to be engaged in construction where they were: building logging trails; trimming trees near power lines; repairing cement on an offshore rig; and supplying architectural and engineering services without substantial supervision over a construction site.

Maritime Standards

Coverage under maritime standards is defined in terms of "ship repairing," "ship building," "ship breaking," and "longshoring." Employers covered under these standards are those who engage in altering, converting, cleaning and maintaining vessels; building and installing equipment; breaking down a ship's structure; and loading, unloading, moving or handling of barges, ship's stores, gears etc., into, in, on or out of a ship.

Agricultural Standards

Those who must comply with the agricultural standards include those who are involved in a farming operation which is defined as any operation involved in the growing or harvesting of crops or the raising of livestock or poultry, or related activities conducted by a farmer, on sites such as farms, ranches, orchards, dairy farms or similar establishments.

No Alternative Standards Allowed

Employers are expected to comply with these standards in every detail and the fact that an employer has adopted his own safety methods, for example, is no reason not to comply with OSHA's standards. Compliance with OSHA standards is not determined by the numbers of accidents at the employer's place of business. The fact that an accident occurred does not necessarily mean there has been a violation. Similarly, however, absence of accidents does not mean there are no violations: OSHA seeks to prevent injury and illness by eliminating hazardous conditions.

RECORD-KEEPING

Another employer responsibility under OSHA which is extremely important is recordkeeping. This is an important part of an employer's compliance with OSHA. All employers (unless specifically exempted) covered by OSHA are subject to the recordkeeping, posting and notice requirements of the Act.

Exemptions

There are several exemptions: 1) for employers who have less than ten employees. Although they must report fatalities, they need not comply with the recordkeeping requirements; 2) for employers engaged in retail trade (those selling merchandise to the general public for personal consumption), finance, insurance and real estate, (those engaged in banking, credit other than banking, security dealings, insurance, and real estate); and service industries (personal and business services, legal, educational, social or cultural services and membership organizations).

What to Record

What needs to be recorded? Regulations require recording and reporting of "work-related deaths, injuries and illnesses other than minor injuries requiring only first aid treatment and which do not involve medical treatment, loss of consciousness, restriction of work or motion, or transfer to another job."

1. The obligation to record only arises as to work-related injuries or illnesses which are those which are directly related to the work place and occur in the work environment.
2. Occupational injury is defined as "any injury such as a cut, fracture, sprain,

amputation, etc., which results from a work-related accident or from exposure in the work environment."

3. Occupational illnesses are "any abnormal condition or disorder, other than one resulting from an occupational injury, caused by exposure to environmental factors associated with his employment." Examples of these include skin diseases, dust diseases of the lungs, respiratory conditions due to toxic agents, poisoning, disorders due to physical agents, disorders due to repeated trauma, and other occupational illnesses.
4. Work-related injuries or illnesses that result in a fatality or in lost workdays must be recorded as well as occupational injuries which; a) require medical treatment other than first aid; b) require transfer to another job or employment termination; c) involve a loss of consciousness or restriction of either work or motion.
5. The employer is charged with the responsibility of determining whether an injury or illness is work-related and thus needs recording.

STEPS IN THE RECORDING PROCESS

There are three steps in the recordkeeping process: Log, Supplementary Record, and a Summary.

The Log

The employer must keep a log of injury and illness causes and must enter these within 6 workdays after learning of the event. Information required includes: the date of injury or illness, employee's name, job title or description, injury or illness description, any fatality, lost workdays, or job transfer and changes in the illness or injury.

Supplementary Record

A Supplementary Record is also required to be recorded in the log and includes:

1. employee's name, address, occupation and vital statistics;
2. where and how the accident occurred;
3. extent of the injury or illness;
4. fatality (if appropriate) and
5. name and address of physicians or hospital

Summary

The employer must prepare an annual summary of injuries or illnesses. The summary derives from the year's totals entered in the log and includes the following information: calendar year covered, company name, establishment name, establishment address, certification signature, title and date. This summary is required even if there are no injuries or illnesses reported for the year. A further requirement is that the summary be posted no later than February 1, and remain posted until March 1 of each year in a location where employees can easily see it.

EMPLOYEE ACCESS TO EXPOSURE AND MEDICAL RECORDS

An employer whose employees are exposed to toxic substances and harmful physical agents at the workplace is required to provide access for his employees (and OSHA) to exposure and medical records. Employees who are subject to exposure to toxic substances or harmful physical agents have a right to access to 4 kinds of exposure records.

Kinds of Exposure Records

a. environmental monitoring records
b. biological monitoring results
c. material safety data sheets

d. any other record disclosing the identity of toxic substances or harmful physical agents.

In general, exposure records must be kept for 30 years and medical records must be kept for the length of employment plus 30 years. Upon request, the employer must provide access to these records within 15 days and in a reasonable place at a reasonable time.

EMPLOYER RIGHTS

Certain employer rights have been established during the administration of OSHA. A simple listing of these will provide the student with the breadth of those rights.

The employer has the right to:

1. The consultative services of OSHA concerning safety conditions at the workplace without the threat of a citation.
2. The employer has the right to discipline those employees who refuse to comply with safety standards promulgated by OSHA for the employee's own protection.
3. The employer is entitled to accompany the compliance officer during inspections of the facility.
4. The employer is entitled to be present during any on-the-premises interviews conducted by OSHA with his employees.
5. The employer has a right to confidentiality with regard to certain information obtained by OSHA.
6. The employer is entitled to judicial review of any advisory order of OSHRC in the appropriate United States Court of Appeals.
7. As will be discussed later the employer may apply for a variance from any standard.

EMPLOYEES DUTIES AND RIGHTS

The Act provides that "each employee shall comply with occupational safety and health act standards and all rules, regulations and orders issued pursuant to this Act which are applicable to his own actions and conduct." The full responsibility for compliance rests however with the employer and an employer is not relieved of his responsibilities under the Act simply because an employee has refused to comply. It is important therefore that employers take all measures possible to ensure employee compliance, including discipline of employees who refuse to comply.

Rights Granted to Employees

OSHA grants a number of rights to employees to encourage their involvement in safety and health matters. These rights arise in three steps: a) at rulemaking, b) enforcement, and c) adjudicatory steps. OSHA further requires that employees be informed of these rights. The employer therefore has the obligation to post OSHA posters in conspicuous places throughout the workplace.

Specific rights of employees granted by the Act include:

1. petitioning for adoption of a standard
2. serving on a standards advisory committee
3. seeking judicial review of new standards
4. filing a complaint with OSHA
5. bringing a mandamus action in district court to compel the Secretary to conduct an inspection when there are eminent dangers.
6. participating in the inspection tour

7. participating in conferences
8. having the employer post copies of all citations
9. having the right to inspect the log of occupational injuries and illnesses
10. initiate inspections through written request
11. accompany the compliance officer during an inspection of the worksite
12. immediate notification of any imminent danger discovered by the compliance officer during his inspection
13. notice from the employer who is contesting a violation so the employee might intervene
14. right to participate in any variance proceeding brought by the employer
15. protection from anti-OSHA discrimination safety complaints by employees to OSHA or any federal, state or local agency that has authority to regulate or investigate occupational safety and health conditions on protested activities.

INSPECTIONS

The primary responsibility for the enforcement of OSHA belongs to the Compliance Safety and Health Officers whose main job is to conduct inspections of employers' worksites to determine employer compliance with the standards.

The Act 657(a)

The Act states that:

Upon presenting appropriate credentials to the owner, operator, or agent in charge [inspectors are authorized]

(1) to enter without delay and at reasonable times any factory, plant, establishment, construction site, or other area, workplace or environment where work is performed by an employee of an employer; and

(2) to inspect and investigate during regular working hours and at other reasonable times, and within reasonable limits and in a reasonable manner, any such place of employment and all pertinent conditions, structures, machines, apparatus, devices, equipment, and materials therein, and to question privately any such employer, owner, operator, agent or employee. 657(a).

Probable Cause Requirement

If the employer refuses to admit the inspectors, the inspector may seek a search warrant from the United States District Court. In order to obtain the warrant however, the Department of Labor must establish probable cause for seeking such a warrant. (Case: Marshall v. Barlow's Inc. 436 U.S. 307(1978).

Exceptions to Search Warrant Requirements

There are three exceptions to the search warrant requirements:

1. Emergencies—a lifesaving purpose is usually a prerequisite to any company search without a warrant.
2. Consent—this may be given by any authorized management official such as a plant manager, foreman, or other management official.
3. Open view—mere observance of what is open to public view does not constitute a search. If the premises are open to the public, then a search warrant is not required unless the business has a reasonable expectation of privacy.

Penalties

OSHA clearly evidences the intent of Congress to create a surprise inspection program. According to the Act, giving advance notice of an inspection is a violation punishable by a fine up to $1000, or imprisonment for not more than 6 months.

INSPECTION PROCEDURES

According to the OSHA compliance manual, the following procedures may be expected during an inspection:

1. An inspector arrives on the premises and presents his identification.

Opening Conference

2. He entertains an "opening conference" with the Conference employer's safety supervisor or other agent in charge. During the conference, the CO will indicate what records he wants to inspect, what the inspection tour will encompass, and will give the employer copies of applicable law, standards and regulations. At this time, the employer should state what trade secrets will be encountered and request confidentiality. It is advisable that all employer representatives be prepared at all times for a surprise inspection. The extent of the employer's consent in the absence of a warrant can be established by the employer representative's actions. If only limited consent to enter the workplace is granted, it must be clearly stated to the inspector.

Records Review

3. The inspector will request a look at the employer's records to ascertain that the recordkeeping requirements are being satisfied.

Employer Representation

4. The inspector will request that an employer representative (either a safety committee member or shop steward) be present. When the inspector commences his "walk-around" inspection, both the employer and employee representative are allowed to be present.

Inspector Procedures

5. The inspector can address employees in the plant, take photographs, and take measurements and samples. Inspections may last a part of a day or several days depending upon the type of facility.

Imminent Danger Discovered

6. If the inspector discovers an imminent danger situation, he will usually ask the employer's representative how it can be abated immediately. If the employer refuses to abate the danger, he is subject to an injunction by a federal district court.

Closing Conference

7. After the inspector has completed his tour, he will hold a closing conference with the employer at which time he would present a citation to the employer if warranted.

Inspection Priorities

Inspections are made according to the following priorities:

a. Existence of an imminent danger
b. Whenever there is a fatality, or five or more employees are hospitalized for more than 24 hours.
c. A fatality—catastrophe investigation
d. Investigation of complaints
e. Regional programmed inspections

Inspection Concerns

During the walk-around tour, typically an inspector will check or look for the following:

1. Slippery surfaces.
2. Properly marked exits.
3. Safe work platforms, proper railings or scaffolds, manlifts and similar devices.
4. Ventilation, occupational noise exposure, ionizing radiation, etc.
5. The storage of hazardous materials such as compressed gases, acetylene, hydrogen, oxygen, nitrous oxide, flammable and combustible liquids, spray finishing areas, drip tanks, explosives and blasting agents, and liquified petroleum gases and anhydrous ammonia.
6. The use of personal protective equipment, including equipment for the eyes,

face, head and extremities, protective clothing, respiratory devices, safety belts, protective glasses and approved foot protection.

7. Sanitation in lavatories, work areas and cafeterias.
8. Safety color coding for marking physical hazards.
9. Medical services and first aid.
10. Fire protection devices.

List of Safe Exposure Levels

Currently, the focus of OSHA's concern is on the elimination of atmospheric hazards. A list of safe exposure levels to various hazards may be obtained from NIOSH.

CITATIONS

Section 658(a) of the Act provides that a citation must "describe with particularity the nature of the violation, including reference to the provision of the Act, standard, risk, regulation, or order alleged to have been violated. In addition, the citation shall fix a reasonable time for the abatement of the violation." There are 2 critical elements in the citation: a description of the alleged violation and a reference to the standard purportedly violated.

Content of a Citation

A citation will:

1. Set a date by which the employer must do feasibility studies or design and implement the modification of the plant or certain equipment.
2. Impose a monetary penalty if appropriate
3. Require prominent posting of the citation at or near each place a violation referred to in the citation occurred 658(b)
4. If the employer is contesting the citation, he may post a notice in the same location where such citation is posted indicating it is being contested and why.
5. The employer is usually notified by certified mail of any citations and notice proposed penalty. 659(a)
6. The citation and notice of penalty need not necessarily be sent to a management official with authority to spend corporate funds to either pay the penalty, abate the alleged violation or contest the enforcement proceedings. According to the Commission, service of the citation and notice is properly served on the employer if it "is reasonably calculated to provide an employer with knowledge of the citation and notification of proposed penalty and an opportunity to determine whether to contest or abate." It appears then that service is proper even if sent to an employee if he should know to whom in the corporation to forward the documents.

Contesting a Citation

Once a citation has been received, the employer has 15 working days, excluding Saturdays, Sundays, and federal holidays in which to file a Notice to Contest with the OSHA area director who issues the citation. (659(c))

If the employer does not contest a citation within the 15 day period, then it becomes final (659(a)). The postmark on the employer's notice of contest is the critical date for timeliness. The notice of contest must be in writing although there is no particular format. It should state each item being contested and whether or not the contest is limited to a particular citation, a penalty, a statement period or all three; it should be signed and dated. Grounds on which the abatement is based need not be indicated.

The employer must also send the notice to authorized employee representatives such as labor unions and post notice for unrepresented employees at the same place the citation is posted. A timely notice of contest which is filed in good faith will tell the citation's statement requirement pending a final decision by the Commission. Once the Notice of Contest has been filed, the Secretary of Labor issues a complaint and this complaint, as in a court case or other administrative proceeding, starts the cause of action, in this case, before the OSHRC. The employer responds to the complaint with an answer within 15 days after service of the complaint and there is a hearing before an administrative law judge who issues a decision.

Appeal Process

The decision may be appealed to OSHRC if any member decides to hear the case. If however OSHRC does not take the case, the decision becomes final. A final decision may be appealed to a United States Circuit Court of Appeals (660).

PENALTIES

OSHA has the right under the Act to assess a range of penalties for employer violations:

De minimis notice	$0
Non-serious	$0-1,000
Serious	$1-1,000
Repeated	$0-10,000
Willful	$0-10,000
Failure to abate notice	$0-1,000 per day

Gravity of the Violation

Penalties for serious and non-serious violations are based on the gravity of the violation. The commission has devised a means for determining the gravity of a violation based on a number of factors:

1. The number of employees exposed to the hazard. The higher the number, the more serious the violation.
2. Duration of exposure. Again, the longer the period of exposure, the higher the penalty.
3. Whether the employer has taken precautions against injury. Evidence of precautions taken will lower the gravity of the penalty.
4. The degree of probability that an accident would occur. One indication of the likelihood of injury is the employee's accident record.

Determining the Appropriate Penalty

Other assessment factors the Committee uses in determining the appropriate penalty are size of the employer's business, evidences of the employer's good faith, evidence of overall safety programs, attempts at compliance both before, during and after an OSHA inspection, cooperation with the inspection officer, prompt abatement of any violations, and past history of compliance with OSHA.

Violations Explained

1. Serious violations. Generally this is defined as a violation in which there is a probability of death or serious physical harm to an employee from a hazard. The hazard must be one which is recognized by the employer although he need not have actual knowledge of it. 666(b).
2. Non-serious violations. Typically these refer to violations of specific standards. Although the fine can be as high as $1,000, as a matter of policy penalties for other than serious violations to not usually exceed $300. 666(c).

3. Willful violation. If a willful violation causes death, the penalty can be six months in prison; if the employer is convicted twice, the penalty can be one year in prison and up to a $20,000 fine. A critical aspect of this violation is intentional flouting of OSHA. 666(e).

VARIANCES

An employer may request either a permanent or a temporary variance under the Act.

Temporary Variances

A temporary variance may be requested when an employer is unable to meet the requirements of a standard within the time specified for compliance. Inability to comply may be due for example to any one of the following: 1) unavailability for professional or technical personnel; 2) unavailability of necessary materials or equipment; 3) inability to complete the necessary construction or alteration of facilities in the time provided. 655-(b)(6)(A) To obtain a temporary variance an employer must also establish that he is taking all available steps to protect his employees against the hazard covered by the standard and that his program will achieve compliance with the standard as soon as possible. A temporary variance will remain in effect only for the time needed to achieve compliance, although this period may not extend for more than the year. The employer, however, has the opportunity to renew the variance twice, but only for a maximum period of 180 days each. Employers must notify employees of the request for a variance.

Permanent Variances

An employer may request a permanent variance if he can prove that the conditions, practices, means, methods, operations or processes used or proposed to be used by an employer would provide employment and places of employment to his employees which are as safe and healthful as those which would prevail if he complied with the standard 655(d). The Act further states that permanent variances may only be granted to an employer after a hearing, notice to employees, establishment of proof that the employer's methods are as safe as those afforded by the appropriate standard, and finally that employees safety and health will not be impaired by a violation of the standard. The commission, the employer or the employees can notify or revoke the order granting the permanent variance after six months from the date of issuance.

SPECIAL CONSIDERATIONS

Multi-employer worksites. There are two types of multi-employer situations which present problems to employers in terms of compliance with OSHA. The first of these defines the joint-employer situation where one or more employees have employment relationships at the same time with more than one employer. In these cases, neither employer is necessarily protected from liability. Two or more employers may be cited for the same violation. If, however, one employer can prove that he took adequate precautions such as safety training and instruction of employees he can avoid liability under the Act.

The other type of multi-employer situation involves a prime contractor and sub-contractor. In analyzing, whether a prime contractor should be held responsible for violation by its sub-contractor, the Commission has set forth the following guidelines: 1) What was the degree of supervisory capacity; 2) What was the nature of the violation; 3) What was the nature and extent of precautionary measures taken. It is suggested that "the general contractor's duty with respect to safety standard violations by its sub-contractors is not necessarily full compliance, but depends on what measures are commensurate with its degree of supervisory capacity." Marshall v. Knutson Construction Co., 556 F. 2d 596, 601 (8th Cir. 1977).

Trade Secrets

An employer may not prevent an OSHA inspection to protect trade secrets, but the employer should identify them to the inspector who is then on notice as to their confidentiality. It is also advisable to follow up with a letter to the line district office identifying the trade secrets and request their confidentiality (664).

SAFETY PROGRAMS

Ask students to suggest elements necessary for a good safety program. Suggested elements are set forth below.

Instructor Note:

It is important for future business managers to think in terms of implementing safety programs which will meet the concerns of OSHA. In that regard, students should be asked to devise a safety program for a hypothetical plant.

RECOMMENDED SAFETY MEASURES

Employers must inform supervisory personnel of their responsibilities regarding safety. It is critical that supervisors bear the burden as they are on the scene and observe dangers and thus are the appropriate personnel to implement safety programs and train employees in safety awareness and the use of protective gear. Consideration should be given to requesting that the seller warrants that the equipment purchased meets all current OSHA standards and is so labeled.

In designing a safety program, students should consider inclusion of the following:

1. Creation of a safety committee consisting of supervisors, employee representatives, union representatives. The committee would oversee safety at the plant, receive complaints or concerns from employees and would report directly to management.
2. Implement a suggestion box for employees to submit safety-enhancement ideas.
3. Develop a safety manual.
4. Implement safety training sessions with employees who are motivators.
5. Implement a safety award program with gifts, money, free dinners, etc. as rewards.
6. Conduct walk-around safety inspections on a regular basis. The walk-around should include inspection of safety equipment, safety showers, labeling chemicals, and adherence by employees to safety requirements and practices.
7. The employer should implement a program of progressive discipline for safety violations.
8. Safety requirements should be included in contracts with outside contractors.
9. OSHA inspectors should be informed of the safety program when they arrive to inspect.
10. All employees should be made aware of the concern for safety by colorful posters, handouts etc.

RESOURCES

Future management should also be made aware of sources to which they can turn for advice in connection with OSHA compliance. Below is a suggested list for students.

1. An employer's insurance carrier
2. NIOSH, 4676 Columbia Parkway, Cincinnati, Ohio 45226
3. Local OSHA Area Directors' Offices
4. The Department of Labor
5. Commerce Clearinghouse and Bureau of National Affairs
6. Industry trade associations
7. National Safety Council

CASE STUDY

Dynamic Duo, Inc. opened up its manufacturing plant several months ago. Dynamic Duo, Inc. is owned and operated by two enterprising business students from Poedunk University in Poedunk, U.S.A. They employ 50 employees most of whom work on the floor of the plant handling the heavy equipment needed to manufacture widgets. There is one supervisor in charge. Dynamic Duo, Inc. is concerned about safety, but the owners know nothing about OSHA. They hire you as a consultant to implement compliance with OSHA.

QUESTION: As their consultant, how would you approach the problem and what kind of advice and help would you give?

Before the consultant has had a chance to advise Dynamic Duo, they are visited by a compliance officer who simply knocks, enters and starts conducting her own tour of the plant. At the end of the tour on which neither management nor employees were present, the CO presents Dynamic Duo, with a citation and penalty. Dynamic Duo calls you as their legal consultant and asks you what they should do next.

QUESTION: What questions would you ask Dynamic Duo's Management? What legal steps would you recommend that Dynamic Duo take?

Unfortunately for Dynamic Duo., Inc. five employees are injured all on one day. One is seriously injured, having caught his hand in a conveyor. Another has mysteriously become ill and three others have suffered minor cuts. They call you in again as a consultant and ask you whether they need to inform anybody of the accidents or to record them somehow.

QUESTION: What advice would you give them concerning their obligation under OSHA to record accidents?

***(Instructor:** This short fact situation ties together many of the principles set forth in this chapter. It is recommended that students be asked to answer the questions in essay form using their class notes (based on the lecture) as a guide.*

SAMPLE TEST QUESTIONS

1. Name some of the benefits to management of OSHA compliance.
2. Name the four categories of employers covered under OSHA standards.
3. What are an employer's two duties under OSHA?
4. Explain the procedure for recordkeeping under the Act.

ANSWERS TO QUESTIONS

1. Some of the benefits are: 1) dollar savings evidenced by reduced worker compensation claims and reduced workdays lost; 2) improved labor-management relations by improving employee morale and reducing labor turnover.

2. 1. General industry
   2. Construction
   3. Maritime and longshoring
   4. Agriculture

3. The employer's two duties are: 1) to comply with the general duty clause which requires the employer to furnish to his employees employment and a place of employment which are free from recognized hazards which are causing or likely to cause death or serious physical harm to his employees, and 2) to comply with all applicable safety and health standards created by OSHA.

4. There are 3 steps in the recordkeeping process: log, supplementary record, and summary. The log records all injuries and illnesses of employees. The supplementary record records the employee's name, address, occupation and vital statistics; when and how the accident occurred; extent of the injury or illness; fatality, and name and address of physicians or hospital. The summary is prepared annually by the employer and records all injuries and illnesses for that year.

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HOW OSHA FUNCTIONS

INSPECTION BY CO

CONFERRAL BETWEEN CO AND OSHA DIRECTOR

ISSUANCE OF CITATION, PENALTY OR FINE, IF ANY

EMPLOYER MAY FILE NOTICE OF CONTEST

PROTEST HEARD BY ADMINISTRATIVE LAW JUDGE (ALJ)

ALJ DECISION REVIEWED BY OSHRC

OSHRC ORDER MAY BE APPEALED BY EMPLOYER TO COURT OF APPEALS

UNIT II

THE IMPACT OF HAZARD CONTROL ON PRODUCTION AND PROFITABILITY

Robert J. Firenze
Indiana Labor and Management Council, Inc.

METHODS: Lecture and demonstration LENGTH: 60 Minutes

PURPOSE: To demonstrate the immediate and the unseen costs incurred as the result of accidents, and to show how a hazard control program will help reduce costs and increase profitability.

OBJECTIVES: To introduce the student to:
1. Types of accident costs
2. The effects of hazards on the production process
3. Cost accounting techniques
4. The role of management in hazard control
5. The accident sequence

SPECIAL TERMS:
1. Variable Costs
2. Fixed Costs
3. First Iceberg Effect
4. Second Iceberg Effect
5. Worker's Compensation
6. Loss Incident
7. Actual Loss

INSTRUCTOR MATERIALS:
1. Lesson plan
2. Chalkboard or flip chart

TRAINEE MATERIALS: Participant outlines made by instructor from lesson plan.

UNIT II

THE IMPACT OF HAZARD CONTROL ON PRODUCTION AND PROFITABILITY

INTRODUCTION

Any accident will produce consequences. Industrial accidents yearly take over 13,000 lives, cause 2.4 million disabling injuries and another 8 million lesser injuries, and cost more than $27 billion.[1]

Human costs

According to National Safety Council estimates, 315 million days are lost in a given year due to injuries and deaths, both on and off the job. This loss of productivity is equivalent to losing the productivity of 1.25 million workers for an entire year. Stated another way, it is equivalent to shutting down all schools, colleges and universities for a calendar year, closing all hospitals for six months, or shutting down the executive branch of the federal government for half a year. These figures do not include future time lost—estimated at 120 million days or almost forty percent of the original loss—because of accidents occurring in that given year. Nor do they include productivity lost because of occupational illnesses.

ACCIDENT COSTS—THEIR EFFECT ON PROFITS

The manager's basic objective is to bring together production, labor and capital to produce a product or service. The ultimate goal is making as much profit as possible. At the same time, losses must be kept to a minimum so that the business can run smoothly. When costs are determined, both variable and fixed costs must be established.

Variable costs

Variable costs include raw material, labor, packing material, power and water. These costs vary in proportion to the number of units produced. For example, 100 units of a product costing $100 per unit will cost $10,000 in all to produce.

Fixed costs

Fixed costs do not vary; the same cost will be incurred regardless of the amount produced. These costs consist of management salaries, rates, taxes and depreciation. They are a function of time, rather than of productivity. In this type of cost, the cost of the product will reduce per unit as the amount produced increases.

Effects of accidents on fixed costs

With fixed costs, assuming all goes well, the organization can establish a rate of productivity whereby it can achieve the greatest amount of profit possible. However, when an accident occurs, that balance is thrown askew. The machinery and the product may be damaged. Perhaps an injury occurs as well; that will automatically cut productivity. Not only does the organization's output decrease, but overtime hours may have to be worked as well to meet production deadlines, or maintain the minimum weekly output.

THE FIRST ICEBERG EFFECT

H. J. Matthysen, General Manager of the National Occupational Safety Association of South Africa, has developed a theory he calls the first and second iceberg effects.[2]

Two types of costs

The two types of costs arising after an accident included in the first iceberg effect are the insured costs, and the uninsured or (hidden costs).

Insured costs

Insured costs include transport to the hospital, medical attention, hospitalization, rehabilitation and compensation. These are generally included in the organization's accident fund. Other insured costs sometimes covered by commercial insurers include property damage, fire losses, loss of profits and extra compensation (stated benefits).

Uninsured costs

Uninsured costs include a host of expenses.

Make-up salary

Accident funds generally pay only a fraction of the injured worker's salary. The amount paid monthly for temporary, total disablement is also limited. Usually, the employer makes up the salary of the injured worker. The employer is, in effect, paying wages for work not received and on the assumption that the work the employee would have produced would have been equivalent to the loss in wages.

Onlookers

"Onlookers" costs include the wages of workers who crowd around after an accident occurs.

Equipment damage repairs

Equipment damage and repair costs include the cost of repairing or replacing the equipment that was damaged, cleaning up the area in which the accident occurred, and re-setting and re-starting the equipment.

Decreased output

Once an employee has been injured in an accident, his productivity may be impaired, either temporarily or permanently, depending on the nature of the injury.

Training

Even if the worker is replaced, it will cost money to train a new worker hired to replace the injured one.

Overtime

Overtime costs are just what they sound like. As we said earlier, the organization's workers will probably have to put in overtime hours in order to meet deadlines or to maintain the organization's minimum output for profit.

First aid

Obviously, a worker injured in an accident will require medical attention. This medical attention may be in the form of first aid performed by a health staff permanently hired by the organization. Maintaining the staff will cost money.

Investigations

Costs incurred while carrying out investigations and filling out reports may be quite high. It's not always easy to assess precisely how much the investigative work will cost; however, it is a necessary expenditure. It should be noted that, in all likelihood, the organization's regular tasks may be neglected while the investigation is underway.

Hidden costs

"Like all icebergs," Matthysen warns, "the mass below the surface is the most dangerous, especially when we consider what these hidden costs could add up to."[3] According to some estimates, the ratio of insured costs to hidden costs is something like one-to-four. Others make no specific figures available, their proponents claiming that a definite ratio cannot be determined. It is possible that each organization calculates the total cost of accidents in a slightly different way.

Direct/indirect cost ratio

A recent example of accident costs calculated on a sampling basis cited by Matthysen indicated that the ratio of insured to hidden costs was one-to-ten. It is true that, from all outward appearances, an organization may show no decrease in productivity after an accident occurs. Nevertheless, in order to maintain that level of productivity, costs will have to go up in proportion to the severity of the accident.

THE SECOND ICEBERG EFFECT

The second iceberg effect means simply that numerous accidents may occur that are never reported. These include accidents that do not result in injury, or accidents that result in only minor injury. But the fact that an accident does not produce any injury, or any serious injury, does not mean that it does not slow production. Therefore, vast amounts of money may be lost in these unreported accidents. Matthysen estimates that perhaps only 16% of all accidents result in injury. This estimate allows for a greater number of accidents to go unreported—and the costs of these accidents can add up to a lot, even if the costs of the individual accidents seem negligible.

DIRECT AND INDIRECT COSTS

Among the direct costs of accidents are lost wages, workers' compensation costs, medical expenses, fire damage, health insurance administration expenses and increased premiums. Others costs are less obvious: cost of repairing the facility, replacement costs of equipment and material damaged rental equipment, and fees for legal counsel. Indirect costs are the value of time lost by workers other than the person injured. These expenses include time spent in giving first aid to injured workers, time lost due to production slowdowns (including possible overtime necessitated by the interrupted work process), and payment for contracted services with no work in return. More difficult to assess are the costs of lowered morale among workers and the loss of client confidence.

Heinrich's incidental costs

Herbert W. Heinrich (1881-1962), a pioneer in industrial safety, introduced the concept of "incidental costs" in a paper presented to the New York Safety Congress in 1925. He pointed out that, while the insurance company pays compensation awards and liability claims, these are only the first visible monetary losses. The contractor himself "must assume an incidental accident cost which, while not susceptible to accurate measurement, is nevertheless substantial in amount and in fact frequently exceeds the direct cost of the accident cost." What did Heinrich include in the category of "incidental cost"?

> I refer to the lost time of the injured man; to the time lost by other employees who crowd around in sympathy; to breakage and other property damage; to time lost in obtaining and perhaps "breaking in" a new man; to the cost due to the demoralization of fellow employees; and to that cost which is frequently incurred because the delay resulting from accidents prevents the contractor from fulfilling conditions that would entitle him to a bonus or reward for prompt execution of the work, or because accidents resulting in delays make it necessary for him to pay a forfeit.[4]

Heinrich estimated that "the average incidental accident-cost paid for by the contractor himself was more than four times the loss covered by insurance." This so called four-to-one accident cost ratio was a major reason for acceptance of accident prevention by management.

Assessing human costs

It is surely obvious that placing a monetary value on human losses is a Herculean task, to say the least. How does one go about putting a price tag on suffering and pain? Historically, it can be seen that the number of accidents has declined while the cost of accidents has risen, and continues to rise. This increase in cost is partly a result of inflation and partly a result of looser application of workers' compensation laws.

WORKERS' COMPENSATION

Closely related to accident costs are workers' compensation and product liability. Workers' compensation is provided in the statutes of all fifty states. Workers' compensation is a sort of "no-fault insurance" for workers. Legislation regarding compensation is based on the premise that one of the costs of conducting a business is providing medical care and specified compensation for persons who are injured or become ill as the result of their work in that business. Compensation serves not so much as a penalty against the employer for wrongdoing as an obligation inherent in the social contract. The compensation statutes are particularly valuable to discussion on safety in that they focus on locating and correcting causes of accidents, rather than on fixing blame. Insurance companies, rather than the employers, actually pay the benefits; however, the incident goes on the employer's record, and this often provides the motivation for escalated attempts to prevent such problems in the future. The premiums these employers pay for their insurance are influenced by claim costs; further, various incentive-rating plans offer economic advantages to employers to improve their accident records.

Pitfalls

There are certain problems with workers' compensation. For one, benefits and eligibility vary from state to state. For another, certain types of workers are automatically excluded from coverage. Such workers include farmers, workers in very small establishments, and domestic and casual workers. Then, too, procedures for proving that an injury or illness has been related to work can be cumbersome and can pit the worker and the employer against each other. This is particularly true in cases of illness, whose original causes can be very difficult to prove.

THE PRODUCTION PROCESS

The production process brings workers, equipment and materials into interaction with each other to accomplish a given task. Time is an important element in the production process. Any accident interrupts the production process to some degree, even if the accident does not result in injury, property damage or wasted material.

An interruption, in turn, increases the time needed to complete the task. It may also reduce the efficiency and effectiveness of the overall operation and increase production costs. Sometimes, a succession of interruptions, or one long one, will also prevent the production schedule from being met. This can lead to failure to attract new business in the future. Lost time is particularly relevant because it equates with reduced efficiency and, therefore, reduced profits.

PRODUCTION ACCOMPLISHMENT AND CONTROL

Control, by definition, keeps the system on course and prevents unwanted changes from occurring. However, it also implies allowing for variations within the system, providing they remain within controlled limits. Any production system has built-in limits, both upper and lower, of control. These limits provide the direction and also the acceptable leeway for the system's operation. Adequate control of the system includes quality control, personnel, purchasing and other factors. Each of these factors interacts with the other factors to produce the desired effect.

The success/ failure model

The production process also implies absolutes of success and failure. Figure II-1 illustrates the continuum model of success and failure, with total failure and total success at either end of the model.

Total failure

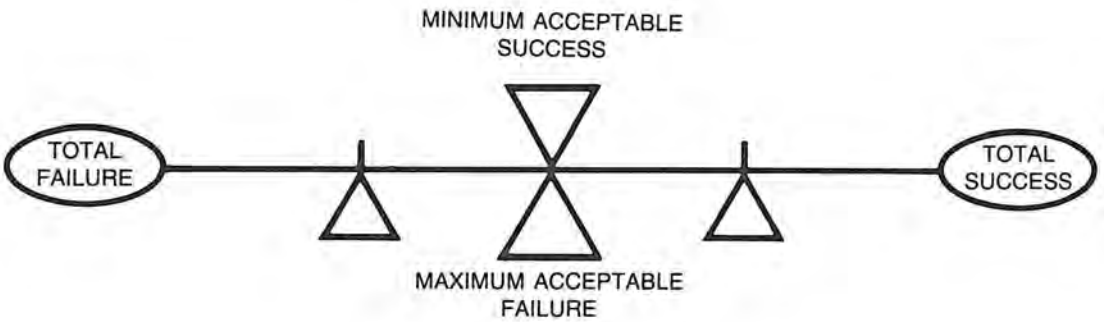
Total failure is characterized by numerous mistakes being made during the production process, many of which account for long interruptions, equipment and building damage, personal injury and inadequate quality control. The final product is delivered late or of poor quality—perhaps both. Costs are incurred for repair, replacement and workers' compensation.

Total success

At the other end of the model, total success is achieved when the task is completed without failures or breakdowns of any sort, when the work force has produced at maximum capacity, when maintenance work required has been minimal, and when the company makes a profit from the finished product.

Middle ground

Neither total failure or total success is a norm. Most often, a production process will fall somewhere in between these two extremes. Therefore, the model also provides for a break-even point, at which a minimum acceptable success (or maximum acceptable failure) occurs.. The breaking-even point allows for a certain number of failures, as well as for a certain amount of productivity.



"In a dynamic system, success is assured if failure is prevented": Failure—Inability of a system or portion of a system to perform as specified under specified conditions for the specific time, number of cycles or trials, when installed, operated, maintained and logistically supported as specified. Mode of Failure—Manner in which a system or portion of a system can exhibit failure. Mechanism of Failure—The sequence of cause-effect events leading from the primary cause of failure to the mode of failure. Minimum Acceptable Success—The point where, although the job doesn't come off totally successful, processes are accomplished with a tolerable number of losses and interruptions, thus keeping the efficiency and effectiveness of the company's operations within acceptable limits of control.

Figure II-1 The continuum model. From Robert J. Firenze, "The Logic of Hazard Control Management," from *National Safety News,* September 1971. Reprinted with permission.

Determining accident factors

In order to set realistic goals for the production process, the company should first determine the major accident causative factors likely to cause the major failure situations. It should be determined where these factors are, how important they are, and what are their potential effects. Control measures can then be instituted. This will help to reduce the risk of serious failure situations. The method used to identify major hazards may be either an informal inspection or detailed, recorded analysis. Control measures may take the form of some type of process innovation, change in personnel, machine guarding or personal protective equipment. In addition to the control measures, monitoring systems should be used for assessing continuously the effectiveness of these controls in reducing the hazard.

Minimum acceptable success

The concept of minimum acceptable success will serve as a guideline in the hazard control program in that it will establish a minimum level at which the organization must operate all the time. Further, it will facilitate the accomplishment of greater success by prohibiting the organization's standards from falling beneath that level.

THE PRODUCTION PROCESS AND HAZARD CONTROL

In Figures II-2 and II-3, this interaction among workplace elements is further demonstrated. Again, the element of time is not shown on the models, but without it, the process cannot take place. When an incident occurs that extends the time allotted for completion of the task, the organization itself absorbs the cost. Conversely, it sometimes happens that when the system is accelerated and work hours are increased to compensate for some loss, the problems management has hoped to alleviate are exacerbated instead. Whether or not an accident culminates in injury, property damage, wasted material, or other undesirable events, it is nevertheless disruptive. Disruption means that the production process suffers. Control, then, is the necessary ingredient in a production process to achieve maximum operational efficiency and effectiveness.

THE EFFECTS OF HAZARDS ON THE PRODUCTION MISSION

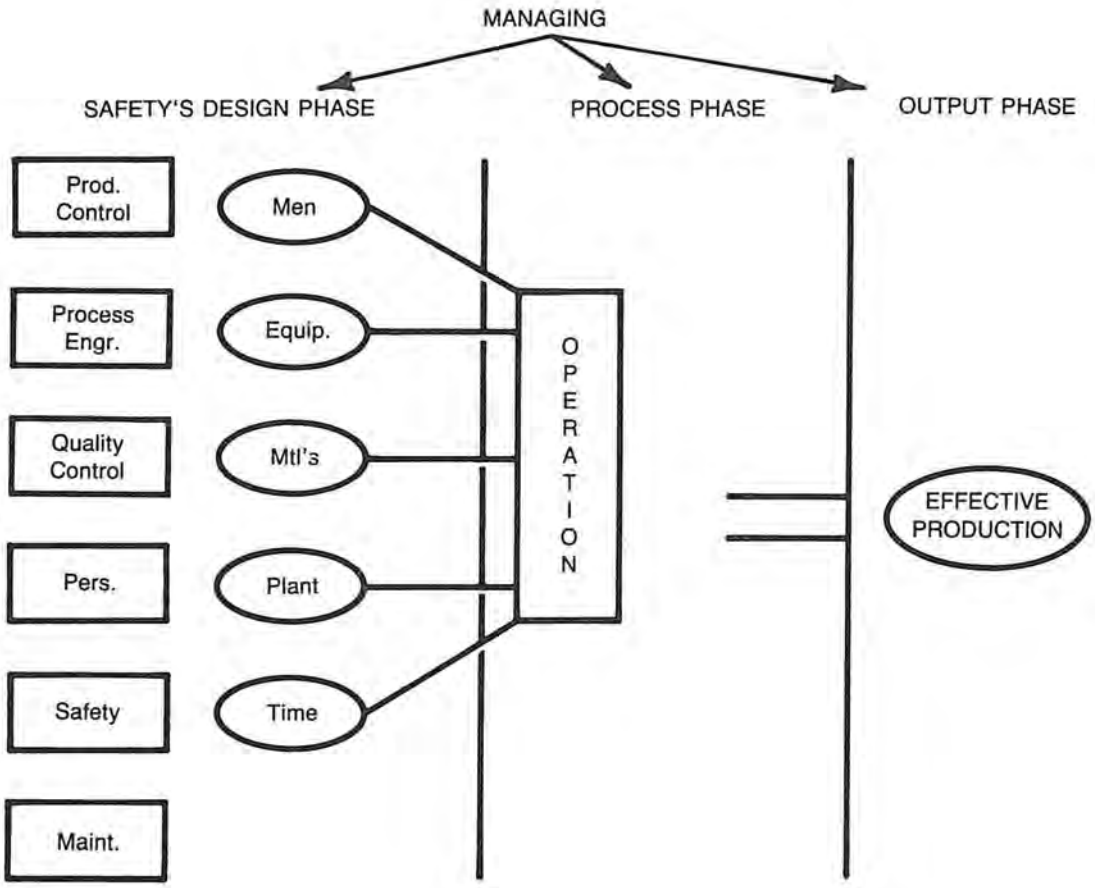
Standards of acceptability and unacceptability are built into each production system. These standards, as we noted earlier, provide both direction and leeway for the system's production process.

Standards—Example

The following example will illustrate the impact these controls may have on the production process. An ordinance manufacturing company is under contract to produce ten thousand 500-pound bombs for a Department of Defense agency. If the company is able to perform the task without interruption, if equipment does not break down, if materials used and product produced meet standards, if the physical plant is not damaged, and if the production experiences minimum time loss, the production goal will be met and the operation will be under control.

Example

On the other hand, if a worker is injured in an accident, time may be lost, production may slow, the cost of the operation may increase and the efficiency of the operation will be reduced. Suppose, further, that a problem occurs in one of the explosives-mixing kettles, resulting in a massive detonation. In this instance, the losses can be expected to be much greater, possibly including any combination of the following: severe injury or death, loss of equipment entirely, and damage to the plant. It is likely that the product will not be finished on time, as well.



The production process under control: [1] The output of the system is evaluated from two "standpoints": success or failure. [2] Success is guaranteed if failure is prevented. [3] Failure must be defined in advance [Undesired Events].

Figure II-2. Interaction of workplace elements when production is under control, From Robert J. Firenze, "The Logic of Hazard Control Management," *National Safety News,* September 1971. Reprinted with permission.

Error-free performance an ideal

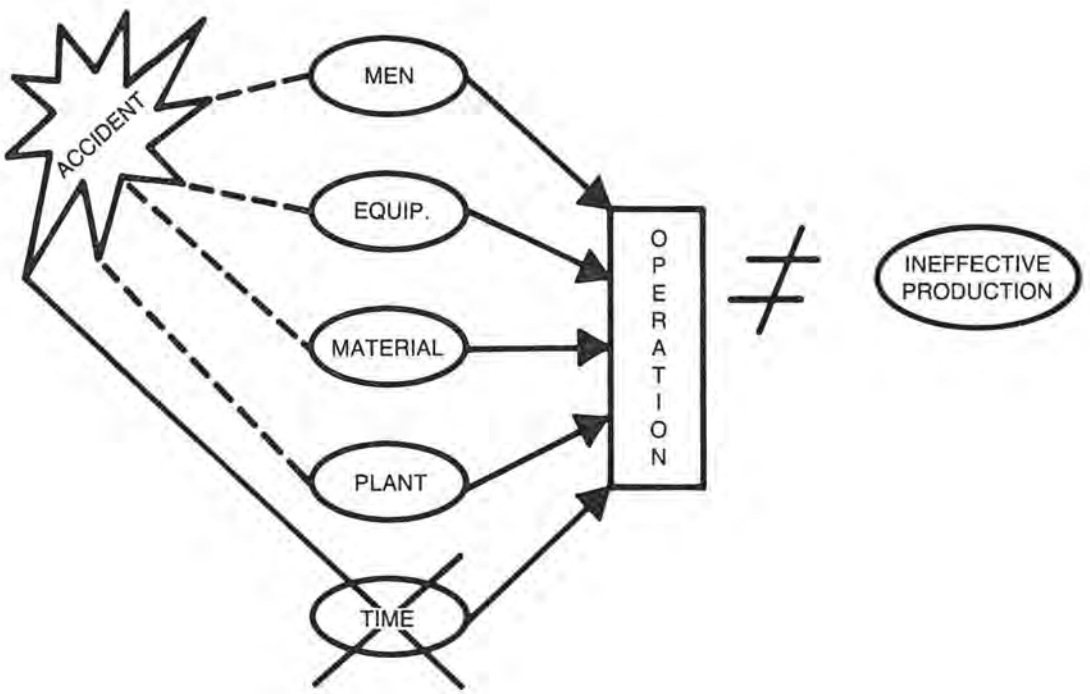
Error-free performance is, of course, an ideal; it is therefore rarely achieved. The purpose of hazard control is to pinpoint hazards before they can interrupt the production process and create serious setbacks in the organization's productivity.

COST ACCOUNTING OF ACCIDENTS

The following list outlines factors that should be included in a cost accounting of an accident. Routine cost accounting practices of the organization should be controlling factors. Basic information used in the procedure should include employee and supervisors wage and benefit rates, overhead rates, machine rates and material costs.

Lost time expense

The first step in cost accounting is documenting the time lost in the accident. Regular working hours should be clearly delineated from overtime hours. After



"Accidents" interrupt production: delay decreases effectiveness and control.

Figure II-3. Interaction among workplace elements when an accident occurs. From Robert J. Firenze, "The Logic of Hazard Control Management," *National Safety News,* September 1971. Reprinted with permission.

Documenting lost time

the time is thus divided, the sum should be multiplied by the sum of the wages and benefits for each category; then, the overhead rate is applied to the appropriate base. The time taken up in cleaning and investigating the accident should also be included, since a considerable amount of time may be taken up in investigation and reporting.

Extended benefit expenses

If the company must pay benefits to a worker injured during an accident at work, these benefits should be counted. Such benefits include health and life insurance. If the benefits are not paid, the loss is charged against the employee's losses.

Cost of machine downtime

Some machinery may be very expensive, either due to the rate required for the machine to pay for itself, or the cost for leasing it. It may be, too, that one machine's downtime will affect numerous other machines in the area. When costs such as this are estimated, a differentiation must be made between the downtime that results directly from the accident, and time that may be added on for additional work on the down machine. For example, time lost while waiting for replacement parts to a damaged machine would be included.

Cost of machine repairs

Cost of machine repairs is precisely what it sounds like. Any extra expenses incurred here, aside from straightforward machine repairs (such as extra expenses for parts of equipment not included in the accident) should not be counted. When this is estimated, allowance should be made for salvage value; however, re-work expense should not be dismissed. Any indirect materials rated against direct materials should also be included.

Clean-up expense

Any expenses not accounted for in the lost-time expenses will be included in clean-up expenses. Included would be such items as extra materials, equipment, labor and possible outside services.

Cost of reduced efficiency

Even after the immediate damage caused by the accident has been taken care of, some residual problems may remain that decrease the organization's productivity. These problems may last for several hours or even several days. The percentage of reduced efficiency may be calculated by either subjective or objective means. If cost accounting is a firmly established practice at the organization, costs will be relatively easy to calculate. Rates of production after the accident can simply be compared to rates of production under normal circumstances. If, on the other hand, cost accounting is a new practice within the organization, percentages will have to be estimated. It's important to note here that, if only one department within the organization is involved in the accident, it is still important to consider the effect of that department on other departments.

Extra labor expense

If extra wages are involved in replacing an injured employee, these wages should be considered in the calculations. The costs in this category will include overtime hours to compensate for the injured employee, as well as selection and training costs if a new employee is hired. Penalties for the accident may be assessed against the organization by federal or state agencies. These will account for a portion of the costs in this category. In addition to these are included delays and contractual penalties.

Legal expense

Legal expense is another self-explanatory category. The organization may be held liable for an accident in a lawsuit; if so, the costs of obtaining legal assistance can be considerable.

Insured expense

Assessing this type of expense provides a means for assigning a representative portion of the insurance premium to the accident. Premium rates for workers' compensation are highly responsive to accident losses. The following methods may be chosen.

One method involves assigning the full cost of all accidents resulting in losses of less that $2,000. Accidents resulting in losses of over $2,000 can be discounted using the National Worker's Compensation Board's Actual Primary Loss Conversion Table. The purpose of this formula is to impose penalties on frequently occurring accidents by providing discounts on more serious accidents. Another method charges the insured worker's compensation losses at full face value. A third method increases the losses by a loss conversion factor. If the organization is self-insured, or if it is on a loss-responsive retrospective rating plan, it may be beneficial to increase the losses by a factor that will represent the actual loss to the organization. Loss conversion factors typically range from 1.1 to 1.40.

PRODUCT LIABILITY

Product liability is another issue connected to accident costs. The Federal Interagency Task Force on Product Liability estimates that over 500,000 product

liability suits are filed every year. An increase in the number of suits filed has increased the cost of insurance premiums paid from approximately $25 million annually in 1950 to approximately $125 million annually in the early 1970s. The number of suits filed is not the only thing that has risen dramatically, either. The amount given in awards has also risen considerably. Approximately three-quarters of all bodily injury cases are paid out of court with no lawsuit; such payments averaged about $1,300 in 1977. Of the remaining cases, three-quarters involve filing suit but settling it out of court. These payments averaged $40,000 in 1977. A small number of cases (3.5 percent) received court awards, averaging $116,000 in 1977.

Three types

In addition to workers' compensation, an injured worker can also sue the manufacturer of the product that caused the injury. Product liability laws in the various states have been known to hold the manufacturer responsible for three general types of defects:

1. Defects in construction
2. Defective design
3. Inadequate warning of an inherent danger, or inadequate instructions on the proper use of the product.

Damages as well as injuries

Traditionally, work-connected liability cases have involved accidents. It's only recently that occupational disease claims have begun to surface. To decide such cases, courts have concentrated on the adequacy of warnings or instructions concerning dangers and proper use of the product. In determining adequacy, courts have considered several factors:

1. Awareness by the producer of the harmful effects of the product at the time of manufacturing
2. Severity of adverse health effects
3. Assumption by the user of the risk involved in using the product
4. Technological feasibility of providing adequate instructions and warnings.

THE SAFETY PROFESSIONAL'S CIVIL LIABILITY

An additional consideration in pricing the exorbitant costs accidents may incur is the civil liability of the safety professional. In a number of cases, a safety director has been held personally liable in suits filed after an employee under his supervision has been injured or killed. However, it should be noted that safety personnel are not generally held responsible if they have made recommendations that have not been heeded.

THE LOSS INCIDENT AS THE BASE FOR ACTION

The base for the measurement system is the accident, because it represents an undeniable manifestation of underlying problems. Of course, there are various types of accidents. Some of them result in injury to people. Others cause losses of property by fire, explosion or mechanical breakdown. Perhaps the most costly is the type that removes the product from its position in the marketplace, perhaps for a long time after production resumes. The most frequent type of accident, albeit less dramatic, is the one in which no significant injury, property damage or business interruption occurs. Because so many of these types of accidents occur, they are excellent topics for study. But it can be difficult to obtain reports on these accidents.

Classification by severity

Losses are classified according to their severity. Minor losses have arbitrarily been assigned a value of $500 in minor injury and damage expenses between $500 and

$25,000. Major losses exceed $25,000 in expenses. It may bother some people to see human loss reduced to dollars and cents; the purpose is not to assign humanity a monetary value, but to set standards by which losses can be studied.

No-loss classification

Two other classifications could be included as well. The no-loss accident would include all near-misses. For the purpose of measurement, these no-loss incidents may be assigned into any of the above categories according to their potential loss.

Disastrous classification

At the other extreme, disastrous accidents involve a loss of more than one life and/or more than $1 million in damage. These are so infrequent that they may be statistically insignificant. Therefore, they may also be included in the major classification without affecting the results.

The results of the accident—that is, whether they are in the form of injury, damage or business interruption—and the severity of these results have little to do with the casual factors. However, the information gleaned from the study pertaining to causal factors will be essential in establishing prevention procedures.

Purpose of studying severity

Yet, aside from the issue of causal factors, it is vital to study type and severity of accident results. First, they will help to appraise the potential of the accident. Simple analysis will help to form predictions about what would happen if the existing protective devices had worked better, or worse, than they did. The appropriate corrective action will be self-evident. Second, type and severity classifications are important because they can reveal information about the probabilities of each classification occurring. When a certain number of a certain type of accidents occurs, for example, some of these will be minor, some serious and some major.

THE ROLE OF MANAGEMENT SYSTEMS IN HAZARDS CONTROL

The responsibility for controlling hazards cannot be placed solely upon one individual or even one department within an organization. Organizations whose safety programs have proved unsatisfactory have often been found to have one trait in common: The program is based on the notion that the safety director and his staff can carry out all the objectives of the program independently of the cooperation of the organization as a whole. This means that line organizations are freed from the responsibility of accounting for losses occurring under their supervision. Obviously, this leaves the safety staff vulnerable to at least two kinds of undesirable situations. In one, the staff may become the scapegoat when a loss does occur. In another, it may be called on to "bail out" a division in trouble. In either case, the underlying problem—the one that causes the trouble—remains unexplored. A more effective program provides for interaction between the line organizations and the safety staff. Such interaction should include discussion, cooperation and collaboration.

Cooperation of entire organization is essential

The successful hazard control specialist realizes that he cannot achieve his task without cooperation from the entire organization, especially personnel in management. Of course, realizing this fact and putting it to use can often be two different things. Many organizations whose experiences with safety specialists have been unsuccessful may be hesitant to "try again." It has happened, for example, that the head of the safety staff lacked the skills or characteristics to provide significant input into the organization's overall objectives. Sometimes the head of the safety staff was in fact capable of significant input but hesitated to seek the cooperation of those in powerful positions within the organization. Finally, there have been safety specialists who attempted to shape the organization around

their own beliefs about hazard control, rather than fitting the safety strategies to the existing system and accepting slower progress toward their goals.

Safety specialist must be competent

Obviously, then, the hazard control specialist must be competent. He must be able to demonstrate that competence, as well, to everyone in the organization, from the workers up to those in top management. The specialist does not gain credibility merely by holding that position; credibility is earned, not endowed. A further characteristic of the successful hazard control specialist is a willingness to integrate ideas into the overall organizational plan and thereby lose some personal plaudits that might come his way if he kept his plan separate.

Effective hazard control program

The most effective hazard control program will feature close relationships among each of the organization's management departments and between these management departments and the safety department. In order to gain the cooperation of management, it is necessary to apprise members of management of the extent of the hazard control problem within the organization.

A fractured organization

Setting up limits in which each department avoids "doing somebody else's job" creates a fractured organization, the very antithesis to cooperation which is so essential to the success of the safety program. It may also prevent each department from operating at full productivity, even though the limitation is intended to achieve just the opposite.

Why departments fail to contribute

However, there are often reasons why departmental leaders fail to contribute greatly to hazard control. For one, a department may have a limited work force for accomplishing even the most essential operational tasks; taking on additional tasks may cause a strain. Further, their financial resources may be limited. Finally, they may never have been told precisely what they can contribute to hazard control, or how they can benefit by it.

Cooperation increases all-around performance

These may all be valid reasons for de-emphasizing departmental cooperation in the safety program. However, the point to be stressed here is that, not only can such cooperation contribute significantly to the safety program, it may allow the departments to discharge the tasks assigned to them at the same time—often more efficiently and effectively. While performing the tasks assigned to them, they can simply look for the report factors that may cause accidents, and they can do this without incurring additional expense.

Example

For example, the manufacturing engineering department's regular plant audits that assure process conformity with established performance standards may be augmented by appraisals of these same processes to determine their conformity with established safety, health and environmental standards.

Purchasing department

The purchasing department is another management system essential to the safety program. This department, over the years, accumulates resources for the organization—such as tools, machines, or materials—without considering their potential safety hazards. The fault does not lie entirely with the department itself. Top management should stress that this department should consider the safeguards necessary to protect against hazards inherent in their purchases.

Facilitating each department's cooperation

In order to make each management department aware of its role in the safety program, top management must first define its hazard control objectives. Next, the functions of each management system must be assessed to determine its poten-

tial contribution to the safety program. Finally, the safety department must furnish the technical support required by each department for maximum contribution.

THE ANATOMY OF ACCIDENTAL LOSS

Before a safety program can be assessed for effectiveness, the process by which it occurs must be understood. Accidents and the resulting costs occur along a sequence of cause-and-effect. There are three distinct phases of the accident/cost sequence: the loss exposure, the loss incident and the actual loss.

The cause-and-effect sequence

Any loss exposure consists of many causes and effects. A cause leads to an effect which, in turn, becomes a cause for another effect, and so on. Each of these cause-and-effect sequences is called a causal factor; and causal factors can be divided into primary and contributary factors. Primary causal factors are the immediate cause of an accident. Sometimes, they are the sole cause as well. Contributary factors are just what their name implies; they contribute to the primary factor in causing the accident.

THE LOSS INCIDENT

The loss is the accident itself. The event progresses swiftly, going from the incipient to the full development stage in a matter of seconds—sometimes even less. By nature it is an unforeseen event. In this generic definition, the potential for loss is unlimited; however, this potential need not be realized for the incident to qualify as an accident.

LOSS CONTROL

The causes of most accidents can be identified by thorough analysis. Very often organizations do not investigate accidents unless a serious loss has resulted. The problem with that is that the focus is on the effects of accidents, rather than on their causes. The effects of an accident should be attended to by staff members involved in fire protection, maintenance, medical assistance, and so on; the causes should be attended to by line personnel with the authority, responsibility and accountability to observe and prevent possible causes of accidents.

Anticipate and control accident causes

It is best, therefore, to anticipate potential causes of accidents and to control them accordingly, before they present a problem. For example, an eye protection program should be instituted before someone experiences an eye injury, a machine guard should be placed in a hazardous piece of equipment before it injures a hand or a foot.

Reporting system

Because the most dramatic losses are the most easily reported and remembered, a system of reporting must be developed that will include the non-serious losses and the accidents that do not result in losses at all. This is so that the causes of all accidents will be on record regardless of the outcome of the accidents. Such methods may be based on the results of sampling or on conclusions of systems analyses when the potential accidents are developed and analyzed for causal factors.

Summary

In this unit, we have demonstrated the difference between visible and unseen accident costs, and have shown how they affect the production process of the organization. We have shown how cost accounting techniques can be used to calculate precisely how much accidents are costing an organization. We have discussed the role of management systems in hazard control. And we have broken down the accident sequence into three phases. Unit VII, "Evaluation of Safety and Health Program Effectiveness," will describe methods for assessing the success of hazard control programs in reducing these costs and other hazard-related nuisances.

SAMPLE TEST QUESTIONS

1. Explain the difference between Matthysen's first and second iceberg effects.

2. What are three pitfalls associated with workers' compensation?

3. Which of the two extremes—total success or total failure—is the norm for the production process? Explain your answer.

4. What is the major role of management in the hazard control process?

5. Name the three distinct phases of the accident sequence.

ANSWERS TO QUESTIONS

1. The first iceberg effect deals with insured and uninsured costs; it demonstrates how hidden costs may make up a considerably greater portion of accident costs than do the insured costs. The second iceberg effect involves small costs that gradually add up as the result of minor accidents that go unreported.

2. First, benefits and eligibility vary from state to state. Second, certain types of workers (such as farmers and workers in very small organizations) are excluded from coverage. Third, it can be very difficult to prove that injuries or illnesses are work-related.

3. Neither is the norm. The production process usually falls on a continuum between the two extremes. The break-even point on the continuum represents the minimum acceptable success.

4. The first priority of management is to foster cooperation among all the organization's departments. It should do this by setting an example of cooperation in its own hierarchy.

5. The three phases are the loss exposure, the loss incident, and the actual loss.

NOTES

1. Based on 1979 figures in *Accident Facts* (Chicago: National Safety Council, 1980), pp. 2–4.

2. Matthysen, H. J., "The Cost of an Accident and How It Affects Profits," in *Selected Readings in Safety* (Macon, GA: Academy Press, copyright 1973).

3. Matthysen, H.J., *op. cit.*

4. Quoted in David A. Gibson, "Herbert W. Heinrich," *Professional Safety,* April 1980, pp. 21–22

5. Firenze, Robert J., *The Process of Hazard Control* (Dubuque, IA: Kendall/Hunt Publishing Company, copyright 1978), p. 64.

6. Table I, Primary Rating Values of Actual Losses, *Experience Rating Plan Manual for Worker's Compensation and Employer's Liability* (New York: National Council on Compensation Insurance, 1980).

7. Retrospective Rating Plans, *Basic Manual on Worker's Compensation and Employer's Liability* (New York: National Council on Compensation Insurance, 1980).

8. See 1977 Survey of Product Liability Closed Claims in the United States, Insurance Service Office, quoted in *An Interim Report to Congress on Occupational Diseases,* U.S. Department of Labor, June 1980, p. 96.

9. Gilmore, Charles L., *Accident Prevention and Loss Control* (American Management Association, Inc., copyright 1970), p. 33.

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UNIT III

THE ROLE OF HAZARD CONTROL IN THE MANAGEMENT PROCESS

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METHODS: Lecture and demonstration LENGTH: 60 Minutes

PURPOSE: To demonstrate the techniques and processes necessary for smooth operation of the hazard control program.

OBJECTIVES: To introduce the student to:
1. Hazard control as it relates to the management process
2. Tips for implementing a worker-cooperation program
3. Risk calculation techniques—past and present
4. The five essential processes in hazard control
5. The loss control and management process.

SPECIAL TERMS:
1. Responsibility
2. Accountability
3. Authority
4. TOR Analysis
5. Integration
6. Risk-reward Justification
7. Regulatory Compliance

INSTRUCTOR MATERIALS:
1. Lesson plan
2. Chalkboard or flip chart

TRAINEE MATERIALS: Participant outlines made by instructor from lesson plan.

UNIT III

THE ROLE OF HAZARD CONTROL IN THE MANAGEMENT PROCESS

INTRODUCTION

The process of managing an organization, or even one of its subdivisions, is a constant challenge. For every problem that is confronted and resolved, new ones will arise to take its place.

HAZARD CONTROL AS IT RELATES TO MANAGEMENT PROCESS

The hazard control function is a classic example of this. No matter how diligently hazards are ferreted out within the operational system, new ones can be expected to arise almost immediately. This is due, at least in part, to the fact that the operational system is a dynamic one—one in which change is constantly taking place. Therefore, the capacity for unforeseen complications is great. Seen in one way, management is highly creative and energetic, equalizing creative differences of opinion and overcoming a resistance to changes that become almost an inherent part of long-established organizations. Considerable skill and perception are required to carry out management objectives. Seen in another way, however, management can also be a frustrating experience, a drain on the very creativity and energy needed to accomplish needed objectives. People in management positions must continuously keep their minds open to numerous problems and solutions. Well-laid plans may come tantalizingly close to success, only to fail in some way at the last minute. Further, complications may emerge at a time when the organization is least able to cope with them. Finally, simple, logical plans have a way of becoming convoluted as they are passed from one person to another and from one department to another, ultimately becoming a tangled mass of confused and controversial directives.

Management: Highly creative

A frustrating experience

A major satisfaction

One of the major satisfactions cited pertaining to the managerial role is the close interaction and the high degree of cooperation among the members of the management system.

A major pitfall

One of the major pitfalls of the management process has been the implementation of new ideas, techniques and methods without much thought being given to how these new elements will work within the structure that already exists. In addition, these implementations are often added without an initial assessment of the benefits they are capable of producing. It is therefore very difficult to measure changes and improvements.

The hazard control program as it relates to profit

Problems with profit-based justification. Difficulty in identifying all costs

It has probably tempted more than one hazard control specialist to promote a certain program on the basis of its profit advantages. To show that the program has indeed benefitted profits demonstrably puts a lot of pressure on the specialist, when the time comes to evaluate the results. Basing the success of the hazard control program solely on a reduction in accidents and their resulting costs presents a number of major problems. First, it becomes extremely difficult for the hazard control specialist to identify all costs related to the organization's accidents.

This includes direct costs as well as indirect, the latter of which would be uninsured costs incurred during the course of and after the accidents.

Difficulty in proving savings

A second problem presented by basing the hazard control savings program on profit is that it often cannot be proven conclusively that a given amount of money spent on the administration of the program yielded a given amount of money in savings on accident costs. It isn't easy to convince people that a certain accident would have cost more without a certain program than it did with it, or that accidents that didn't happen at all would have cost a given amount if they had.

Rarity of accidents

A third reason why it is unwise to justify the program on the strength of profit advantage is the fact that accidents are relatively rare events. It is possible that an organization could disband its hazard control program completely for some time without suffering an accident, or without incurring greater accident costs than it has with the program in use. The organization may therefore draw the mistaken conclusion that the money it saves by discontinuing the safety program actually increases its profits.

Possibility of increased accident rate despite program

Let's consider another situation that doesn't work out any better for the hazard control specialist. Suppose a rate well-thought-out and carefully administered hazard control program is integrated into the overall management plan. Ample financing, labor and similar resources are available for carrying out the program. In spite of this, however, the organization suffers a greater number of accidents than it did before, along with greater costs to cover these accidents. This might be due to unforeseen circumstances, inadequate information in specific areas, or problems outside the jurisdiction of the hazard control organization. No matter, management will very likely respond to the increase in accidents by making unnecessary changes in the hazard control program while ignoring the changes that could improve it. Some of these changes made may prove to be counter-productive. At any rate, management is only viewing the situation from the cost angle. Clearly, in a case like this, this angle is not to the hazard control specialist's advantage.

Keep approach realistic

Fortunately, something can be done to avoid a situation like this. The hazard control specialist should acquaint top management with the real purpose and benefits, other than savings alone, of the program. These would include remaining effective and keeping up in business. The hazard control program is consistent with the overall objectives of the organization; however, a sudden rise in accident rates and costs for, say, one year is not a realistic assessment of the program success. A trial period of three to five years is much more likely to yield a reliable picture of the program's effectiveness.

Example

In another case, a hazard control specialist may be hired by a company in a crisis. The organization must find some way to reduce its accident costs or else go out of business. After studying all available accident data, including workers' compensation premiums, medical and hospital costs, OSHA fines, and insurance penalties, the specialist sets up a comprehensive hazard control program. However, as the system is put into effect, the specialist discovers that the hazard data received as a result of improved reporting indicate even more serious problems than the company had reported. In this kind of situation, it could take a few years to get the company back on its feet. While the new program may be able to provide immediate relief, its greatest impact will show when it has taken substantial root in the system.

Careful appraisal

When a hazard control specialist first begins the process of setting up a viable hazard control program, a very careful appraisal should be made of how the organization must be made to understand the purpose of the program, what benefits will accrue to the organization as a result of the program objectives, and what roles the members will play in carrying them out.

PLANNING

Once the hazard control specialist has set measurable, realistic goals and drawn up a blueprint for the program's construction, the next step is to decide what steps in what order will best carry out the plan.

Two essential characteristics

Planning, an integral part of the management process, is the function by which an organization adapts its resources to changing internal and environmental forces.[1] As a predetermined course of action, it has two essential characteristics. First, planning must involve the future. Second, it must involve action.

Identifying need

The first step in the planning function is the perception and identification of organizational safety and health needs and requirements. Goals and targets must be set so that organizational activity can be focused in that direction.

Three steps in the planning process: Appraise the environment; Choose organizational role; Provide specific facts.

Three steps must be taken in the planning process. The first is to appraise the future political, economic and competitive environment in which the organization exists. Second is to decide on a desirable role for the organization within this environment. Third is to provide specific facts (intervening variables) that have direct impact in the direction the organization has set for itself. During the planning stage, the hazard control specialist should ask himself the following questions:

1. What is the organization's policy toward hazard control?
2. What are the hazard control program's requirements?
3. What will it take to get the job done?
4. How will increase or decrease in performance be measured?

ORGANIZING

Once the planning is complete and the organization has a firm idea of where it wants to go and what it must do to get there, a vehicle is necessary to bring the plans to fruit. This vehicle is known as organizing. Organizing provides for existing and potential action by the organization, among other things. It provides for prudent and effective distribution of tasks among the work force and lays the foundation for the delegation of responsibility and authority. The results of organizing are therefore work division, work assignment and authority delegation. Further results are the specification of coordinating activities and interrelationships necessary for harmony and effectiveness.

Two major issues

The manager faces two major issues during organizing: first, organizational productivity must be maximized, and second, lines of responsibility and authority must be understood and feasible.

Identify important issues

Peter Drucker theorized that, in an attempt to maximize productivity, an organization is likely to direct 80 percent of its time and resources to issues capable, at best, of producing 20 percent of the desired results. Conversely, it might also be said that it could direct 20 percent of its efforts to issues capable of yielding 80 percent of the desired result. This is unless it makes a conscious effort to identify and direct efforts toward the important issues. Most hazard control programs that have proven ineffective invariably fail to set specific guidelines for hazard assess-

ment and evaluation. Whenever hazards are not removed from an organizational system according to a specific plan, or whenever they are evaluated on a scale that does not delineate a clear hierarchy of importance, the less important hazards easily attract attention while hazards with significant impact are overlooked.

Delegating responsibility and authority

Delegating responsibility and establishing authority is particularly crucial in the area of hazard control so that workers in the organization will know who can be relied on to accomplish objectives.

Responsibility

A word of caution. "Responsibility" is one of the least understood terms in management terminology. As it is used in this unit, it refers to the continuing obligation of a person or group to carry out an assigned order or mission. Responsibility cannot be re-assigned. This means that the manager cannot shift responsibilities to a subordinate, no matter what position the manager holds in the organization.

Accountability

"Accountability" is a term steadily growing in popularity in the field of hazard control. Accountability is little more than responsibility, although it also implies liability for the proper discharge of duties by the subordinate.

Authority

Authority, on the other hand, is the necessary prerogative granted those in key positions to carry out the tasks for which they are held responsible. Authority is the legal or rightful power granted a person to command others. Power carries with it the connotation of an ability to exert continuous force in order to accomplish a certain task; and it is likely that those who have the ability are far more likely to get their jobs done than those who do not. Since authority is the power to carry out assignments, and responsibility is the obligation to accomplish them, it follows that authority must correspond to responsibility. Both relate to the same assignments. During the planning phase, the hazard control specialist should ask himself the following questions:

1. Where should actions take place?
2. What are the priorities?
3. Who in the management system will participate?

ACTUATING

The actuating function of the management process might be called the "people function;" it is the function that encourages members of the organization to carry out their prescribed tasks with enthusiasm. In simplest terms, the actuating process requires the skillful direction of people so that they can be motivated to accomplish organizational objectives. In order to do this, they must be given a sense of their importance in the plan and of the benefits that will accrue to them as a result of their participation.

Complications

Sparking employee interest can often be complicated by the very methods designed to engender cooperation. It is a common complaint among employees that

Employees feel ignored

"I gave my advice but nobody did anything with it." While it may appear that way to the employee, other factors may be involved. For instance, the employee may not have been given a clear idea of how the advice was to be used, or of why his advice was asked for in the first place.

New plans fail

Frequently, management will institute a new plan only to have it fail. The failure happens because of a semiconscious conspiracy among disillusioned workers. If

they ignore the new plan, it will disappear as have the others before it. This kind of cynicism usually appears after the organization has already implemented several hazard control programs supposedly using employee input, but failing to tell the workers how the input was used. A new hazard control specialist will obviously have a great deal of resistance to overcome entering an organization like this.

Workers must understand organizational priorities

One thing that must be done is to make the workers understand the priorities of the organization. In the case of the worker who gave good information and advice but felt that it had been ignored, it may well be that the organization took note of the information. But suppose the worker reported a number of minor hazards, whereas, while discussing the subject with other workers, the organization uncovered a number of major hazards. It would obviously correct these first. The worker who reported the non-serious hazards may take the organization's inaction as an indicator that cooperation is unimportant because no one really cares. This worker is unlikely to participate again if asked.

Listening is essential

This surely makes it obvious that management must communicate very clearly to its workers what it is trying to accomplish and why, and should make them understand that its responses may not be as immediate as they might like; even so, their cooperation continues to be important. The single most important technique of the actuating process is sympathetic listening to individual employees to find out what they think on a day-to-day basis. It is the workers who know what's going on at the basic level. They are the ones who see the errors made; perhaps they have made some themselves. The successful hazard control specialist is the one who can encourage employees to open up, not to incriminate other workers or perhaps even themselves, but so that they can begin to see the gradual ripening of the fruits of ongoing cooperation. During the actuating stage, the hazard control people need to be told what happened to their ideas and why. It's especially important that workers be informed about the effectiveness and results of their input.

Use of specific goals as guidelines

If specific goals can be achieved by employee involvement, the program should be designed specifically for the purpose of getting employees involved. That may seem self-evident; however, it is often overlooked. Many people seem to think that if employees get involved in the hazard control program, productivity will increase as a direct result. And that isn't necessarily true, although other benefits—such as reduced absenteeism and turnover—may accrue.

Training in problem-solving

In a similar vein, employee involvement in problem-solving will not necessarily lead to better solutions. It will certainly produce a greater store of information. But to increase problem-solving abilities, workers must be trained in problem-solving methods.

Personnel peculiarities

Finally, any program must take into account not only the needs of the organization but also the peculiarities of its personnel. For instance, supervisors with poor interaction with their subordinates must be given special training. And the resistance of older workers to change may have to be overcome before the program can be implemented.

CONTROL: Preventing counterproductive changes

Control is the activity oriented toward preventing counterproductive changes in operations. Control is a function of the overall system that ensures direction in conformity with objectives.

Adequate hazard control requires several conditions.[3]

Prompt sensing and reporting

1. Control tools must be capable of promptly sensing and reporting systems of inadequacy so that the system can correct problems. When a control cannot provide speedy efficiency, it will act as an anesthetic, lulling those involved into a false sense of security. For example, when accident, injury and loss data are not reported until the end of the year, it is too late for management to take any action. A better method would allow for these data to be reported as they occur.

Exceptions at critical points

2. A good control must point out exceptions arising at critical points. The control must show an aggregate of deviations and simultaneously trace them to areas critical to the operation.

Understandable

3. The control should be understandable by everyone affected by it. Complex mathematical formulas in detailed hazard analyses, or statistical summaries too difficult to decipher for the valuable information contained in them, complicates communication. They may even destroy them.

Point the way to preventive or corrective action

4. The control should point out the path to preventive and/or corrective action. Tools adequate to hazard control should locate failures, disclose the individuals responsible for them, and suggest action to correct inadequacies.

During the control, phase the hazard control specialist should ask himself the following questions?

1. Are the actions being performed?
2. What has been done? Where and how has it been done?
3. Are these actions in accordance with plans?
4. What instruments are needed to measure program effectiveness?

HAZARD CONTROL—A FAILURE-ORIENTED FUNCTION

In the overall management process, the hazard control function is failure-oriented. That doesn't mean that those involved in it are pessimistic, or that they are doomed to failure. It does mean that the hazard control specialist's work life is devoted to searching out possible failures. It doesn't take the specialist long to figure out that it's advantageous to think in terms of failure, because it is much easier to get a consensus on what constitutes failure than what constitutes success.

Fewer failures than successes

Further, in any system, there are fewer failures than there are successes. Those in the hazard control function will benefit most from this relationship by focusing on the things that might go wrong.

Challenge and fulfillment

Finally, it is challenging and fulfilling to find the failures in a system and to offer solutions that will correct them. This psychological satisfaction may prove the greatest reward in a field that is often difficult and frustrating.

RISK CALCULATION

Previous techniques

At some point in every program, the safety program manager has to make a decision regarding which hazards justify program emphasis, and the extent to which the manager should concentrate valuable resources to correct the situation. Usually the manager will look at the severity index of a number of accidents and base allocations on the ranking of each situation vis-a-vis severity. This is justifiable technique, but in so doing, the manager may often overlook the more frequent accident with a lower severity. In the long run, the cost in terms of injuries, ill-

nesses and economics may be higher for the more frequent but less severe cases than it is for the high-severity cases. Conversely, if a manager elects elements for control based upon frequency of accidents, those infrequent but potentially severe cases may be overlooked. One technique that is often used is to combine frequency and severity to arrive at a "criticality" index. This may be simply multiplying the frequency index by a measure of severity (i.e., workdays lost per case or the American National Standards Institute Z16.2 charging methods).

A MATHEMATICAL APPROACH[4]

William Fine has developed a formula that "calculates the risk" of a hazardous situation and gives a numerical evaluation to the urgency for remedial attention to the hazard. The calculated risk scores are then used to establish priorities for corrective effort.

Risk scores

The seriousness of the risk due to a recognized hazard is calculated by use of the "Risk Score Formula." A numerical evaluation is determined by considering three factors:

Consequences

1. The *consequences* of a possible accident arising at the existence of a hazard

Exposure

2. The *exposure* to the basic cause

probability

3. The *probability* that the complete accident sequences will occur following exposure.

The technique uses the following formula:

Risk score = Consequences x Exposure x Probability

Recommended rating scheme

To apply the technique and use the formula R = C x E x P, a numerical value is assigned to each of the terms of the formula. Fine recommends that consequences be classified in terms of degrees ranging from minor (cuts, bruises and bumps) to catastrophic (numerous fatalities, damage over a million dollars, etc.). For each classification as shown in Table III-1, a quantitative or numerical rating is assigned. If an identified hazard has a potential of producing a catastrophe involving numerous fatalities or property damage in excess of a million dollars, for the purpose of calculating a risk factor, its numerical value will be 100. If it is more common and the identified hazard can produce a disabling injury or property damage up to $1,000, it will have a rating of five.

Consequences

Table III-1

Consequences:	Weight
Catastrophe; numerous fatalities, damage $1,000,000+	100
Multiple fatalities, damage $400,000–$1,000,000	50
Fatality, damage $100,000–$400,000	25
Extremely serious $1,000–$100,000	15
Disabling injury $0–$1,000	5
Minor cuts, etc.	1

The term exposure in the formula is likewise given a numerical rating value ranging from .5 (remotely possible, not known to have ever occurred), up to 10 (oc-

curring continuously or many times daily). The selection of the appropriate exposure level is based upon observation, experience and knowledge of the activity concerned. Numerical values recommended by Fine for exposure categories between the extremes of remotely possible to continuous are shown in Table III-2.

Table III-2

Exposure—If exposure to the hazard occurs:	Weight
continuously or many times daily	10
frequently (daily)	6
occasionally (1/wk or 1/mo.)	3
usually (1/mo.—1/yr.)	2
rarely	1
remote possibility	0.5

Probability

Probability is the third term assigned a numerical value in the equation. The probability of an event occurring is determined by careful consideration of each step in the accident sequence from the initial triggering event to the consequences. As in the other two cases, a numerical rating is assigned to each probability classification ranging from .10 for cases that are almost impossible (i.e., have never happened) to 10.0 for the events that are likely and expected to result if the hazard event takes place. Again, values between these classifications are shown in Table III-3.

Table III-3

Probability—Complete accident sequence is:	Weight
most likely and expected result	10
50/50 chance	6
unusual or coincidental	3
remotely possible	1
has never happened	0.5
almost impossible	0.1

Procedure

The concept of assigning a numerical value to various risks is not conceptually very complicated. Problems in its use come in assigning rating values or weights. As shown in some of the examples, it really isn't important what numerical value is assigned for each factor or each level. It is important that the analysis be consistent. If a consequence of a hazardous condition is considered extremely serious, it really doesn't make any difference whether the analyst assigns a numerical value to that classification of fifteen, ten or thirty; the important thing is that it be consistent, and that each time the analysis is run, the same numerical score is assigned to an "extremely serious injury classification or consequence." Obviously, if ratings and weights are changed, calculations will be thrown off and comparisons from one time to another made invalid. See Appendix III-A for examples showing how to work out this concept.

COST JUSTIFICATION

After the hazard has been recognized and a calculated risk assigned, the task of the safety manager is to design and select appropriate corrective action. Fine offers a modification for expansion of the risk formula to include a measure "justification" or a technique for estimating whether or not the cost of the fix is justified. It makes good sense from an economic standpoint to adopt only those programs for which the cost of the fix is less than or equal to the cost of the problem. Humanitarian goals and objectives aside, if the cost of remedial action is greater than the cost of the problem, in economic terms at least, the project should not be conducted. Fine's technique takes this into account by dividing the risk factor by the product of the program cost, times the degree of correction. We then have a formula for cost-justification of:

$$J = \frac{R}{CF \times DC}$$

Here the cost factor is a measure of the estimated dollar cost of the proposed corrective action. For the purposes of the formula, we can use the actual dollar cost of the project, or we can use a subjective rating, which is the approach Fine recommends. For example, ratings are shown ranging from .50 for projects or corrective action under $25 to 10.0 for those in corrective actions in excess of $50,000.

Cost Ratings	Weight
Over $50,000	10
$25,000–$50,000	6
$10,000–$25,000	4
$ 1,000–$10,000	3
$ 100–$ 1,000	2
$ 25–$ 100	1
$ 0–$ 25	0.5

Now, the true cost of any program is not the dollar amount paid for, but the degree to which the program will eliminate or correct the undesired event. A program that is relatively inexpensive but also not very effective may, in the long run, be more costly than a program with a higher implementation cost but that is very effective in reducing the undesired event. The net gained, therefore, may be completely different. The cost-justification formula proposed by Fine takes into account the different degrees of effectiveness. In the denominator of our formula, we multiply the cost-factor by a degree of correction that is an estimate of the degree to which the proposed corrective action will eliminate or alleviate the hazard, forestall the hazard event, or interrupt the accident sequence. The estimate will be based on experience and knowledge of the activity concerned. The classification and associate ratings for degrees of corrective action are again shown in the hazard. They range from slight effect on the hazard (to which is assigned a value of six) to the hazard positively eliminated (a value of one). Let's now use the same examples we used for the calculation of risk to look at some justification scores (refer to Appendix III-A).

Correction Factor	Weight
100% effective	1
Hazard reduced by 75%	2
Hazard reduced by 50–75%	3
Hazard reduced by 24–50%	4
Slight effect on hazard	6

Example no.1

The first example in Appendix III-A involves the hazard of pedestrians and vehicles using the same roadway. A possible corrective action to reduce this risk would be the construction of a sidewalk alongside the road. The estimated cost is $1,500. The J formula is then used to determine whether this expenditure is justified. The C, E and P components are given in the earlier discussion as 25, 3 and 0.5, respectively. Since the estimated cost is $1,500, CF = 3. The degree of correction accomplished by building a parallel sidewalk is judged to be at least 75% but not 100%; therefore, DC = 2 (see Table I, factor 5). The calculations are:

$$J = \frac{25 \times 3 \times 015}{3 \times 2} = \frac{37.5}{6} = 6.25$$

Since J is less than 10, the conclusion is that the cost is not justified. It is important to note that the lack of sufficient justification evaluates the situation from the safety viewpoint only. Management might believe there is added justification for morale or other purposes. Additionally, since the risk score is still a substantial 37.5, other, less costly corrective measures should be sought. This might include improved administrative controls to enforce one-way traffic measures, reduce speed, and encourage pedestrians to use another exit gate. This will reduce the risk score by reducing both exposure and probability.

Example no. 2

The second example involves the hazard due to compressed air being used in a shop without proper pressure reduction nozzles. The proposed corrective action is installation of proper pressure-reducing nozzles on the 50 air hoses, at a cost of $8.00 each, or $400. To determine justification for the expenditure, values for each element in the formula are required. The values of C, E and P as discussed before are 5, 10 and 6 respectively. The cost of the corrective action is $400, so CF = 2. The corrective action will reduce the hazard by at least 50%, so DC = 3. Substituting in the formula:

$$J = \frac{5 \times 10 \times 6}{2 \times 3} = \frac{300}{6} = 50$$

Since J is well above 10, the cost of installing pressure-reduction nozzles is strongly justified. The third example is concerned with the doubly hazardous location of

Example no. 3

the 12,000-gallon propane storage tank. The proposed corrective action is to relocate the tank to a place where it will be less likely to be damaged by any external source, at an estimated cost of $16,000. The values of C, E and P are set at 25, 1 and 1.5 respectively, with the two hazards combined. Since the cost of relocation is $16,000, CF = 4. In even the best location available, there remains

a remote possibility of damage to the tank, so DC = 2. The J formula would then read:

$$J = \frac{25 \times 1 \times 1.5}{4 \times 2} = \frac{37.5}{8} = 4.7$$

Based on the established criteria, the cost of relocation is not justified. It is emphasized that the conclusion reached does not mean that the hazard is of little or no significance. The risk score is still 37.5, and this remains of appreciable concern. Since the potential consequences of an accident are quite severe, effort should be expended to reduce the risk, either by reducing the exposure or the probability of by devising another, less costly corrective action. In this case, an additional steel plate barrier could be erected to protect the tank from the compressed air activities, and one or two strong posts in the ground could minimize danger from the road. Thus, the risk score and the probability of serious damage to the tank would be considerably lessened at nominal cost.

RISK ANALYSIS

Risk analysis is a name given to a process that is an integral part of the various analytical methods, the quantification of the degree of risk. Risk analysis, though sometimes used interchangeably with hazard analysis, is a term usually reserved for analyses that are primarily statistical, inferring specific accident rates from general data.

Computing risk

A general definition of risk is "a hazard which has been evaluated to determine its inherent harmfulness, as well as the effect of control options available to regulate it."[5] More specifically, risk is the mathematical expression of possible loss over a specific period of time or number of operational cycles. It is computed by multiplying the probability of loss by its consequences or severity.

One formula for determining risk is the following:[6]

$$\text{Risk}\left(\frac{\text{expected loss}}{\text{unit time or unit activity}}\right) =$$

$$\text{Probability}\left(\frac{\text{event frequency}}{\text{unit time or unit activity}}\right) \times$$

$$\text{Consequence}\left(\frac{\text{loss or cost}}{\text{event}}\right)$$

In this formula, probability is defined as the number of times an event occurs divided by the number of opportunities for its occurrence. Usually, it is expressed as the probability per unit time (for example, man-hours) or per unit activity (for example, vehicle miles). The consequence factor can be defined narrowly or broadly. The narrowest definition would include direct losses. A broader definition would include:

1. Direct losses (e.g., workers' compensation, dollar property damage);
2. Tangible indirect effects (e.g., loss productive time);
3. Intangible effects (e.g., adverse publicity).

Risk management and risk acceptance

Safety systems diverge at the point where they say that risks are acceptable. Risk management, then, is that part of management decisionmaking dealing with minimizing and controlling hazards and accepting assumed risks. What determines risk acceptance? A past president of the American Society of Safety Engineers thinks it is the result of four perceptions:[7]

1. Self-image
2. Maximum severity of the injuries, damage, and/or other losses that could occur
3. Probability of occurrence
4. The public's sensitivity to the effects of an occurrence.

In recommending which risks are acceptable, the safety professional must walk a fine line between the ideal solution and the cost-beneficial one. On the one hand, if he recommends ideal solutions to eliminate all risks in all situations, management will view the safety professional as a starry-eyed visionary and be unreceptive when he makes recommendations to correct serious hazards. On the other hand, if he evaluates everything according to cost regardless of the seriousness of the hazard, if he dislikes bringing up unpleasant facts, unhealthy situations and expensive solutions, then he is not serving his profession, his company or his fellow employees. Given the definition of risk management above, it is clear that the title of risk manager does not properly belong to insurance managers (although the two are linked in the Risk and Insurance Management Society). Just as the term loss control, though originally associated with the insurance industry, now is seen as an approach to accident and injury reduction, so too risk management must transcend a narrow definition.

Risk management, a major component of system management

Risk management is a major component of system safety management. Risk management means making decisions with far-reaching ramifications for the safety and health of workers. Therefore, it is an upper-level management function, based on inputs from safety and insurance managers. But top management must always remember that, although it can delegate authority, it cannot delegate responsibility. Applying the principles of good management is as effective in hazard control and accident prevention as it is in any other facet of business.

ESSENTIAL PROCESSES IN HAZARD CONTROL

Hazard control can be defined as the function directed toward recognizing, evaluating and eliminating (or at least reducing) the destructive effects of hazards arising from human errors and from the physical and environmental aspects of the workplace. Its primary function is to locate, assess and set effective preventive and corrective measures for those elements that detract from operational efficiency and effectiveness. In addition to familiarizing management with the consequences of system failures, hazard control can pinpoint hazards before failures occur. The anticipatory character of hazard control helps move the system within acceptable limits toward its objective.

Five essential processes

There are five essential processes in hazard control:

1. Identification and evaluation
2. Management decisionmaking
3. Control methodology
4. Program monitoring
5. Evaluation of results.

Identification and evaluation

The first process in a comprehensive hazard control program is that of identifying and evaluating hazards located in the workplace. These hazards are associated with machinery, equipment, tools, operations and the physical plant. Information about hazards in the workplace can be acquired from workers and supervisors, insurance company loss control representatives, manufacturers, labor representatives and business agents, safety and health personnel, inspection and accident reports, and hazard analysis.

Hazard analysis

Hazard analysis is a particularly valuable tool. As we saw earlier in this unit, the greatest benefit of hazard analysis is that it forces those conducting the analysis to view each operation as part of a system. Each step in the operation is assessed, and the attention is given to the relationship between steps and the interaction between workers, equipment and the environment. Other benefits include:

Benefits

1. Identifying hazardous conditions and potential accident situations
2. Providing information so that effective control measures can be established
3. Determining the knowledge, skill and physical requirements needed to execute specific tasks
4. Discovering and eliminating unsafe procedures, techniques, motions, positions and actions.

Three other techniques

Three other techniques for identifying and evaluating hazards are safety sampling, the critical incident technique, and Technic of Operations Review (TOR).

Safety sampling

Safety sampling, also called behavior or activity sampling, uses the expertise of those within the organization to identify and evaluate hazards. It is based on the quality control principle of random sampling inspection. The degree of accuracy depends largely on the number of random items selected.

Worksheet listing unsafe acts

The first step in the safety sampling is to develop a worksheet that lists unsafe acts specific to the organization. Such acts are easily developed from accident records. Personnel—usually management or safety staff members—who are familiar with operations and well-trained in recognizing unsafe practices make rounds of the organization. They record on a safety sampling sheet both the number and type of unsafe conditions they observe. A code number is used designate specific unsafe conditions (such as hands in die, failure to wear safety glasses and protective clothing, failure to lock out source of power while working on machinery, crossing over belt conveyors, working under suspended loads, improper use of tools, or transporting unbanded steel).

Observations

Observations must be made at different times of the day, when workers are not aware that sampling is being conducted, and throughout the various parts of the organization. In a short time, the observations can be converted easily to a simple report that shows precisely what specific unsafe conditions exist in what areas, and what supervisors need help in enforcing good work practices. Safety sampling measures both worker activity and supervisory success in safety. The information is unbiased and therefore irrefutable. What has been observed has been recorded. Like the umpire in a baseball game, the observer "calls 'em as he sees 'em." Both safety sampling and the critical incident technique can also be used as monitoring and evaluation tools.

Problem with safety sampling: Observations difficult to record

A problem with safety sampling is the difficulty in recording observations by areas of responsibility. In an actual program at one of Monsanto's manufacturing plants, it was found that employees working for a specific foreman might be assigned work in any part of the plant. Furthermore, while it was important to recognize maintenance and material-handling personnel, they were working throughout the plant, including production units. In the actual work setting, this last problem was solved by color-coding head protection—blue for maintenance, orange for material handling, yellow for production. The safety sampling program was declared a success, and no fault was found with the fact that 80 percent of recorded safety defects were the result of human error. The emphasis on unsafe acts is justified by stating that "unsafe acts contributed to 83.8% of the serious injuries during one recent 16-month period."[8]

Emphasis may lead to misunderstandings

However, safety sampling's emphasis on "unsafe acts" and "human error" may lead to misunderstandings. This method is too quick to point the finger at the worker while disregarding other factors. For example, if a worker is not wearing gloves during an operation, this unsafe act would be noted. What would not be recorded, however, is that the controls of the machine are difficult to operate while wearing gloves. The system demands, therefore, are imposing an unsafe act, but the safety sampling would react to symptoms, not causes.

Critical incident technique

The critical incident technique can identify practices or conditions that need to be corrected before a loss or accident occurs. Its objective is to discover causal factors that are critical; that is, factors that have contributed to an actual or potential loss-producing incident. Most safety professionals agree that, for every accident reported, there are hundreds of unreported "near-misses." The critical incident technique furnishes data on observed "accidents waiting to happen."

Reported significant observation

The critical incident technique is also known, especially to those in the field of nuclear safety, as Reported Significant Observation (RSO) because "critical" and "incident" had quite other connotations in that field. It was recognized as a significant hazard reduction tool during the development of the Management Oversight and Risk Tree (MORT) program for the U.S. Atomic Energy Commission. It also has been used by the Air Force in its aviation psychology program and is regarded as a modern and viable technique for gathering information.

Interviews

In order to obtain a representative sample of workers exposed to various hazards, people are selected from various sections of an organization. An interviewer questions a number of people who have performed particular tasks within a specific environment. According to William E. Tarrants, who pioneered the technique, the section from which the samples are selected "can be based on major exposure categories; on particular target segments of the worker population for whom the countermeasure is directed; or on any other basis relevant to the nature, scope and objectives of the study."[9]

Unsafe incidents are reported

The interviewer asks these people to describe unsafe acts they have made or observed in the past, or unsafe conditions that have come to their attention. Of course, workers must have no fear of punitive action, for the information is valuable for both its candidness and the specificity with which it describes hazardous situations.

Unsafe incidents are classified

Incidents are then classified into hazard categories, and problem areas are identified. Data are carefully analyzed for patterns, systematic problems, hidden problems and positive features. In many cases, the technique will indicate ways in which the causal chain can be broken and the accident avoided. Sometimes, a description of a good design will inadvertently reveal an underlying problem. For example, in describing the effectiveness of a module removal tool, one participant wrote, "Many of our tools are too heavy to use or ineffective for the job they are designed to do. This is not the case with this tool."[10] The technique also can lead to improvements in hazard control management by asking what defect in the management allowed unsafe acts to occur and unsafe conditions to exist.

Technique must be repeated

Because the worker/equipment/environment system is not static, the critical incident technique needs to be repeated at intervals. A new sample of workers can reveal new problem areas and measure the effectiveness of the accident prevention program. However, to avoid an overburden and to allow for development of new experiences, the technique should be applied to the same organization no more frequently than about once every six months.

Drawbacks

Time

One of the biggest drawbacks of the technique is the time it involves for safety personnel. If the interview method is used, the participants' time is matched hour-for-hour by the interviewer's time. On the other hand, if a questionnaire is used to save time, there will be a certain number of invalid responses because participants misinterpreted a question, did not follow directions, or used the opportunity to grind some personal axe or voice some personal problem. A skilled interviewer, by contrast, can detect and correct misinterpretation without leading the participant to a predetermined answer.

Immediacy may skew results

Another drawback is that, if a study is conducted immediately after a major accident, participants' responses are apt to reflect the accident and skew the results. A waiting period may be necessary before initiating the study.

TOR analysis

TOR analysis is a method that shares characteristics with both hazard analysis and the critical incident technique. Like hazard analysis, TOR probes each step in the process and the interrelationship between the steps. Like the critical incident technique, TOR begins with a particular event. While hazard analytical methods deal with hypothetical events, TOR starts with an incident that has actually occurred. Accidents and injuries are incidents, and so are wasteful and inefficient situations. TOR is, therefore, reactive rather than predictive. TOR, Technic of Operations Review, is the brainchild of D. A. Weaver, in *ASSE Journal,* June 1973. When an operational error occurs, a supervisory group sits down to find the major cause. The causes listed to probe for management deficiencies that allowed the undesired event to occur. Weaver divides TOR into five steps, which can be accomplished within approximately one hour.

Facts

1. Get FACTS. Describe the incident.

State

2. STATE the proximate cause, selecting from the items in the cause code. Reach consensus on one number as the beginning point.

Trace

3. TRACE underlying contributing factors. List the trace numbers for the cause factor. Discuss each briefly, deciding whether the factor contributed to the incident. If it is irrelevant, cross it out. If it is relevant, add to the list the trace numbers for this cause factor and discuss. Usually, in 20 or 30 minutes, this quick overview comes to a natural end.

Eliminate

4. ELIMINATE some of the contributing factors to isolate the important factors in the case study.

Seek

5. SEEK feasible corrective action. Once the problem is defined, the discussion deals with its solution.

According to Weaver, even if corrective action does not immediately follow, the diagnosis of the causes for the trigger incident remains valid. Furthermore, a problem correctly defined is usually half solved. The cumulative record reveals what operational errors occur repeatedly, pinpointing deficiencies and defining the need for improvements.

Ranking hazards by risk

Ranking hazards by risk means evaluating the hazards that have been identified both in terms of their consequence (or severity) and their probability (frequency). The logical outgrowth of hazard identification, and ranking provides a consistent guide for corrective action. It specifies which hazardous conditions warrant immediate action, which have secondary priority, and those that can be addressed in the future.

Management decisionmaking

Once hazards have been identified and evaluated, management is provided with full and accurate information, including control alternatives so that intelligent, informed decisions concerning hazard control can be made. Usually management will choose one of three courses of action:

1. Take no action at all.
2. Modify the workplace and/or its components.
3. Redesign the workplace and/or its components.

Management must furnish motivation

Making decisions on the basis of hazard reports is just one management responsibility in the hazard control program. Management not only reacts, it takes the initiative in furnishing the motivation to get the program started, in overseeing its operations, coordinating its activities, and in providing meaningful criteria to measure the program's success. Management decides what the hazard control programs should yield in terms of reduced accidents, injuries, illnesses and their associated losses. It is management that sets objectives and policy and supports safety professionals in their requests for necessary information, facilities, tools and equipment to conduct an effective hazard control program and establish a safe and healthful work environment.

Safety policy statement

Basic to management's announced and demonstrated commitment to the hazard control program is a formal safety policy statement. Policy is the management tool that asserts direction and resolves competing and conflicting goals and priorities. A safety policy statement should not be a species of poetry asserting noble aspiration but the voice of the big boss.

Policy declaration

The National Safety Council suggests that a policy declaration include the following:

1. That the company intends to comply with all safety laws and ordinances.
2. That safety of employees, the public and its product are paramount
3. That safety will take precedence over expediency or shortcuts
4. That every effort will be made to reduce the possibility of accident occurrence.

This policy declaration, signed by the chief administrator of the organization, should be given wide publicity and made available to all personnel. Such a policy should require active participation of all those involved in the program's operation. It also should state management's intention to integrate hazard control into all its operations, emphasizing that efficient operation means minimal accidents and losses.

Measure accountability by activities and results

It has been suggested that accountability be measured in terms of activities and results. Activities would mean that management measures line safety activities by looking at safety and tool box meetings, activity reports on safety, inspection and incident reports, accident investigation, and Job Hazard Analysis. Accountability for results would mean charging accidents to departments (by charging claim costs to the line and/or including accident costs in the profit and loss statements); prorating insurance premiums; putting safety into the supervisor's appraisal; or having safety affect the supervisor's salary. When it includes safety and health performance as an element in determining promotions, pay increases, or disciplinary action, management underlines the importance it attaches to a safe, healthful working environment.

Integral part of operations

Management's commitment to safety is manifest in its insistence that safety and health information be an integral part of training methods, materials and operations. Management also guarantees a system where hazard control is considered an important part of process design and equipment purchase, preventive maintenance, and workplace design and layout. It makes sure that effective fire prevention and protection controls exist. It informs subcontractors fully, at the time of negotiating the contract, of applicable standards and makes sure that they comply fully with company and other relevant safety regulations. Management also sees to it that the work environment is adequately protected against airborne fumes, mists, smokes, vapors, dusts, noise, vibration and other agents that have the capacity to impair health or cause discomfort among workers, be such damage immediate (acute) or long-term (chronic).

Management commitment

Research aimed at discovering what factors are shared by successful occupational safety programs reaches an important conclusion: management commitment to safety is the major controlling influence in attaining success in industrial accident prevention efforts. What do companies with outstanding safety performance have in common? Management is concerned with and involved in safety, as reflected by:[11]

Indicators

1. Knowledge of safety problems
2. Conviction that high safety standards are attainable if safety receives the same emphasis as do quality and quantity of production and sales
3. A respected position and important functions for the company safety officer
4. Regular inclusion of safety issues on agenda of company meetings, in-plant publications
5. Personal inspection and safety audits of work areas by a top management official
6. Extensive formal and informal contacts between workers and management on safety issues
7. A published policy expressing management's attitude toward safety
8. Behavior in accordance with safety regulations that sets an example.

Interestingly enough, another characteristic of low-accident plants, besides management commitment, is that little importance is attached to prizes and contests for motivating job safety. This conclusion confirms the view that motivation alone is ineffective as a means of generating safe behavior, that its success may be limited and temporary. Why? Motivation has limited success because it places the responsibility on the worker for avoiding accidents and, at least by implication, assigns blame to the worker if he has an accident.

Gimmicks no substitute

Gimmicks are no substitute for sound management practices. One safety officer, eager to focus attention on eye protection equipment, hired a pretty model in a bathing suit to walk through the plant. She sported a black eye patch and carried a sign: "I didn't think I looked good in safety glasses." Despite the sudden surge of interest in using eye protection, the gimmick lulled the company into thinking it had dealt with the issue when the basic problem had not been addressed.

Control by establishing preventive and corrective measures

After hazards have been identified and evaluated and information for informed decisions has been provided, the next process involves the actual installation of control measures. Controls are of two kinds: administrative (i.e., through personnel management, training and education, monitoring, limiting worker exposure, housekeeping and maintenance, purchasing) and engineering (i.e., isolation of source, lockout procedures, design, process or procedural changes, monitoring and warning equipment, chemical or material substitution).

Administrative controls

Companies having better-than-average safety performance also experience fewer turnover rates. Given that fact, it follows that there also was found a greater core of married, older workers with longer job service. Why were these firms able to maintain a stable work force? These companies had comprehensive personnel selection and development practices and employee support services. When management is concerned with well-being of workers, it reaps rewards. There are fewer accidents due to new worker inexperience, and there are more positive attitudes toward following safe job procedures.

Training and education

Training and education is another administrative control. New workers need to be introduced immediately to safe job procedures. Follow up instruction is also important because new materials are constantly being marketed, new processes and equipment are introduced, revised or updated, and new information becomes available. H. G. Wells said that human history becomes more and more a race between education and catastrophe. Hazard control can apply this statement to its own efforts in training and education.

Physical examinations

The physical examination for new employees provides an opportunity to identify individuals who are particularly susceptible to specific substances. This examination can also be used to ascertain whether the employees can satisfy the minimum physical requirements of the task, whether they possess, for example, sufficient hearing, visual acuity, lifting ability, or color sensitivity. Periodic medical examination is also important as a monitoring device (see following section on monitoring), to ascertain that worker exposure is kept within acceptable limits.

Scheduling

Scheduling can be another kind of administrative control. Worker assignments can be rotated to limit the number of hours per day that an employee must wear a respirator.Noisy operations can be scheduled for several short time periods during a day or over a number of days rather than in one long, continuous period.

Housekeeping and preventive maintenance

Housekeeping and preventive maintenance are essential to a successful hazard control program. An effective program incorporates the housekeeping function into all processes, operations and tasks. The ultimate goal is for each worker to view housekeeping as an integral part of performance, not as a supplement to the job to be done. When the worker can concentrate on his required tasks without excess scrap material, tools and equipment interfering with his work, he can operate more efficiently and create a product of higher quality. Time can be used for work, not in searching for tools, materials or parts. When everything has an assigned place, there is less chance that materials and tools will be taken from the workplace or misplaced. When aisle and floor space is uncluttered, movement within the workplace is easier and safer, and machinery and equipment are accessible for cleaning and maintenance. Furthermore, an orderly workplace permits easy exit. It means that fire emergency and extinguishing equipment can be located and obtained more quickly.

Preventive maintenance: orderly, uniform, continuous and scheduled

Preventive maintenance is orderly, uniform and continuous. Scheduled maintenance can prevent breakdown and prolong the useful life of equipment and buildings. Some advantages to be gained from preventive maintenance include safer working conditions, decreased downtime of equipment because of breakdown, and increased life of the equipment.

Purchasing

Purchasing is another administrative control. Those responsible for purchasing items for the organization are in a key position to help reduce hazards in three ways.

Items purchased with adequate safety controls; Compliance with safety regulations

First, they can make certain that tools, equipment, materials and machinery are purchased and shipped with adequate regard for safety. Where it is available, suppliers must provide information on toxicity and contents of all raw materials. Second, they can be certain that all items comply with federal and state regulations and with local ordinances. Third, they can be cost-conscious, realizing that every accident has both direct and indirect costs. The organization cannot afford "bargains" that later result in accidents, losses and occupational disease. Keeping dangerous defects out of the manufacturing process requires the cooperation of design, purchasing, manufacturing and quality control personnel.

Engineering controls

Engineering controls can be divided into three major categories:

1. Design
2. Safeguarding
3. Process or procedural changes.

With the increased emphasis upon product liability, design safety is coming into its own. One rather jaundiced assessment concludes, "Whenever it becomes more expensive for a manufacturer to produce machinery or equipment of unsafe or negligent design because of tort liability, then safe design will become a reality."[12]

Safeguarding

The two major forms of safeguarding are mechanical safeguarding (guards, shields and barriers) and personal protective equipment. Personal protective equipment is normally considered the last line of defense or as a supplement to engineering controls. It does not take the place of other controls and such controls as substitution, isolation and ventilation.

Process or procedural changes

Sometimes it is possible to modify a process to reduce the hazard. For example, brush-painting or dipping instead of spray painting can minimize the concentration of airborne contaminants. Vapor degreasing in tanks with adequate ventilation controls can replace hand-washing of parts in open containers. Substitution of nontoxic or less toxic materials for highly toxic ones is a very practical method of reducing or eliminating a health hazard. For example, carbon tetrachloride can be replaced by such solvents as methyl chloroform, dichloromethane or a similar substance. Wherever possible, detergent and water cleaning solutions can replace organic solvents.

Isolation

Isolation is a particularly useful control measure for jobs requiring relatively few workers. Isolation can be accomplished by a physical barrier (for example, sound-absorbing screens to reduce the noise from a piece of machinery), by time (for example, scheduling procedures producing toxic vapors when few workers will be exposed), or by distance (for example, remote controls).

Local exhaust ventilation

Local exhaust ventilation is considered a classic method of control. A local exhaust system captures or contains contaminants at their source before they escape into the workplace environment. Such a system removes air contaminants from the work area rather than diluting them. Local exhaust ventilation should be used only when the contaminant cannot be controlled by substitution, isolation, enclosure or changing the process. However, even though a process has been isolated, it still may require a local exhaust system. It is beyond the scope of this unit to explore in depth the preventive and corrective measures that control hazards. The preceding discussion illustrates only briefly the control strategies the hazard control specialist may use. The fourth process in the hazard control program deals with the monitoring of activities in order to locate new hazards and assess the effectiveness of existing controls.

Monitoring

Three functions: inspection, testing, & surveillance accident investigation

Monitoring can involve three functions: inspection, industrial hygiene testing and medical surveillance, and accident investigation. Including all three functions means that monitoring is performed before the operation begins, during the life cycle of the operation, and after the system has broken down. A system approach to hazard control will use each of these methods. Monitoring has been defined as a set of observation and data collection methods to detect and measure deviations from plans and procedures in current operations.

Inspection

Inspection can be defined as "that monitoring function conducted in an organization to locate and report existing and potential hazards which have the capacity to cause accidents in the workplace."[13] An essential part of hazard control inspection works because it is a vital managerial tool, not a gimmick. Inspection can be viewed negatively or positively: faultfinding, with the emphasis on criticism; or fact-finding, with the emphasis on locating potential hazards that can affect safety and health adversely. The second viewpoint makes the most sense. Effective fact-finding inspection depends on three things:

1. Adequate yardsticks to measure a particular situation
2. Comparison of what is with what ought to be
3. Corrective steps being taken to achieve desired performance.

Failure to analyze inspection reports for causes of defects means the ultimate failure of the monitoring function. Corrective action may fix the specific item but fail to fix the system.

Reviewing monthly accident reports

When management reviews monthly accident reports, it exercises an essential auditing function. It uses accident reports to make decisions to prevent similar accidents from occurring. When accident investigation reveals the need for or desirability of specific corrective action, management has the responsibility for determining whether the recommended action has indeed been implemented. Management looks for answers to certain key questions of its own. Are all significant accidents being reported? Are all parts of the organization equally committed to the hazard control effort? Are there trends or patterns in accidents or injuries? What system breakdowns predominate? What supervisors require additional training? What procedures are followed to make certain that remedial action is taken? Are employees advised of the results of accident investigation and of preventive measures being instituted?

Accident trends

Accident investigation

Accident investigation is a monitoring function that occurs after the fact. The hazard control system already has broken down. No amount of investigation can reverse the accident. Nevertheless, accident investigation serves an important function when past mistakes are used to improve future operations. As George Santayana has written, "Those who cannot remember the past are condemned to repeat it."

Evaluation

The final process in hazard control is to evaluate the effectiveness of the overall program. Evaluation answers such important questions as, How much is being spent to locate and control hazards in the organization? What benefits are being received? What impact are the benefits having on improving operational efficiency and effectiveness? Evaluation examines the hazard control program to see whether it has accomplished its objectives (effectiveness evaluation) and whether objectives have been achieved in accordance with the program plan (administrative evaluation, including such factors as schedule and budget). There is no magic formula that can instantly evaluate the hazard control effort.

Benefits to organization

Present methods are flawed

Present methods of evaluation are flawed. When evaluation is based on accident data, what is being measured is not occupational safety but the lack of it. Because it is often only chance that determines whether a given incident results in a near-miss or a catastrophic event, a hazard control program based on illness, injury and exposure statistics is built on shifting sand. Management is saying in effect, "Unsafe, hazardous conditions will be allowed to exist unless and until losses occur. An evaluation program based on accident data depends on injuries, illnesses and exposures. Without losses there is no evaluation. Evaluation methods can use data in other ways: number of tool box meetings, inspection reports and so forth. It is easy to succumb to the temptation of mishandling data, particularly when evaluation is used to justify particular programs or proposals, to prove the effectiveness of a certain technique or to demonstrate the need for a certain countermeasure. Sometimes, quite unconsciously, the evaluator sifts the data, discarding unfavorable indicators as "irrelevant" or "inconclusive" and selecting for his use only those statistics that bolster his hypothesis.

Reactions may present problems

The way workers react to the evaluation process also can present problems. Research and evaluation can indicate the need for new programs requiring new funds. William Tarrants, who has done research in the measurement of industrial safety performance, suggests that new knowledge may reveal that "many of our past notions about safety program effectiveness simply do not have a basis in fact, and that much of the effort being put forth in the name of accident prevention

is being wasted.'' Management may not appreciate an evaluation that seems to question the very assumptions on which the hazard control program is based. Evaluation can point out inadequacies, hardly welcome news if the purpose of the process was to stroke egos or to justify business as usual.

Middle-level management may feel threatened

Furthermore, middle-level management may think that evaluation can limit, threaten or interfere with its position. If evaluation requires extra recordkeeping or additional information, the middle-level manager may consider it a distraction from the job at hand and an extra, unnecessary burden, especially if the information is not essential for everyday operations. What is needed is an evaluation method that replaces intuition, speculation, and trial-and-error prevention attempts with a scientific approach that assesses the worth of an activity.

Performance standards

One spin-off of a satisfactory evaluation method is that performance standards could replace specification standards. Many existing specification standards do not afford workers the needed protection and discourage innovative hazard control methods.

Labor and management support

An effective evaluation method must have support from both labor and management. Support can be expected only if it results in a safer, healthier work environment. Given the absence of a reliable measurement instrument, perhaps the wisest course is to base an evaluation on several factors. According to Tarrants, ''The best we can hope for is a combination of instruments which will add further dimensions to our ability to identify and evaluate accident problems.'' The techniques to be used will depend on the situation. Among the criteria that may assist management in determining the effectiveness of its occupational hazard control program are the number of injuries to workers compared with work hours; the cost of medical care; material damage losses; facility damage costs; equipment and tool damage or replacement costs; and the number of production days lost due to accidents.

Experience modification

One guide to the success of the program is the experience modification computation submitted each year to the company by the carrier of its workers' compensation insurance. Experience modification applies only to workers' compensation, that part of the hazard control effort that focuses on preventing injuries. It does not measure other areas (for example, fire, property damage, motor vehicle accidents, product safety, public liability).

LOSS CONTROL AND THE MANAGEMENT PROCESS

The definition of loss control currently in use encompasses not only illnesses and injuries but all incidents resulting in damage to equipment or materials, loss of production time, and/or expenditures of time or money for extra labor. In order to be successful in reducing injuries and operating costs, hazard control must adhere to the fundamentals of good management. These include:

New loss control concepts: Accountability; Integration; Risk-reward justification

Accountability—the concept that holds each manager directly accountable for all activities in his sphere of responsibility. **Integration**—the concept that requires that all programs and activities function in relation to all others. **Risk-reward justification**—the concept that requires justification that each activity and expenditure be justified from its ability to return to the organization at least the value of the input.

Regulatory compliance

Regulatory compliance—the requirement that all regulations be complied with, taking into consideration the impact on employees, the community, the economy and the organization itself.[14]

Safety and health program elements

A hazard control program is only as good as the people who manage it. Following is a brief discussion of factors that can reduce the effectiveness of those in charge of the hazard control program.

The safety manager

A serious problem is a lack of consensus on what the word "safety" entails. Some organizations seem to think that hanging safety posters, running safety contests, showing safety films and similar maneuvers are sufficient for their plants' safety. Others think of safety as something to be dealt with once the production and quality control factors are taken care of. Therefore, safety managers may have a difficult time trying to gain cooperation from fire protection personnel, engineers, industrial hygienists, products safety specialists and so on, who wish to remain autonomous. In addition, some safety managers have difficulty in gaining access to up-to-date financial information relating to losses, premiums, legal settlements and so forth from their risk managers, who believe that such information is privileged. Too often, safety managers are cut out of the selection process when loss control services are selected. Sometimes, this is because the risk manager doesn't want to be bothered with the quality of the service or because the risk manager fears negative reactions to the service by upper management. Sometimes, it is because of real or perceived incompetence in the safety manager.

The risk manager

Specifically, the risk manager's functions are to identify and evaluate risks, to eliminate and/or control risks, to assess retentions of risks and to determine those risks that should be transferred.[15] Risk managers face some of the same frustrations as do safety managers. There are many who have been unable to sell management on the value of current philosophies of risk management. In essence, many of them are insurance managers, held accountable for identifying potential risks and for buying appropriate insurance policies. They may even be asked to submit claims for every single loss—even very small ones—so that the insurance company pays. Buying insurance should be the last priority of the risk manager, not the first. It would be much more valuable to try to determine ways to eliminate, control and retain risks first.

Hierarchy of safety and health program elements

Lawrence R. Decker recently advanced the theory that there is a clear hierarchical relationship between safety and health program needs and, therefore, the activities or elements that address them.

Top level: Visible management commitment

The lack of top management support is commonly given as a reason for the failure of a hazard control program. But it's important to understand precisely what management commitment means. It does not mean that management must condone any and every act performed in the name of hazard control. But it does mean that management will support efforts to achieve hazard control effectively and efficiently. There are some schools of thought that claim that top management commitment is not absolutely essential, and that such commitment can be sought at lower management levels. Certainly, support from these lower levels is as important as support from the upper levels. The problem with settling for support that begins at lower levels is that less time and resources will be available to carry out prevention programs.

Level 2:

We've discussed the terms responsibility, authority and accountability earlier in this unit.

Responsibility /authority /accountability

Having a hazard control manager can certainly go a long way toward the accomplishment of hazard control objectives, but it won't go the whole distance

without the proper meting-out of tasks. The assignment of responsibility in a certain task should automatically carry with it the authority required to accomplish it. Accountability, however, should be documented in writing.

Level 3: Goals and objectives

Once the first two levels have been looked after, it is necessary to set goals and objectives that will be measurable and meaningful to everyone within the organization. These may be in terms of achievement such as incidence rates, accident costs and so forth, or in terms of desired activities such as the number of safety meetings, inspections, job hazard analyses, etc. Perhaps they may be stated in a combination of terms.

Level 4: Availability of resources

There should be ample time, equipment, money and professional guidance to develop, institute and manage the hazard control program.

Level 5: Rules and work procedures

At the fifth level are the rules and procedures that enable the hazard control program to be carried out. In general, the most successful hazard control programs have these characteristics in common:[16]

1. Plant-wide safety and health rules are in writing, usually in a single document
2. Safety and health rules are readily accessible, either posted or distributed for all employees
3. Rules are reviewed periodically and revised as necessary to ensure that they continue to reflect desired practices and behaviors
4. Safety and health rules are discussed with employees frequently and in detail sufficient to maintain familiarity
5. Safety and health rules are enforced in the same manner and consistently as other rules
6. Managers, supervisors and visitors are required to follow the same rules as other employees.

Rules relating to any specialized job or work area should also be written out and readily available for reference and training purposes.

Level 6: Special-emphasis programs

At the sixth level are special programs designed for specific jobs hazards, such as working in confined spaces and welding and cutting. Sometimes, when one of these special-emphasis programs fails, the hazard control specialist will look for deficiencies within that specific program. He may not find them there. Often, the specialist is so wrapped up in the special-emphasis program that he overlooks the other layers, both above and below the special-emphasis program.

Level 7: Motivation

At the seventh level, the focus is on incentives and awards designed to motivate employees to behave safely or to discourage them from behaving in an unsafe manner. There are two theories regarding worker behavior that will help to establish motivators in the hazard control program. The first theory is that people do not choose to behave in an unsafe manner. They follow the motivational influences that are strongest at a given point. Contests and slogans may help to override negative influences by maintaining a high level of consciousness about hazards. The second theory is that different things motivate different people. Finding the motivators strongest for each individual depends largely on the level of needs satisfied and the level of needs sought. Some workers, for example, are seeking job security, while others are seeking better pay to increase their standard

of living. Still others may feel rewarded with less tangible benefits such as recognition, social status or job pride.

Level 8: Auditing

It remains to audit the effectiveness of each individual element of the hazard control program and to provide feedback to the management system. Surveys and inspections will already be in use as part of some of the special-emphasis programs. Other methods of auditing, such as questionnaires, interviews and team assessments, may also be used to evaluate the program.

CONCLUSION

The hazard control program must be carefully planned, organized, implemented and controlled in order to achieve optimum results. The hazard control specialist should know about risk calculation techniques, both those from the past and those currently being put into use. The five basic processes in hazard control must be understood before they can be integrated successfully into a program. Finally, getting a feel for the level of importance of each hazard control element on the program hierarchy will aid the hazard control specialist in understanding the structure and in tracing breakdowns when they occur. The management process can be very satisfying as well as highly frustrating. Knowing ahead of time how to circumvent the frustrations can help to keep the satisfactions paramount.

SAMPLE TEST QUESTIONS

1. In this unit, we discussed four major problems with justifying a hazard control program on the basis of profit alone. What were they?

2. What are the four functions of the hazard control management process?

3. What are the five essential processes in hazard control?

4. Five administrative controls were discussed in this unit. What were they?

ANSWERS TO QUESTIONS

1. It can be difficult for the hazard control specialist to identify all costs related to accidents. It can be difficult to prove that a savings has been achieved. Accidents are relatively rare events. And, there is a chance that, for reasons unrelated to the hazard control program, the organization's accident rate may go up after the institution of the program.

2. The four processes are planning, organizing, actuating and control.

3. The five essential hazard control processes are identification and evaluation; management of decisionmaking; control methodology; program monitoring; and evaluation of results.

4. Administrative controls include training and education; physical examinations; scheduling; housekeeping and preventive maintenance; and purchasing.

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Appendix III-A

Examples of Assigning Numerical Values to Risk

Instructor's Note: These are examples referred to in the text that can be used in class. The recommended technique is for the whole class working as a group to determine the risk calculation based on the information in the first example. Examples 2 and 3 should be worked independently in small groups, and the results compared.

Example 1

This example involves a quarter-mile stretch of two-lane road used by both vehicles and pedestrians departing or entering the ground. There is no sidewalk, so pedestrians frequently walk in the road, especially when the grass is wet or snow-covered. There is little hazard to pedestrians when all the traffic is going in one direction only. The hazard occurs, however, when vehicles are going in both directions and passing each other. The vehicles require the entire width of the road, and pedestrians must then walk on the grass alongside the road. An accidental fatality could occur if a pedestrian steps into the road, or remains in the road at a point where two vehicles are passing.

Three steps are required to determine a risk score for this situation. One must list the accident sequence of events that could result in the undesired consequences, select the value for each element in the formula, and perform the actual calculation.

The accident sequence might involve the following seven events.

1. It is a wet or snowy day, making the grass along the road wet and uninviting to walk on.
2. At quitting time, a line of vehicles and some pedestrians are leaving the grounds, using this road.
3. One pedestrian walks on the right side of this road and is oblivious to the traffic. (This is the hazard event.)
4. Although traffic is one-way at this time, one vehicle comes from the opposite direction, causing the outgoing traffic line to move to the right edge of the road.
5. The pedestrian on the right side of the road fails to observe the vehicles, and he remains in the road.
6. The driver of one vehicle fails to notice the pedestrian and strikes him from the rear.
7. The pedestrian is killed.

Given the above series of events, the components of the formula are supplied below. The consequence is a fatality; therefore, C = 25 (refer to Table I). In relation to exposure, the hazard event is the pedestrian remaining in the road and failing to notice the traffic. Therefore, E = 3. Factor in Table I given the approximate frequency of occurrence.

The probability of all events of the accident sequence following the hazard event is "conceivable, although it has not happened in many years." The reasoning is as follows: events 4, 5, 6 and 7 are individually unlikely, so the combination of their occurring simultaneously is extremely remote. Event 5 is unlikely because a number of drivers would undoubtedly sound their horns and force the pedestrian's attention. Event 6 is unlikely because most drivers are not deliberately reckless. Event

7, a fatality, is unlikely because vehicle speeds are not great on the road, and the most likely case would be a glancing blow and minor injury. Not even a minor injury has ever been reported in the real situation. In view of the above, the probability (P) is equal to 0.5.

The third step involves substitution of values into the formula and the performing of the simple arithmetic.

$$R = C \times E \times P = 25 \times 3 \times 0.5 = 37.5$$

It should be noted that the risk score of one case alone is meaningless. Additional hazardous situations must also be calculated for comparative purposes and to develop a definite pattern.

Example 2

In this example, events are discussed that actually took place several years ago. In a machine shop fifty compressed air hoses were being used for general cleaning purposes. The air hoses were being used without proper pressure reduction nozzles. This created potential eye hazards, from objects blown under pressure. Although eye protection was worn by most workers the possibility of a serious eye injury existed.

Applying the same three steps as in the first example, the accident sequence is:

1. Many machine operators use compressed air streams to blow metal chips from work.
2. Most employees occasionally remove their safety glasses while still in the hazardous area. (This is the hazard event.)
3. One employee who is not wearing eye protection walks past a machine while an air hose is being used.
4. A metal chip blows into the employee's eye.
5. A serious eye injury results.

The consequence in this incident is a disabling eye injury, so C = 5. The exposure is directly observable. The hazard event, an employee removing his eye protection while still in a hazardous area, occurs many times daily, so E = 10. The probability of the total accident sequence is judged to be quite possible, so P = 6. The calculation is:

$$R = C \times E \times P = 5 \times 10 \times 6 = 300$$

Example 3

The third situation is more complex than the last two. A 12,000-gallon propane storage tank is subject to two hazards. One is inherent in the fact that the tank is located beside a well-traveled road. The road slopes and is occasionally slippery due to rain, snow or ice. It is possible that a vehicle (particularly a truck) could lose control, leave the road, and strike and rupture the tank, causing a propane gas explosion and fire that could destroy several buildings. The consequences might amount to $200,000 in damage plus possible fatalities. The second hazard is the tank's location close to very highly compressed air lines and equipment. A high-pressure pipeline explosion could result from a malfunctioning safety valve, a human error in operating the equipment, damage to a pipeline or other causes. Blast or flying debris could possibly strike the propane storage tank, rupture it, and cause it to explode with the same consequences as the runaway vehicle.

In this case, there are two hazards, so the evaluation is conducted in two parts, one for each of the hazards. The two scores are then added. Considering first the situation involving the runaway vehicle, the sequence might be as follows:

1. Many vehicles are driven down the road beside the storage tank.
2. The road has suddenly become slippery due to an unexpected freezing rain.
3. One truck starts to slide on the slippery road as it descends the hill. (This is the hazard event.)
4. The driver loses control of the vehicle at a point uphill from the tank and moving toward it.
5. The vehicle's brakes fail to stop it from sliding.
6. The vehicle heads directly toward the tank.
7. The vehicle strikes the tank with enough force to rupture it and permit the propane gas to begin to leak.
8. A spark or flame, perhaps from a vehicle fire, ignites the propane.
9. An explosion occurs.
10. Building and equipment damage is $200,000. Therefore, C = 25.

The hazard event that would start the accident sequence is the truck starting to slide on the road. This has happened rarely. Therefore, the exposure factor (E) is equal to 1. To decide on the likelihood that the complete accident sequence will follow the occurrence of the hazard event, consider the probability of each event:

Event 4: The loss of steering control at the precise point in the road approaching the tank is possible but would be unusual.

Event 5: Once the vehicle started to slide, if the road were ice-covered, it would be expected that the brakes would fail to stop the slide.

Event 6: The vehicle heading directly toward the tank is highly unlikely. Momentum would cause the vehicle to continue straight down the road.

Event 7: The likelihood of the vehicle striking the tank with great force, and squarely, is extremely unlikely.

If a vehicle were sliding on an ice-covered surface toward the tank, it would be easily diverted from its direction of travel by a number of obstructions between the road and the tank. When the roads are slippery, travel is curtailed and drivers are cautioned to drive slowly. A slow rate of speed would be unlikely to produce enough force to damage the tank. The shape and position of the tank are such that a vehicle would tend to glance off the side. However, events 8, 9 and 10 are likely to follow if event 7 takes place.

In sum, the highly unlikely nature of most of the events from 4 through 7 gives a net probability of almost one in a million: It has never happened, but it is conceivable. Therefore, P = 0.5. The calculation for this first risk is:

$$R_1 = 25 \times 1 \times 0.5 = 12.5$$

The second hazard is treated similarly. The list of events is:

1. Normal daily activities involve the operation of equipment and pressurizing of pipelines, some of which are in the vicinity of the propane storage tank.
2. A pipeline containing air compressed to 3,000 pounds per square inch, approximately 50 feet away from the storage tank, has become deteriorated or damaged. (This is the hazard event.)
3. The pipeline bursts.
4. Metal debris is thrown in all directions by the blast and several pieces strike the propane tank with sufficient force to rupture the tank.
5. Propane starts to leak from the tank.
6. A spark ignites the propane fumes.
7. The propane-tank explodes.
8. Building damage is $200,000 and one man is killed.

The pipeline hazard rates as C = 25. In regard to the hazard event, high-pressure air lines have occasionally been neglected or damaged. The frequency of such occurrences is considered unusual. Therefore, E = 2. An estimate is made of the probability that a damaged pipeline will explode and that the explosion will occur close enough and with enough force for flying debris to strike the propane tank with great force. Several bursts have occurred in the past few years, but none has damaged the propane tank. Few of the pipelines are close enough to endanger the tank. After careful observation, the accident sequence is considered very remotely possible. The classification is placed at P = 0.5. The score for the second risk is then determined:

$$R_2 = 25 \times 2 \times 0.5 = 25$$

Finally, the two scores are added:

$$\text{Total} \quad R = 12.5 + 25 = 37.5$$

UNIT IV

EMPLOYEE TRAINING AND EDUCATION

Robert J. Firenze
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METHODS: Lecture and demonstration LENGTH: 60 Minutes

PURPOSE: To examine the role of employee training and education as an essential part of the overall safety and health program.

OBJECTIVES: To acquaint the student with:

1. The need for and benefits of employee safety and health training and education
2. The impact of safety and health training and education in the workplace
3. The factors that go into the decision to train
4. The factors that help management determine who needs training and education
5. The types of training
6. The aspects of training to be evaluated.

SPECIAL TERMS:

1. Training and Education
2. Job Analysis
3. Initial Safety/Health Orientation
4. Pre-Job Safety/Health Instruction
5. Planned Personal Safety/Health Contacts
6. Correctional Safety Contacts

INSTRUCTOR MATERIALS:

1. Lesson Plan
2. Chalkboard
3. Student supplementary materials

TRAINEE MATERIALS:

1. Participant outlines made by instructor
2. Supplementary materials

UNIT IV

EMPLOYEE TRAINING AND EDUCATION

INTRODUCTION

Probably everyone understands fairly well the difference between training and education. The word "training" conjures up pictures of students practicing a certain task until it can be performed smoothly and without error. The word "education" conjures up pictures of classrooms, blackboards, lectures and exams. In training, the students are perceived as active participants. In education, they are perceived as passive. But what, precisely, do training and education each entail in industry?

Training vs. education

Training is a process whereby workers acquire a skill or set of skills. It involves a modification of certain behaviors to achieve the desired result. **Education,** on the other hand, requires the modification of certain thought processes as well. Knowledge must pass from one individual to another. In addition, the one who receives the information must develop cognitive skills so that the information received can be processed and used again. In this respect, the learner is just as actively involved in the process as is the learner in a training program. The success of a training program is easily assessed in the degree to which the trained workers can perform their tasks and attain the desired result. Education is measured by subtler means, in the amount of information the learners have retained and the different uses to which they put the acquired information. Although training and education are discussed here as separate entities, the fact is that, more often than not, any type of learning program will use a combination of the two types. The degree to which each of these elements is used depends largely on the particular needs of the learners.

Intensity of the learning experience

Let's examine the principle of intensity, in which an idea is made vivid through association with a clear experience, using as many of the physical senses, and as many training devices, as possible.

The five senses and learning

The best kind of instruction occurs in a triad: by telling, showing and doing. A report by the Industrial Audio-Visual Association[1] illustrates the contribution of each of the five senses to learning:

1% of all learning occurs through taste
1.5% of all learning occurs through touch
3.5% of all learning occurs through smell
11% of all learning occurs through hearing
83% of all learning occurs through sight.

The same report examined the data from a different perspective, finding that we remember:

10% of what we read
20% of what we hear

30% of what we see
50% of what we both see and hear
80% of what we say
90% of what we say as we act.

Before training begins

The following items must be considered before a training program can be developed:

1. An organizational assessment must be made to determine specific training needs.
2. A direction in which the program will move must be established, and goals and objectives must be set.
3. The program must correspond to organizational needs.
4. All resources—be they human or otherwise—must be available to meet the program's objectives.
5. The organization must establish a level of commitment.
6. The program must promise maximum results with the minimum cost.

The importance of understanding company objectives

Because a training program is usually favored over an educational program in industrial applications, it is important for a company preparing to train its employees to determine the desired end product. If it wishes only to inform its workers of something, any number of educational approaches will suffice. If, on the other hand, it wants its workers to be able to perform a given task in a prescribed manner, it must focus its attention on finding the proper training program.

Remember: Training develops skills. . .

The end product of any training program is a skill, which can be measured in qualitative and quantitative terms. Some companies that have spent large sums of money to train their employees by the use of educational programs to impart needed skills have found, to their great disappointment, that they failed to obtain the desired result. Their workers were unable to meet the new job requirements. They could not, because they did not learn the skills to meet those requirements.

... but education may not

For example: Suppose a company wants to train several of its employees to be qualified welders. If it designs a program of instruction that emphasizes the general types of welding methods, characteristics of metals, welding apparatus, safety precautions and so on . . .what has it accomplished? The workers now know the general types of welding methods, characteristics of metals, and so on. Granted, these are important subjects. But the workers still don't know how to weld; and that was the reason for having the instructional program in the first place. It is important to know specifically what is wanted before a decision to educate or train is made.

Instruction varies in emphasis

It is important to also remember that no instructor teaches only by educating or only by training. Any instructional method will always involve some mix of the two. The problem is finding the program that is properly weighted in either education or training, depending upon whether the desired end product is to be knowledge or skill.

IMPACT OF TRAINING PROGRAMS

Before selection of a training program can begin, it is important to set realistic goals for expected results. For instance, it has been demonstrated in a number of studies that training programs seem to have the most influence in helping

workers to learn new tasks more quickly than they would without, and to be involved in fewer accidents during their first few months or years on the job than do new workers who are not involved in a training program.

Accident reduction

Reduction of the number of accidents among new workers is often dramatic. Overall, this can mean a savings of millions of dollars to an organization, especially if its rate of employee turnover is high.

Reduction in unsafe acts

Similar studies have shown a reduction in the number of unsafe acts committed, resulting in a decrease of the number of accidents and injuries.

New job skills

A further benefit to be derived from on-the-job training, aside from a reduced accident rate especially at the onset of employment, is an increase in speed at which the new job skills are acquired.

New employees may perform more safely

To look at the situation in another way, studies have shown that more injuries occur during the first month and year of service in a given occupation than during any other month or year. First-year workers as a group incur a disproportionately small fraction of industrial injuries as a group. These conclusions should be regarded with caution, however, as they are based on studies that were limited in scope. They should be seen as results that can predict likely trends across industry in a variety of specific applications.

Combined general and specialized instruction

One study further attempted to determine distinguishing factors among organizations offering safety training programs but showing different rates of success. It was found that organizations enjoying the greatest degree of success were the ones offering the greatest opportunity for both general and specialized safety training programs with supplementary instruction for production personnel.

Training is only a partial solution

Generally, safety training programs alone are not The Great Panacea. They represent only part of the solution to the problem of industrial accidents and injuries. An organization truly committed to improving its safety record will have to institute other measures as well. As a part of the total commitment, however, safety training programs can do much to enhance the organization's efforts to reduce the number of accidents that occur.

WHO BENEFITS AND HOW

Greater ability of workers to recognize hazards

Aside from the direct results noted earlier, safety training programs may produce subtler results. For instance, workers benefit by being able to recognize hazardous situations and to report them before accidents occur. Health costs will be lowered, and workers will suffer fewer losses to their earning potential due to disabling injuries. Advance training may also have positive psychological results, fostering confidence that promotes greater productivity.

Worker behavior modified

The worker's behavior may also be modified following a training program. He may be better prepared to assess the potential hazards of a situation, avoid adverse exposures, and use the needed personal protective equipment than an untrained worker.

Increased productivity

Employers will benefit by the implementation of such programs, too, because the productivity of the workers can be expected to increase. An obvious benefit is the reduction of costs incurred as the result of fewer accidents and injuries. Accidents can create a variety of expenses, both obvious and unseen. Experienced

workers may be lost permanently, requiring new ones to be trained to replace them; and machinery may be damaged in an accident. The costs can be high for replacing or repairing equipment; furthermore, the organization is losing money during the time that portion of the operation is not functional. Sometimes, workers who have been injured will bring lawsuits against the organization. Litigation can be very costly. Finally, organizations whose records show high accident rates must pay high premiums on their insurance. All these costs may be avoided as an indirect result of safety training programs.

DECIDING WHEN TO TRAIN OR EDUCATE

There are various ways by which an organization may decide to institute a training program. Some of the methods for deciding on a particular training program are specific to the organization's needs and well-thought-out; others are slap-dash and undirected. It should be obvious which approach will offer the best results.

First Approach: Response to perceived problem

Often, the way a program comes to be instituted is through a sequence in which, first, the department manager contacts the training officer of an organization about his concern over a certain problem, such as high employee turnover, that has convinced him that the supervisors are lacking in a specific skill, such as employee relations. The training officer contacts a nearby university or other source of adult education courses, or designs a program to fit the need stated to him by the department manager. Supervisors are then selected to attend the program; at its completion, the supervisors are asked to assess the program.

Problems

There are several problems with this approach, despite the fact that, from all outward appearances, something appears to have been accomplished. Probably the most obvious problem is that from the very onset of the process—from the moment that the department manager contacts the training officer—the problem may have been misidentified. It may be that the supervisors are not necessarily the individuals needing training.

Is the problem identified correctly?

Does the "canned" program address the problem

The next problem occurs at the next step, when the training officer contacts an outside source for a training program. In all likelihood, what he will receive from the source will be a "canned" program that has already been designed. The extent to which this canned material may be adapted to the organization and its perceived problem will depend on both the source of the program and on the training officer. Obviously, that leaves a lot of room for error.

Is the participants' assessment of the program valid?

Let's move on to the next step. If we can assume that the supervisors chosen to attend have been selected properly and attended the program willingly, we cannot by any means assume that their assessment of the program will be necessarily valid. Certainly, if the problem has been identified incorrectly at the outset, it will matter little whether they liked the program. If the problem was correctly identified, however, the supervisors may feel resentful and defensive about having been identified as lacking in certain skills. Therefore, their views on the program may be negative. Or, they may assure the questioner that they liked the program because they believe that is the "right" answer. Either way, the feedback will not be constructive.

Second Approach: Keeping up with the Joneses

A second approach is more likely to appear in a large organization than in a small one, because large corporations tend to be more competitive, and to maintain the appearance of keeping up with the other large organizations. In this approach, a manager may attend a conference and hear of a training program that has been

instituted at a competing organization. Even though the program does not address any particular problem at his organization, the manager thinks it sounds like a good idea, and requests the training officer to put such a program together. Assuming that the organization can afford the expense and time, this may not be such a bad thing. But if limited money is being spent on programs to the exclusion of programs that are needed more, there is an obvious waste.

Third Approach: Buying an attractive package

A third approach is similar. It's a well-known fact that private enterprises that design training programs will naturally advertise their services. One of the most direct ways is to send flyers to corporations that might be able to use the programs. If the flyers are well-designed and attractive, they will achieve the desired result: they will catch the eye and the interest of the organization, and the search begins for personnel who might attend. Again, this might not be such a bad idea. But as you'll notice, all three approaches rely on certain assumptions being correct in order to be successful. In this case, it must once again be assumed that the programs offered by the enterprises can be adapted to fit specific organizational needs, and that the organization can afford to spend the money.

A systematic approach

The very best approach will take into consideration as many factors as possible before making a decision. There are numerous variables that can change the picture dramatically, such as:

Who needs it?

Who needs the training and education? This may seem like an obvious question, yet finding the answer can often be difficult, as was illustrated in our discussion of the first approach. Likely candidates are often newly hired employees, or those who have recently been transferred to new tasks. Sometimes, however, finding the answer to this question must be postponed until the second one can be answered; namely, . . .

What is needed?

What training and education do they need? We demonstrated what can happen if the problem is incorrectly identified at the outset of the program selection process. Answering this question correctly will almost automatically identify those who need it. In the case of an organization with high employee turnover, it can almost be guaranteed that there will be an on-going need for training new employees. A more in-depth way of arriving at the answers to these two questions is by asking the six essential questions of the newspaper business: who, what, when, where, why and how?

Who?

The who question can be answered by asking who is involved in the problem or perceived need. It is not essential at this time to pinpoint the central figures; identifying all persons involved in the problem is sufficient for the time being.

What?

What are the problems they are involved in? Again, this question can be answered somewhat generally for the moment. It will be narrowed down as the other questions are answered.

When?

When have the problems been observed? When did they begin? How often do they occur? Knowing the time at which problems are observed can provide important clues for the solution.

Where?

Where the problems occur is another important delimiting factor. The training officer should spend a great deal of investigative time at the scene of the problem, interviewing employees who work there.

Why?	The why question can be asked at least two ways: why are the problems occurring, and why are they problems?
How?	Finally, a precise description of how the problem occurs is needed to complete the picture. It should be added that some creativity is needed in discovering all of the ways each of the six questions can be applied to the situation. Usually, all six of them apply in a number of ways, and it's important to see them from a number of angles in order to cover all possible ground.
What are the purposes?	*What are the purposes of the training and education?* A training program should be expected to accomplish something. If an organization has made up a list of desired results, it will have a much better idea of what type of program it is looking for.
What are the objectives	A related question. *What are the instructional objectives that need to be incorporated in the training program?* Helps to break the purposes into specific categories that can be addressed by the program.
What programs meet the objectives?	*What training and education programs best meet the specified instructional objectives?* Programs already in existence may be useable as they are, or they may be flexible enough to be adapted to the needs of the organization. Sometimes, two programs that are inadequate by themselves may be combined to form one program that will meet the needs. Otherwise, the employer may, and probably should, opt for having a program designed especially to fit his organization's needs.
What does the program promise?	*What benefits does the program promise?* Not only must the program fulfill the organization's needs, the benefits expected must be realistic. An organization should be wary of a program that sounds too good to be true. It probably is.
What is the program content?	*What is the program content?* The content must be suited to the workers who are to be trained. This includes the level of instruction and the vocabulary used to get the meaning across. Program content that introduces material with which workers are already familiar is wasteful; conversely, information that assumes a great deal of advance knowledge on the part of new employees may not be absorbed. The level of education of the workers to be trained is also important to know, so that the language can be fitted precisely to the workers' usage. The language should neither baffle with highly technical terms nor insult the intelligence with unnecessary simplicity.
Where and when will instruction take place?	*What is the place and time of the program?* If training services are to be provided by an outside source, this will obviously be a more pressing issue than if it is an in-house program. In either case, several factors must be assessed. For example, how long can the organization afford to have the employees away from their jobs? Will it, in fact, be necessary for them to be away from their jobs at all? How much will it cost? Does the organization have the training facilities necessary for the program? Should the employees be trained on their own time, or should time be allotted during regular working hours for the training to take place?
What will it cost?	*What are the costs of the program?* The goal cost of the training program will include the cost of assessing the workplace, instructor fees, purchase of materials such as visual aids, and loss of employee productivity.

What results are observed?

What do evaluation and feedback indicate? The primary assessment of the training program will be whether or not it met the desired objectives. Have the employees benefitted, improved? Have accidents been reduced as a result of the program? The assessment should also include an evaluation of whether or not the same—or better—results could be achieved in the future at a lower cost. See Appendix IV-A for a sample checklist that can be used in the training decision process.

BASIC PRINCIPLES OF TRAINING PROGRAM DESIGN

A systematic approach to the development of training programs should emphasize assessment of organizational need and specification of instructional objectives, precisely controlled training experiences to achieve these objectives, criteria for performance, and evaluative information that provides feedback for organizational decisions. A model for this approach is shown in Figure IV-1.

Instructional need

The first important component of the model is an assessment of instructional need with an emphasis on job, worker and organizational needs. The assessment of instructional need is designed to provide precise behavioral objectives that describe the terminal behaviors that trainees will be able to perform on completion of the program. With this approach, there is a de-emphasis on objectives such as "to appreciate the problem of welding hazards," which are so vague that they can be fulfilled by a number of behaviors.

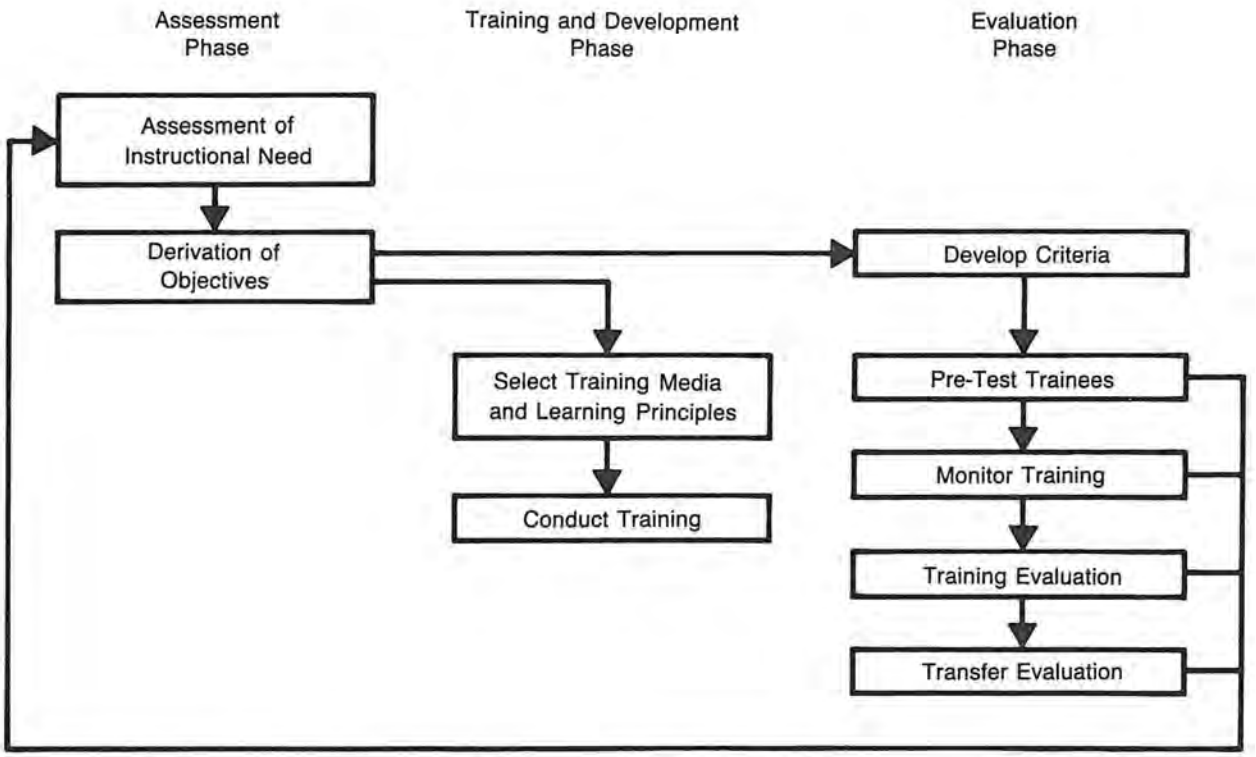

Figure IV-1. From Goldstein, I. L., *Training: Program Development and Evaluation.* Belmont, California: Brooks, in press.

Training medium

The model indicates that the particular training medium selected should be related to specific objectives to be achieved. Thus, particular techniques like simulators are useful for the training of complex motor behaviors while other techniques such as programmed instruction are more useful for imparting information.

ESTIMATING COST

It would be beneficial if, after considering all these questions, a program could be implemented that would suit the organization's needs perfectly—and be inexpensive as well. Reality does not admit for such ideas, however, so estimating the cost of the program is very important. Cost data can best be calculated by course development, participants, instruction and facilities. Computation of participant cost should include salary, associated benefits, travel expenses and daily costs, and should be broken down on a cost-per-instructional-hour basis.

Three groups of costs:
1. One-time fixed
2. Investment
3. Recurring

Another way of determining cost is to separate expenses into three groups: one-time fixed costs, which would include hazard assessment, planning, and testing and evaluation; investment costs, to include initial training, equipment, and training program packages; and recurring costs, including personnel salaries, employees benefits, maintenance of equipment, replacement and recurring training costs, payments for outside training assistance, miscellaneous materials and supplies, and miscellaneous overhead costs. Appendix IV-B shows a sample of an organization's training cost assessment.

MAKING THE PROGRAM COST-BENEFICIAL

When the training (or educational) program is still in the design stage, three major areas should be considered: (1) involving participants while minimizing interruption to the organization; (2) knowing which subject matter will benefit the group and also to specific segments of the group; and (3) being able to cover adequately the program's essential subject matter, which often must be done within severe time constraints. These three areas must be assessed again when the impact of the program is evaluated.

Establish priorities

In understanding the importance of minimizing the interference with the organization's regular operations, planners must weigh the value and cost of options, such as classroom vs. on-the-job instruction. If classroom instruction is chosen, the schedule should be staggered so that all personnel will not be away from their jobs at the same time. This is to make certain that interruption will be minimal and that productivity will not drop off.

JOB ANALYSIS

Before a training program is instituted, a job analysis must be conducted. The job analysis consists of a careful study of the jobs within the organization. Once the jobs have been studied, the specific content of the training needed can more easily be determined. The job analysis should serve the following purposes:

Purposes of job analysis

It should ascertain job requirements, working conditions, and health and safety requirements. It should determine employee qualifications to work on or near hazardous equipment or conditions as new employees, as employees at regular duties and as employees newly assigned to the task. Finally, it should study and analyze work processes and procedures to find better methods of doing work with an eye toward simplifying these processes and procedures.

Checklist

In order to make the most of a job analysis, a checklist should be used so that key observations will always be recorded. Appendix IV-C provides a sample checklist for a job analysis. Because the job analysis can be very time-consuming

and expensive, it is generally better to collect more information than needed rather than have to repeat the analysis.

Observation

One method of collecting job information is to use workers and supervisors who are very familiar with the job and who understand each phase of the job. These employees can be used to observe the operations and to interview workers performing similar jobs.

Questionnaire

Another method involves providing questionnaires to be completed by employees. Appendix IV-D shows a sample questionnaire of this type. The questionnaires should be completed and returned within a given period. Supervisors should then review the results with each employee to verify answers. It should be stressed to the employees that the information provided on the questionnaires should represent current practices, not how they have been in the past, nor how employees would like them to be.

Description of each job

A job analysis should include detailed descriptions of each job. A comparison of desired performance, taken from these descriptions, and observed performance, will indicate the training needs of the organization.

TYPES OF TRAINING AND EDUCATION

There are basically three phases of training. Initial safety orientation, pre-job safety instruction, and one-on-one.

Initial safety instruction

Safety orientation is not the same thing as job instruction. The purpose of safety orientation is to cover the subject areas with which the worker must be familiar. If the worker has previously occupied the position, the orientation should be designed to refresh his memory on what he at one time knew, as well as updating him on changes that have taken place since he last occupied that position.

Informs or refreshes

If the worker is new at the job, the orientation should be given before specific job instruction. If the worker is returning to the position after an absence, the orientation may be given either shortly before he re-assumes the position, or shortly thereafter. The orientation should include several subject areas.

Hazards

The worker must learn the major area hazards, common area hazards, and hazards associated with adjacent processes and equipment.

Protective equipment

Use of correct personal protective equipment should be discussed. The worker must be told which types of equipment are required, which are recommended. and why they must be used.

Rules/Regulations

Safety rules and regulations should be discussed as well.

Pre-job safety instructions

Pre-job safety instructions should be given when a worker is assigned to perform any new task. Safety instructions are especially needed for hazardous tasks that occur infrequently, since the worker's knowledge of how to perform such a task, and of the hazards involved, is most likely minimal. Subject areas that should be covered in pre-job safety instructions include obvious and potential hazards, unsafe acts likely to be committed, required protective equipment, general safety precautions, such as lockouts, and what to do in the event of an emergency.

Planned personal safety contact

The planned personal safety contact is a one-on-one type of instruction and, for that reason, is the most reliable method. An example of this method would be

to appoint a supervisor or some other knowledgeable individual to contact individual workers for discussion of a specific safety topic that relates to the worker's job. The method is considered the most cost-beneficial, because the worker is much more likely to concentrate on the transferred message, to better understand, and to provide feedback by which his cooperation and comprehension can be determined.

ASPECTS OF TRAINING THAT CAN BE EVALUATED

Discussions of the aspects of a program that can be evaluated can be complicated. Changes in attitudes, knowledge, skills, job performance and costs, as well as in the quality of the training facilities and the climate of the trainee's organization, are all important variables. It's important to arrange these variables into a meaningful order and to interpret their meanings.

The Likert model

A model developed by Rensis Likert[3] identifies the causal, intervening and end-result variables. To apply this model to the evaluation of a training program, the program itself can be viewed as a causal variable. According to the model, the program should affect the organizational climate, an intervening variable, and lead to a change in output, an end-result variable. The overall relationship among the variables is important in this model. For example, if the intervening variable—the organization—is indifferent, the long-range improvement in output—the end-result variable—will be adversely affected. This will be true regardless of the quality of the causal variable, the training program.

Three variables

To include all the elements of training onto the model, they can be grouped under each of the three Likert variables. The training program's content, methods, aids and facilities are causal variables. Leadership style, communication patterns and the decision-making process are intervening variables. Reduced costs, better services and increased production are the end-result variables. These variables are illustrated below.

Causal variables

1. Causal Variables:
   a. Training content: the relevance of the program's content to training needs in areas such as attitude, knowledge, skills and job performance
   b. Training methods:
      (1) Group methods: individual participation in the learning activity through group conferences, discussions, demonstrations or other group activity
      (2) Individual methods: individual readings, guided study, individual coaching, job rotation experience and one-on-one
   c. Training Aids:

Experienced trainer

      (1) Trainer: practical experience, teaching experience, educational background and personal qualities

Training materials

      (2) Materials for the trainee: text material, outlines, work sheets, case studies, supplementary reading, manuals, etc.
      (3) Materials for the trainer: instructor's guide, discussion questions, outlines, lesson plans, manuals, etc.

Audiovisual aids

      (4) Audiovisual aids: charts, films, slides, posters, mock-ups, flannel boards, displays, etc.

Good facilities

      (5) Facilities: proximity of the training area

Intervening variables

2. Intervening Variables. ***Example:*** Motivational techniques: use of rewards and disciplinary action to gain workers' compliance with the employers' directives, workers' level of commitment to their work group or agency's goals.

End-result variables

3. End-Result Variables. The best evidence of a training program's effectiveness is the measurable changes it produces in the trainees' attitudes, skills, knowledge and job performance. As previously stated, these changes depend, to a great extent, on the quality of the training program's content, facilities and instructors (causal variables) and the agency's organizational climate and decisionmaking process (intervening variables). Theoretically, the assessed value of the causal and intervening variables should be reflected in the end-result variables, or the achievements of the trainees. The answer to the question, "What was the impact of training"? lies in an analysis of the original goals and objectives of the training. If goals and objectives were specific, training officers can measure results against such end-result variables as:

What was the impact of the training?

   a. Reduced operating costs
   b. Better quality of production
   c. Increased man-hours of production
   d. Increased number of employees able to meet production or job standards
   e. Reduction in frequency and/or severity of accidents
   f. Reduced turnover
   g. Decreased absenteeism
   h. Fewer grievances and disciplinary problems.

IMPACT OF OSHA TRAINING GUIDELINES ON BUSINESS AND INDUSTRY

Ever since the OSHA Act was implemented in 1970, employers have been required to bring employees from all levels of the organization into some type of safety training program. A recent survey of the Bureau of National Affairs found that, because of the Act, 63% of all manufacturing and 48% of all non-manufacturing organizations had instituted new or supplementary training programs.

CONCLUSION

Before an organization can implement a safety training and/or educational program, it must know the difference between training and education, and which of the two will yield the desired results. The various groups who can benefit from instruction should be considered. The best method for selecting the proper program—a method that involves asking a number of specific questions—should be used. Designing the program and making it cost-beneficial requires careful consideration of the types of programs available. Finally, no training or education program is complete without provisions for evaluation of the program.

SAMPLE TEST QUESTIONS

1. What is the major difference between training and education?
2. What are the purposes of the job analysis?
3. What are the three main types of training discussed in this unit?
4. What are the three types of variables discussed in the Likert model?

ANSWERS TO QUESTIONS

1. Training imparts a skill or set of skills, while education imparts knowledge and requires the modification of certain thought processes.

2. It should ascertain job requirements, working conditions, and health and safety requirements. It should determine employee qualification to work on or near hazardous equipment or conditions. Finally, it should study and analyze work processes and procedures to find better methods of doing work with an eye toward simplifying these processes and procedures.

3. The three types of training discussed were initial safety orientation, pre-job safety instruction, and one-on-one contact.

4. The Likert model identifies the causal, intervening and end-result variables.

NOTES

1. Industrial Audio-Visual Association, P.O. Box 656, Chicago, IL 60690.

2. Curtis, J.A. "A Study of the Patterns of Injuries in the Mining Industry Following Implementation of Training Requirements," unpublished dissertation, Catholic University, 1982.

3. Likert, Rensis, *The Human Organization: Its Management and Value* (New York: McGraw-Hill, 1967).

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Appendix IV-A

CHECKLIST FOR THE TRAINING DECISION PROCESS

Step 1: Who, if anyone, needs training?

1.1 Have we established the real problem that improved training is expected to improve or alleviate?

1.2 Who needs extensive training to learn an unfamiliar job?

1.3 Who might improve their performance by additional or refresher training?

1.4 Who might become more promotable through training?

1.5 Have we determined that training is needed?

Step 2: What training do they need?

2.1 Have we established the best way of performing the job or operation?

2.2 What background is needed in learning the job or operation?

2.3 Have we prepared a job analysis sheet?

2.4 Have we spotted the types of learned performance involved which indicate the need for special instructional methods?

2.5 What standards of performance are expected from an experienced worker on the job?

2.6 How will the performance standards be measured?

2.7 Have the results of the analysis to identify who needs training and the type of training been verified by the trainee's immediate supervisor?

Step 3: What are the purposes of that training?

3.1 Will training be given specifically to meet the established needs of individual trainees?

3.2 Is training the best solution to the problem?

Step 4: What are the instructional objectives that need to be incorporated into the training program?

4.1 Have we specified the total content in which training is needed?

4.2 Have we decided the best way to handle each aspect of the training?

4.3 What standards of performance do we expect the trainees to have before and after the formal training course?

4.4 How will these performance standards be measured?

4.5 In selecting instructional methods, did we consider the importance, learning difficulty and types of learned performance involved in each aspect of the training?

Step 5: Is there commitment throughout the organization for providing training?

5.1 Have trainees been screened to establish their individual training needs?

5.2 Do supervisors of the trainees fully support the proposed training plan?

Step 6: What training and development programs best meet the specified instructional objectives?

6.1 Is the training program needed?

6.2 Who should offer the program?

6.3 Who will present the program?

6.4 What is the program content?

6.5 Where is the time and place of the program?

6.6 Is there an adequate lesson plan to guide the presentation of each session?

6.7 How will the progress of the trainees be checked during the course?

6.8 Does the content offer sufficient variety to maintain the trainees' interest?

6.9 What instructional aids and equipment will be needed to prepare for the course?

Step 7: What are the anticipated benefits to be derived from the training?

7.1 How will they be measured?

7.2 Are the benefits aligned with perceived deficiencies?

Step 8: What are the costs of the program?

8.1 What is the direct cost of instruction?

8.2 Have we included travel, per diem, salary and fringe benefits of trainees and instructors in our cost estimate?

8.3 What are the costs of facilities, special equipment, etc.?

8.4 What were the costs of preliminary analysis, needs identification, etc.?

8.5 Who will pay the costs of the training?

8.6 If dollars aren't available internally, are there outside sources of funding?

8.7 Have we established the training program that deserves top priority?

8.8 Are top administrators in full support with the list of training priorities?

8.9 Apart from training, what else is needed to alleviate the problem?

Step 9: Implementation, evaluation, and utilization of feedback.

9.1 Was the course presentation adjusted to meet the needs and difficulties of the trainees?

9.2 Have the trainees been checked and given regular feedback on their progress?

9.3 Was assistance given to trainees that needed additional coaching?

9.4 Were the trainees' performance standards checked at the end of the course?

9.5 Were the trainees allowed to apply their learning immediately after the course?

9.6 Were the trainees briefed on the standards of performance expected of them as experienced workers?

9.7 Were the trainees given the additional training and coaching they needed to bring them up to the standard in the minimum time?

9.8 Were the trainees' performance standards checked as soon as they were thought to have reached the standard expected of an experienced worker?

9.9 Did the results of the course evaluation indicate that the trainees learned what was taught?

9.10 Did the trainee's performance on the job during the followup period indicate that what was taught had helped them to reach the standards expected of an experienced worker?

9.11 Have the results obtained helped to alleviate the original problem?

9.12 Could the same (or better) results of the training be obtained in the future at a lower cost?

9.13 What modifications will be made for future training courses?

Appendix IV-B

I. **Start-up Costs**

A. Planning & Development of New Hire Training Program

1. Safety/Training Director's Time = 40 hours x $17/hr	$ 680.00
B. Materials Development/Acquisition	
1. Worker training materials	
a. New Hires = $2/ea. x 10 new hires	$ 20.00
b. Supervisors = $2/ea. x 10 supervisors	20.00
c. Transferees = $2/ea. x 15 transferees	30.00
d. Normally assigned workers = $2/ea. x 300 workers	600.00
2. Visual aids	500.00
3. Equipment (audio visual)	$ 400.00
Sub Total	$1,570.00
C. Planning & Development Supervisors Program	
1. Safety/Training Director's Time = 20 hours x $17/hr	$ 340.00
2. Visuals	150.00
Sub Total	$ 490.00
TOTAL START-UP COST	$2,740.00*

*Does not include the cost of hazard assessment to determine specific training needs. This cost could range from $300–$3,000.

II. **Initial Training Cost**—New Hires and Supervisors

Training 10 new hires and 10 supervisors per year

A. Trainor for new hire program

1. Safety/Training director = 2 hours x $17/hr	$ 34.00
B. Trainor for supervisors	
1. Safety/Training director = 4 hours x $17/hr	68.00
C. Hourly Wage per Trainee	
1. New hires = 2 hour program x 10 new hires x $8.52 hr	170.40
D. Hourly Wage per Trainee	
1. Supervisors = 4 hours x 10 supervisors x $13.18/hr	527.20
TOTAL COST	799.60

III. **Initial Training Cost**—Transferees

Training done by supervisors for an average of 15 transferees per year

A. Supervisors hourly wage	
1 hour per transferee x 15 transferees x $13.18/hr	$ 197.70
B. Transferees hourly wage	
1 hour x 15 transferees x $11.88/hr	178.20
TOTAL COST	$ 375.90

IV. **Initial Training Cost**—Normally Assigned Workers

Based on an average of 300 workers

A. Supervisors time making planned safety contacts	
30 minutes per worker x 300 workers x $13.18/hr	$1,977.00
B. Normally assigned workers hourly wage	
300 workers x 30 minutes training x $11.88/hr	1,782.00
TOTAL COST	$3,759.00

V. **Recurring Training Costs**

A.	New Hire	$20.44 per worker
B.	Supervisors	64.00 per supervisor
C.	Transferee	25.00 per transferee
D.	Normally Assigned	12.53 per worker
E.	Materials Cost	2.00 per worker/supervisor

TOTAL ALL COSTS (excluding recurring costs) $7,673.00

Appendix IV-C

CHECKLIST OF CONSIDERATION IN ORGANIZATIONAL ANALYSIS

I. ORGANIZATION OBJECTIVES

A. *Present*

1. How does the clientele currently regard the quality of goods and services we are providing?

2. Is the quantity of goods and services we are currently providing adequate?

3. What is the methodology of delivering the needed services?

B. *Future* (two to six years)

1. What will be the essential and desirable public services that we must provide?

2. What will be the quantity and quality of these services?

3. What technologies will be used to deliver these services?

II. ORGANIZATIONAL STRUCTURE
(A poor organizational structure can affect individual and group performance.)

A. *Present*

1. Is there a delineated division of responsibility among the various offices of the organization?

2. Is there adequate coordination and communication between the levels of the hierarchy and between the various offices within the organization?

3. Is there a system of policies (guides to action) to ensure uniformity and coordination in meeting objectives?

4. Are roles clearly defined and communicated?

B. *Future*

1. What revisions in the organizational structure will be necessary to meet the future objectives?

2. Will the manpower be available to deliver the goods and services? (See Chapter 6 for a more detailed explanation of manpower planning.)

III. FINANCIAL CONCERN

A. *Present*

1. What funds are currently available?

2. How are the funds currently allocated between the various offices of the organization?

3. How does our current salary and fringe benefit program compare?

B. *Future*

1. What funds will be available?

2. How much will the taxpayers be willing to pay for what quantity and quality of goods and services?

3. What will be employee expectations as to income and fringe benefits?

IV. DECISIONMAKING AND COMMUNICATION PROBLEMS

A. The decisionmaking process

1. Who has the relevant information?

2. Who makes the decisions?

3. How are decisions made?

4. Who will have to implement the decisions?

B. Communication patterns

1. Does information flow down and across the organization in an effective manner?

2. If not, what is there that inhibits information flow?

V. SYMPTOMS THAT MAY BE CURRENTLY PRESENT
(From review of records and reports)

1. How many complaints do residents make?

2. How much are the maintenance costs?

3. What are the overhead costs?

4. How much waste is there?

5. How much time is required to make changes?

6. How long does it take to complete tasks?

7. How much time is required to switch processes?

8. How long does it take to locate trouble?

9. Are complaints corrected within a reasonable time?

10. How is employee morale?

The trainer who wants additional information regarding employee attitudes toward the organization may administer the SRA Employee Inventory to his employees. The SRA Employee Inventory can be used to measure five types of employee satisfaction.

1. Satisfaction with Working Conditions (Nine items related to adequacy of working conditions, effects of these conditions on work efficiency, adequacy of equipment, reasonable hours of work and absence of physical and mental pressures).

2. Satisfaction with Financial Reward (Seven items related to adequacy of pay, effectiveness of personnel policies with respect to pay and benefit programs and pay in comparison with other organizations or departments).

3. Confidence in Management (Nineteen items related to management's organizing ability, its handling of employee benefit policies, its adequacy in two-way communication and its interest in employees).

4. Opinion About Immediate Supervisor (Twelve items related to the supervisor's success in work organization, knowledge of the job, ability to get things done on time, ability to supply adequate equipment, communication to employees of what was expected, ability to emphasize proper training, obtainment of employee's cooperation, fair treatment of employees, the honoring of promises made, encouragement to employees and interest in employee welfare).

Appendix IV-D

JOB ANALYSIS QUESTIONNAIRE

(This Job Analysis Questionnaire was developed by the City of Fort Wayne under the auspices of an Intergovernmental Personnel Act Grant.)

GENERAL INSTRUCTION SHEET

(Read Before Completing Questionnaire)

The purpose of this questionnaire is to request your assistance in providing facts about your job. The information you furnish will serve as a basis for a new and current job description that will be prepared at a later date. It is important to secure information from those who know most about the work. This naturally means the person filling the position. Therefore, we are requesting that you complete the attached questionnaire. Below are a few suggestions that are important in preparing the questionnaire.

1. Read through the questionnaire completely before you begin.

2. Take your time. You may not want to begin your answers immediately, but allow some time for your thoughts to form.

3. Be fair and objective. Especially remember: consider only the nature of the job and do not base your answers on a consideration of yourself as a person filling the job.

4. Be as brief as possible, but give sufficient detail to make your meaning clear to others not completely familiar with your work.

5. In the items calling for you to list your duties and responsibilities, use brief sentences beginning with a descriptive action verb. Examples: operates a variety of office machines; assists in the supervision of snow removal; inspects storm sewers, drains, and manholes; prepares written reports on progress.

6. Please print or type your responses.

7. If there is not enough room for your answers, attach additional pages.

8. If there is anything unusual or peculiar about any phase of your work that should be considered, use the back side of the final page to explain these situations.

9. Please return questionnaire to your supervisor or department head within four days after you receive it.

10. If you have any questions, contact _____ at extension _____, immediately.

JOB ANALYSIS QUESTIONNAIRE (Continued)

NAME: DATE:

TITLE AT PRESENT: DEPT. DEPT. NO:

TITLE THAT BEST DESCRIBES YOUR JOB: HOW MANY OTHER PEOPLE IN YOUR DEPT. DO THE SAME JOB?

BUILDING/LOCATION: PHONE:

☐ FULL-TIME ☐ PART-TIME SHIFT _____ WHAT HOURS WORKED?

☐ HOURLY ☐ SALARIED ARE YOU PAID OVERTIME?
☐ FREQUENTLY ☐ OCCASIONALLY ☐ NEVER

IF UNION MEMBER, NAME UNION:

NAME, TITLE & PHONE NO. OF IMMEDIATE SUPERVISOR

DUTIES AND RESPONSIBILITIES

DESCRIBE YOUR WORK by listing those actual DUTIES AND RESPONSIBILITIES that are *basic* to your job and that you perform *regularly*. Then list those duties and responsibilities that are *not* basic to your job and that you perform only occasionally, but which are nevertheless a part of your job. First, list the duties in order of importance. Then, note in the column on the right the approximate amount of time spent on each of your *basic* duties during a week's work.

APPROXIMATE % OF TIME

If not covered above, LIST ALL SPECIAL TOOLS, EQUIPMENT, & MACHINES used in your work and the purposes for which they are used. In each case, list the approximate amount of time you spend using the equipment you list.

JOB ANALYSIS QUESTIONNAIRE (Continued)

BACKGROUND

1. Please answer these questions *without* reference to your own personal educational background.

   A. Estimate the minimum formal education needed to effectively perform your job duties.

   B. State what kind of EDUCATIONAL BACKGROUND (which field of study, etc.) is necessary to effectively perform your duties.

   C. List any additional educational background or knowledge—as opposed to actual work experience—that would be needed, such as a special course or a knowledge of a particular science—for instance, data processing or electrical wiring.

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2. Please answer these questions *without* reference to your own personal work background.

   A. Give the kind of WORK BACKGROUND that is necessary to effectively perform your job duties, estimating the *minimum* number of years required for each previous job that you list.

   B. Specify any other work background that is necessary but can be attained through on-the-job orientation or training.

   C. List any special skills—such as typing or carpentry—which are needed and *how much* skill (basic? average? considerable?) is actually needed.

JOB ANALYSIS QUESTIONNAIRE (Continued)

RESPONSIBILITY

1. A. List and explain the kinds of INDEPENDENT ACTIONS AND DECISIONS that you are called upon to make as a part of your job, and estimate *how often* you make them.

   B. How much of your work is supervised, and how closely is it supervised? (Consider such actions as planning work schedules by yourself, initiating memorandums, and solving problems by taking action without first checking with someone else.)

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2. A. List those duties of your job which require a high degree of ACCURACY, also those duties which require a high degree of MEMORY, and finally those duties which require a high degree of ANALYSIS.

   B. After each duty listed, explain *why* it requires a high degree of accuracy, memory, or analysis.

JOB ANALYSIS QUESTIONNAIRE (Continued)

RESPONSIBILITY

3. A. Specify your duties in regards to REPORTS AND RECORDKEEPING—for example, do you compile data for reports, or write them, or type them, or approve them?

   B. Specify what kind of report or record it is, and how long it normally is (one page? two pages?).

   C. Are these reports or records used only within your department or sent to other departments, agencies, cities, etc.?

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4. A. List exactly what kinds of MONEY, MATERIALS, AND EQUIPMENT you are truly responsible for, and explain *how* you are responsible for them.

   B. Concerning this responsibility, what would be the costliest error that you could make in the course of your normal duties? (Please give an approximate amount in dollars.)

JOB ANALYSIS QUESTIONNAIRE (Continued)

RESPONSIBILITY

5. A. Explain what kind of CONTACT WITH OTHER PEOPLE you have in the normal course of your job—for example, with the public, persons in other departments, persons within your department, etc.

   B. Explain the nature of these contacts—for example, are you a go-between for two departments, are the people you contact often hostile, are your meetings generally routine and businesslike?

   C. Estimate how often each kind of contact is made within a day or a week.

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6. A. Explain your responsibilities for the WORK OF OTHER PEOPLE. (For example, although you might not actually supervise someone else, you might *direct* or *coordinate* their work.)

   B. Explain your responsibilities for the SAFETY OF OTHER PEOPLE and *how* you contribute to their safety.

   C. List the number of persons for whom you are responsible in any way, name their jobs or positions, and briefly note after each job whether you are responsible for *work* or *safety*.

JOB ANALYSIS QUESTIONNAIRE (Continued)

EFFORT

1. List any job duties that often lead to MENTAL, NERVOUS OR VISUAL STRAIN AND FATIGUE. For each duty listed, state:

   A. The kind of strain or fatigue that is experienced
   B. How great the strain or fatigue normally is
   C. The number of times each day or week this occurs

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2. List any job duties that often lead to PHYSICAL STRAIN AND FATIGUE. For each duty listed, state:

   A. The kind of strain or fatigue that is experienced
   B. How great the strain or fatigue normally is
   C. The number of times each day or week this occurs

---

3. List any probable JOB HAZARDS AND OTHER UNFAVORABLE WORK CONDITIONS that you are regularly exposed to during your work. For each hazard or unfavorable condition listed, please give:

   A. A reasonable estimate of the amount of risk to you or of its unfavorable effect on your job.

   B. The number of times each day or week this hazard or condition is experienced.

JOB ANALYSIS QUESTIONNAIRE (Continued)

Manager—Supervisor Supplement

Because of the variety and complexity of their duties, department managers and their assistants are asked to reply to the following questions, which touch upon job responsibilities not common to other positions.

A. List each work group that you are accountable for.

B. After each group mentioned, briefly state their overall function.

A. List those areas in which you have the authority to set policy.

B. List those areas in which you have only the authority to contribute policy ideas.

C. List those areas in which you have only the authority to interpret policy.

JOB ANALYSIS QUESTIONNAIRE (Continued)

Manager—Supervisor Supplement

A. Beyond the administration of your routine duties, identify those special assignments, projects or programs that you are responsible for planning, organizing, implementing or directing and that require analysis, creativity and problem-solving ability.

B. Explain the nature of each responsibility listed and what special abilities are required by it.

Indicate the extent of your responsibility for selecting, assigning, training, counseling, or discipling personnel.

UNIT V

PRINCIPLES OF BEHAVIOR IN OCCUPATIONAL SAFETY AND HEALTH

Professor William L. Hopkins, Ph.D.
University of Kansas

METHODS: Lecture and Discussion, optional quiz LENGTH: 50 Minutes

PURPOSE: To introduce and discuss occupational safety and health, the contributions of behavior to safety and health problems, and the basic principles of behavior control.

OBJECTIVES: To introduce the student to:

1. The importance of occupational safety and health
2. The interactive ways in which physical conditions and behaviors contribute to safety and health problems
3. The principles of behavior control
4. Examples of ways in which applications of the principles can affect work behavior

SPECIAL TERMS:

1. Engineering controls
2. Behavior controls
3. Critical incident technique
4. Job hazard analysis
5. Antecedents
6. Consequences
7. Reinforcement
8. Consequences
9. Punishment
10. Extinction
11. Immediacy of consequences
12. Frequency of reinforcement
13. Frequency of punishment
14. Contingent consequences

INSTRUCTOR MATERIALS: Lesson plan, transparency projector, transparencies (made from stencils at the end of this unit). Copies of quiz (made from questions at the end of this unit).

STUDENT MATERIALS: Pencils or pens

Unit V

PRINCIPLES OF BEHAVIOR IN OCCUPATIONAL SAFETY AND HEALTH

IMPORTANCE OF OCCUPATIONAL SAFETY AND HEALTH

Historically, employees accepted most consequences of occupational hazards.

Employers now have responsibilities for safety and health.

Debates about controlling hazards have obscured fundamental facts.

Large numbers of injuries and deaths from work accidents.

Less clear but enormous consequences from occupational health problems.

A century ago many employers assumed no responsibility for workplace safety and health of employees. If someone wanted to work for a particular firm, they hired into a job with no systematic warning about possible hazards. Employers made few attempts to control workplace hazards. Employees assumed all personal consequences of the disasters that frequently occurred.

Our culture has matured to the point that it is no longer acceptable to assume that endangered safety and health are natural results of employment. We expect employers to be knowledgeable about potential health and safety hazards and to take all reasonable precautions to prevent injury, illness, and death. We have come to recognize that employers also lose when injuries, deaths, and illnesses occur.

During the last two decades there has been abundant argument about: the best ways to control workplace hazards; the responsibilities of employers; the right and obligation of the Federal Government to force entry into plants and mines to inspect them for hazards; the right of the government to force compliance with standards for controlling hazards, and the appropriateness of those standards. These debates have often obscured some fundamental facts about occupational safety and health.

The incidence of injuries, deaths, and illnesses from occupational hazards is staggering. There are over two million disabling injuries and at least thirteen thousand deaths every year.[1]

The total number of occupational illnesses and ensuing deaths produced each year is not easily determined because many such illnesses develop slowly over many years. For example, exposures to asbestos may take twenty or more years to produce lung cancers. In addition, the causes of many illnesses are still obscure. This makes attribution to occupational exposures difficult. Nevertheless, occasional glimpses of what are probably the tips of icebergs are chilling. One million, five-hundred thousand U.S. workers are being exposed to inorganic arsenic which is well-known to cause cancer of the scrotum. One million living Americans have been exposed to asbestos during work. Three hundred thousand of these asbestos workers are expected to die of cancer.

It is clear that strong moral and economic arguments exist for improving our efforts to control occupational safety and health problems.

IMPORTANCE OF BEHAVIOR TO OCCUPATIONAL SAFETY AND HEALTH

Behavior control is crucial to hazard control. Useless arguments were started by assertions about causes of accidents.

The control of human behavior is central to the control of workplace hazards. However, there has been a great deal of confusion and argument surrounding this point. It demands clarification. In one of the classic texts on safety, Heinrich[2] stated that eighty percent of all industrial accidents were attributable to unsafe actions of the persons involved, while only twenty percent were attributable to unsafe conditions. The exact meaning or source of this statement has never been clear but one possible interpretation was that the workers involved in accidents were responsible for them and should absorb the costs. This, at least, amounted to a wave of a red flag guaranteed to generate counter attacks. Other authorities quickly asserted that, in fact, eighty percent of accidents were attributable to unsafe conditions while only twenty percent were attributable to unsafe acts.

This controversy continues to occupy too much attention. Sometimes representatives of organized labor may encourage workers to behave more safely instead of satisfying the fundamental obligation to provide a safe place to work. There are representatives of management who will just as quickly say that they have reasonably safe places to work if they could only get their employees consistently to exercise prudence.

Every accident and exposure involves both hazards and behaviors.

Neither position is particularly productive. Fitch, Hermann and Hopkins[3] outlined a simple strategy that assumes that every accident must involve both hazards and behaviors. Outlandish behavior may occur but no harm is done unless there are environmental hazards that can hurt people. Alternatively, places of work may have machinery that is capable of great harm or chemicals that are rapidly or slowly toxic. However, no harm occurs unless people's behaviors bring them into contact with these hazards. Therefore, harm requires both physical hazards and behavior that at least exposes the person to the hazards.

Safety and health problems involve both hazards and behaviors.

If harm always involves both hazardous conditions and hazardous behaviors, it is clear that the control of either or both of these factors will solve the problems inherent in occupational safety and health.

Many professionals prefer to emphasize control of conditions first and behavior controls second.

Even though comprehensive safety and health efforts will nearly always include control elements for both physical hazards and hazardous behaviors, many professionals often prefer to place first emphasis on the control of the physical environment and then employ behavior controls as a means to supplement physical control. There are several reasons for this. Engineering controls are generally assumed to be more reliable than are means of controlling behavior even though there is little hard evidence to support the assumption. The closer to the source a hazard can be controlled, the more likely that control will be effective. Controls close to sources usually involve engineering controls. It is probably also significant that the people responsible for controlling health and safety problems are often professional engineers or have engineering backgrounds. They may be quite knowledgable about controlling physical conditions and relatively ignorant about controlling human behavior.

Engineering controls without behavior controls are never satisfactory.

In any case, engineering controls, alone, are never sufficient and good behavior control is often useful when no satisfactory engineering controls are available. Two simple examples will easily illustrate this.

Even the best engineering controls require behavior controls for maintenance and emergencies.

Polyvinyl chloride, which is widely used in the manufacture of coverings for auto seats, furniture, and plastic pipe, is a carcinogen. The federal government strictly limits workplace exposures to it. Exposure control is typically accomplished by keeping the chemical enclosed in engineered systems and by using exhaust hoods to capture any of the gas that escapes the closed system as PVC materials are manufactured. However, there are many ways in which human behavior is important to controlling exposures even in this highly engineered system. Human behavior maintains the engineered system and without this behavior the system would soon become unsafe. Emergencies such as failed pipes or seals require behavior to shut down the system, perhaps evacuate people from the area, contain the escaped PVC, clean up the area and restore it to some safer condition. Even when the engineering controls are working perfectly, human behavior can minimize exposures to the small amounts of PVC gas that escapes during manufacturing.

Picture a Caterpillar tractor working down the steeply sloping sides of an open-pit mine. A few moments of inattention or poor judgment can send the operator and machine tumbling down the side of the mine pit. Are there ways engineering controls can contain this hazard? There probably are things that engineers could do to help. It is also likely that most of them are so expensive that the operator would not vote that they be installed because of the reduction in pay that would be necessary to finance them. Good behavior control, in this case, is not the only solution, just the only solution anyone close to the problem will find satisfactory.

Behavior controls are necessary and can be economical.

A sensible way to proceed is to ask that engineering controls be explored as a first and preferred line of defense with behavior controls serving as necessary adjuncts to all forms of engineering control. Then, as best engineering controls are found to be inadequate, behavior controls might be viewed as secondary lines of defense. When such carefully thought out applications are implemented, behavior controls can be useful and economical.

WHAT IS BEHAVIOR?

Behavior is observable action. Behaviors of many people contribute to safety and health.

Human behavior is such a commonplace concept that it may have everyday meanings that are not as precise as intended here. Behavior is any observable action of another person. A line worker's completing an assignment is behavior, as is spilling a puddle of lubricant on the floor. A maintenance worker's cleaning and installing new filters for an air exhaust system so that the system will efficiently remove PVC from the area of a molding machine is behavior. An engineer's designing a better exhaust system is behavior, as is a manager's deciding to allocate funds for the construction of the new improved system. There will be important safety and health behaviors of people in all levels and divisions of most work organizations.

To illustrate the many ways behavior can be important to safety and health, suppose a driver of a delivery truck runs a stop sign, has a wreck, is injured so that she loses two weeks from work and destroys the truck. What behaviors might be involved? First, consider possible immediate, contributing behaviors:

Examples of different behaviors that might contribute to a wreck

1. She failed to stop.
2. She was driving too fast.
3. She failed to look both ways at the intersection.
4. She failed to take last minute evasive action.
5. She failed to test the brakes before driving the vehicle.

Examples of behaviors that could have prevented the wreck

Consider some possible preventive behaviors:

1. She could have stopped.
2. She could have driven more slowly.
3. She could have looked both ways at the intersection.
4. She could have avoided entering any intersection when there was the threat of collision with another vehicle.
5. She could have taken evasive action.
6. She could have tested the brakes before driving.

Behaviors of people not directly involved in an accident can be important

It is easy to see that people typically focus on the behaviors of the person immediately involved in the accident. However, the behaviors of many other people may be just as important.

Examples of contributing behaviors

Consider some possible contributing behaviors of other people:

1. The maintenance department sent her out with a vehicle that had faulty brakes.
2. The city traffic engineers had poorly marked a blind intersection.
3. The city maintenance crews had failed to clear obstructions from the intersection.
4. The training department had failed to properly instruct her in the operation of the vehicle before assigning her a route.
5. The engineer who designed the van failed to make adequate provisions for easy operation of the brakes.
6. The operations department puts so much emphasis on number of deliveries per hour that drivers are not properly motivated to drive safely.
7. The chief executive is insufficiently sensitive to the suffering and morale problems that result from accidents and failed to realize the cost-containment possibilities in safety so that he does not pass this emphasis along to other people in the organization.
8. The union has pressed for benefits such that people who are injured on the job receive reasonable compensation but one result of these benefits is that people have more accidents.

IDENTIFYING IMPORTANT BEHAVIORS

The variety and number of behaviors that can contribute to safety and health problems should be convincing that productive control of behavior is an important focus. It should be clear that the results of such efforts can be important to the morale and economic life of work organizations.

Focus on behaviors that are especially important to safety and health

The number of behaviors that can contribute to safety and health problems and, therefore, the number that might be profitably controlled is so large that efforts typically have to be made to focus on those that are particularly important. Some of the methods for doing this are quite formal but beyond the scope of this lecture. For the convenience of brief discussion, we will distinguish between retrospective methods and prospective methods. Retrospective methods identify behaviors that have contributed to injuries or illnesses after they have occurred. Prospective methods identify important behaviors before harm has occurred.

Retrospective identification of important behaviors

Retrospective safety and health work typically includes accident investigations which are aimed at identifying behaviors which may have contributed to injuries or illnesses and alternate behaviors which might prevent such events. All investiga-

Accident investigations

tions should routinely focus on behaviors as well as on physical hazards. Medical records are typically kept on some of the variables that are thought to be significant to important work-related illnesses and diseases. This would include information such as the part of a plant in which the affected person worked, the kinds of jobs being performed, and the chemical exposures which may have been involved. However, such records rarely include information on behavior. Specialized investigations would have to be conducted beyond the typical medical investigation to provide useful information about behavior.

Prospective identification of important behaviors: Critical incident technique.

One prospective method that still focuses on historical information is the critical incident technique.[4] With this method, employees are asked if they have noticed any recent events which *almost* resulted in a serious accident, injury or chemical exposure. The focus on near misses may identify important behaviors which can be corrected before they contribute to injuries or illnesses.

Job safety analysis

Another common prospective method is well-known in most manufacturing organizations large enough to employ industrial engineers. This method is the job safety analysis, a variation on a job task analysis, in which the behavioral components of each job are studied to determine which are hazardous or should be changed in some specifiable way.

Goals can be achieved by controlling either behaviors or results of behaviors.

Presently, we will see that it is not only possible to control behavior but the products or results of behavior as well. Important products or results of work behaviors include such outcomes as the number of accidents and injuries per unit of time, the various costs of injuries and accidents, exposures to important chemicals, and the number and kinds of hazards present in particular places.

PRINCIPLES OF BEHAVIOR

Once important behaviors have been identified, the next important part of the process is to control the behaviors as needed.

Behaviors related to safety and health are controlled the same ways as other work behaviors

Methods to promote important safety and health related behaviors are the same as methods used to promote any behaviors at places of work. The methods are built on a few principles that can best be understood if you visualize that all responses or instances of behaviors occur, in time, with other events. This can be diagrammed as follows:

ANTECEDENTS_____RESPONSES_____CONSEQUENCES

TIME _____

Antecedents precede responses; consequences follow responses.

An antecedent is anything that precedes a response in time. A consequence is the event that follows a response. Someone calls your name. That is an antecedent for your response of looking up. The consequence of your looking up is a friend's waving to you. The morning work whistle blows as an antecedent for your beginning work. Being paid may be one consequence of the work.

Reinforced behavior occurs more frequently. Examples of reinforcers are money, recognition, appreciation.

PRINCIPLE 1: Behavior that is reinforced will occur more frequently.

An example of behavior being influenced by a reinforcer, a consequence, might be a worker's being given money for work. The money causes the behavior to occur more frequently. If you don't believe this, try getting people to work for very long without their receiving money in return. Another example might be the increase in the number of safety suggestions and appreciation from co-workers and supervisors for making suggestions.

The term reinforcement is roughly synonymous with reward but it has a more precise meaning. A reward is something most people value. A reinforcer is any event which follows a behavior and makes that behavior more likely to occur again. A reinforcer is a particular kind of consequence, the kind that causes a strengthening of the behavior it follows.

It isn't a reinforcer if it doesn't strengthen the behavior it follows.

It should be clear that the concept, reinforcement, is an empirical one. Only those consequences which strengthen the behaviors they follow are, by definition, reinforcers.

PRINCIPLE 2: Behavior that is punished will occur less frequently.

Punished behavior occurs less frequently. It isn't punishment if the response isn't weakened.

This principle conforms quite closely to the employer's notion of punishment, except, punishment is an empirical concept. It is particularly worth noting that the intent of the person applying the consequence to another person's behavior counts for nothing. Only the effect of the consequence on the second person's behavior provides for the accurate diagnosis that the consequence is a punisher.

A person may intend that a consequence be punishing but the effect may be quite different. Examples of reprimands functioning as reinforcers

The research literature contains a number of examples in which one person obviously intends to punish the behavior of a second person but the effect of the consequences applied to the second person's behavior clearly is not that of punishment. In one of the classic early studies[5] an elementary school teacher had a group of students who were constantly wandering around the classroom talking to each other, throwing things in the trash can, or bothering other students. This teacher had a high rate of saying things like "Sit down, Tommy!." "Martha, get back to your seat!." "Everyone, return to your seats." The teacher was not trying to devastate anyone with her comments but it is clear that they were intended to be mild punishers designed to control some of the wandering around the room. The researchers' advice to the teacher? Quit telling the kids to sit down. The teacher followed the advice and the rate of the children being out of their seats declined accordingly. In fact, the teacher's telling the kids to sit down had not been functioning as punishment, as she intended, but as reinforcement which maintained their walking around the room. This error in judging the effect of a reprimand must occur thousands of times a day on plant floors and warehouse docks. A foreman intends to have one effect but, for whatever reasons, his efforts have just the opposite effect.

Clearly understand that a consequence of a response is a punisher if, and only if, the response becomes less likely to occur.

If a response is followed by no consequence, it becomes weaker.

PRINCIPLE 3: A response that is followed by no consequence is less likely to recur.

Extinction involves response weakening because of a lack of reinforcement.

The process by which a response becomes less likely to occur because it is not reinforced is called extinction. Extinction, then, involves the weakening of a response when it is not reinforced. A person works hard doing a good job on some assignment but there are no significant consequences for the behavior. The boss doesn't indicate noticing the accomplishment. There is no extra pay or promotion. No one compliments the effort. The effort is likely to diminish. How many times has the scenario been repeated in our places of work?

Extinction can be used to weaken unsafe behaviors.

Extinction can be made to work for you in some circumstances. Suppose a worker frequently clowns on the job in some unsafe fashion because other workers laugh. Their laughter is the reinforcement that maintains the dangerous responses. Suppose you could somehow get them to ignore the antics of the clown? Without the reinforcement, at least some extinction would surely occur.

Immediate consequences are more effective than delayed ones.

PRINCIPLE 4: The more immediately a consequence follows a response the more likely it is to affect the response.

The principle is often referred to as the "principle of immediacy." It is probably familiar to you in many forms. People are notorious for putting off work until the deadlines and associated consequences for not meeting them are impending. Then, they work hard because the consequences are near in time. The bonus you might obtain nine months from now if you do a good job today isn't nearly so likely to affect your behavior as the commission you receive tomorrow. If you work hard on an assignment today, but your boss doesn't say anything about it for three or four weeks, your behavior probably won't be nearly so reinforced as it would if the recognition were more prompt.

Less frequent reinforcement can produce more frequent responding.

More frequent punishment weakens responding more than does less frequent punishment.

PRINCIPLE 5: Under some circumstances, the less frequently reinforcement follows a response, the more frequently the response occurs.

The more frequently punishment follows a response, the less frequently the response occurs.

As strange at it may seem, behaviors sometimes become stronger as they are reinforced less frequently. If you don't believe this principle, ponder the very high and persistent rates of responding generated by the occasional reinforcement provided by gambling.

Use frequent reinforcement to develop behaviors, and less frequent reinforcement to maintain them.

If you want a response to be very persistent, a useful developmental strategy to follow is to, at first, have the response reinforced regularly. After the response is well-established, the regularity of reinforcement can be very gradually diminished until it follows only occasional responses. The good manager finds ways to frequently reinforce the work and efforts of subordinates when they are new on the job but, as they become established, can gradually reduce the frequency of reinforcement. However, there should be a strong warning that the manager should never completely stop the reinforcement unless there is clear evidence that there are other reinforcers which will maintain the response.

If you are going to use punishment, try to punish every instance of the response.

In contrast to the way different reinforcement can maintain good response rates, frequent punishment is always the best bet for suppressing a response. If you are going to try to suppress some behavior by using punishment, try to punish the response every time it occurs.

Antecedents control behavior only if they are associated with reinforcement.

PRINCIPLE 6: The antecedents of behavior exert a directing control over behavior to the extent that they are differentially related to functional consequences.

Suppose a supervisor tells a worker to do a job in a particular way. The telling is an antecedent. It goes before the response. Will it direct the response the supervisor intends to the extent that the antecedent is related to important conse-

The effects of instructions depend on the extent to which they are associated with reinforcement or punishment.

quences? If the supervisor never asks for unreasonable things, bothers to follow-up to see if instructions are followed, honestly lets workers know that their efforts are appreciated, isn't shy to reprimand someone who fails to carry out a reasonable assignment, works to get deserving people promoted, and will do whatever is necessary to get someone disciplined or fired if they seriously fail to carry out reasonable assignments, the antecedent will probably direct the behavior. However, if the supervisor never checks up on his employees to see what they are doing, forgets who is assigned to do what, ignores good efforts, just as reliably ignores poor efforts, promotes on the basis of personal considerations, and allows subordinates to reinforce each other for ignoring work assignments, the chances are good the antecedents will have no directing effect on behavior.

Influence over behavior results primarily from control of consequences rather than from control of antecedents.

This principle sets this form of management of behavior apart from many others. In a simple fashion, this principle implies that, to reliably control behaviors, you must learn to understand the consequences of behavior. If you want to make sure that you influence a behavior, make sure that you can influence important consequences of behavior. In contrast, most forms of management emphasize the use of antecedents to try to influence behavior. We exhort people to work harder or better. The exhortation is an antecedent. We rely heavily on instructions and orders with little consideration of the consequences that follow the behaviors we try to make occur. The instructions and orders are also antecedents.

Antecedents intended to encourage particular behaviors mean little if the consequences are to the contrary.

We hold team meetings hoping that our listening to what the workers have to say will magically cause them to work harder or more carefully. This is an antecedent. What will happen if all of the significant consequences are stacked for lethargic behavior and sloppy work? The antecedent will go for naught. We decorate our shops with posters asking people to work carefully. They are also antecedents. What if the job pressures still encourage them to take short cuts? They will take them. Consequences control behaviors. Antecedents prompt behaviors to occur just to the extent that they are associated with effective consequences.

Antecedents may be useful to first get behaviors to occur but consequences keep them occurring.

COROLLARY TO PRINCIPLE 6: Antecedents can be useful to get behaviors to first occur but consequences are crucial to keeping them occurring over time.

Any manager may give another employee a set of instructions on what to do and how to do it. In many cases this antecedent will be sufficient to get the work started. However, the smart manager will bother to follow up frequently on the job to apply reinforcement for the continuing efforts. What will happen if the instructions say to do one job but the effort involves peer pressures? The lack of reinforcement for doing the job could push the behavior in a contrary direction. The behavior, even though set into motion by the antecedents, will soon die out.

IMPLICATIONS OF PRINCIPLES

This brief collection of principles provides us with a broad understanding of why people behave as they do and give us important leverage in getting people to behave in the ways that will help them in the long run.

Smoking involves long-term punishment but short-term reinforcement.

Why in the world would someone smoke, receiving only a small amount of pleasure from the habit when other consequences of smoking include lung cancer and heart attacks? The little bit of pleasure is immediate. The punishers are quite long-term and probabilistic.

Most professional problems reflect short-term reinforcement.

Why do people in professional areas behave in their own worst interests? For example, why would someone with a very promising career compromise their promotions for the sake of a hobby such as golf? The common reason is that the pleasures of winning at golf are immediate. The professional success is delayed.

There are short-term reinforcers for unsafe behaviors.

Why would a person stick an arm into a potentially operable auger and risk losing it when it would take only five minutes to lock-out the control box for the machine? The odds that someone will turn on the auger are low. The pay-off for ignoring the risk is immediate. If there were a 100 percent certainty that the consequence of even one second in the auger would be the loss of an arm, no person would fail to install the lock-out.

Unproductive behavior often involves short-term reinforcement and long-term losses.

Why do people behave very unproductively with the long-range effect that their companies go out of business because they are not competitive? Because the immediate rewards are received regardless of productivity while hard work always has some attendant punishment. The potential loss of job and standard of living is too long-range to have any effect on the work behavior.

Why do people behave in ways that are harmful to them? They are reinforced for behaving that way. They are punished in some way for behaving to preserve their safety and health. The natural punishments that result from injury and disease are so improbable and long-range that they do not influence the behavior.

If we are going to help people to be productive or safe, or to behave in ways that preserve their health, it is clear that we need to learn how to use the reinforcers and punishers at places of work for a better purpose than is usual. First, reflect for a few moments on the ways in which the more common workplace reinforcers and punishers are presently used. List all of the broad kinds of reinforcers and punishers, things that people value or dislike, that occur in places of work. Your list might look something like the following:

Which common reinforcers are dependent on safe and healthful behaviors, which punishers on unfortunate behaviors?

PAY	BONUSES
RAISES	PROFIT SHARING
PROMOTIONS	RETIREMENT BENEFITS
HEALTH INSURANCE	LIFE INSURANCE
WORKING CONDITIONS	DISABILITY PAY
SICK PAY	EFFORT AND TROUBLE
PERSONAL INTERESTS	INTRINSIC REWARDS
SOCIAL PLEASURES	SOCIAL PUNISHERS
SUSPENSIONS	FIRING
THREAT OF FIRING	INTERACTIONS WITH MANAGEMENT

Next arrange these reinforcers and punishers into three columns to indicate whether each, as it typically occurs in places of work, occurs as a consequence of valuable behavior in such a way to promote that behavior, retard that behavior, or is usually independent of whether valuable behavior occurs.

Consequences that workers like or dislike should be contingent on appropriate behaviors to be effective.

A few cautions are in order. People are not used to looking at rewards and punishers strictly in terms of whether they occur as consequences of desired or undesired behaviors. They will say something like, "The management at the places where I have worked is also talking up productivity, therefore, MANAGEMENT INTERACTIONS should go in the 'promote work' column." This is not the idea. The question is whether management interactions that are reinforcing occur as

consequences of productive work, or punishing management interactions occur as consequences of poor work. The chances are good that in most places of work the interactions workers have with management are neither very reinforcing nor terribly punishing. Rather, they are probably designed to be inspirational or threatening. In addition, they probably occur at random times, or perhaps pleadingly, when the latest production data are relatively poor.

Ask whether each of the kinds of events is likely a reinforcer, a punisher, or a neutral consequence. Then, ask if each is presented to people dependent on safe and healthful events and behaviors, or is presented independently of safety and health. Reinforcing consequences that are dependent on safe behaviors or results of behavior should be placed in the "promote safety and health" column, reinforcers that are dependent on unsafe behavior in the "retard safety and health column," etc.

Most reinforcers and punishers are irrelevant or contingent on the wrong behaviors and do not promote safety and health.

This exercise typically yields perhaps one or a few items in the "promote safety and health" column, several more in the "retard safety and health" column and the majority in the "irrelevant" column. Sometimes students are tempted to argue with each other about whether a particular reinforcer or punisher should be placed in one or another of the columns. These arguments can be instructive if brief. Usually, the differences of opinion exist because the people have worked in companies that have different policies or one or both of the students forget to adhere strictly to the concept of dependent or contingent reinforcement.

A manager's learning to better use reinforcers and punishers is a high priority.

If the most important determinants of behavior are their consequences, and, if most of the important consequences at places of work are irrelevant to safety and health or, perhaps, actually function to exacerbate safety and health problems, it is obvious that the manager's learning to better use the available reinforcers and punishers should be a very high priority.

The misuse of most reinforcers and punishers is not only true for safety and health but also for most other organization goals.

(In passing, the instructor might note that these arguments apply not only to the promotion of safety and health but also to many other problems at work. You could conduct similar analyses of the ways the available reinforcers and punishers promote, retard, or are irrelevant to attendance at work, productivity, control of waste, problem solving, the proffering of useful suggestions, etc. This author predicts that you will obtain very similar results regardless of the performance area you analyze.)

APPLICATIONS OF PRINCIPLES

Before addressing the question of whether the principles can be used to promote safety and health, consider the broader question of ways they have been used to improve many forms of work performance. Several hundred examples of applications are now in the literature. Most of the examples, for reasons that will be discussed presently, have emphasized the better use of reinforcement instead of punishment.

Most examples of behavior management emphasize the use of reinforcers rather than punishers.

Sales reps wouldn't call the home office often enough.

Records of calls were kept.

Kreitner and Golab[6] report a simple demonstration of the usefulness of reinforcement. A company complained because management could not get local sales representatives to call in to the home office as often as they preferred. The calls were deemed necessary to keep the sales staff abreast of new prospects, customer complaints, requests for repeat business, service requests and emergencies. The company established a procedure whereby the receptionist who received the calls kept a log on all calls made by each of the sales staff and forwarded the log to the sales manager. The manager notified the sales persons of the results of the

Managers told of records and refunded cost of calls.

recordkeeping and simply refunded the costs of the calls to the people who made at least three calls per day. The number of calls made per day to the home office by the sales staff increased by 58 percent.

Increase in calls.

Turnaround times of trucks at cotton mills were slow.

A company which processed cotton into finished cotton goods operated a large fleet of trucks to transport materials from plant to plant. Perhaps one plant ginned raw cotton, which was transported to a different plant for spinning into thread which was then moved to a third plant for weaving. Woven cloth might be transported to another plant for cutting and sewing, etc. The trucks were often held up unnecessarily by slow service given them at the loading docks of the plants. Runnion, Johnson and McWhorter[7] attacked this problem by relying on performance information provided by recorder discs produced by devices mounted in the trucks. The discs provided a permanent record of when the truck was in motion, how long it waited at various locations, etc. This information was converted into the average turnaround time at each plant. Company headquarters began sending weekly letters to each of the plant managers to report the results of the recordkeeping on truck turnaround time. If the records indicated that a particular plant met the company goal of average turnaround times of less than forty-five minutes, the letter to that plant manager included a simple statement of thanks for the efforts being made. Average turnaround time quickly declined from 67 minutes to 38 minutes per plant. The frequency of the letters was reduced to one every two weeks, and then, to one every four weeks, on average, with no loss in the improvement.

Weekly feedback on average turnaround times.

Letters of thanks when targets were met.

Big reductions in turnaround times.

Attendance control had been based on progressive discipline.

Simplify discipline policy and add reinforcers for attendance.

Thirty to 50 percent reductions in absences.

Savings of several million dollars.

Kempen and Hall[8] describe the initial steps in overhauling the attendance control policies of Western Electric manufacturing plants. In two plants the control procedures initially used by the company amounted to progressive discipline procedures beginning with verbal warnings and leading up to suspension without pay and the possibility of being terminated. In an attempt to better control absences, one of the plants tightened the discipline procedures with the result that nearly one-hundred employees were terminated. This resulted in a week-long wildcat strike and the decision to overhaul the policies. Changes in policies amounted to simplifying the discipline procedures and reducing them to a series of warnings and, importantly, providing several forms of reinforcement such as days off without penalty, freedom from the obligation to punch the clock, and immunity from discipline, all dependent on regular attendance. Decreases in absences ranged from about thirty percent to almost fifty percent. Western Electric has gradually extended these revised attendance control procedures to plants throughout the company with a savings from reduced costs of absences estimated at several million dollars.

Poor productivity and indifferent work by waitresses.

James George[9] reported on the results of consultation provided to a chain of three restaurants that were experiencing difficulties centering around the inability to control personnel costs. Restaurant managers had to follow a company established pay scale but were free to decide the hours worked by each waitress. There was no relationship between waitresses' pay and the number of customers they served or the dollars of business they accounted for. Most waitresses wanted to work at slack times when there were few customers in the restaurants and there was a good bit of jockeying for preferred times and numbers of hours worked. Labor costs were unpredictable, variable, and generally higher than the levels considered workable by the company ownership. The waitresses were, of course, paid by the hour.

Pay was set at 7 percent of sales.

Company owners estimated that they could make money if they could hold the costs of pay for the waitresses at seven percent of the gross sales of the restaurants. Therefore, George followed the simple expedient of recommending that waitresses' pay be set at seven percent of their sales. The waitress who sold $100 worth of food in an hour would make $7 in pay, etc. Many things quickly changed. A couple of waitresses quit the company saying that they didn't like the uncertainty of the sales-dependent pay system. A couple of others who had planned to quit work remained with the company because they suddenly had the opportunity to make more money. Waitresses now wanted to work only when there were plenty of customers in the restaurants. Waitresses did not want to remain at the restaurant unless there was business. The average pay per hour of the waitresses who remained with the company increased considerably and, of course, the company's labor costs for waitresses were now a constant proportion of gross sales. If sales declined or increased, labor costs for waitresses changed accordingly.

Labor costs became controllable.

These are just a few examples of the ways in which the behavior of people at work can be changed when the above principles are used in rational fashions.

SAMPLE TEST QUESTIONS

1. Explain why the arguments about whether accidents and injuries are caused by workers' acts or by physical conditions are not useful.

2. Are engineering controls ever sufficient, in the absence of behavior controls, to protect workers from safety and health hazards?

3. What is behavior?

4. Suppose a machinist pulls a heavy piece of work off a table. It falls on his foot and breaks a toe. What are some behaviors of this worker that are important to this injury?

5. Suppose a machinist pulls a heavy part off of a table. The part falls on his foot and breaks a toe. What behaviors of other workers might be involved in this accident?

6. What are some methods for identifying behaviors that are important to safety and health?

7. What effect does reinforcement have on behavior?

8. What effect does punishment have on behavior?

9. What is extinction?

10. What does the principle of immediacy state?

11. How should the frequency of reinforcement be related to responding?

12. How should the frequency of punishment be related to responding?

13. What determines whether antecedent stimuli such as instructions, orders, exhortations, requests, and assignments affect behavior?

14. How are behavior management principles quite different from other behavior management methods?

15. For what purposes are antecedents and consequences relatively effective to influence behaviors?

16. Why would an unsafe behavior occur if it may have very punishing long-range consequences?

17. How are most reinforcers and punishers at places of work used?

18. What happened when waitresses were paid, not by the hour, but according to how much food and drink they sold?

ANSWERS TO QUESTIONS

1. Because every accident and injury involves both hazards and behaviors.
2. No. Even the best engineering controls will require maintenance, which involves behavior, or they will occasionally break down and require emergency behaviors.
3. Any observable action of a person.
4. There are many possibilities. Some examples are:
   a. The worker pulled too hard.
   b. The worker could have braced the part so that it would not come off the table even if pulled.
   c. The worker could have worn shoes with safety toes.
   d. The worker could have asked for help in moving it.
5. There are many possibilities. Some examples are:
   a. An industrial engineer should have designed the table to have a lip on it.
   b. The production supervisor may be rushing workers to the point that they can not behave safely.
   c. A safety expert may be failing to present a good case to a plant manager that safety is important.
   d. The workers' peers may reinforce macho behavior, so workers have to try to do difficult jobs alone.
6. a. Accident investigations
   b. The critical incident technique (analyzing "near misses")
   c. Job safety analyses
7. It causes it to occur more frequently.
8. It causes it to occur less frequently.
9. The weakening of a response as a result of its not being reinforced.
10. That the more quickly a consequence follows a behavior the more likely it will affect the behavior.
11. Frequent reinforcement is best for developing new behaviors. Once a behavior is well-established less frequent reinforcement is useful to maintain it.
12. If punishment is going to be used to suppress some response, every instance of the response should be punished.
13. The consequences, reinforcers and punishers, associated with the antecedents.
14. Most methods rely primarily on the use of antecedents to try to control behavior while these principles emphasize the use of consequences as more important.
15. Antecedents are useful to get behaviors started. Consequences should be used to keep them going once they are started.
16. Because there are short-range reinforcers for the unsafe behavior.
17. Most of them are non-contingent, occur independently of important behaviors. Few are contingent on the appropriate behaviors.
18. Their wages increased. They sold more food per hour of work. They wanted to work when there were customers in the restaurant. Labor costs became related to income.

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HEINRICH — 20% OF ACCIDENTS ATTRIBUTABLE TO UNSAFE CONDITIONS
80% OF ACCIDENTS ATTRIBUTABLE TO UNSAFE BEHAVIORS

OTHERS — 20 % OF ACCIDENTS ATTRIBUTABLE TO UNSAFE BEHAVIORS
— 80 % OF ACCIDENTS ATTRIBUTABLE TO UNSAFE CONDITIONS

FITCH, HERMANN AND HOPKINS—EVERY ACCIDENT AND INJURY AND EXPOSURE MUST INVOLVE BOTH HAZARDOUS CONDITIONS AND UNSAFE BEHAVIOR.

OCCUPATIONAL SAFETY AND HEALTH FACTS:

13,000 DEATHS PER YEAR

2,000,000 DISABLING INJURIES PER YEAR

UNKNOWN NUMBERS OF DEATHS DUE TO HEALTH PROBLEMS
(HEALTH PROBLEMS ARE OFTEN DELAYED, HARD TO ASSOCIATE WITH EXPOSURES)

ENGINEERING CONTROLS ARE AIMED AT CONTROLLING HAZARDOUS CONDITIONS

BEHAVIOR CONTROLS ARE AIMED AT CONTROLLING HAZARDOUS BEHAVIORS

BEHAVIOR IS ANY OBSERVABLE ACTION

SUPPOSE THE DRIVER OF A DELIVERY TRUCK RUNS A STOP SIGN, HAS A WRECK AND IS INJURED. WHAT BEHAVIORS MIGHT BE INVOLVED?

1. _____
2. _____
3. _____
4. _____
5. _____

IN THE CASE OF THE DRIVER OF THE DELIVERY TRUCK, WHAT BEHAVIORS OF PEOPLE OTHER THAN THE DRIVER MIGHT CONTRIBUTE TO THE ACCIDENT?

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

METHODS TO IDENTIFY IMPORTANT BEHAVIORS:

A. RETROSPECTIVE (AFTER THE FACT) METHODS

1. ACCIDENT INVESTIGATIONS

B. PROSPECTIVE (BEFORE THERE IS HARM) METHODS

1. CRITICAL INCIDENT TECHNIQUE—NEAR MISSES
2. JOB SAFETY ANALYSIS (STEP-BY-STEP)

ANTECEDENTS . . . . . .RESPONSES . . . . . .CONSEQUENCES

TIME _____

PRINCIPLE 1: BEHAVIOR THAT IS REINFORCED WILL OCCUR MORE FREQUENTLY

PRINCIPLE 2: BEHAVIOR THAT IS PUNISHED WILL OCCUR LESS FREQUENTLY

PRINCIPLE 3: A RESPONSE THAT IS FOLLOWED BY NO SIGNIFICANT CONSEQUENCE IS LESS LIKELY TO RECUR

PRINCIPLE 4: THE MORE IMMEDIATELY A CONSEQUENCE FOLLOWS A RESPONSE THE MORE LIKELY IT IS TO AFFECT THE RESPONSE

PRINCIPLE 5: UNDER SOME CIRCUMSTANCES, THE LESS CONSISTENTLY REINFORCEMENT FOLLOWS RESPONSES, THE MORE FREQUENTLY THE RESPONSES OCCUR

THE MORE CONSISTENTLY PUNISHMENT FOLLOWS RESPONSES, THE LESS FREQUENTLY THE RESPONSES OCCUR

PRINCIPLE 6: THE ANTECEDENTS OF BEHAVIOR EXERT A DIRECTING CONTROL OVER BEHAVIOR TO THE EXTENT THAT THEY ARE DIFFERENTIALLY RELATED TO FUNCTIONAL CONSEQUENCES

PRIMARY CONTROL OF BEHAVIORS RESULTS FROM CONSEQUENCES RATHER THAN FROM ANTECEDENTS

ANTECEDENTS THAT WOULD DIRECT BEHAVIOR IN A PARTICULAR WAY HAVE LITTLE EFFECT IF THE CONSEQUENCES ARE HAVING A CONTRARY EFFECT

COROLLARY TO PRINCIPLE 6: ANTECEDENTS CAN BE USEFUL TO GET BEHAVIORS TO FIRST OCCUR, BUT CONSEQUENCES ARE CRUCIAL TO KEEPING THEM OCCURRING OVER TIME

PAY	BONUSES
RAISES	PROFIT SHARING
PROMOTIONS	RETIREMENT BENEFITS
HEALTH INSURANCE	LIFE INSURANCE
WORKING CONDITIONS	DISABILITY PAY
SICK PAY	EFFORT AND TROUBLE
PERSONAL INTERESTS	INTRINSIC REWARDS
SOCIAL PLEASURES	SOCIAL PUNISHERS
SUSPENSIONS	FIRING
THREAT OF FIRING	INTERACTIONS WITH MANAGEMENT
_____	_____
_____	_____

WHICH OF THE VARIOUS COMMON REINFORCERS AND PUNISHERS ARE TYPICALLY:

DEPENDENT ON USEFUL BEHAVIOR?	DEPENDENT ON HARMFUL BEHAVIOR?	INDEPENDENT OF USEFUL/HARMFUL BEHAVIOR?
_____	_____	_____

UNIT VI

BEHAVIOR CONTROL METHODS FOR OCCUPATIONAL SAFETY AND HEALTH

Professor William L. Hopkins, Ph.D.
University of Kansas

METHODS: Lecture and discussion, optional quiz LENGTH: 50 Minutes

PURPOSE: To introduce the student to behavior control methods for occupational safety and health.

OBJECTIVES: To introduce the student to:

1. The distinction between skill and motivation problems
2. Methods for determining whether a performance discrepancy results from a lack of skill or lack of motivation
3. Changing consequences of behavior to reduce motivation problems
4. The distinctions between information-presenting, education, and training
5. Providing training to reduce skill problems
6. Examples of providing training and changing consequences to reduce safety and health problems

SPECIAL TERMS:

1. Performance Deficit
2. Skill Problem
3. Motivation Problem
4. Goal Setting
5. Social Reinforcement
6. Performance Feedback
7. Token Reinforcer
8. Information-presenting
9. Education
10. Training
11. Corrective Feedback
12. Simple Training
13. Complex Training

INSTRUCTOR MATERIALS: Lesson plan, transparency projector, transparencies (made from stencils at the end of this unit). Copies of quiz (made from questions at end of this unit).

STUDENT MATERIALS: Pencils or pens

Unit VI

BEHAVIOR CONTROL METHODS FOR OCCUPATIONAL SAFETY AND HEALTH

SKILL PROBLEM AND MOTIVATION PROBLEMS

Are behavior problems resulting from a lack of skill or a lack of motivation?

Use different procedures depending on the kind of problem.

Business and industry often fail to distinguish between skill and motivation problems.

Training is commonly provided when motivation is needed.

When developing a behavior control program it is useful to first consider whether the problem reflects a lack of skill, a lack of motivation, or a combination of these two. A worker might operate a machine improperly because she does not know the proper way to operate it. Alternatively, she may know the proper means of operation but, for whatever reasons, not be sufficiently motivated to perform properly. Distinguishing between these sources of faulty performance is important because fundamentally different behavior control procedures should be used depending on the source of the problem. It should be clear that training is used to solve skill problems and changes in consequences to solve motivation problems.

In this author's experience, business and industry do not consistently make the distinction between skill and motivation problems and, consequently, frequently employ useless procedures. Although there are important instances in which motivation is provided when training is needed, the much more common mistake is to provide training when motivation is needed. Examples of the latter include the company management which wanted training to cause line workers to spend more of their time attending to assigned tasks and less time in non-productive pursuits. The workers already knew how to do their jobs. Therefore, they had no need for training. A different company complained that their sales force frequently ignored the long-range importance of making cold calls. The force knew how to make calls, even cold calls. There was simply no effective reinforcement for their doing so. Requests to train people to behave safely are common. Frequently, simple investigation reveals that they already have all the skills that management needs for immediate work.

There are occasional examples in sales and sports of highly motivated people who don't have necessary skills.

An example of providing motivation when training is needed is the management of new sales people in businesses such as life insurance. They work under commission systems that provide money dependent on sales. However, many new sales staff simply do not have the skills to sell insurance. Their efforts are not reinforced and they gradually give up. Professional sports includes many examples of extremely highly motivated people who simply do not have the skills to be successful.

To distinguish between skill and motivation problems ask: Does the person sometimes behave as desired?

Several procedures are useful to distinguish between skill and motivation problems. None of these procedures is fool-proof. Each should be used cautiously, and several of the procedures should probably be considered before any definitive broad-scale solutions are attempted.

Ask if the person sometimes behaves as desired. If a person sometimes behaves correctly, the chances are that the skills are present but, on occasion, there is insufficient motivation. This rule can prove faulty in cases in which the worker

may have the skills to perform correctly in some circumstances but not others. The sporadic correct performance may result because of changes in the circumstances.

(May not know how to behave in all situations)

Does just about everyone know how to do the job?

Ask if just about everyone in a particular job knows how to perform the job correctly. If they do, you begin to assume that the appropriate skills are common knowledge and that your particular performer also knows how to behave but simply isn't motivated to do so. This can, of course, be a mistaken assumption when the one worker has been inadequately trained.

(One worker may not have been trained.) Does the poor worker usually expend good energy?

It is often useful to ask yourself if the person about whom you are concerned usually expends reasonable energy in doing assigned jobs. If there is good evidence that the person often works hard, particular performance deficits, especially those that consistently involve the same set of skills, are likely to be indicative of skill problems.

Can the person do the job correctly on request?

A straightforward test of whether a poor performance involves a lack of skill or a lack of motivation consists of asking, or having a direct supervisor ask the person in question to correctly perform the task. If the person can do as asked, it is evident that the person has the necessary skills. Failures to perform on other occasions are likely the results of insufficient motivation.

Could the person do the job if highly motivated?

Managers may ask themselves if they judge that the person in question would be able to perform correctly if extremely motivated. If the worker were highly motivated, for whatever reasons, would he be able to behave as desired? Hypothetically, if you offered him $100 to do as requested, would he be able to provide the desired performance? If your answer to this hypothetical question is yes, you assume that the person has the necessary skills.

Performance deficits can involve both skill and motivation problems.

A motivated person may seek out needed skill.

Answers to these questions may, of course, be mixed. You may be dealing with a problem that involves both a lack of skill and a lack of motivation. If this is your conclusion, you will generally try to provide both training and improved motivation. However, those who enjoy pressing for understanding still often ask whether it is less a mistake to provide training when motivation is needed or motivation when training is in order. There can be no universal answer to this question. However, the motivated person seeks out knowledge and training and, thereby, solves his problems without formal assistance. The skilled but unmotivated person is without useful recourse until some productive motivation occurs.

DEALING WITH MOTIVATION PROBLEMS

General steps for solving motivation problems.

Assume for the moment that a problem has been analyzed as primarily involving deficits of motivation. What next steps can be taken? Employees who have worked in the field called organizational behavior management have suggested a series of steps considered useful in dealing with motivation problems. These are:

1. Specify the objectives.
2. Consider sharing the objectives.
3. Analyze the existing consequences for and against the desired performance.
4. Arrange for reinforcement for the desired behavior or results of behavior.
5. Arrange to eliminate existing reinforcement for competing behavior or performance.
6. Adjust the consequences as your results require.

Objectives are what you hope to produce.

Specifying the objectives simply means knowing precisely what it is you plan to try to accomplish. Know which behaviors you want people to engage in. Know which undesirable behaviors you wish eliminated. Know what results you hope to achieve.

Involving people in goal setting may be useful.

Considering sharing the objectives refers to a bit of a controversy which exists today. One theory listed in useful literature[1] suggests that a good way to manage people's behaviors is to involve them in goal setting. This does not mean dictating goals to them, or deciding which goals would be useful for them and then trying to sell them these goals. Rather, goal-setting theory says that people should share in the selection and discovery of the goals that are appropriate for them. You may want to include this as a part of your method. However, the rule is stated as "Consider sharing the objective" to cover the cases in which you judge that you may better achieve your goals if they are not shared. This might cover the case in which you can develop a program that would successfully change a person's motivation while their prior knowledge of the goals would be offensive to them.

The occurrence of undesirable behaviors implies that there is reinforcement for that behavior.

There may be punishment for the desired behavior.

The only reinforcers for safe behaviors may be long-range or unlikely.

What are your people's reinforcers?

How can you make the reinforcers contingent on desired behavior?

Sometimes you may need to eliminate the reinforcement for the undesired behavior.

If someone is engaging in an undesired behavior and is failing to behave usefully, it must be the case that the undesirable behavior is being reinforced and the reinforcement for the desired behavior is non-existent or weak in comparison to reinforcement for other behavior. Perhaps, the desired behavior is even being punished in some fashion. You will find it useful to try to discover the forms of reinforcement that are operating. In the case of unsafe behavior, it is likely that there are production pressures that cause people to hurry or take short cuts that expose them to hazards. The ways of behaving that best reduce exposures to hazards may require more effort than safer ways of doing jobs. Peer groups may reinforce macho, tough or indifferent behavior. The only reinforcer or punisher that would encourage safe behavior may be the long-range and improbable chance that the person will be harmed. You need to understand these sources of reinforcement and punishment so that you can control them. Under almost all circumstances it will be useful to arrange for reinforcement of the desired behavior or performance. The steps in doing this are to understand what are reinforcers for the people with whom you are working, to select some functional reinforcer(s) you have at your disposal and to arrange for those reinforcers to occur dependent on the occurrence of the desired behavior or performance. Several examples of ways in which these steps can be accomplished are given.

Less frequently, it will be important to find ways in which reinforcement for undesirable behavior can be eliminated. This often takes the form of trying to change peer group pressure from reinforcement for hazardous behavior to reinforcement for safe behavior or, perhaps, the elimination of management pressures for taking hazardous short-cuts. In many cases you will conclude that the major impediments to safe behavior are the effort and bother that are natural consequences of doing jobs carefully. It may be impossible to eliminate these. Accordingly, your major intervention will consist of trying to make the reinforcement for behaving safely sufficiently powerful to offset the natural consequences that promote hazardous behavior.

Try again, if your first attempt to solve a problem is only partly successful.

Even the experienced hands in organizational behavior management often produce results that are only approximations of what is desired in their first attempts at changing consequences. The alert manager will find more and more ways that useful consequences can be put to work, once some experience at working with consequences is acquired. Therefore, don't expect that you will be perfectly satisfied with your first attempt at improving motivation.

USING SOCIAL REINFORCEMENT

Some particular consideration about reinforcing behaviors will be useful.

Social reinforcement is the behavior of one person reinforcing the behavior of a second person. Praising a person for doing something well is social reinforcement.

Social reinforcement is the behavior of one person that reinforces another person. The best known example is praise or recognition. It is often the case that one person can reinforce a particular response of another person simply by praising the other person dependent on the occurrence of the response. A current best-seller, One-Minute Management,[2] talks about how common management tactics can be vastly improved by spending just a few minutes each day looking for things that people are doing well and praising them when they are observed doing them well.

Social reinforcement should be:

1. Timely
2. Honest
3. Sincere
4. Of good variety
5. Descriptive

Don't delay praises.

A praise or compliment can be delayed indefinitely. The best rule follows from Principle 4 (see Unit V, page V-9). The sooner after the response the praise occurs, the better.

Praise only when it is deserved. You have to bother to be observant to know that a praise is deserved.

A praise must be honest. The person must have done a good job. The desired behavior must have occurred. A praise that is not accurate reflects poorly on the person doing the praising and there is the risk that an unwanted behavior will be strengthened. To be an effective praiser of other people you have to be discriminating. You have to bother to notice what people are doing.

Praise if you are trying to help the other person. Don't praise if you are just trying to manipulate.

Sincerity is hard to define. One person is saying something good about a second person. The person delivering the praise had better mean it. This means that you must have an appreciation for the welfare of other people and want to help them if you are to be an effective praiser. If your only goal is to manipulate other people by getting them to behave in ways that benefit you, but not necessarily them, you may as well save your breath. Your praise may be effective for a while but your true colors will eventually be seen by all and you will pay the price of being an exploitive manipulator.

If you appreciate what other people do, bother to learn to tell them in many different ways.

If, in praising people, you say the same things over and over, you will, at least, be expected of being an insincere manipulator who doesn't care enough to think of something new to say. People will become bored by the repetitive praises. "You are doing a good job, John." "Good job, John." "That's a good job, John." "Good job, John." Want to hear it again? Probably neither would John. If you are going to praise, take time to learn a lot of ways to praise. Bother to think of a lot of ways to say nice things to and about people.

Describing the praised behaviors will help make the praise effective.

Because you will rarely have the chance to be perfectly consistent in delivering praises immediately after the desired behaviors have occurred, it will be useful to mention, along with your praise, exactly what you are trying to reinforce. "Good job, John. You got your crew to remove every one of the dangerous piles of lumber almost as soon as we found them." The descriptive praise avoids misunderstandings. It naturally adds to the variety of what you say and it demonstrates to the person you are praising that you know what is going on. You have made an effort

to see exactly what is being accomplished. (An interesting exercise for a class of no more than twenty or so students is to ask them to talk freely with each other for a few minutes and then ask them to, in turn, praise one of the people with whom they have been talking. Class members can provide feedback to each other regarding the quality of the praise. It is, of course, interesting at some point to note how well the people providing feedback incorporate the elements of praise into their comments.)

USING PERFORMANCE FEEDBACK

Performance feedback involves information about performance.

Performance feedback consists of providing information about performance to the performer. The exact functions feedback occupies are probably often multiple, and different in different settings. However, under certain conditions feedback might constitute reinforcement or punishment or some combination of the two. It might serve as an antecedent stimulus to prompt a worker to behave in a certain way. It might serve as a prompt for a supervisor to provide social reinforcement or punishment to a worker for the good or poor performances reflected in the feedback. In any case, performance feedback has often produced from ten to thirty percent improvements in a variety of kinds of performances.

Characteristics of performance feedback.

Performance feedback should be:

1. Timely
2. Accurate
3. Generally provided in graphic form
4. Generally provided for individuals and, perhaps, for specific groups of workers.
5. Provided in relation to realistic expectations and organizational objectives

Provide performance feedback weekly or daily.

There are examples in which feedback is provided as infrequently as once a month. However, most people in the field recommend that feedback on most forms of performance be provided daily or weekly. This means that the feedback will occur fairly promptly following the performance and it will occur fairly often. If feedback is to be provided as infrequently as once per month, it may be important to accompany the feedback with some tangible reinforcers.

Provide reinforcement with infrequent feedback.

Feedback must be accurate.

If performance feedback is to function as reinforcement or punishment, or as a prompt for a supervisor to deliver reinforcement or punishment, it is essential that the feedback be accurate. Otherwise, the resultant feedback or punishment will result in problems discussed above.

Graphic feedback is quantitative, easy to understand, easy to compare to standards, good to show trends.

Graphic feedback has a considerable advantage over most other forms of feedback, in most circumstances. It, of course, provides quantitative information about the performance. It provides functional pictures about performances in relation to standards. It provides information about trends in performance. Information about trends may allow for the reinforcement of behaviors that are trending towards goals long before the goals are reached.

Public displays of exemplary performance may be useful.

Public displays of feedback about poor performance can be punishing.

In most instances performance feedback should be specific to individual performance. It should be provided to individuals. Sometimes it may be desirable to publicly display graphic feedback about individual performance, particularly if that performance is exemplary or improving impressively. In such cases, it is hoped that the public display will bring social reinforcement to the individual. Public display of poor performance should be considered with caution because of the chances of bringing unnecessary punishment on a person, perhaps forcing the person to justify his performance by attacking company policy and job standards.

Feedback about the performance of a group can be used to develop group pressures.

Graphic displays of the aggregate of the performances of a group may be considered in instances where it is desirable to generate group pressures for performance. Again, the possibilities of the kinds of reactions likely to be generated by the graphic display should be considered.

Graphic feedback can include standards or goals.

Standards or goals, if they are realistic and fair, can be plotted on graphs indicating performance. Such standards can be developed with any desired degree of input by the person(s) for whom the standards are intended. The standards provide a level against which current performance can be compared and a means of estimating the rate at which improvements towards the standard are being made.

USING TOKEN REINFORCEMENT

Token reinforcers have little intrinsic value but can be exchanged for things of value. Token reinforcers can be exchanged for many backup reinforcers.

Tangible reinforcers are manipulable things which are reinforcing for the person who receives them. A token reinforcer is a manipulable reinforcer which has little intrinsic value but which can be exchanged for many things of value. Money is the best known example of a token reinforcer. Trading stamps are token reinforcers, as are points, that are arbitrarily awarded to allow for score-keeping in contests and games. The advantages of token reinforcers are that they can be easily handled, in contrast to the backup reinforcers for which they can be exchanged, and they can be highly generalized by having them be exchangeable for a large number of backup reinforcers. Therefore, they are likely to be valuable to the recipient regardless of the reinforcers for which the recipient is, at the moment, deprived.

Characteristics of token reinforcement:

Token reinforcement should be:

1. Timely
2. Accurate
3. Constructed to include many backup reinforcers
4. Descriptive

Token reinforcement should be delivered frequently and with little delay following the occurrence of desired performance.

Token reinforcement should be contingent on desired behavior or performance.

As with all reinforcement, the delivery of the reinforcer must be contingent on the occurrence of the wanted response or performance. If the reinforcer is presented, dependent on the occurrence of some behavior other than that which is wanted, expect that behaviors other than those which are wanted will be strengthened.

Ask people what should be included in the menu of backup reinforcers.

The more backup reinforcers for which the tokens can be exchanged, the better the chances that the token will always be reinforcing for an individual. There are also better chances that there will always be some backup reinforcer for every individual receiving tokens. It will be useful to consult the workers who will receive the tokens to determine the kinds of things they predict will be reinforcing for them. It is also likely to be useful to monitor the items for which the tokens are exchanged to determine useful and useless items among the menu of backups. New items may be experimentally introduced into a menu to see if people will select them.

Money is a very effective token reinforcer because it can be exchanged for so many backup reinforcers.

Money is a highly generalized token reinforcer. Why not use money in special reinforcement programs to motivate workers to behave safely? It is largely a yet unproven point. However, there is a folklore that says money may not be as useful to promote particular behavior as would be specially constructed token reinforcement menus. If money is used as a reinforcer it is likely to be added to the family

Money can be exchanged for mundane reinforcers.

resources and doled out for food, sneakers, gasoline and utility bills. However, a token which can be traded only for more particularized backups such as golf clubs, vacation trips, meals at good restaurants, tickets to sporting events, or personal prizes may be more effective to reinforce desired behaviors.

USING PUNISHMENT

Psychologists have incorrectly thought that punishment only temporarily suppressed behavior.

It is important to understand some of the more important complications that can result from the use of punishment. For several decades many psychologists thought that punishment was not effective to reduce the frequency of unwanted behavior. A favorite interpretation of the effects of punishment was that it could be used to temporarily suppress behavior but it was not useful to eliminate behavior. If punishment is weak, and if the punished behavior is being maintained by uncontrolled reinforcement, the punishment may only suppress the behavior only temporarily. However, it is also clear that strong punishment can weaken behavior for very long periods of time, perhaps indefinitely, under many circumstances. Whether it is useful to use punishment to weaken behavior is a much more complicated question.

The period of suppression depends on the severity of the punishment.

There is always reinforcement maintaining unwanted behavior.

When punishment is used, there is often insufficient reinforcement for correct responses.

In all circumstances in which an unwanted behavior is occurring assume that there is some source of reinforcement for the unwanted behavior. If there were no reinforcement, it would not be occurring. Further, if the wanted behavior is not occurring or is weak in comparison to the unwanted behavior, there must be insufficient reinforcement for it. At least, the reinforcement for the wanted behavior is weak in comparison to the reinforcement for the unwanted behavior. These considerations set the stage for a discussion of the problems that often accompany the use of punishment.

Punishment may suppress unwanted behavior without developing wanted behavior.

First, punishment can suppress the unwanted behavior without there being much of an increase in the frequency of the wanted behavior. This would occur when the reinforcement for the wanted behavior is quite inadequate. In contrast, reinforcement would more likely strengthen the wanted behavior at the expense of the unwanted behavior.

If punishment will be used, it may have to be continued indefinitely.

Punishment may have to be used indefinitely to maintain the suppression of unwanted behavior. This would be the case if the punishment were not strong enough to produce a permanent suppression and the reinforcement for the unwanted behavior were not eliminated. In such circumstances, expect that an instance of punishment will produce suppression of the unwanted behavior for a while but that the unwanted behavior will eventually begin to recover and will have to be punished again to keep it suppressed.

Punishment may produce unwanted emotional responding.

Punishment sometimes produces unfortunate emotional responding. This can range all the way from passive emotional responding such as crying to aggressive emotional responding such as physical retaliation.

Punishment may prompt subversion.

Punishment can prompt subversion. People will start looking for ways to behave in the unwanted way and still avoid the punishment. This would be a particularly likely problem if the source of reinforcement for the unwanted behavior is not eliminated and the reinforcement for the wanted behavior remains weak.

Cooperation among peers caused by punishment may increase the likelihood of subversion.

The likelihood of subversion can increase dramatically if several people cooperate to protect each other. Such cooperation to protect from punishment is, of course, likely if all involved are subject to punishment and all are inadequately reinforced for positive behavior. In such instances, it is likely that there will be social reinforcement from the peer group to cooperate in subverting the punishment. This is in addition to the other sources of reinforcement for the unwanted behavior.

Cooperation among workers to avoid punishment can undermine efforts to develop cooperation with useful organizational goals. Many instances in which organized labor has thoroughly undermined the use of punishment represents an example for a straightforward effort to cooperatively avoid excessive or unfair punishment.

The effects of severe punishment can spill over and suppress wanted behaviors.

If punishment is severe, and it may have to be severe if it is to off-set the effects of the reinforcement that is maintaining the unwanted behavior, the effects may generalize to behaviors in addition to those that are inappropriate. In such instances there may be a generalized decrease in responding so that useful, as well as harmful, behaviors are suppressed.

The person doing the punishing may become generally unpleasant to be around.

The person who administers a lot of punishment, particularly severe punishment, may come to be such a generally punishing stimulus that people will avoid him. This can be a problem particularly for a supervisor who should be playing a key role in cooperative endeavors but who is being consistently avoided because of his frequent association with punishment.

Punishment is generally not a useful means to develop behavior.

There are many problems associated with the use of punishment. This discussion should prompt the consideration that punishment is not a particularly useful way to motivate behavior in a positive manner.

Even though there are serious problems associated with the use of punishment, there may be circumstances when punishment must be considered. Clear examples would be instances where a person, despite proper training and warning, behaves in a way that seriously threatens their own or another person's life or well-being.

Rules for the use of punishment:

When punishment is indicated, certain conditions should be met:

1. The rules and the consequences for breaking them should be stated in advance.
2. People should know the proper way to behave.
3. There should be many more opportunities for reinforcement for correct behaviors than punishment for inappropriate behaviors.
4. Punishment should be reserved for particularly serious behaviors.
5. The punishment should be as immediate as possible following the behavior.
6. The duration of the punishment should be short.
7. The punishment should be directed towards the behavior, not the person.
8. The punishment should be accompanied by a very brief description of the behavior being punished.
9. Punishment should be administered consistently and fairly.

Forewarning minimizes unwanted reactions.

Several of these conditions are aimed at avoiding the problems that can accompany the use of punishment, others at maximizing the chances of producing the desired effect. Having rules and consequences stated in advance is aimed at

minimizing unfortunate reactions to punishment and at insuring that the person knows the correct behavior, so that you do not punish because of a skill or knowledge deficit.

Be sure to reinforce some behavior to replace the unwanted behavior you will punish.

Using much more reinforcement for correct behaviors than punishment for incorrect behaviors and reserving punishment for particularly serious behaviors has several purposes. This practice will help to insure that there is reinforcement for the correct behavior as a replacement for the incorrect behavior. This will help you to make sure that you are not asking for one behavior when all reinforcement given for production and other work considerations is strengthening the unwanted behavior. This will help to keep you or other supervision from becoming generally aversive. It will help to minimize attempts at subverting your punishment. It will help to make clear the fact that your intent is to generate the behaviors that will help people rather than to simply arbitrarily exercise some power you may have.

Keep punishment short.
Find a behavior to reinforce.

You have already studied the importance of the immediacy of consequences. Keeping the duration of punishment short helps to complete the punishment and return to finding ways to reinforce the behaviors that should be occurring in the particular situation.

Being careful to have the punishment directed towards the behavior, and not the person, will help you to make it clear that you generally expect good performance from the person. It will help to minimize the necessity that the person will have to fight back or attempt to subvert your efforts.

Briefly describing the behavior being punished will help to insure that you suppress the behavior intended and will minimize the extent to which you suppress behaviors that you don't want to weaken.

If you punish the same behavior over and over, suspect that there are other problems.

If a behavior is deserving of punishment one time it occurs, it is probably deserving of punishment every time it occurs. You would not want to be inconsistent in dealing with people unless you judged that there were differences in skills or knowledge. If you find yourself punishing the same behavior over and over, suspect that you: have not provided the necessary training skills, have failed to eliminate the reinforcement for the unwanted behavior, or you are not providing sufficient reinforcement for the desired behavior.

INFORMATION-PRESENTING, EDUCATION AND TRAINING

Information-presenting involves just that—there may be no learning. Education includes provisions to insure that the learner can write or talk about the topics of interest.

The terms education and training are used in so many imprecise ways a terminological distinction is in order. First, information-presenting is simply the presenting of information, by any means by the trainer or educator. Information-presenting specifies something about the behavior of the instructor but nothing about changes of the behavior of the person who is the object of the exercise. This person may sleep through the presentation and there may be absolutely no change in behavior.

With education there are procedural guarantees that the person who is the object of the work has some particular behavior. Generally, the guarantees provide only that the person has some written or spoken verbal behavior about the topic of interest. The guarantees usually take the form of tests that are used to sample the verbal repertoire of the learner. Universities typically give tests that require written verbal responses, and less frequently, spoken verbal responses. Universities provide some sort of guarantee that a person can talk or write about cer-

tain things. However, the nature of what is learned is seldom specified with much precision. The point is that universities and other educational institutions seldom check to see if learners acquire real-world skills. They simply sample what a person says or writes about real-world phenomena.

Training provides tests of whether the learner can perform the real-world behaviors of interest.

Training includes some procedural guarantee that the learner learns the specific real-world behavior of interest. Again, the guarantee is usually provided by what we call a test or checkout. However, with training, the test probes the learner's repertoire of on-the-job skills rather than verbal knowledge about on-the-job skills.

Most business and industry "training" is actually only information-presenting.

Working with this distinction, it is clear that most of the "training" that occurs in business and industry is what we are calling information-presenting. Certain information is presented by the trainer or teacher and there are no guarantees that the process has any effect on the behavior of the learner. When business and industry "training" provides tests that might probe the repertoires of the learners, they usually sample verbal skills of what the learners can write or say about the phenomena of interest. We rarely know whether business and industry "training" has effects on the behaviors of interest because the effort rarely includes tests for those behaviors.

Information presenting and educating may or may not affect the on-the-job behaviors of interest.

Do not assume that information-presenting and education have no effects on work behaviors. Either process may have some effects. The point is that, as they are ordinarily conducted, we do not know what those effects, if there are any, are. Furthermore, in the absence of on-the-job tests of skills, there are no mechanisms for improving the effects information-presenting and education can have on real work skills.

Suppose that we always want to provide training, rather than just information or education, when a person is assumed to have a skill deficit. How can that be accomplished reasonably? It will be useful to distinguish three kinds of training which we will call corrective feedback, simple training, and complex training. Corrective feedback will be used to briefly correct incorrect performance. Simple training will be used whenever we wish to develop a skill having only a few components, perhaps using a fire extinguisher or cleaning up a spill. Complex training is useful when the performance includes a large number of components such as would be the case with learning to safely fly an airplane or to minimize exposures to toxic chemicals in a complex job.

USING CORRECTIVE FEEDBACK

Corrective feedback is used when someone doesn't know how to behave.

Use corrective feedback when formal training isn't necessary.

Corrective feedback is information about how to perform that is provided to someone who is performing incorrectly. It is used, in the face of an incorrect performance, to prompt a correct response the next time it is appropriate. Corrective feedback is used as an alternative to punishment in circumstances in which you assume that a person is well motivated but has failed to perform correctly because of a skill deficit. The skill deficit is so simple or involves so few responses that more formalized training is unnecessary.

Characteristics of corrective feedback

Useful corrective feedback is:

1. Timely
2. Non-punitive
3. Descriptive of the incorrect behavior
4. Explanatory of why the performances were incorrect

5. Descriptive of the correct behavior
6. Done in such a way to include practice of the correct alternative, your observation of the practiced performance, further feedback and reinforcement if possible.

An example of the first several steps of corrective feedback might be, "You just walked across the puddle of spilled lubricant. That is dangerous because you could slip, fall down, and hurt yourself. The proper thing to do is throw some absorbent onto the spill and gradually take up the absorbent from the edge of the puddle so you never have to walk on it. Make sure you have a dry, non-slippery surface on which to stand as you work."

Remember that the person is motivated but simply has a skill or knowledge deficit.

Independently of intent, many people have difficulty providing feedback, in the face of an incorrect performance, unless the feedback is in the form of disciplinary action. Remember, corrective feedback is used when the performer behaved incorrectly because of a lack of skill or knowledge about correct performance. Presumably the person is motivated, is trying to perform correctly. Punishment, then, is inappropriate.

Explain why the performance was not correct.

What is appropriate is to tell the person that he has performed incorrectly and describe the details of the incorrect performance. The person should then know exactly what was not done correctly. It is also useful to provide an explanation of why their way of doing something is not correct. That explanation will help them to learn the principles that are involved in the performance and perhaps to better understand the reasons for the ways the job should be performed.

Model how the person should behave and explain why that way is correct.

The feedback should specify the correct way to behave. A demonstration is often a useful way to communicate how you want someone to behave. A brief explanation of why the suggested way is correct, again, may help the person to learn the principles involved in the performance.

Remember that you are actually training someone when you provide corrective feedback. Notice that good training provides the learner an opportunity to practice and subsequently demonstrate the correct performance. The demonstration of course, provides an opportunity for you to make sure the skill is correctly performed, and to provide feedback to confirm that it is correct or to change it if it is not.

CONDUCTING SIMPLE TRAINING

The steps in simple training.

The steps in carrying out simple training are:

1. Specify the objectives.
2. Communicate the objectives to the learner.
3. Provide for practice of the objective behaviors.
4. Test for the objective behaviors.
5. Provide feedback.
6. Provide reinforcement.
7. Recycle to mastery.
8. Provide for maintenance of the skills.
9. Evaluate and modify the training as indicated.

This list of procedures allows for very effective and straightforward training that is more easily accomplished than the length of the list may imply.

Watch or videotape an expert to determine objectives

You need to know exactly what you are going to try to train someone to do, before you begin training. Specifying your objectives involves determining the exact behaviors you will train. There are good methods to determine behavioral objectives for training. Watching or videotaping an expert doing the job is the standard method. Carrying out the job yourself and asking the expert to criticize your performance is a check on your understanding.

A live or videotaped demonstration is a good way to communicate your objectives.

If you know what you want someone to learn, the next logical step is to show or tell the learner exactly what that is. Much of the research and controversy over how to train is centered around questions about what are the best methods for communicating objectives. For the moment, assume that showing someone is a good method. You can show someone with a live demonstration which you or an expert can carry out. If you are going to be training people repetitively, it may be useful to videotape or film someone doing the job. If the other procedures are used correctly, the exact method by which you communicate the objectives is probably not particularly important, as long as they are communicated accurately.

Provide for practice under realistic conditions.

You are going to insure that someone can perform as desired. Providing for practice of the skill is the beginning step of your procedural guarantee. You want the person to be able to perform on the job; then provide the opportunity to practice on the job. By providing the learner the opportunity to practice the skill you not only increase their chances of learning, you set the stage for insuring that they learn. You can look in on the practice to see if the behavior is occurring as intended. The looking in is, of course, an on-the-job test.

Conform and reinforce correct responses, correct incorrect ones.
If it is worth learning, use a recycle to mastery procedure.

Feedback and reinforcement provide for the strengthening of a correct performance or the correction of one that is in error.

If a learner is not performing perfectly at the end of the test, should the person be cast on the scrap heap for failure? Why should you assume that the learner has failed to learn rather than that you have failed to teach? What should you do if, as is often the case, the learner can perform some of the behavioral objectives correctly but does not do all of them as specified? How would you like to fly on a commercial jet with a pilot who made a grade of "C" on landings? How would you like to have your appendix removed by a surgeon who made eighty-eight percent on the test on tying of arteries? If something is worth learning, it is worth learning perfectly. If someone has part but not all of the skills, why not simply, and usually quickly, take the person back through the lesson until the performance is perfect? Why not recycle the learner through the steps until the skills are mastered?

The procedures involved in testing and recycling to mastery provide the guarantee that the learner has the desired skills.

Be sure there are reinforcers for the behaviors. Infrequently used skills may require occasional retraining.

Providing for maintenance can involve either making sure that there are reasonable consequences for the skill as they are used on the job, and in the case of infrequently used skills, it might include refresher testing and training.

On-the-job tests provide evidence for the effectiveness of training as well as evidence of the skills learned. Therefore, data from the tests can be used as a basis for evaluating training. Such an evaluation may determine that training is effective or that it should be changed in particular ways.

Training someone how to operate a soda acid fire extinguisher is an example of simple training.

These training procedures actually make good common sense when you begin to translate the general forms of the methods into particulars. Suppose you want to train people to operate a soda acid fire extinguisher (Note: this does not include the judgments involved in knowing when such a fire extinguisher should be used.) This includes a simple collection of behavioral objectives. A person should lift the extinguisher from its wall hanger, carry it to the fire, grasp it by the top and bottom, turn it upside down, and direct the stream from the extinguisher at the base of the flames.

You might best communicate these objectives by showing the learner the specific steps in correct sequence. After your demonstration, you might ask the learner to practice the steps as you watch. While the learner is practicing, provide corrective feedback for any mistakes and confirmation if the performance is correct. Probably nothing more than social reinforcement, "That's good!" or "That's the way to do it. Good job!" is necessary or appropriate. You might provide an on-the-job simulated test to see if the learner can perform as specified. If there is a failure, you simply repeat your demonstration and allow for more practice, testing, feedback, and reinforcement until a perfect performance results.

Maintenance of the skill depends on the opportunity to use the acquired skills and on the reinforcement dependent on their occurrence. If evaluation of the training is important, it can be carried out by data collected on the performances during the on-the-job tests.

Steps in complex training:

Slightly more complex training is required if the skills to be learned are greater in number. The list of training methods includes:

1. Specify the objectives
2. Sequence the objectives
3. Break collections of objectives into short lessons
4. Communicate the objectives to the learner
5. Provide practice (memory) guides
6. Provide for practice on the objective behaviors
7. Provide frequent tests
8. Accumulate test criteria
9. Provide feedback
10. Provide reinforcement
11. Recycle to mastery
12. Provide for maintenance of the skills
13. Evaluate and modify the training as indicated

Five of these procedures are additions to those specified for simple training and are necessary to accommodate the greater number of behaviors involved in the desired skills.

Sequencing determines the order of presentation of the objectives.

Sequencing to determine the order in which the objectives will be presented is particularly important as the list of objectives becomes long. Several criteria are deserving of consideration as the objectives are sequenced. First, skills that are prerequisites for other behaviors should be taught before the other behaviors. If skill in ***A*** is necessary before ***B*** can be learned, you had better teach ***A*** before ***B.*** Generally, it is a good idea to present easier to learn skills before the more difficult to learn ones. This allows the cooperation and confidence of the learner to build before greater demands are imposed. This usually, but not always, includes teaching simpler skills before more complex skills.

Look for prerequisites, simpler and easier behaviors.

Sequencing can be accomplished in a straightforward fashion by analyzing to see which behaviors are prerequisites for others and by noting the relative difficulty and complexity of the list of skills.

Keep lessons short.

Research generally suggests that people have much shorter attention spans than most training programs and most forms of education accommodate. Instead of having a few long training sessions, a better approach, especially as the list of objectives becomes long, is to have short training sessions to communicate objectives to the learner. A functional rule is to keep the number of objectives presented in one lesson as small as is necessary so that the lessons will be from five to fifteen minutes long. This stays close to attention spans of adult learners and allows for manageable numbers of objectives during practice.

A memory guide is a list of objectives the learner can keep.

A practice or memory guide is a list of objectives involved in a lesson. The guide is given to learners to help them remember the objectives from the time they are communicated until they can be practiced.

Frequent tests help keep errors out of performances and make learning easier. Accumulating test criteria helps maintain already learned skills as new ones are practiced.

Frequent tests allow the learner to get feedback and, hopefully, reinforcement before errors become permanently incorporated into repertoires. Frequent tests also minimize the number of new objectives for which the learner is responsible at any one test.

If a learner acquires skills *A, B, C, D,* and *E* and then quits practicing them while learning skills *F, G, H, I,* and *J,* there is a tendency for the first learned skills to be lost as the new ones are learned. The solution to this is to have earlier learned skills reviewed in later lessons and tests. A particularly effective form of review is to incorporate criteria for passing earlier tests into later tests. This accumulation of lesson criteria is designed to insure that the skills are maintained over the period of learning.

Otherwise, the methods for training complex behaviors are like those for training simpler collections of behaviors.

APPLICATIONS TO SAFETY AND HEALTH
Examples of use of the methods.

These kinds of methods can be combined and incorporated into programs to promote improved performance in a very large number of different areas. There have been programs to control tardiness, to promote attendance at work, to promote productivity, even in machine-paced production, to control waste, to reduce fuel consumption and to improve quality of production. Safety and health represents one particular kind of application.

Training alone was not sufficient to get miners to behave safely.
Gave tokens to individuals and groups of workers who went for periods of time without injuries and accidents.

David Fox[3] trained miners in an open pit mine in Wyoming to behave in ways that result in fewer accidents and injuries, but found that introducing the skills into people's repertoires was not sufficient unless they were also motivated to behave safely. He next established a token economy in which the miners received tokens of little intrinsic value for going periods of time without having accidents and injuries. They received additional tokens if every member of their work team avoided accidents and injuries. This was, of course, designed to encourage workers to look after each other and pressure each other into behaving safely. The tokens could be exchanged for a variety of backup reinforcers so that there might be a backup which would be important to every worker. The awarding of the tokens was, naturally contingent upon safe performance. If miners had accidents or injuries, they lost their awards for periods of time, depending on the severity of the accidents and injuries.

Tokens were trading stamps which could be exchanged for prizes and gifts.

The tokens used by Fox were trading stamps. The backup reinforcers were the various prizes, clocks, golf clubs, luggage, etc. for which the stamps could be exchanged. Using the existing trading stamp system allowed Fox to avoid the bother in establishing a new token economy. This system still required that the miners exchange the tokens for prizes that were individually meaningful rather than simply incorporating dollars, the tokens, into the regular family budget.

Program at the mine involved reinforcement for safe records rather than safe behaviors.
Decreases in frequency of lost-time accidents, days lost from work, vehicle accidents, damage costs, compensation costs.

In this program, Fox was not directly reinforcing safe behavior but was providing reinforcement for workers going for periods of time without injury or accident. The beneficial effects of Fox's token economy for reinforcing safe performance were quite broad. The frequency of lost-time accidents at the mine declined, over two year's time, by about 85 to 95 percent. The percentage decrease in the number of days lost from work as a result of injuries was just as great. The number of equipment and vehicle accidents declined by about 65 percent. Equipment damage costs declined by 80 percent and compensation costs by fifty percent.

Savings in costs can add considerably to profits.

Managers often think in terms of trying to increase sales if they want to improve profits. Often, profits are a very small percentage of gross income. Therefore, increases in units of sales add only marginally to profits. However, every penny of costs saved often adds directly to profits. These returns are in addition to improved morale and cooperation when safety is improved. Looking at direct costs alone,

Incentive programs can be effective for long times if properly designed.

Fox's program yielded a positive return on investment beginning with the first year the program was in effect.

There are occasional complaints that special incentive programs may work for a while but that people tend to become tired of them over time. There is no sound evidence that this problem exists. If this problem occasionally occurs, it is probably testimony to poorly managed programs or to poorly designed token systems that have backup reinforcers for which everyone eventually becomes satiated. To be effective the tokens have to be presented contingently on accurate data.

The mine program was effective for nine years.

Fox's program was maintained without loss in effectiveness for nine years, until the mine was closed because of falling prices for ore. In fact, because of a slight adjustment Fox made, the data improved during the long period the token system was in effect. After the first couple of years, Fox noticed that nearly all of the

Double awards during especially dangerous winter months.

accidents that were occurring at the mine happened during the winter, when work conditions were particularly difficult. He decided to double the stamps awarded during the winter months and the adjustment produced an additional cost-effective improvement in the safety records.

Similar problems at a coal mine.

The parent company that owned the mine in Wyoming also operated a coal mine in New Mexico that was having severe safety problems. The mine had two deaths the year before Fox consulted with them about the development of an incentive program similar to the one he set up in Wyoming. The experience with the reinforcement program at the coal mine largely replicated the earlier results Fox obtained. Soon after the token reinforcement system was begun, the frequency of lost-time injuries and the number of days lost from work due to injuries, decreased dramatically. All of the costs associated with injuries and accidents also decreased with the result that this program, too, was paying for itself within a year of its beginning.

Reinforcement program produced similar results.

Program using trading stamps, in combination with other methods, set up for off-shore oil rigs.

Five to one return on investment

Mobil Oil[4] was the next recorded case to follow this approach. The Mobil incentive program also used trading stamps and was established to try to control injuries and costs on off-shore drilling rigs in the Gulf of Mexico. Their experiment with trading stamps as reinforcers was complemented by the simultaneous introduction of weekly safety inspections of drilling rigs, mandatory safety training programs, and improvements of safety equipment on the rigs. Therefore, it is not possible to sort out precisely which effects are attributable to the incentive program or to other procedures. Nevertheless, the overall improvement was impressive. The company received a $1,000,000 refund from its insurer because of the improving safety record, and the return on investments have been estimated at better than five to one. The company saves more than five dollars for every dollar it invests in the combined safety program.

Note that managers were far removed from the workers and behaviors for much of the time.

A particular feature of the programs at the mines and at the off-shore oil rigs that is worth noting is that there was no direct reinforcement of behavior. In all three cases, reinforcing safe behavior would be difficult because the workers are far removed from supervisors for considerable periods of time. For instance, at the mines, a dump truck driver might spend an entire day a mile or more from the immediate supervisor. Therefore, there would be little opportunity for the supervisor to know whether or not the worker was behaving safely. The alternative is to provide reinforcement contingent on periods of time during which accidents and injuries do not occur. This is a common business practice. Piece rate pay is not provided for a worker's behaving in a particular way but is contingent on products or results of behavior. Commissions are not dependent on particular behaviors but on evidence that sales have occurred.

Special token system was created for urban bus drivers.

Bob Haynes[5] noticed this particular feature of the incentive programs when asked to develop a safety program for bus drivers in a large metropolitan area. The bus company had an ongoing safety training program, but the drivers still had many accidents. All evidence suggested a large percentage of these accidents could be avoided. The drivers were removed from supervision for long periods of time, sometimes farther than the workers at the mines and oil rigs. Therefore, Haynes recommended that the company adopt an incentive program to reinforce drivers for avoiding accidents and injuries.

For various reasons, the bus company was reluctant to use trading stamps but did not object to token systems in principle. Therefore, Haynes constructed a token

system that was unique to the bus company. Individual drivers were given points if they went for pay periods without accidents. They received additional points if other drivers on the same teams also avoided accidents. The points could be exchanged for such things as tickets to ball games, coupons for purchases at fast food restaurants, and even bus passes!

The token system was used first for a subset of drivers with good effects and, then, replicated with remaining drivers.

The safety records of the drivers who were first allowed to work with the token reinforcement system quickly exceeded that of control drivers who were not on the program. When the control drivers were placed on the reinforcement program, their safety records also improved. The return on investment for this program was about three to one.

There was no particular magic in using the trading stamps as tokens in the reinforcement program. Points could just as well have served as tokens. The mining and oil drilling token systems were probably superior to that developed for the bus company but, only because they included many more backup reinforcers. The trading stamp systems probably also included fewer administrative problems.

Training and reinforcement to cause fiberglass workers to protect themselves from toxic chemicals.

Programs that have included training and formal reinforcement systems have been developed to teach and motivate workers to behave in ways to reduce their exposures to toxic chemicals. Hopkins[6] reports on an elaborate program designed for the fiberglass-reinforced plastics industry. First, workers were trained to engage in specific behaviors such as: engaging exhaust ventilation before spraying mixtures containing toxic chemicals, and maintaining good housekeeping conditions. The good housekeeping conditions included such practices as frequently changing filters on spray booths so that they would efficiently remove the toxic chemicals from the vicinity of the workers.

Training focused on many behaviors and housekeeping conditions. Short training sessions, on-the-job practice, feedback, recycle to mastery, reinforcement, accumulative test criteria, post-training feedback and reinforcement.
Big effects in one plant.
Large changes in exposures to toxic chemicals.
Replications in 2 other plants.

The training program focused on eleven specific work behaviors and twenty housekeeping conditions. The objectives were communicated to the workers with short five- to ten-minute videotapes which showed experienced workers engaging the the specific behaviors. After watching a video tape, the workers practiced the objective behaviors in their own work areas and were given tests to determine what they had learned. The tests were objective and provided feedback, positive feedback. Trainers also provided social reinforcement for good performances and workers were given small sums of money for passing the tests which had cumulative lesson criteria. Once a worker passed a test over specific skills and housekeeping conditions, periodic feedback and reinforcement was provided contingent on continued use of the specified behaviors and maintenance of the conditions.

These procedures were first introduced into one plant while another plant served as a control. Virtually all specified behaviors changed as desired and all housekeeping conditions came to meet criteria in the first plant while there were only insignificant changes in the control plant. In addition, as the behaviors and housekeeping conditions changed, there were large changes in several measures of the workers' exposure to the toxic chemical. These effects were subsequently replicated with the second plant while a third served as a control. An additional replication was then produced in the third plant.

Programs to reduce hazards in laboratories and manufacturing plants.

Very simple procedures have been used to reduce the number of hazardous conditions existing in university laboratories[7] and in a custom products fabrication plant.[8] The procedures consist of frequent, objective inspections for hazards. Any hazards found are noted on a form that specifies the location and kind of hazard along with specific suggestions for improvement. In these applications, hazards included things like: unsecured compressed gas cylinders and unguarded drive belts in the laboratories, and material stacked in walking aisles or flammable materials not stored in adequate places in the plant. Positive comments were written on the feedback forms by the production manager or other person in a position of authority, whenever improvements in conditions were noted.

Feedback and social reinforcement based on data from inspections.

Use of personal protective equipment is important in some industries.

Use may involve natural punishment of discomfort.

Use of short-term reinforcement to encourage wearing of protective equipment.

Supervisors in a shipyard provided feedback and praise for wearing glasses, produced lower rates of eye injuries.

Similar programs for ear protection in noisy plants.

Feedback in one industry.

A token economy.

In many industries, injuries result because workers fail to wear personal protective equipment in risk situations. Speculatively, several sources of counter-productive consequences can contribute to these failures. First, a certain amount of extra effort is often involved in obtaining, maintaining, and using such equipment. The equipment may be uncomfortable to the extent that usage is limited. In some job settings there may be social punishment for the non-macho use of protective devices. Working against these consequences may be the inadequate long-range possibility of hearing loss or eye injury. Accordingly, researchers have begun to investigate the utility of using managed short-term reinforcement contingent on appropriate usage of personal protective equipment. Smith, Anger, and Uslan[9] report on the first successful application of behavioral methods for getting workers to use protective equipment. They trained first-line supervisors of shipfitters in a large shipyard to notice whether or not the use of safety glasses was being practiced (60 percent of all injuries to these workers were eye injuries), to record observations, and to give praise and approval to the workers using the glasses. Four of five supervisors who used these methods produced lower rates of eye injuries among their workers.

Zohar, Cohen and Azar[10] and Zohar and Fussfeld[11] have developed behaviorally-based procedures for encouraging the use of ear protection by workers in noisy industries. The first of their studies used a simple feedback procedure to increase the use of ear plugs. In the second study, management and workers cooperatively developed a token system to promote hearing protection usage. Daily tours of the weaving in a department of a textile factory were conducted by department supervisors. Each worker seen wearing ear protection was given a token. During a second walk through the department the supervisor marked on the tokens a number from 1 to 10 to indicate that the token was worth 1 or 2 or 3, etc. points. The numbers corresponded to the number of workers who were wearing protection that day. The points could be exchanged for consumer products the workers had selected as being important to them.

The token system was effective for four successively treated groups.

The procedures were applied at different times to four different groups of workers so that later treated groups could serve as controls for the earlier treated ones. Before the treatment was applied, the use of ear protection averaged about 70 percent for three groups of wearers and increased within a week to an average of about 95 percent. The fourth group was composed of the maintenance workers who cared for the machinery in the department. Their initial usage averaged only 30 percent. Within seven working days their average had also increased to about 95 percent.

Identification of safe and unsafe behaviors in a meat processing plant.
Graphic feedback and positive comments from supervisors increased safe behavior.

Komaki, Barwick and Scott[12] implemented a program to encourage workers in a meat processing plant to behave safely. Pairs of safe and complementary unsafe behaviors were defined and presented to workers in a brief orientation program. Part of the program consisted of showing graphs of data on the percent of incidents workers were performing safely, based on data that had been collected by trained observers. These graphs were posted in conspicious places and were updated daily. Supervisors were trained to provide positive comments to workers when they saw them behaving safely. These procedures increased the number of incidents performed safely from 70 to 77 percent to 96 and 99 percent in two different departments in which the procedures were successively introduced.

Frequency and severity of injuries in auto plants.
Detect safe and unsafe conditions, show ways to do jobs safely; safety audits of equipment and behavior, correct faulty conditions and behaviors without punishment, social reinforcement, tangible reinforcers.
Very large reductions in frequency and severity measures of behaviors.

A particularly systematic and comprehensive safety program which is partly based on behavioral methods was reported by Jaime Hermann.[13] He worked with four different departments of auto manufacturing plants to try to control the frequency and severity of injuries. The program began with worker participation to detect and correct unsafe conditions. Next, every job was analyzed to determine the steps involved, the hazards, and the ways in which the jobs could be performed safely. Results were communicated to workers in weekly safety meetings. Each week a person representing management conducted a safety audit of equipment and behaviors. Whenever sub-standard equipment or an unwanted behavior was detected, the supervisor was asked to talk with the worker in a non-punitive fashion to correct the job procedure. Periodically, improved performance was recognized by memoranda from the production manager and by photos of the workers. The workers also participated in a raffle of lottery tickets contingent on good safety records. These methods produced very large reductions in both frequency and severity of injuries. For example, in one department the frequency of medical and disabling injuries averaged 177 per month before and 79 per month after Hermann's program began. The severity measure in the same department averaged 3.708 (3.708 days lost due to injuries per million person hour worked) before the program and .91 during the program. In a second department, the severity measure declined from 1.699 to 0, from 1.426 to 338 in the third and from 3.324 to 1.737 in the fourth.

These are just a few examples of ways in which behavior can be controlled to improve the safety and health of workers in business and industry. Behavioral methods seem to be quite general in the sense that all work behaviors are subject to the principles presented. Therefore, whenever control of a particular behavior is important to safety and health, appropriate methods can be developed with a good chance that results will be successful. Places of work appear to have a large variety of reinforcers that can be used to strengthen desired behaviors. Although typical business practice involves presenting these to workers independently of useful behaviors, they can be incorporated into productive programs in straightforward and effective ways.

SAMPLE TEST QUESTIONS

1. Distinguish between skill and motivation problems.

2. What are some questions to ask to help you decide if a problem results from a lack of skill or a lack of motivation?

3. What are general steps to take to solve motivation problems?

4. The occurrence of unsafe behavior always implies something about the variables controlling that behavior that you should try to take into account. What is that?

5. Why is it so important that you want to help the person you are praising?

6. Why is it something of a compliment if you can, in many different ways, tell people that they have done good jobs?

7. What is performance feedback?

8. What are the advantages of providing feedback in graphic form?

9. What is token reinforcement?

10. What is a good way to determine the menu of backup reinforcers for which tokens can be exchanged?

11. Why may money not be as useful as other backup reinforcers in token reinforcement programs?

12. When is corrective feedback useful?

13. What are two problems that can result from the use of punishment?

14. Distinguish among information-presenting, education, and training.

15. What are the functions of "recycling to mastery" in training?

16. What is an effective way to decide what your training objectives are?

17. What is an effective way to communicate objectives?

18. What considerations are relevant to whether a newly learned skill is likely to be maintained?

19. In complex training why is it important to accumulate test criteria?

20. Briefly, how were token economies used in mines and on off-shore oil rigs to promote safety?

21. When a bus company needed a token reinforcement program to promote safety but did not want to use trading stamps what was a simple solution?

22. How were workers induced to reduce their exposures to toxic chemicals in fiberglass reinforced plastics plants?

ANSWERS TO QUESTIONS

1. In skill problems the person may be well motivated but not have the skills to behave as desired. With motivation problems the person has the necessary skills but the consequences are not causing the behaviors to occur.

2. Does the person sometimes behave as desired? Does just about everyone know how to do the job? Does the person usually expend reasonable energy? Can the person do the job correctly on request? Could the person do the job if highly motivated?

3. Specify your objectives
   Share your objectives if appropriate
   Analyze the existing consequences
   Arrange for reinforcement of wanted behavior
   Arrange for extinction of unwanted behavior
   Further adjust the consequences as needed

4. That the unsafe behavior is being reinforced in some way and that it may be difficult to eliminate that behavior unless the reinforcement is eliminated.

5. If you are simply trying to manipulate or take advantage of the person you are praising, that fact will eventually become obvious and is likely to make your interactions more unpleasant than if you have never praised in the first place.

6. You care enough about what they are doing that you are bothering to find many different ways to say that they are performing well.

7. Data about performance provided to the performer.

8. Graphs make quantitative information easy to interpret. They make trends easy to see. They allow for the easy display of standards and performance in relation to standards.

9. Reinforcement involving objects of little intrinsic value which can be exchanged for backup reinforcers.

10. Ask the people who will be the beneficiaries of the token economy what they would like as reinforcers. Monitor the selections of backup reinforcers to see which are particularly popular.

11. Money, given as special reinforcement, contingent on particular behaviors or accomplishments, may simply become mixed into the family finances so that the person whom you are particularly trying to reinforce is not affected.

12. When someone has behaved incorrectly but is well motivated and you judge that formal training is not required to correct the performance.

13. Any two of the following:
    - Punishment may suppress one unwanted behavior without developing a wanted behavior as a replacement.
    - Punishment may produce unwanted emotional responding.
    - Punishment may prompt subversion.
    - Punishment can suppress wanted as well as unwanted behaviors.
    - The punishing person becomes unpleasant to be around.

14. Information-presenting specifies that the teacher presents information. With education there is some examination of the extent to which the learner acquires written or spoken behaviors about the phenomenon of interest. Training includes provisions that can insure that the learner has the skills of interest.

15. It provides for another learning opportunity for the person who performs less than perfectly on indicated skills and allows every learner to master every skill.

16. Watch or videotape an expert doing the job and note the specific steps involved in the performance.

17. Show the learner, via a live or filmed videotaped demonstration, what you want done.

18. Whether there are reinforcers which might maintain the skill. Whether there are opportunities to use the skill.

19. To keep people from forgetting previously learned skills as they are learning new ones.

20. Workers were given trading stamps which could be exchanged for gifts and prizes for going for periods of time without having accidents and injuries.

21. A special token reinforcement was created for the bus drivers. They received points for working without injuries. The points could be exchanged for prizes and awards.

22. They were trained the behaviors that would allow them to reduce their exposures and were reinforced for engaging in those behaviors.

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SKILL PROBLEM—THE PERSON IS WELL-MOTIVATED BUT DOES NOT KNOW HOW TO PERFORM

MOTIVATION PROBLEM—THE PERSON KNOWS HOW TO DO THE JOB BUT IS NOT PROPERLY MOTIVATED TO DO IT

DISTINGUISHING BETWEEN SKILL AND MOTIVATION PROBLEMS:

DOES THE PERSON SOMETIMES BEHAVE AS DESIRED?

DOES JUST ABOUT EVERYONE KNOW HOW TO DO THE JOB?

DOES THE PERSON USUALLY EXPEND REASONABLE ENERGY?

COULD THE PERSON PERFORM CORRECTLY IF ASKED?

COULD THE PERSON PERFORM CORRECTLY IF HIGHLY MOTIVATED?

GENERAL STEPS FOR DEALING WITH MOTIVATION PROBLEMS:

1. SPECIFY THE OBJECTIVES
2. CONSIDER SHARING THE OBJECTIVES
3. ANALYZE THE EXISTING CONSEQUENCES FOR AND AGAINST THE DESIRED PERFORMANCE
4. ARRANGE FOR REINFORCEMENT FOR THE DESIRED BEHAVIOR OR RESULTS OF BEHAVIOR
5. ARRANGE TO ELIMINATE EXISTING REINFORCEMENT FOR COMPETING BEHAVIOR OR PERFORMANCE
6. ADJUST THE CONSEQUENCES AS YOUR RESULTS REQUIRE

FAILURE OF DESIRED BEHAVIOR TO OCCUR IMPLIES THAT THERE IS INSUFFICIENT REINFORCEMENT, OR PERHAPS EVEN PUNISHMENT, FOR THAT BEHAVIOR

OCCURRENCE OF UNDESIRED BEHAVIOR IMPLIES THAT THERE IS SOME REINFORCEMENT FOR THAT BEHAVIOR

SOCIAL REINFORCEMENT SHOULD BE:

1. TIMELY
2. HONEST
3. SINCERE
4. OF GOOD VARIETY
5. DESCRIPTIVE

PERFORMANCE FEEDBACK SHOULD BE:

1. TIMELY
2. ACCURATE
3. GENERALLY PROVIDED IN GRAPHIC FORM
4. GENERALLY PROVIDED FOR INDIVIDUALS AND, PERHAPS, FOR NATURAL GROUPS OF WORKERS
5. PROVIDED IN RELATION TO REALISTIC GOALS IN MANY CIRCUMSTANCES

TOKEN REINFORCEMENT SHOULD BE:

1. TIMELY
2. ACCURATE
3. CONSTRUCTED TO INCLUDE MANY BACKUP REINFORCERS
4. DESCRIPTIVE

CONSIDERATIONS BEFORE USING PUNISHMENT:

IF THE PUNISHMENT IS WEAK, AND IF THE PUNISHED BEHAVIOR IS BEING MAINTAINED BY UNCONTROLLED REINFORCEMENT, THE PUNISHMENT MAY SUPPRESS THE BEHAVIOR ONLY TEMPORARILY

STRONG PUNISHMENT CAN WEAKEN BEHAVIOR FOR VERY LONG PERIODS OF TIME

ALWAYS ASSUME THAT THERE IS SOME REINFORCEMENT (WHICH SHOULD BE ELIMINATED) FOR AN UNWANTED BEHAVIOR

ALWAYS ASSUME THAT THERE IS INSUFFICIENT REINFORCEMENT FOR THE WANTED BEHAVIOR IF IT ISN'T OCCURRING OR IS WEAK IN COMPARISON TO THE UNWANTED BEHAVIOR

POSSIBLE PROBLEMS WITH THE USE OF PUNISHMENT:

PUNISHMENT CAN SUPPRESS THE UNWANTED BEHAVIOR WITHOUT ESTABLISHING A WANTED BEHAVIOR

PUNISHMENT MAY HAVE TO BE USED INDEFINITELY TO SUPPRESS AN UNWANTED RESPONSE

PUNISHMENT MAY PRODUCE UNFORTUNATE EMOTIONAL RESPONDING

PUNISHMENT CAN PROMPT SUBVERSION

PUNISHMENT MAY PROMPT PEOPLE TO COOPERATE TO AVOID THE PUNISHMENT

PUNISHMENT CAN UNDERMINE COOPERATION FOR USEFUL GOALS

SEVERE PUNISHMENT MAY SUPPRESS BEHAVIORS IN ADDITION TO THOSE TOWARD WHICH THE PUNISHMENT IS DIRECTED

THE PERSON ADMINISTERING PUNISHMENT CAN BECOME GENERALLY UNPLEASANT TO BE AROUND

IF YOU ARE GOING TO PUNISH, OBSERVE THE FOLLOWING:

1. THE RULES AND CONSEQUENCES FOR BREAKING THEM SHOULD BE STATED IN ADVANCE
2. PEOPLE SHOULD KNOW THE PROPER WAYS TO BEHAVE
3. THERE SHOULD BE MANY MORE INSTANCES OF REINFORCEMENT FOR CORRECTED BEHAVIORS THAN PUNISHMENT FOR INAPPROPRIATE ONES
4. PUNISHMENT SHOULD BE RESERVED FOR PARTICULARLY SERIOUS BEHAVIORS
5. THE PUNISHMENT SHOULD FOLLOW THE BEHAVIOR AS IMMEDIATELY AS POSSIBLE
6. THE DURATION OF THE PUNISHMENT SHOULD BE SHORT
7. THE PUNISHMENT SHOULD BE DIRECTED TOWARDS THE BEHAVIOR, NOT THE PERSON
8. THE PUNISHMENT SHOULD BE ACCOMPANIED BY A VERY BRIEF DESCRIPTION OF THE BEHAVIOR BEING PUNISHED
9. PUNISHMENT SHOULD BE ADMINISTERED CONSISTENTLY AND FAIRLY

INFORMATION-PRESENTING SPECIFIES THAT THE INSTRUCTOR PRESENTS INFORMATION

EDUCATION PROVIDES SOME GUARANTEE THAT THE LEARNER CAN TALK OR WRITE ABOUT THE SUBJECT OF INTEREST

TRAINING PROVIDES SOME GUARANTEE THAT THE LEARNER CAN PERFORM SOME REAL-WORLD BEHAVIOR

INFORMATION PRESENTING AND EDUCATION MAY HAVE SOME EFFECTS ON REAL-WORLD BEHAVIORS BUT THERE ARE NO GUARANTEES THAT THEY DO

USEFUL CORRECTIVE FEEDBACK IS:

1. TIMELY
2. NON-PUNITIVE
3. DESCRIPTIVE OF THE INCORRECT BEHAVIOR
4. EXPLANATORY OF WHY THE PERFORMANCE WAS INCORRECT
5. DESCRIPTIVE OF THE CORRECT BEHAVIOR
6. DONE IN SUCH A WAY TO INCLUDE PRACTICE OF THE CORRECT ALTERNATIVE. YOUR OBSERVATION OF THE PRACTICED PERFORMANCE, FURTHER FEEDBACK AND REINFORCEMENT

THE STEPS IN CARRYING OUT SIMPLE TRAINING ARE:

1. SPECIFY THE OBJECTIVES
2. COMMUNICATE THE OBJECTIVES TO THE LEARNER
3. PROVIDE FOR PRACTICE OF THE OBJECTIVE BEHAVIORS
4. TEST FOR THE OBJECTIVE BEHAVIORS
5. PROVIDE FEEDBACK
6. PROVIDE REINFORCEMENT
7. RECYCLE TO MASTERY
8. PROVIDE FOR MAINTENANCE OF THE SKILLS
9. EVALUATE AND MODIFY THE TRAINING AS INDICATED

THE STEPS IN CARRYING OUT COMPLEX TRAINING ARE:

1. SPECIFY THE OBJECTIVES
2. SEQUENCE THE OBJECTIVES
3. BREAK COLLECTIONS OF OBJECTIVES INTO SHORT LESSONS
4. COMMUNICATE THE OBJECTIVES TO THE LEARNER
5. PROVIDE PRACTICE (MEMORY) GUIDES
6. PROVIDE FOR PRACTICE ON THE OBJECTIVE BEHAVIORS
7. PROVIDE FREQUENT TESTS
8. ACCUMULATE TEST CRITERIA
9. PROVIDE FEEDBACK
10. PROVIDE REINFORCEMENT
11. RECYCLE TO MASTERY
12. PROVIDE FOR MAINTENANCE OF THE SKILLS
13. EVALUATE AND MODIFY THE TRAINING AS INDICATED

NUMBERS 2, 3, 5, AND 8 ARE REQUIRED BY THE COMPLEXITY OF SKILLS

UNIT VII

EVALUATION OF SAFETY AND HEALTH PROGRAM EFFECTIVENESS

Robert J. Firenze
Indiana Labor and Management Council, Inc.

METHODS: Lecture and demonstration LENGTH: 60 Minutes

PURPOSE: To illustrate the necessity for and impact of effective program evaluation on the total safety and health program.

OBJECTIVES: To introduce the student to:
1. Types of evaluation
2. Management considerations in establishing evaluation criteria
3. Elements of a measurement system
4. Low vs. high accident rate companies.

SPECIAL TERMS:
1. Safety and Health Audit
2. Evaluation
3. Incident Rates
4. Critical Incident Technique
5. Cost Measurement
6. Safety Sampling

INSTRUCTOR MATERIALS:
1. Lesson plan
2. Chalkboard or flip chart

TRAINEE MATERIALS: Participant outlines made by instructor from lesson plan.

UNIT VII

EVALUATION OF SAFETY AND HEALTH PROGRAM EFFECTIVENESS

INTRODUCTION

Safety Audits

Checklists

A regular safety audit of an organization's facility to determine what safeguards are being taken against all possible hazards is an essential part of the organization's safety and health program. There is no one, specific system for measuring the success of safety performance; but many in use are quite good. The best approach for finding one for each organization is to combine elements of the most effective systems to meet specific needs. Most systems include checklists for use in inspections based on a number of standards, variations of work observation and reporting programs, and analysis of injury trends and loss sources.

Value of safety audits
1. Increased participation
2. Lowered costs

The value of the safety audit program is easily ascertained by looking for three things: sustained participation by management, increased employee involvement, and reduction in costs. The best safety audit programs will have all three elements in proportion to each other.

Stephen V. Magyar suggests that a well-designed audit program is one that:[1]

1. Management can participate in and feel comfortable with
2. Provides an objective means for evaluation of the elements essential to sound injury and loss control (i.e., safety performance)
3. Can be easily communicated and understood, particularly in the shop
4. Provides the basis for establishing objectives and the "real measurement of real progress"
5. Can be used as the base for a safety award of incentive bonus program
6. Continually generates observable improvements in the way people work.

TYPES OF EVALUATION

Evaluation can be defined as the process of comparing the results of a project with the original objectives established for the project.

Project objectives

A project may have more than one set of objectives, but they often fall along a continuum. For example, a project may have as an ultimate objective a reduction in occupational losses. An immediate objective might be training foremen to increase their knowledge and skills in production systems. An intermediate objective would be incorporating the knowledge and skills into the daily work routine. With the immediate and the intermediate objectives met, the ultimate objective can now be met.

Project activities and effects

The evaluation will examine project activities and their effects. There are two principal types of evaluation used to assess social programs that can be applied to industrial safety programs as well.

Administrative evaluation

Administrative evaluation, often called monitoring, examines activities to determine whether they have been accomplished in accordance with the program plan. This type of evaluation generally focuses on two important aspects of program activity.

Specific program activities

Specific activities, or outputs, of the program are measured in quantifiable terms. These terms include the number of personnel employed, the nature of equipment purchased, and the number of tasks completed.

Program schedule

The program schedule is also examined. The time required for the completion of each task is compared with the project plan. Administrative evaluation provides important information about the progress of activities. This information can then be used in the planning of similar projects, sometimes with the result of the significant cost savings.

Effectiveness evaluation

Effectiveness evaluation examines the effect of project activities in order to determine whether the program objectives have been met. While administrative evaluations are essential in the management of safety programs, effectiveness evaluations are intimately tied to proper development of such programs. Effectiveness evaluations determine which procedures actually have been effective in reducing occupational loss. This means that such evaluations operate at the immediate and intermediate objective level.

LEVELS OF EVALUATION

The level at which the evaluation takes place is as important a factor in accuracy and applicability as the evaluation type. There are three levels at which evaluation is carried out.

Personal evaluation

At the personal level, evaluation will be highly individualized. It may take different forms. A group of experts within the organization may be called in to offer advice on a given problem and offer a "brain-stormed" solution which is, in essence, a personal evaluation. The major characteristic of the personal evaluation is its subjectivity, however informed it might be. It is therefore not recommended as a mode of appraising the worth and effectiveness of a program.

Clinical evaluation

Clinical evaluation involves the combination of precise data and personal judgment. Although the term "clinical" suggests the medical field, the fact is that physicians are not the only persons who use this type of evaluation. Any good executive, for instance, will consult production schedules, costs, profits, personnel and marketing information before making an important decision regarding production, manufacture and sales.

Advantage

Disadvantage

The advantage of clinical evaluation is obvious: it provides reliability in the use of facts and figures to the person making the decision. The disadvantage of clinical evaluation, in comparison with personal evaluation, is that the former takes greater time and effort to collect and analyze data.

Scientific evaluation

Scientific evaluation is the most systematic and, therefore, the most time-consuming of the three types of evaluation. It requires careful planning and collection of data, and it also eliminates most elements of personal judgment. Generally, all data are quantified. The influence of any outside factors is taken into account whenever possible.

Advantage

Disadvantage

The major advantage of the scientific evaluation is its accuracy in identifying cause-and-effect relationships between activities and their effects. The disadvantages of the scientific method are the large amounts of time, money and effort usually needed to carry it out. Further, the scientific method does not apply well to such areas as human behavior; it can be very difficult to quantify human behavior. A more serious limitation of the scientific method is the difficulty of controlling the many influences on and changes in society that can affect the outcome of a social experiment.

MANAGEMENT PARTICIPATION

The best kind of management participation in the safety audit program will be at the highest level of management possible, and will be as uncomplicated as possible. Rating standards that can be understood by everyone in the organization should be set and made clear; the method for rating performance should be based on observable, objective evidence.

Unsuccessful audit programs

Audit programs that rely on vague standards, complicated checklists and intuitive, subjective rating systems are likely to get "lost in the pile," because they will not produce adequate results. The only results that can be expected from this type of program are confusion and apathy.

Management acceptance

In introducing the six elements of a good safety audit program, we said that management ought to "feel comfortable with" the program. The precise meaning of that statement is one that evolves slowly as the merits of the program become evident. It is likely to be influenced by such factors as time commitments, the precision with which safety requirements are stated and the length and detail of reports and follow-up procedures. The program can be streamlined as problems in each of these areas arise.

Audit program design

The following general procedure and outline may help in the design of a safety audit program.[2]

Safety performance audits

1. Safety performance audits
   - Twice each month, the entire organization should be audited for safety performance.
   - The first safety audit should be scheduled sometime during the first half of each month and should be unannounced.
   - The second audit can be announced in advance; it should take place sometime during the last quarter of the month.

Areas audited

2. Areas audited
   - The organization should be divided into operations, then again into clearly defined units or areas; for example, shipping/receiving, maintenance, etc.
   - Jurisdictions should not overlap; that is, if two operations take place in one building, buildings should be audited as a whole, rather than by function.
   - Audits should relate directly to group safety performance in a defined area rather than to the performance of a series of small dissimilar groups that may or may not overlap.
   - In cases where more than four audit areas are identified, it may be necessary to group the areas into audit tours and stagger the tours so that no member of management is involved in the audit more than 1½ to 2 hours per month.

Safety performance

3. Safety performance
   - Three persons should conduct each audit.
   - Two of the three auditors should be selected by the safety director; the third should be the manager responsible for the area being audited.

Audit responsibilities

4. Audit responsibilities
   - The auditors should conduct a "walk-around' tour of each area to be audited.
   - The two appointed auditors should complete a rating sheet for each area.
   - The third auditor, the area manager, records all problems uncovered in the audit.
   - Ratings are reviewed at the end of each audit. The review should identify where the problems are and what must be done to correct them.
   - The area manager should prepare a monthly audit summary based on the findings of the audit; this summary should be distributed.

Audit results

5. Audit results
   - There will be four audits in each area per month (two resulting from the unannounced audit and two from the scheduled audit). Ideally, four different management members should be involved in the rating process.
   - All ratings should be averaged and weighted in accordance with the guidelines given in Appendix VII-A.
   - An overall rating for monthly safety performance should be computed for each area.

Monthly audit report

6. Monthly audit report
   - A monthly safety performance report should be compiled and issued by the safety director.
   - Areas where corrective action is needed should be noted and the areas placed in order according to performance ranking.
   - Followup should involve a management team with the area manager providing the needed resources and the safety director coordinating the effort.

EVALUATION CRITERIA

The criteria used for evaluating safety performance must be both consistent and flexible enough to allow for comparisons between different types of operations. Some operations, for instance, are inherently "dirtier" than others, so the final results of their evaluation will necessarily be different from those of the cleaner operations. Still, problems must never be overlooked, simply because constraints exist, such as limited help or space.

Whether problems that could result in injuries are corrected immediately or not, they may still be reflected in the final rating. Once the audit is completed, the ratings can be reviewed and the extent of the impact that these problems have had in the evaluation can then be assessed.

Evaluating safety performance

Safety performance should be evaluated with the use of work standards covering the following areas:[3]

- Safety and work practices;

- Housekeeping practices;
- Storage practices;
- Condition of machinery and/or equipment;
- Injuries.

Each of these levels is given equal weight (20%) and ratings in each are given according to the guidelines outlined in Appendix VII-B.

ESTABLISHING PERFORMANCE OBJECTIVES

Objectives must be established in order to give the audit program direction. The objectives must of course be reasonable and attainable; mostly, they should be clear. Good objectives can be set by the collective ideas of those who must achieve them; they should be uncomplicated; and they should provide a built-in system of evaluating whether the objectives have been met. It may be beneficial to increase the objectives gradually—quarterly, for instance—so that the motivation to continue improving performance will remain steady.

MEASUREMENT OF PROGRESS

Progress can be measured either by assessing objective attainment or by comparing ratings at regularly scheduled times. If the latter is chosen as the method, it may still be beneficial to assess the attainment of objectives until a series of ratings has been completed, as this will take some time. Experience will often be the best yardstick by which progress is measured; over time, workers will be able to tell whether or not they have made progess. Using the rating system, however, will help to indicate precisely to what extent progress has been made, and in what areas.

Characteristics of a good measurement system

A composite list prepared by Fred A. Manuele[4] shows some characteristics of a good method for measuring safety performance. The measurement system should be:

1. Administratively feasible;
2. Adaptable to the range of characteristics to be evaluated;
3. Constant;
4. Quantifiable;
5. Sensitive to change;
6. Valid in relation to what it is supposed to represent;
7. Capable of duplication with the same results from the same items measured;
8. Objective, efficient and free of error.

INCIDENT RATES

Arguments against the incident rate method

The use of incident rates, a reflection of what has already happened, is not unanimously accepted as a means of measuring safety performance. Arguments against using the method indicate that such data are not sufficiently sensitive, that not all incidents are reported, that the data do not reflect current trends, which are constantly changing, and that historical information should not be used to predict future trends.

Are these arguments valid?

The validity of these arguments depends on whether the data are computed in accordance with American National Standards Institute Z16.1, which requires that only injuries relatively high in severity be recorded; or whether they are computed in accordance with OSHA, which requires three to four times greater reporting of injuries. In addition, the use of incident rates loses some credibility when

applied to smaller organizations. Larger populations tend to increase the validity of generalizations.

Broader definition of injuries

It is true that severe injuries are less common than are minor injuries, so perhaps it would be beneficial to include a broader definition of injuries to get a better picture of accident trends. It's also true that historical incident rates do not reflect future trends, as people, machines and the environment are constantly changing. Nevertheless, a record of fluctuations in safety performance will indeed give a picture of the organization's overall safety performance. Factors that are themselves in a constant state of flux, such as people, machines and the environment, can be considered as well to give the whole picture.

Compare like with like

When OSHA incident rates are compared with those of a similar operation, it's best to compare like with like as often as possible, although it can be difficult. It may be easier simply for the organization to set its own performance record, and then to compare subsequent performances with that. Any audit should evaluate a number of features of the organization's safety program.

Management involvement

Management involvement is crucial. Management will attain a safety record that it establishes as acceptable—and establishing means, in this sense, how it transmits the message to the organization. The organization itself may perceive the message incorrectly; nevertheless, that will be the level of safety performance it achieves. This is why management often believes it has one kind of safety program when it really has another kind. Organizations with the best safety records have managements that are involved and held accountable and that also hold their subordinates accountable for the safety record. Management involvement can be demonstrated in a number of ways: by regular communications on the safety subject, by chairing safety committees, and by leading discussions on the safety record or other safety measures at staff meetings.

Professional safety administration

Professional safety administration is another element of the safety program that is essential. The organization will gain a sense of the importance allocated to the safety staff by management in numerous ways: by the time allocated to the staff, the number of members, the provision of training, financial resources, the qualifications of appointed members, and their position in the management hierarchy.

Safety committees

Safety committees can give the safety program a real boost if they are properly organized. In order to be effective, they must have: regularly scheduled meetings at regular locations, regular cooperation at these meetings by management representatives, a schedule of the important topics to be discussed at each meeting, prompt action taken on important proposals, and an atmosphere of cooperation throughout the organization at all levels.

Supervisory training

Supervisory training is another deciding factor in the success or failure of a safety program and should also be evaluated. The training will help to indicate what is expected of the supervisors, and that will in turn indicate what management expects from the safety program. Obviously, an absence of a training program altogether is even more telling than a faulty one.

Employee selection and training

Selection and training of employees should also be assessed. New employees learn very quickly from the example they are given by their immediate supervisors how seriously safety is taken.

Preventive maintenance programs

Preventive maintenance programs will also provide important information as to the organization's commitment to safety. For instance, the presence of many unsafe conditions during inspections indicates that maintenance work is not as conscientious as it should be. Finding out what priority is given to safety work orders by the maintenance department will provide insight into why these conditions are allowed to exist.

Human factors engineering

The audit should also pay attention to human factors engineering, in relation to environmental design. This would include machine design, illumination, heat and cold, humidity, dust and noise.

Training and followup

Training and followup procedures in accident reporting and investigation can reveal a great deal about the weight given safety matters. Not only does the investigation by itself serve an important function of the safety program, it is also very difficult to have the program taken seriously by the organization if accidents are not thoroughly investigated.

Other important areas

Other important areas of the safety program to be evaluated are inspection procedures, medical and first aid facilities, safety rules, emergency plans, and systems for measuring progress and for maintaining interest in the program.

COST MEASUREMENT SYSTEMS

A system for evaluating the cost of a hazard control program is important in that, generally, the people who are in the position of accepting or rejecting a program will understand its benefits best if presented in dollars and cents. For instance, workers' compensation costs have risen over the last few years, while OSHA incident rates have remained much the same. The increase in workers' compensation costs does not necessarily indicate that hazard control programs have declined in quality. The use of costs as a measurement of hazard control programs could therefore be a strong influencing factor for the decision-makers in establishing the need for more effective programs.

ELEMENTS OF A MEASUREMENT SYSTEM

To be effective, a good measurement system should be accurate and sensitive to change.

Accuracy

Accuracy means the ability of the measurement system to measure what it is intended to measure. The first instinct, when instituting a measurement system, is to measure the things that are most meaningful to the program. For instance, if a training program is being measured, the most important criterion of measurement is whether or not the trainees have changed work habits along the anticipated lines: used new techniques, begun to use the appropriate protective equipment, filled out reports more completely—whatever it was that the training program was designed to do.

Taking the easy way out

However, these can be difficult to measure, and, as course objectives become more and more abstract, their benefits become more intangible. Therefore, the measurement system might end up assessing changes in attitude or administering tests to determine the amount of knowledge gained. Probably the worst type of measurement system, and a fairly common one, asks the participants what they thought about the program. This approach yields almost no helpful information at all. But it certainly is easy.

A better approach

The best type of measurement system, on the other hand, may be considerably more difficult, because it must undertake to evaluate whether the program ef-

fected the specific changes it was expected to effect. Sometimes, an indirect measure is acceptable, if it can clearly show the relationship between the "proxy" measure and the desired performance. For example, assume that a group of workers participate in a program designed to reduce eye injuries. Of course, the direct measure in this case would be to compare before-and-after rates of eye injuries. But if, for some reason, it is not possible to take a direct measurement, an evaluation of workers' use of eye protection equipment before and after the program will be acceptable. If this measurement is used, it must be demonstrated that there is a correlation between the use of eye protection equipment and the rate of eye injuries.

Sensitivity

Sensitivity to changes within the system is also an important feature of the measurement system. In fact, the very reason for evaluating is to determine whether the system has changed. Therefore, if the criteria for measurement are unable to reflect this change, any measurements taken will be useless. A good measurement system must strike the proper balance between accuracy—the organization's objectives—and sensitivity to change. The evaluation should collect only the information that is needed.

Other important features

There are other important features of good measurement systems, as well. They should be feasible, given administrative constraints. It must be possible, in other words, to collect, store and analyze the data needed to complete the evaluation.

Reliable

Measurements taken must be reliable. Reliable measurements are those that can be reproduced and validated by other measurements performed by another person. This definition inherently requires objectivity of measurement.

Quantifiable

If measurements can be quantified, so much the better. Besides being generally more objective than measurements that are not quantified, they allow for more analytical types of processing, such as determining statistical influences.

Efficient

Efficient measurements produce information equal to or greater than the value of collection and analysis. A way to gauge this is to ask how the information is to be used, whether it really is important to the evaluation.

CRITICAL INCIDENT TECHNIQUE

The critical incident technique is designed solely for the purpose of identifying critically unsafe acts and conditions in the work environment, and of correcting them before they cause accidents. The technique allows for both an assessment of safety performance and an identification of unsafe practices or conditions that must be changed.

Select sample

To apply the technique, a sample is established of the work population in areas that have been designated as requiring attention. Workers from within the sample are interviewed as to the type of work they have performed within their area, and any unsafe acts or conditions they have noted during that time. Interviewing skills are obviously important to the one who uses this technique. Workers may need encouragement before they will speak out.

Corrective action of two levels

Any corrective action arising from problems identified in the interview should be at two levels. First, actions should be recommended to correct the problems. Second, inquiries should be made into the management systems of the areas where problems were located, to discover where the breakdown occurred and how the system might be improved.

The specific value of the critical incident technique is that it can determine the number of unsafe situations that have been observed and fluctuations in their occurrence over time.

Selection of participants

Once participants have been selected for interviewing, they must be informed of the objectives of the study. Unwilling workers should be allowed to withdraw, and should be replaced with workers who go through the same process of selection and briefing. To assist in the interviewing, participants may be given lists of unsafe conditions taken from similar plants, or the interviewers may ask specific questions to give the discussions direction.

Interviews conducted throughout program

Throughout the progress of the safety program, interviews are conducted. Fluctuations in results gathered from the interviews provide the grounds for measuring the effectiveness of the safety program. Workers selected as participants in the interviews must be representative of the work force as a whole. They must also be familiar with the plant's operation, accident-injury history, and acts or conditions regarded as unsafe.

Participant motivation a must

The usefulness of this technique depends largely on the motivation and cooperation of the participants. They must realize from the outset that the information gathered will not be used to anyone's disadvantage. They must be knowledgeable enough to provide accurate, detailed information about past as well as present events.

SAFETY SAMPLING TECHNIQUES

This technique is also called behavior or activity sampling. It identifies unsafe acts and conditions through observations made by trained personnel. As with the critical incident technique, this approach can identify both the types and the frequency of unsafe acts and conditions.

Records of unsafe acts and conditions

In this technique, records are kept of unsafe acts and conditions observed during routine inspections of the organization. The person who performs the inspection is supplied with a safety sampling sheet on which the number and types of safety defects observed can be recorded. The conditions under which the observations are made should be as controlled as possible. Several observers begin at the same time, following differing, specific routes, and finishing at a designated time. At the end of the observations, each observer summarizes the findings from the sheet; the summaries of all the observers are then combined for the official record of the sample. At this time, any unusual conditions, or conditions requiring immediate attention, can be discussed.

Two conditions for maximum results

Two conditions must be met in order to achieve maximum benefits from this technique. First, observations should be made by personnel familiar with the organization's operations and well-trained in recognizing unsafe practices. Second, observations should be made at random times, so that workers will not know when they are to be observed. All areas in which operations are underway must be available for observation at the time the event is undertaken.

LOW VS. HIGH ACCIDENT RATE COMPANIES

A 1971 study in Wisconsin[5] matched 42 pairs of companies, each pair consisting of a company with a high accident rate and a company with a low accident rate. See Appendix VII-B.

Scoring procedures

A scoring procedure was established to determine distinct differences among matched pairs of respondents in the answers they gave to certain questions. The differences were classified thus: (a) showing response preferences between high vs. low accident members partly or wholly in agreement with those seen in analyzing all respondent pairs, (b) showing response preferences between high vs. low accident members partly or wholly in disagreement with those differences found in analyzing all respondent pairs, and (c) showing no common response preference across either the high or low accident members in the six pairs.[6]

Comparisons of responses

Although differences in response were not always significant for a substantial number, comparisons of the responses did yield some evidence suggesting similarities in the safety program practices of the companies with good accident records. Among these were:[7]

1. The ranking safety official was at the top management level of the work establishment whose staff included either a full-time safety director or part-time persons with significant time assigned to safety program direction;
2. Greater efforts made to influence the safety consciousness of their workers through enlisting family and community involvement in company safety campaigns;
3. Emphasis on using more varied incentives and promotional techniques to enhance safe work performance;
4. More regard for the effectiveness of measures other than suspension in disciplining risk-takers or violators of safety rules;
5. More formalized safety training including special training to fit specific job needs and use of group discussions, lectures by safety specialists, to augment main safety instruction by worker supervisors;
6. Availability of continuing safety training to all employees as opposed to concentrating such training only on those who hold high risk jobs or who have had recent accidents;
7. More frequent though less formal safety inspections of workplaces to supplement or perhaps substitute for more formalized inspections at relatively longer intervals;
8. A slightly older workforce with somewhat longer company service and a slightly greater percentage of married workers.

The more incentives used, the better

On analysis, the data indicated that using a variety of incentives and techniques together produced better results than using just a few. For instance, it was suggested that varied forms of safety instruction, augmented by group discussions and lectures by safety specialists, could be an important means of upgrading safety training. In contrast to the low-accident group, companies with poor accident records tended to use stronger disciplinary measures, such as suspension and dismissal, to place more emphasis on engineering controls for safety problems, to show a relatively inexperienced work force (as compared to the low-accident companies), to use more formal but less frequent inspections than did their low-accident counterparts, and to investigate only major accidents, while the low-accident companies investigated minor accidents as well.

In general, companies with low accident records employed more informal means of producing safety than did their high-accident counterparts. It may be that the high-accident companies had introduced stringent measures in response to their

poor records. It may also be that more informal methods fostered greater rapport and motivation and therefore resulted in better records of the low-accident companies.

Ultimately, however, the deciding factors in whether or not certain methods will work or not may be factors specific to individual industries or companies. Many of the data indicated variances among the low-accident companies; nevertheless, the characteristics listed above remained relatively consistent, and therefore warrant attention.

CONCLUSION

In this unit, we have discussed the various types of evaluation, and factors that should be considered in establishing evaluation criteria. We have examined the elements of a measurement system and evaluation indices. Finally, we have compared strategies of companies with low-accident records against those of companies with high-accident records to search out similarities and differences.

SAMPLE TEST QUESTIONS

1. How many levels are there at which evaluation is carried out? What are these levels?
2. What are the two most important characteristics of evaluation criteria?
3. In regard to measurement systems, what do accuracy and sensitivity mean?
4. On what condition does the success of the critical incident technique depend?
5. What two conditions will provide the greatest results from the safety sampling technique?

ANSWERS TO QUESTIONS

1. There are three levels of evaluation. One is personal, one is clinical and one is scientific.

2. Evaluation criteria must be consistent enough to yield reliable results, yet flexible enough for comparisons between different types of occupations.

3. Accuracy is the ability of the measurement system to measure what it is intended to measure. Sensitivity means that the measurement system can respond to changes within the system.

4. The participants—that is, the workers who are interviewed—must be properly motivated to cooperate with the survey.

5. First, observations should be made by personnel familiar with the organization's operations and well-trained in recognizing unsafe practices. Second, observations should be made randomly so that workers will not know ahead of time when they will be observed.

NOTES

1. Stephen V. Magyar, Jr., "Measuring Safety Performance (a management guide," in *Professional Safety,* November 1983.

2. Magyar, *loc. cit.*

3. Magyar, *loc. cit.*

4. Fred A. Manuele, "How Do You Know Your Hazard Control Program is Effective?" in *Professional Safety,* June 1981, pp. 18–19.

5. Alexander Cohen, Michael Smith, and H. Harvey Cohen, *Safety Program Practices in High Versus Low Accident Rate Companies—An Interim Report* (Cincinnati: National Institute for Occupational Safety and Health, June 1975).

6. *Ibid.*

7. *Ibid.*

REFERENCES

Cohen, Alexander, Smith, Michael and Cohen, H. Harvey, *Safety Program Practices in High Versus Low Accident Rate Companies—An Interim Report* (Cincinnati: National Institute for Occupational Safety and Health, June 1975).

Magyar, Stephen V. Jr., "Measuring Safety Performance (A Management Guide)," in *Professional Safety,* November 1983.

Manuele, Fred A., "How Do You Know Your Hazard Control Program is Effective?" in *Professional Safety,* June 1981.

Appendix VII-A

XYZ COMPANY
FABRICATION/ASSEMBLY DIVISION
BETHLEHEM PLANT

SAFETY PERFORMANCE SUMMARY

FEBRUARY 1982

AREA AUDITED **BLDG A** AUDITORS **S. THOMAS**

	1st AUDIT (UNANNOUNCED)	2ND AUDIT (SCHEDULED)	AVERAGE SCORE	FACTOR	RATING
DATE	02-10-82	02-26-82			
I. SAFETY/WORK PRACTICES	75 75	75 75 × 4	75.0 ×	.20	= 15.0
II. HOUSEKEEPING STANDARDS	80 80	60 80 × 4	75.0 ×	.20	= 15.0
III. STORAGE PRACTICES	30 30	60 60 × 4	45.0 ×	.20	= 9.0
IV. MACHINERY/EQUIPMENT	50 75	75 75 × 4	68.8 ×	.20	= 13.7
V. INJURY EXPERIENCE	TOTAL EMPLOYEES ... TOTAL 1ST TREATMENT INJURIES / TOTAL EMPLOYEES		.785 ×	.20	= 15.7
TOTAL SAFETY PERFORMANCE RATING					68.4

DEFICIENCIES NOTED

- Eye Protection Program needs better enforcement
- Safety Committee Meetings not conducted regularly
- Lift Truck Inspection Program needs up-grading
- Better use of available storage space is needed
- More follow-up corrective action needed for safety problems reported by safety committees
- Table Saw guard not used properly
- Pedestal Grinders need anchoring at the base
- Solvents/Paints not stored properly
- Better clean-up needed at shift end

S. V. Magyar, Jr.
Safety Director

From: Stephen V. Magyar, Jr., "Measuring Safety Performance (a management guide," in *Professional Safety,* November 1983. Reprinted with permission.

UNIT VIII

WORKERS' COMPENSATION

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METHODS: Lecture and discussion LENGTH: 2–3 Hours

PURPOSE: To introduce the business student to the pragmatic realities of workers' compensation programs.

OBJECTIVES: To enable the student to:

1. Understand the "spirit" of workers' compensation laws, their origin and the philosophy behind them.
2. Understand how workers' compensation laws relate to the individual employees (managerial and non-managerial) and to the organization.
3. Increase the students' awareness about how knowledge of and implementation of worker compensation programs can result in savings and/or increased profits to the organization.
4. Understand that accidents and injuries are one type of performance error which can be managed and controlled.

INSTRUCTOR MATERIALS:
Lesson plan
Bibliography
Glossary of relevant terms
Test questions and answers
Class exercise

TRAINEE MATERIALS: Participant module, exam review and class exercises.

UNIT VIII

WORKERS' COMPENSATION

HISTORY & OBJECTIVES OF WORKERS' COMPENSATION

Conditions Prohibiting Recovery of Damages[1]

Before the passage of workers' compensation (WC) legislation, an employee could not recover damages if:

1. The injury was caused by negligence of the injured party or negligence of a fellow worker,
2. The injury resulted from the occupational hazards inherent in the job itself, or
3. The worker died or became disabled as the result of an occupational injury or disease.

The basic employer's attitude placed job risk on the employee.

The basic employer's attitude at this time was that safety was the employee's responsibility and was an inherent part of one's job depending upon the task and nature of the industry. The fact that a worker sought and obtained employment immediately transferred the responsibility for accidents and injuries to the individual employee.

The recourse for employees was to sue.[2]

If an employee were harmed on the job working for an unempathetic employer, the worker's only recourse for indemnification or redress was through the courts. Benefits derived were generally meager and typically were provided only in the case of fatal accidents. These conditions were declared "an outrage" by President Theodore Roosevelt, who strongly urged the passage of the first workers' compensation legislation for federal employees in 1908 (The Federal Employees Compensation Act).

Compensation legislation began in Wisconsin in 1911 and ended with Mississippi in 1948.[3]

All 50 states and five U.S. territories have WC Laws.

In 1911 the first workers' compensation act to be passed and not repealed was found in the state of Wisconsin. Four other states (Nevada, New Jersey, California, and Washington) also became effective that same year. In 1916 the U.S. Supreme Court declared WC laws to be constitutional and slowly but surely all states and U.S. territories adopted some form of compensation coverage for workers residing in their jurisdictions. Today all 50 states, the District of Columbia, American Samoa, Guam, Puerto Rico, and the Virgin Islands have enacted worker compensation acts. The last state to pass such legislation was Mississippi in 1948.

Six objectives of workers' compensation laws.[4]

While each of the states and territories differ in the specifics of their coverage, funding requirements and other details, there are six basic objectives which underlie all workers' compensation laws. These laws exist to:

1. Provide sure, prompt, and reasonable income and medical benefits to work-accident victims or income benefits to their dependents regardless of fault;
2. Provide a single remedy and reduce court delays, costs, and work loads arising out of personal-injury litigation;

3. Relieve public and private charities of financial drains (incident to uncompensated industrial accidents);
4. Eliminate payment of fees to lawyers and witnesses as well as time-consuming trials and appeals;
5. Encourage maximum employer interest in safety and rehabilitation through an appropriate experience rating mechanism; and
6. Promote frank study of causes of accidents (rather than concealment of fault) and to attempt to reduce preventable accidents and human suffering.

THREE COMMON-LAW DEFENSES

Before workers' compensation (WC) laws were adopted, the burden of proof in litigation suits rested with the injured individual employee. In essence, the worker had to prove that the resultant injury was derived due to the employer's negligence. Even a blatantly negligent employer had a good chance to win such litigation suits because of three powerful defenses (inherited from British common-law).

Contributory Negligence

1. The defense of contributory negligence stated that an employer was not legally liable for damages derived due to losses or harm caused by negligence on the part of the individual employee. In cases where the responsibility for injuries was mutually shared by both the employer and employee, damages were apportioned accordingly.

Assumption of Risk

2. The Assumption of Risk was the traditional philosophy which relieved employers from responsibilities for liabilities and injuries suffered by employees during the "normal risk of a job." In these cases, courts accepted the defense that a person who accepted a job also accepted the risks involved, thus absolving the employer from responsibility.

The Fellow Servant Rule

3. The fellow servant rule was a position wherein an employer was not held responsible for injuries derived from (accidental or intentional) actions of the peer(s) of an employee. An injury resulting from negligence or other incidents caused by fellow employees could be remedied only by the injured party suing his/her peer(s).

These three common-law defenses are still used today.

These three common-law defenses basically resulted in alleviating employers' concerns about health and safety issues before 1916 when the Supreme Court declared worker compensation laws (WC) to be constitutional. These defenses are still pertinent today and are used in states requiring compulsory membership in WC insurance. The use of these defenses has been termed the "exclusive remedy rule" because an employer covered by WC insurance is protected from litigation.

WORKERS' COMPENSATION LAWS DIFFER

While WC laws exist in every state and in five U.S. territories, each state and territory differs in the type of coverage, the Insurance Funding Requirements, and the types and amounts of costs/benefits rendered.

Types of worker compensation coverage: Compulsory

WC laws are either compulsory or elective. Compulsory laws are those which mandatorily require all public and private employers in certain (primarily hazardous) industries to carry WC insurance and to provide for benefits specified by their state legislatures. The industries with the highest rates of job-related injuries and deaths are mining, construction, transportation and public utilities.

Elective

Uninsured employers lose their rights to use the three common-law defenses.[5]

Three states, New Jersey, South Carolina, and Texas allow membership in WC Programs to be voluntary or elective in nature. Employers in these states may choose to accept or reject insurance coverage; however, if they are sued by an injured worker, they waive their rights to the use of the three common-law defenses: contributory negligence, assumption of risk, and the fellow servant rule. Thus, according to the U.S. Chamber of Commerce, "for all practical purposes all workmans' compensation (WC) laws are compulsory. . . because conditions for rejection of the act are so severe as to make the privilege virtually inoperative. In a few states, however, courts have created exceptions to the exclusive remedy rule under certain circumstances."

Exceptions[6] [7]

Virtually all states require WC insurance for industrial employment. States differ, however, in their exemptions for certain small employers. (Alabama, Michigan, Missouri, New Mexico, North Dakota, Rhode Island, Tennessee and Virginia allow voluntary exemptions to employers with less than 35 employees and for companies engaged in certain non-hazardous industries.

For example, most states' WC laws exclude farm labor, domestic service, casual employment, and those in the employ of charitable or religious organizations. Other major groups outside the coverage of WC laws are railroad workers engaged in interstate commerce, members of the merchant marines (both of whom are covered by the Federal Employer's Liability Act), the self employed, unpaid family members, volunteers and trainees.

Each state differs in how it requires its employers to finance their WC insurance programs. Most states require employers to pay insurance premiums in advance or to prove their financial ability to carry their own risk. Funding may be monopolistic or competitive and may involve state insurance funds, private insurance companies, or self-insurance by employers themselves.

Monopolistic or Exclusive State Funds[8]

Six states (Nevada, North Dakota, Ohio, Washington, West Virginia and Wyoming) and the provinces of Puerto Rico and the Virgin Islands require employers to insure in a provincial or monopolistic state fund. No private insurers write WC insurance contracts in these states or territories. In some cases, however, employers may qualify as self-insurers. As noted by the American Institute for Property and Liability Underwriters, Inc.:

> Exclusive state funds were established because these arguments were compelling or because of circumstances peculiar to a particular state. Those circumstances sometimes included a politician or organizations with considerable influence who philosophically favored the exclusive fund approach, widely scattered and hazardous exposures in which private insurers had not expressed much interest, and a workers' compensation (WC) law patterned after the German precedent (which was associated with a compulsory state fund) rather than the English precedent (which involved elective coverage and private insurers).

Exclusive State Funds[9]

Supporters of exclusive state funds argue that:

(1) because workers' compensation is compulsory social insurance, private profit-oriented enterprises should not be involved; and
(2) because exclusive state funds have no selling costs and should experience economies of scale, they should have lower expense ratios than either competitive state funds or private insurers.

These arguments seem feasible in view of the fact that in 1981 state funds collected $3.1 billion in premiums.

Twelve states (a list of which was unobtainable at the time of this writing) permit employers to purchase insurance from either state funds or private insurers. In these competitive programs employers can shop for price differentials between the premiums offered by their state and those offered by private insurance companies. As noted by the American Institute for Property and Liability Underwriters, Inc.:

Competitive[10]

> Competitive state funds have been supported as an alternative to private insurers on the grounds that:
>
> (1) employers who could not secure compulsory protection from private insurers should have an alternative source.
> (2) a low-cost, nonprofit public insurance option should exist in a social insurance program, and
> (3) a competitive state fund provides a useful yardstick for measuring the performance of private insurers. They have been preferred over exclusive state funds on the assumption that competition with private insurers produces a more efficient public operation.

Competitive[11]

Although these arguments may be valid under certain conditions, C.A. Williams *et al,* reported that "Recent attempts to allow competition from private insurers in states with exclusive funds have not been successful. This is due in part to difficulties encountered in placing workers' compensation coverage in the private market."

Self-insurance or Retention

All but three states (North Dakota, Texas and Wyoming) and three territories (Guam, Puerto Rico and the Virgin Islands) permit self-insurance. Self-insurance is the term popularly used when employers assume liability for setting up their own reserve fund to pay for benefits and administrative costs associated with workers' compensation (WC) insurance programs. But as noted by the American Institute for Property and Liability Underwriters, Inc.:

Self-insurance is a misnomer[12]

> "Self-insurance is a misnomer because 'self-insurance' is *not* insurance. Insurance is a transfer device, a mechanism or risk management technique that makes it possible to transfer the financial consequences of potential accidental losses from the insured entity to the insurer. Under 'self-insurance' the firm or organization retains the loss exposure."

Self-insurance is found mostly in large corporations.

Self-insurance programs seem to operate best with large corporations who have risks so large that they may benefit from the law of large numbers. These corporations prefer to assume liability for WC and at the same time avoid administrative costs associated with insurance policies. Even so, such corporations must establish protective (medical and legal) services similar to those provided by insurance companies.

Self-insurance[13]

The U.S. Chamber of Commerce notes that employers may set up a reserve fund for self-insurance to pay compensation and other benefits under the WC acts of the states. (Contrary to the treatment accorded insurance premiums, amounts paid into the reserve fund are not always deductible from gross income as a business expense for income tax purposes. However, amounts paid out—as cash or medical

benefits—are deductible. In many cases insurance is purchased because such purchase can dispose of the item of expense and future cost in the current year.)

Group self-insurance is increasing.

Two final facts about self-insurance which should interest business students are that in 1981 employers spent over $2.5 billion just on self-insurance. Also, group self-insurance, which allows smaller employers to pool their risks and liabilities, is now authorized in 22 states.

Self-insurance[14]

The type of insurance funding thus chosen by any employer depends upon whether or not the funding is manditorily specified by state law, relevant cost factors, and/or risk preference of the employer. Firms that cover workers' compensation (WC) through private insurance companies or state funds pay a premium in advance. In contrast, self-insurers have several options for financing. They may simply pay for liabilities as they are experienced, directly from operating funds, or they may provide some advance funding one or more ways. In those states requiring deposits of funds by self-insurers, part or all of the funding for outstanding liabilities is provided for in advance mandatorily.

Advance funding

Even if not required, a self-insurer may set aside reserves, or even formally insure its risk through a wholly owned subsidiary insurance company created for this purpose. Such advance funding prevents severe disruptions in cash flow from unforeseen loss experience or accumulated liabilities.

Interpretation of semantics and statutes[15]

Workers' Compensation laws are based on the premise that industrial employers should assume the costs of occupationally-related accidents, injuries,[15] disabilities or diseases without regard to any fault involved. As mentioned on page 3, the first objective of all state WC laws is to provide a "reasonable" income (replace the wages lost and pay for medical expenses) for workers disabled by a job-related injury or illness. In states using the "whole-man theory," the state system is required to indemnify (to make whole again financially) the worker or his/her family for the effect of the disability on all personal and familial activities (not just replacing his/her earning capacity alone).

Accidents and errors[16]

Interpretation of workers' compensation (WC) laws is somewhat confusing because of individual state differences and because of the use of often-confused terms. Indeed, before delineation of the types of insurance benefits is possible, clarification of some semantics is in order. For example, an "accident" is not synonymous with an "injury." An accident, according to Bill Pope, President of Safety Management Information Systems, Inc., is "any unplanned and undesired event." An accident thus refers to the making of an error which results in something other than error-free performance. An accident can result in an unobserved, potentially harmful behavior, a "near-miss" which is observed, a personal injury, a disability, dismemberment or even death.

Injury[17]

If interpreted narrowly, an accident would refer to the *cause* of an injury, such as a blow to the body or an episode of improper lifting. An injury, on the other hand, would deal with the *harm* or result of the action, such as a broken leg or sprained back.

Until recently WC laws have concentrated on the resulting disability or injury from an accident rather than concentrating on the error(s) which caused the accident. Claims filed depicting similar incidents in different states that have received totally different judgments would be helpful to employers, employees and insurers alike.

TYPES OF INSURANCE BENEFITS

As mentioned before, workers' compensation benefits differ from state to state according to specific statutes. The laws generally provide for survival benefits to dependents, lost income, medical expenses, lump sum or lifetime disfigurement, disability payments (permanent or temporary disabilities can be totally or partially debilitating), and rehabilitation services. Specific state statutes set minimum and maximum rates for specific indemnity benefits based upon some designated proportion (such as 60 percent of the state average weekly wages up to $100 for 26 weeks).

Lost Income[18]

Worker's compensation laws in the various states attempt to reimburse workers for injuries or death arising in the employment context. "Compensation" in this area therefore does not refer to wages or salaries but rather it refers to the money paid by the employer to indemnify the worker for employment-related injuries or death.

Accidental death benefits[19]

In the event of fatal injuries, the benefits provided include a burial allowance as well as a proportion of the worker's former weekly wages. These benefits are paid to the spouse until remarriage and to the deceased person's dependents until a specified age. Accidental death benefits comprise more then 14 percent of all total benefits as of January 1, 1984.

Cash benefits, total disability
(a) Permanent

While death constitutes the ultimate work-related tragedy, death is not always as expensive financially and emotionally to the employer or to the deceased worker's family as is a permanent, total disability. While this statement may sound somewhat harsh, the author has recently heard of a case where a man fell into a printing machine which ultimately crushed most of the man's head. While still alive, the man is in serious condition with little chance for improvement. The man's family thus must live with a father/husband who is permanently and totally disabled. Thus, unlike the loss of an eye or dismemberment wherein a lump-sum payment would be paid to the injured employee, in this case the employer and insurance company are responsible for the injured man's medical cost for *the rest of the man's life.*

(b) Temporary

A second form of total disability may be temporary in nature. For example, an accident, "arising out of and in the course of the employment," which gives an employee a hernia, requires operative surgery, and forces an employee to remain away from the job for two months, constitutes a temporary total disability. Following an adequate recovery time, the employee's physical health should be as good as new. Most cases of cash benefits involve disabilities which are temporary and total in nature.

Partial disability
(a) Permanent[20]

A third classification of cash benefits is for permanent partial disabilities. An example would be when an individual falls down a flight of stairs or slips on a wet floor at work and injures the spine so as to cause permanent loss of 50 percent of the normal functioning in his/her arm. Such injuries are described as being "scheduled injuries" because they involve the loss or use of specific body members and because each state has a specific schedule of rates for the loss of a finger, eye, etc. Most jurisdictions allow a cash benefit correlating to a specific number of weeks of benefits (based on the member involved) multiplied by the weekly benefit amount (based on earnings at the time of injury).

(b) Temporary

The fourth and final classification of disabilities is the temporary partial disability. If the individual who slipped on the floor were merely bruised and took the

week off, the incident would involve a "non-scheduled" injury or temporary, partial disability. In this type of case the individual would soon return to maximum capacity of his/her motor functioning.

Medical benefits

In addition to accidental death and dismemberment benefits and cash benefits, unlimited medical benefits are known to be provided either specifically by statute or by administrative discretion. While states differ in their allowance of employer or employee choice of a physician and whether or not payment of income benefits can be retroactive to the date of injury, all states provide compensation for immediate medical and hospital care.

Rehabilitation benefits

Rehabilitation is considered to be an integral part of an injured employee's medical treatment. While rehabilitation is not part of every injured employees total treatment, it is generally considered to be advantageous for the mental health of the employee and to lessen the paid days away from the job which places a financial and labor burden on the employer.

ADMINISTRATION OF WORKERS' COMPENSATION BENEFITS

The ultimate goal of workers' compensation (WC) is to provide for the quick, simple and inexpensive determination of all claims for benefits and to provide such care and rehabilitation services as are necessary to restore the injured worker to employment. Nearly all of the states have agencies to carry out these administrative responsibilities. The agency is typically found in the state's labor department, a separate compensation department or commission, or an industrial accident board.

The employer reports an accident

Typically, the first step of administering WC claims takes place when the employer reports the occurrence of an injury to: (a) the employer's insurance company, (b) the industrial accident board and/or, (c) the independent agent representing the company.

The insurance company receives and pays claims

The second step of administration occurs when the insurance company receives the medical bills and pays them in their entirety. Again, in some states such as Texas, lifetime medical benefits are possible if required for patient care.

Rehabilitation

The third and final phase of administration is the doctor's possible referral of the claimant to medical and/or vocational rehabilitation.

Worker's compensation (WC) acts thus impose strict liability on the employer for injuries to employees during the scope of their employment. And while these laws first arose out of lawmakers' concern for employees injured as a result of increased industrial mechanization, these acts serve other functions as well. For instance, through such statutes, employees can receive compensation without engaging in costly litigation. The employer faced with financial losses from disabling accidents, injuries and diseases can treat these outlays as costs of production which are deductible expenses to be passed on to consumers. Both sides supposedly benefit, since the employee receives reimbursement for the injuries suffered and the employer's liability to the employee usually ends there; that is, the statutes ordinarily prohibit the employee from suing the employer in a court of law. Such acts, then, are grounded in public policy concerns.

Second injury

One final note: Some states also provide second injury funds in conjunction to relieve the liability of an employer when a pre-employment injury combines with

a current work-related injury to produce a disability greater than that caused by the latter alone.

WHY WORKERS' COMPENSATION IS A CONCERN[12]

Quoting findings from the U.S. Department of Health and Human Services, the U.S. Chamber of Commerce reports that employers spent just over $22.9 billion in 1981 to insure or self-insure their work-injury risks. This amount was almost $.7 billion, or 2.9 percent higher than the 1980 cost of workers' compensation. The prior year, the increase in cost was 8.9 percent. The average cost per $100 of payroll was $1.84 for 1981, compared with $1.96 for 1980.

A substantial part of this growth can be attributed to inflation, but there has been a continued rise in statutory benefit amounts payable for medical care and indemnity awards. Medical costs totaled $4.4 billion in 1981 while compensation payments amounted to $10.6 billion. This sum was about 71 percent of all workers' compensation payments, which totaled $15 billion.

Organizational costs

Needless to say, employers are very concerned about the costs of accidents and injuries because they pay the entire cost of workers' compensation. Premiums are set by insurance companies according to the industry's injury frequency rate as well as the individual employer's safety record. Most insurers use premium rates developed by a rating bureau.

Insurance premiums

Organizations are concerned with the size of the risk factors involved with accidents because the higher the proportion of accidents, the higher the insurance premiums. This approach gives an advantage to large companies over smaller ones because the rates reflect the economies or scales which result from spreading certain fixed costs over a larger amount of premiums.

Medical costs and doctor's fees[22]

Additional factors of importance to employers which result in hard dollar (direct) costs are medical costs and physicians' fees. As noted by Hartman and Cozzetto in 1981, Americans spent $321.4 billion on health care or *10 percent of the Gross National Product.* It is no wonder that companies are promoting wellness programs, wellness centers (such as the one begun by Dr. John Travis in 1975) and Health Maintenance Organizations (HMO's). No longer is employee safety simply an issue of concern to employers. Health and preventative maintenance are also vital areas which directly affect the bottom line.

Equipment repairs and inventory replacement[23] [24]

Two other costs to employers are equipment repairs, and supply and inventory replacement. Casualty insurance carriers developed the concept of "schedule rating" which encourages employers to add safeguards to their machines. The cost of insurance thus is reduced according to a schedule which specifies the expected risks of potential hazards as well as inventory control. In addition to the organizational direct costs mentioned above, workers' compensation is a concern to managers at the operational level due to down time when there is an accidental injury. Managers whose subordinates experience total or partial disabilities typically must deal not only with inquiries, but also other unpleasant situations, i.e., blame from superiors, completion of accident reports, reorganization of work schedules, confront a possible loss of morale and perhaps lowered productivity. Managers' time can be "eaten up" with interviewing and training new employees as well as counseling and retraining the more experienced workers who were directly or indirectly affected by results surrounding an accidental injury or death.

Personal costs

At the employee level, WC pays a minimum level of remuneration for work-related injuries or hardships. Employee "losses" include immeasurable pain and grief (suffered both by the individual and his/her family), a period of possibly extended disability, an altered life-style and a reduced income level. While WC could never "compensate" for an individual's pain and suffering, it does help to alleviate costly litigation and to provide a subsistence level in most cases. Finally, as noted on page 3, workers' compensation's greatest contribution may be that it is helping to promote the study of *causes* of accidental injuries and to decrease the tendency to find fault or to conceal the facts which could help to prevent future tragedy.

Cost benefits v. Cost effectiveness[25] [26] [27]

The costs of any program are always easier to calculate on paper than the benefits of that program. The major weakness of a cost/benefit approach is the use of monetary (or quantitative) data for all aspects of analysis.

Cost effectiveness analysis, on the other hand, assigns monetary values to program costs but then uses nonmonetary terms (or qualitative data) to delineate outcome criteria, outcome levels and evaluative ratios. It is the goal statement as well as the operational definition of what constitutes effectiveness (achievement of those goals) which ultimately determines the success or survival of any program.

WORKERS' COMPENSATION & THE ROLE OF RISK MANAGEMENT [28] [29] [30]

Today we realize that there is no such situation as "safe" or "zero risk" environment. Asbestos, benzene and glycol ethers are merely a few of the carcinogens greeting the public each day in the newspapers and on television. More importantly, organizations, managers and employees alike are gaining an increased awareness of health and safety factors. They are being introduced to the concept of risk management.

Risk Management is a specialty area within the field of general management. It can be defined as "the rational acquisition, allocation and utilization of human and technical resources to accomplish organizational goals efficiently and effectively while minimizing accidental losses and injuries." As noted by Head, "the essence of Risk Management ... is essentially a rational decision-making process." What is an acceptable "accidental death" level (in 1981, the latest year for which data are available, workplace deaths totaled 11,200) depends upon the thinking of the specific employer. This thinking ultimately correlates highly with workers' compensation premiums.

Dan Petersen, author and Associate Director of the Safety Management Program in Tuscon, Arizona, lists five steps of the Risk Management process:

1. Recognition and identification of the sources of risk.
2. The measurement of the probability and financial cost of their recognized possibilities of loss.
3. Selection of the appropriate techniques in handling the risk and development of a plan of action to be taken.
4. Application of this plan of action.
5. Follow-up to determine the effectiveness of the implementation (application) of the plan to action.

These steps in essence are similar to those of the scientific method and the strategic planning process. The difference, however, is emphasis on *prevention*

of disabling injuries and other losses. When no individual loses work time, we all benefit.

Importance of workers' compensation to you[31]

Employers typically tend to look at WC as a normal cost of doing business. In a recent national study of businessmen's attitudes conducted by Harris and Associates and the Wharton School of Business, "no more than five percent of the business community (was found to be) aware of imminent changes in the workers' compensation laws which could affect every business in the country." These mistakes can be lessened and even prevented if time is taken to emphasize and to promote the safety and health function.

A final note: The DuPont Corporation has a policy that "a job will not be done unless it can be done safely." This philosophy is translated into performance evaluations such that without a good safety record, supervisors will not be promoted. It is this philosophy (backed by top management support and communication) which notedly saved DuPont $26 million in one year (1980) alone. As noted by Main, "that saving ($26 million) equalled 3.6 percent of DuPont's profits. To make up the difference, DuPont would have had to increase sales by nearly $500 million. That seems reason enough to be fussy about safety."

GLOSSARY OF TERMS

Ergonomics—an approach which takes human factors into consideration in the design of work places and production lines.

Exclusive Remedy Rule—an employer covered by workmans' compensation (WC) insurance is protected from litigation suits employing the common-law theories.

Indemnification—a reimbursement or payment to compensate for loss, damage or penalty.

Redress—to correct; to restore to a normal condition.

Schedule Rating—a mechanism developed by casualty insurers which rewards employers who add safeguards to machinery and thus defray financial and personal losses.

Whole Man Theory—the state system which pays not only for lost wages, but also pays for personal and familial losses suffered.

KEY TO WORKERS' COMPENSATION EXAM

1.	T	p. 3	
2.	T	p. 3	
3.	T	p. 4	
4.	T	p. 3 & 4	
5.	F	p. 4	
6.	F	p. 4 & 5	
7.	F	p. 5	
8.	F	p. 6	
9.	F	p. 6	
10.	T	p. 6	True/false Section
11.	T	p. 7	
12.	T	p. & 7	
13.	F	p. 8	
14.	F	p. 9	
15.	F	p. 10	
16.	T	p. 10	
17.	T	p. 3	
18.	T	p. 11	
19.	T	p. 11	
20.	T	p. 12	
21.	C	p. 3	
22.	D	p. 5	
23.	B	p. 7	Multiple Choice
24.	B	p. 7 & 8	
25.	A	p. 8 & 9	

26.	S	p. 3	
27.	A	p. 4	
28.	F	p. 4	
29.	T	p. 4	
30.	Y	p. 4	
31.	N	p. 4	
32.	H	p. 5	
33.	E	p. 5	
34.	L	p. 5	Matching Section
35.	P	p. 5	
36.	I	p. 5	(This section spells out:
37.	Z	p. 6	"Safty n' help iz gud
38.	G	p. 7	job ckmq")
39.	U	p.7	
40.	D	p. 10	
41.	J	p. 8	
42.	O	p. 9	
43.	B	p. 10	
44.	C	p. 11	
45.	K	p. 11	
46.	M	p. 11	
47.	Q	p. 11	
48.		p. 3 & 4	
49.		p. 4	
50.		p. 3	Subjective Section
51.		p. 11	
52.		p. 10 & 11	

WORKERS' COMPENSATION STUDENT REVIEW SHEET

PAGE	TRUE/FALSE	MULTIPLE CHOICE	MATCHING	SUBJECTIVE	TOTAL POINTS
1	0	0	0	0	0
2	0	0	0	0	0
3	4	2	2	10	18
4	3	0	10	3	16
5	1	2	10	0	13
6	3	0	2	0	5
7	2	4	4	0	10
8	1	2	2	0	5
9	1	0	2	0	3
10	2	0	4	6	12
11	2	0	8	7	17
12	1	0	0	0	1
TOTALS	20	10	44	26	100

Matching Terms:

indemnification-

courts-

risk management-

provincial-

retention-

zero risk-

contributory negligence-

cost effectiveness-

English-

German-

cost/benefit-

the fellow servant rule-

schedule rating-

advance-

whole man-

funding-

elective-

compensation-

schedules-

assumption of risk-

second injury-

the exclusive remedy rule-

WORKERS' COMPENSATION STUDENT EXAM

True/false section: worth 1 point each. Directions: Please mark a T or an F to the left of each statement. Make sure your answers are clearly legible.

Answers:

_____ 1. Before the passage of workers' compensation legislation, it was the employers' attitude that safety was an inherent part of an employee's job responsibilities.

_____ 2. The first workers' compensation legislation for federal employees began in Wisconsin.

_____ 3. Today all states have workers' compensation laws.

_____ 4. Each state and each U.S. territory's laws differ in the specifics of their coverage, funding requirements and the costs/benefits rendered.

_____ 5. The three common-law defenses were inherited from German precedent.

_____ 6. Workers' compensation laws are federal legislation.

_____ 7. In elective state funds employers can shop for price differentials between the premiums offered by their state and those offered by private insurance companies.

_____ 8. Self-insurance is a risk management technique that makes it possible to transfer the financial consequences of potential accidental losses from the insured entity to the insurer.

_____ 9. Self-insurance programs seem to operate best with small employers.

_____ 10. Monies paid by employers into reserve funds for self-insurance are not always deductible from gross income as a business expense for income tax purposes.

_____ 11. Workers' compensation laws are based on the premise that industrial employers should assume the costs of occupationally-related accidents, injuries, disabilities, or diseases without regard to any fault involved.

_____ 12. The first objective of all state workers' compensation laws is to provide a "reasonable" income for workers disabled by a job-related injury or illness.

_____ 13. Death is more expensive financially to the employer than even permanent total disabilities.

_____ 14. Rehabilitation is considered to be an integral part of every injured employee's total medical treatment.

_____ 15. The cost of workers' compensation is paid by taxes which are shared equally by the employer and employee.

_____ 16. The higher the proportion of accidents, the higher will be an employer's insurance premiums.

_____ 17. A major purpose of workers' compensation is to "compensate" an injured employee for his/her pain and suffering.

_____ 18. The costs of any program are always easier to calculate than the benefits of that program.

_____ 19. The essence of risk management is essentially a rational decision making process which depends ultimately on the thinking of the employer.

_____ 20. Employers typically tend to look at workers' compensation as a normal cost of doing business.

Multiple Choice Section: Worth 2 points each. Directions: Place the letter identifying the correct response in the space to the left of each question. There is only one correct answer to each question.

_____ 21. Before the passage of WC legislation an employee could not recover damages under specific conditions. Which of the following is **not** one of these conditions?
A. The injury was caused by negligence of the injured party.
B. The injury was caused by negligence of a fellow worker.
C. The injury resulted from dysfunctional hygiene.
D. The injury resulted from the occupational hazards inherent in the job itself.
E. The worker died or became disabled as the result of an occupational injury or disease.

_____ 22. Which is **not** a category of employees which are exempted by workers' compensation coverage?
A. Small employers
B. Self-employed
C. Non-profit employees
D. Non-exempt employees
E. Trainees

_____ 23. Which term is **not** matched with its proper definition?
A. An accident is any unplanned and undesired event.
B. An injury is the making of an error which results in something other than error-free performance.
C. An accident can result in an unobserved potentially harmful behavior, a "near-miss" which is observed, a personal injury or even death.
D. An accident refers to the cause of an injury.
E. Workers' compensation laws traditionally have concentrated on the injury resulting from an accident rather than the cause of the accident.

_____ 24. Which statement is **not** true about workers' compensation?
A. Specific state statutes set minimum and maximum rates for specific indemnity benefits.
B. Claims filed depicting similar incidents in different states are consistent in judgements and remedies.
C. WC laws in the various states attempt to reimburse workers for injuries or death arising in the employment context.
D. The ultimate goal of WC is to provide for the quick, simple and inexpensive determination of all claims for benefits and to provide for such services as are necessary to restore the injured worker to employment.

E. Employers who experience financial losses from disabling accidents, injuries and diseases treat these outlays as costs of production which are deductible expenses to be passed on to consumers.

_____ 25. Which was **not** included as a type of benefit provided to worker compensation claimants?
A. Compulsory
B. Accidental Death
C. Dismemberment
D. Medical
E. Rehabilitation

Matching Section: Worth 2 points each. Directions: Place the letter corresponding to each matching term below to the left of its definition or identifying phrase. Please note that **each term may be used only once.**

A. Courts
B. Schedule Rating
C. Cost/benefit
D. Compensation
E. Funding
F. Contributory Negligence
G. Advance
H. Elective
I. English
J. Scheduled
K. Cost Effectiveness
L. Provincial
M. Zero Risk
N. The Exclusive Remedy Rule
O. Second Injury
P. German
Q. Risk Management
S. Indemnification
T. The Fellow Servant Rule
U. Whole Man
Y. Assumption of Risk
Z. Retention

Answers:

_____ 26. Before the passage of workers' compensation legislation, if an employee were harmed on the job working for an unempathetic employer, the worker's only recourse for ___(26)___ or redress

_____ 27. was through the ___(27)___.

_____ 28. This common-law defense applies in cases where the responsibility for injuries and damages awarded are mutually shared by both the employer and employee.

_____ 29. This common-law defense is used where an injury resulting from negligence or other incidents caused by peers could be remedied only by the injured party suing his/her peer(s).

_____ 30. This common-law defense states that a person who accepts a job also accepts the risk involved, thus absolving the employer from responsibility.

_____ 31. The use of the common-law defenses has been termed ___(31)___ because an employer covered by worker compensation insurance is protected from litigation.

_____ 32. New Jersey, South Carolina and Texas have this type of worker compensation coverage.

_____ 33. This type of activity may be classified as monopolistic or competitive and may involve state insurance funds, private insurances companies, or self-insurance by employers themselves.

_____ 34. This term is synonymous with monopolistic state funds.

_____ 35. Compulsory state funds are associated with ___(35)___ precedent while elective coverage and private insurers are associated

_____ 36. with ___(36)___ precedent.

_____ 37. This term is synonymous with self-insurance.

_____ 38. The purpose of this type of funding, whether by private insurance companies, state funds or self-insurers, is to prevent severe disruptions in cash flow from unforeseen loss experience or accumulated liabilities.

_____ 39. This "theory" is used in state systems which require payment not only for lost wages but also for personal and familial losses suffered.

_____ 40. This term when related to WC laws, refers to the money paid by the employer to indemnify the worker for employment-related injuries or death.

_____ 41. Permanent partial disabilities are described as being ___(41)___ injuries because they involve the loss or use of specific body members and because each state has a specific schedule of rates for the loss of a member.

_____ 42. This term refers to the type of fund set up in some states which relieves the liability of an employer when a pre-employment injury combines with a current work-related injury to produce a disability more than that caused by the latter alone.

_____ 43. Casualty insurance carriers have developed this concept which encourages employers to add safeguards to their machines.

_____ 44. The major weakness of a ___(44)___ is the use of monetary or quantitative data for all aspects of analysis.

_____ 45. This type of analysis, on the other hand, assigns monetary values to program costs and uses nonmonetary terms to delineate outcome criteria and levels, and evaluative ratios.

_____ 46. Today we realize that there is no such thing as this type of environment.

_____ 47. This term was defined as the rational acquistion, allocation and utilization of human and technical resources to accomplish organizational goals efficiently and effectively while minimizing accidental losses and injuries.

Subjective Section: Worth 26 points. The value of each question is shown in parentheses to the left of each question.

(5 pts.) 48. Please list 5 basic objectives which underlie all workers' compensation laws.

1.

2.

3.

4.

5.

(3 pts) 49. Please list three industries with the highest rates of job-related injuries and deaths.

1.

2.

3.

(5 pts) 50. Please list the five States to first pass workers' compensation acts.

1.

2.

3.

4.

5.

(7 pts) 51. Please list five steps of the risk management process.

1.

2.

3.

4.

5.

(6 pts) 52. Please list 6 reasons why employers should be concerned with safety and health issues? (any 6 from those listed)

1.

2

3.

4.

5.

6.

7.

8.

9.

10.

End of Exam

GROUP EXERCISES

1. Assume that one member of your group is a work study student who fell down the stairs in your college of business and partially disabled him/herself temporarily. Is this student entitled to workers' compensation? Would the entitlement (or lack) of benefits differ if the student were on break? What if the accident occurred after normal work hours?

2. Call a small employer (1–3 employees) and call one of the largest employers in your city. Using the same facts as enumerated in Group #1 (except utilize full-time exempt and part-time non-exempt workers) would the employee be entitled to workers' compensation payments? What would happen if the accident and injury occurred during break or after hours? What would happen if the student(s) were not disabled in any way?

3. Is there a relationship between affirmative action requirements and workers' compensation laws?

4. Contact a member of one of your trade union locals in your city. In addition, contact an executive in a management hierarchy which is in the same industry as the union member. Is there a discrepancy between labor's view toward health and safety and that of management?

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8. Williams, C. A. *et al. Principles of Risk Management and Insurance.* Vols. I CPCV Vol. 1 Malvern, Pa:—American Institute for Property and Liability Underwriters, Inc. 1981, p. 314–315 (Vol. II, p. 138-140).

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SELECTED CASE STUDIES

Principal Contractor:
A. James McKnight, President
National Public Services Research Institute
Landover, MD

CONTENTS

INTRODUCTION

This packet contains 10 case studies illustrating the effect of safety and health upon the success of business management. They are intended for use by schools of business administration to serve as a means of acquainting business students with the importance of safety and health.

Use of the case studies does not require a technical understanding of safety and health; all of the technical information needed is supplied. Nor are the case studies intended to develop a technical study of safety and health; that is a subject in itself. The purpose of the case studies is to help expand the student's mastery of the subject they are being taught by illustrating the way in which safety and health impinges upon it.

The various case studies address different aspects of business management: production and operations, plant management, personnel, organization, product design, marketing and advertising, training, customer relations, capital budgeting, and small business management—to name a few. We have not attempted to associate individual case studies with specific courses; only instructors can tell which case studies are most appropriate to their subject.

To make the studies most useful in teaching business management courses, the following steps have been taken.

- Heavy emphasis has been placed upon the financial implications of management decisions affecting safety and health. Where decisions result in illness or injury, dollar costs are described.

- The case studies focus upon management decisions rather than the actions of employees. The view underlying the case studies in prevention of illnesses and injuries is first and foremost a management responsibility.

- Concluding each case study is a series of questions. The questions are intended to provoke thought rather than simply to elicit answers. Students should be given ample opportunity to discuss the questions in class. A set of teacher notes has been provided to help guide discussion.

- The case studies are expected to serve as an integral part of business management subjects; they are not intended as a digression into safety and health as a topic. Unless students emerge with an understanding of the way in which safety and health forms an integral part of the particular business management subject they are studying, the case studies will not have been successful.

The cases are:

The Athenian Restaurant Fire—A fire in a newly renovated restaurant resulted in an unreimbursed loss of $200,000. The fire occurred primarily because the owners neglected a potential safety hazard in the interest of expediting the opening of a new business. The case illustrates the need for small businesses to address safety as a management concern and not allow it to "slip through the cracks."

Brandon Electrical Cooperative—Failure to use prescribed procedures for removing a telephone pole resulted in injuries to three linemen. One of the injuries resulted in permanent disability. Unreimbursed losses totalled $34,851. The accident resulted primarily from the attempts of the linemen to make up for lost time. The study illustrates the importance of training, supervision, and organization in seeing that safety does not take a back seat to operational concerns.

Defective Exhaust System—A child was permanently brain damaged when carbon monoxide collected in the rear of a recreational vehicle. The problem resulted from design errors compounded by ex-

travagant marketing claims. The case illustrates how safety and health hazards can arise due to lack of communication within a company.

Defective Moped Throttle—A young boy was permanently brain damaged when the throttle on a moped he was riding stuck in the open position and the moped crashed into the side of a building. The accident resulted from the combination of a potentially hazardous design and failure to give consumers adequate warning. The case illustrates how safety hazards can result when a company develops a new product line without giving adequate attention to the hazards that can arise during the design process.

A Hay Baler Accident—A farmer lost his left hand and forearm when it became entangled in a hay baler. The manufacturer thought the danger of the hay baler was so obvious as to make a warning unnecessary. The court didn't think so and awarded the farmer half-a-million dollars. The case illustrates the importance of anticipating all possible hazards connected with product use and giving consumers adequate warning.

Punch Press Accident—A new employee lost his right hand in a punch press when the press descended unexpectedly while he was cleaning out metal scrap. The accident resulted from a combination of inadequate training and production shortcuts that bypassed safety devices. The case illustrates the importance of a strong management emphasis on safety accompanied by programs that assure the adequate training and supervision of new employees working with potentially dangerous equipment.

Purchase of Grinding Machines—This case involves the purchase of a new grinding machine which could be purchased with or without shields to contain flying particles. The purchase decision requires the application of safety and health costs and benefits to the process of capital budgeting.

Safety Program in the Highway Construction Industry—A highway construction company sought to minimize accident costs as a part of an overall cost reduction program intended to help the company survive an economic recession. To help identify the safety problems, an analysis was made of the previous year's accidents. Students are given an opportunity to examine the accidents and identify factors that might contribute to them.

Unstable Crane—A crane toppled over after striking the side of a building while lifting a load. The result of the accident was a lengthy work delay and the cost of renting another crane. Threatened with loss of insurance and future business, management was forced to institute a loss-reduction program. Students are called upon to identify the critical ingredients of such a program.

The Vinyl Chloride Health Hazard—This case study traces the chemical industry's response to the health hazard of polyvinyl chloride through a lawsuit lodged against one company by employees. Students are required to judge the company's liability for the illness of its employees. The case study provides an opportunity to consider and discuss management's responsibilities in protecting the health of employees.

If you have suggestions for revision of these case studies, or preparation of new ones, please address them to:

Mr. James B. Walters
Robert A. Taft Laboratory
DHHS PHS CDC NIOSH
4676 Columbia Parkway
Cincinnati, OH 45226

CASE HISTORY SUMMARIES

THE ATHENIAN RESTAURANT FIRE

A fire in a fashionable Washington, DC eating establishment filled the restaurant with smoke and patrons were quickly evacuated without injury. While damage from the fire was negligible, smoke and water caused extensive damage to carpeting, walls, and furniture. It required eight weeks of rebuilding, at a cost of $375,000, to restore the restaurant to its condition before the fire. Unreimbursed insurance claims cost the restaurant one year's profit.

This case is fraught with errors on the part of management. No one in the management structure seemed attuned to safety concerns nor was knowledgeable in the ways and methods of recognizing safety problems. The study makes an excellent case for the need of a broad safety and health program in any organization.

BRANDON ELECTRICAL COMPANY

The Brandon Electrical Cooperative of Brandon County, Kentucky, was involved in an accident resulting in severe burns to three linemen who were engaged in removing one of the Cooperative's utility poles. One of the linemen is yet to recover full use of his legs. A great deal of time was spent at all levels within the organization attempting to determine the causes of the accident and who was to blame.

The purpose of this exercise is to help the student gain an appreciation of the magnitude of dollar loss associated with violations of safety practices and resulting accidents. While students can't be expected to know the costs associated with each source of loss, they can at least identify the sources.

DEFECTIVE EXHAUST SYSTEM

A family was driving a four-wheel-drive recreational vehicle in one of the national parks when a passenger was overcome by carbon monoxide and suffered permanent brain damage. The family sued the manufacturer for $2.8 million, claiming the design of the exhaust system was faulty.

The purpose of this exercise is to show the effect that the design and marketing of a product can have upon the safety and health of its users and, indirectly, upon the financial health of the manufacturer of the product. While they are not uncommon errors, they are the type of error that has cost industry billions of dollars. These losses can be prevented by a better understanding on the part of management of its responsibility toward the users of its products.

DEFECTIVE MOPED THROTTLE

Two brothers were taking turns riding their father's moped around the cul-de-sac at the end of the street on which they lived. When one of them peddled up the street to start the engine, his brother heard him shout something like "I can't stop it." Instead of turning around the cul-de-sac the rider drove right up on the lawn and ran into the brick facing on the neighbor's house. Upon impact, he went over the handlebars and his head struck the house. As a result of the accident, the rider suffered extensive brain damage and will probably require custodial care the rest of his life. A lawsuit was initiated against the moped manufacturer to cover medical expenses

and to provide care for the injured boy throughout the rest of his life. An award of $1.2 million and a second lawsuit forced the manufacturer into bankruptcy.

The purpose of this exercise is to review management errors in design and marketing including product testing, consumer information, and product recall.

A HAY BALER ACCIDENT

A farmer baling hay lost his left hand and forearm when it became entangled in a hay baler. He sued the manufacturer of the hay baler and was awarded $528,000 in damages.

This case is intended to illustrate the importance of applying all known safeguards to the design of a product. At the time the hay baler in question was designed, the use of safeguards to prevent access to mechanisms that could injure a user was well established. Such guards were installed on balers manufactured by competitors. Management chose to bypass a guard on the grounds that the danger of placing any part of one's person inside the baler was so obvious as to make a physical obstruction unnecessary. The case discusses the need to provide safeguards even when a danger is obvious.

PUNCH PRESS ACCIDENT

A worker lost his right hand in a punch press when it descended unexpectedly while he was cleaning out metal scrap. Safety procedures designed to prevent such mishaps were not observed. Worker's compensation covered the injured's medical and compensation costs, but the loss to the company for unreimbursed work time included $4,900 plus a sizable increase in worker's compensation premium.

The student is assigned the task of identifying "lessons learned" from the accident and recommend changes that will prevent future accidents. The task focuses upon action at the management level to improve the overall safety program including: training, supervision, operations, and accident reporting.

PURCHASE OF GRINDING MACHINES

A small products fabrication company is considering the replacement of twelve grinding machines with new semi-automatic machines that will speed up the production process. The safety director has recommended that the new machines be equipped with plastic shields that will prevent flying particles from striking the operators of the machines.

Given certain cost data, the student is asked to determine if the installation of guards on the new machines is a good investment by comparing the average annual percent return of guarded machines with unguarded machines.

SAFETY PROGRAM IN THE HIGHWAY CONSTRUCTION INDUSTRY

As road construction slumped in the late '70s and early '80s, a large northwest highway construction firm sought to reduce its costs. One of the cost areas attacked was accidents. With the help of the State safety agency, an analysis was made of accidents and safety hazards. A safety program was instituted to reduce the number and severity of accidents.

Given data for company accidents, the students are asked to develop safety measures that will have the greatest effect upon cost reduction. Such catch-all safety measures as "better training" or "closer supervision" are not considered acceptable means for reducing accidents.

UNSTABLE CRANE

> A crane was lifting steel beams to the top of a building when it became unstable and turned over. While no one was seriously injured, the crane boom was heavily damaged, resulting in intensive loss and delay of schedule for the steel erection firm.

This case is designed to help students understand the need for a program that will address safety generally, not just prevent specific accidents from recurring. Coming up with the "fixes" for yesterday's accidents will not prevent tomorrow's losses. Accidents are symptomatic of an underlying safety problem which must be addressed in its entirety if accident loss is to be reduced.

THE VINYL CHLORIDE HEALTH HAZARD

> Three employees of a plastics manufacturer initiated a suit against their employer and the chemical company supplying the vinyl chloride used in the manufacturing process. They claimed that the companies had knowingly exposed them to health hazards resulting in debilitating diseases, which may prove fatal in at least one case. The defendants settled out of court for $3.2 million.

The purpose of this case study is to help students to fully understand the responsibility of management to avoid conditions that will lead to illness on the part of employees who are manufacturing their products or ultimate users of the products. The past decade has been characterized by a quantum increase in the number of suits lodged against employers and manufacturers from illness resulting from unhealthful working conditions and products. Because of the extent of disability involved, and the numbers of workers affected, the costs to companies found to be liable are extremely large. Multimillion dollar awards are not uncommon. Several otherwise "healthy" companies have been forced into bankruptcy because of their inability to withstand claims arising out of illnesses to employees and customers.

THE ATHENIAN RESTAURANT FIRE

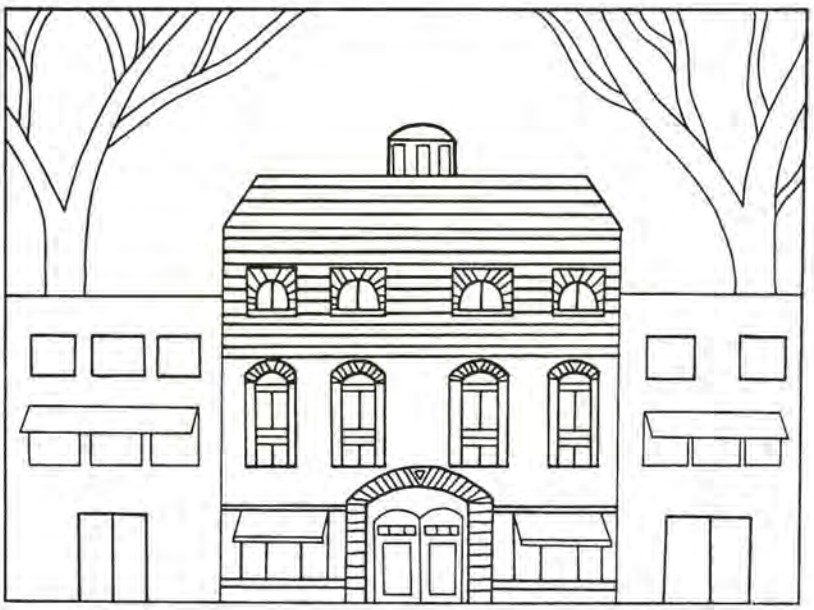
Case Study

At 4:00 p.m., on the afternoon of February 17, 1983, a fire broke out in the Athenian Restaurant, a fashionable Washington, D.C. eating establishment. Smoke filled the restaurant and patrons were quickly evacuated without injury. While damage from the fire was negligible, smoke and water caused extensive damage to carpeting, walls, and furniture. It required eight weeks of rebuilding, at a cost of $375,000, to restore the restaurant to its condition before the fire.

The Athenian Restaurant

The restaurant was owned by Steven and Michael Agnos in a limited partnership. The building occupies what was a four-story in-town mansion. In fact, it was officially classified as an historic landmark.

The Agnos brothers invested $4.5 million in renovating the mansion for use as a restaurant. Practically no expense was spared to achieve a decor that was both attractive and in keeping with the historic character of the building. It was intended to appeal to "the expense account crowd," including out-of-town businessmen, local representatives of large companies, and lobbyists.



A cocktail lounge and the kitchen occupy a half-basement. Food prepared in the kitchen is elevated by dumbwaiter to the dining rooms on the upper floors.

The first floor is divided into four dining rooms. The rooms made up the living area of the original mansion. They were retained in order to give a feeling of intimacy and to control the sound of conversation and clattering dishes.

The next floor houses four additional dining rooms, intended primarily for private parties, although available for use as public dining rooms whenever necessitated by demand.

The top floor provides office space and an employee dressing room and lounge. A single elevator serves all four floors.

Above the top floor is an attic used to store supplies, including foodstuffs, building maintenance supplies, and some materials left over from construction.

Its Problem

The restaurant was scheduled to open in April, 1982, to coincide with the influx of tourists, as well as many businessmen who time their trips to Washington to coincide with the city's prettiest season. However, the opening had to be delayed because of difficulties in obtaining necessary permits and because of a number of problems with electrical equipment. It wasn't until September that the restaurant opened for business. The delayed opening not only resulted in loss of the anticipated heavy spring and summer business, but also the carryover of that business into the fall. In December, the restaurant received a very favorable review from the restaurant critic of the city's major newspaper. Business began to improve throughout December and January, and was still improving in February when the fire broke out. They were expecting to be reviewed by the *New York Times* in March. A favorable review by the *New York Times* is very beneficial in courting expense account trade.

Most of the restaurant's problems can be attributed to lack of sound management—indeed to the lack of any systematic management at all. Throughout the renovation of the restaurant, decisions were made largely on an *ad hoc* basis by the two brothers. They often gave conflicting orders on important issues, while other important issues appeared to "fall between the cracks."

The Agnos brothers had, over the last ten years, managed a family trucking business founded by their father, Ari (Aristotle) Agnos. With deregulation of the trucking industry in the 1980s, the Agnos brothers found it more and more difficult to keep the trucking company a paying proposition. In late 1980 they sold their equipment and facilities to a food chain looking to expand its private fleet. Of the $4.5 million invested in the restaurant, approximately $2 million came from the sale of the trucking company, the remaining $2.5 million being secured from lending institutions.

The Fire

The fire broke out in the attic of the restaurant. More specifically, it began in a small cupola perched atop the slanted roof of the building.

While the exterior of the mansion is of stone construction, the floors and joints are constructed of wood. The roof is wood covered with slate. Because of the age of the building, the fire spread quickly from the cupola, down the roof, to the attic floor.

The smoke generated by the fire was pulled through the interior ducting into all rooms of the building. This was fortunate in that it alerted everyone to the fire. A call to the fire department brought a quick response. In five minutes, an aerial ladder truck was at the scene, and four minutes later water was being directed upon the roof and, through a window, upon the attic floor. Within 45 minutes after the alarm was given, the fire was fully extinguished.

After an investigation, the fire marshall attributed the fire to wiring within the cupola. The wiring carried current to a ventilation system in the cupola. Due to a problem with the ventilation equipment, the wiring overheated. According to the fire marshall, the wooden frame of the cupola had probably been smoldering since the restaurant opened in the morning.

Fire Prevention Efforts

The fire was a complete surprise to the Agnos brothers since they had arranged to have the entire restaurant sprinkled. Through their insurance carrier, they learned that their fire insurance premiums would be reduced by one-half if the entire restaurant was sprinkled. The insurance company had showed that the cost of the sprinkling system would be fully repaid within five years of the operation. However, it was very apparent after the fire that the cupola itself, a 6' x 6' portion of the roof, had been bypassed during installation of the sprinklers. The company installing the sprinkler system had warned Steven that the type

of sprinkler heads available to them would not work in the cupola because of the ventilation system. They proposed to return at a later date with the proper type of sprinkler head and complete the job. Steven agreed, but did not wish to delay the restaurant's opening further just for the installation of a few heads in an area in which he considered fire to be extremely unlikely. He proposed to call the company and arrange a mutually convenient date after the opening. Unfortunately, he forgot about it completely and had never called.

Unknown to Steven, Mike had one of the staff install a ventilation fan in the cupola as a means of keeping attic temperatures down during the heat of the day. The benefit was reduced cost of cooling the four main floors as well as reduced spoilage of foodstuffs. The manual that came with the fan recommended the installation of fuses or circuit breakers to prevent fire in case the ventilation motor overheated. A warning light would be installed on one of the lower floors to indicate when the circuit was open and the fan rendered inoperative. Mike opted to defer installation of fuses or circuit breakers until after the restaurant had opened, figuring that the sprinklers would offer adequate protection in the meantime. Like Steve, he never got around to having the work completed.

The fire marshall inspected the premises the week before opening and, failing to notice the lack of sprinklers in the cupola area, gave the building a fire rating appropriate to a completely sprinkled building. Mike was completely unaware of the lack of complete sprinkler coverage. When he found out what had occurred, he hit the roof (or the cupola). Steven just accused him of second-guessing, saying "who'd have thought a fire would break out in the only place in the entire building we didn't have a damn sprinkler?" He also reminded Mike that the reason the cupola wasn't covered by sprinklers is the ventilation system that Mike had installed and didn't have properly protected.

The Loss

Damage to the building resulting from smoke and water was assessed at $750,000. The insurance company quickly settled, allowing the Agnos brothers to start rebuilding immediately and reopen eight weeks later. The Agnos brothers also carried business interruption insurance. However, assessing the business loss turned out to be a thornier problem than settling the loss from fire damage. The brothers entered a claim for $500,000 to cover the following losses:

- Total loss of revenue during the period the restaurant was closed for repairs.
- Partial loss of revenue during the period immediately following opening due to loss of advanced bookings.
- Loss of kitchen and service staff forced to seek new employment while the restaurant was closed.
- Lag in return of business resulting from lack of awareness that the restaurant had reopened.

The insurance company was only willing to allow $300,000 for business interruption. The $200,000 difference in estimates of business loss represented the difference between the Agnos brothers projection of increasing business resulting from favorable reviews in the newspaper and the change in season versus the insurance company's estimate based solely upon documented levels of business prior to the fire. The inability of the Agnos brothers to support their projections with documented facts forced them to settle for the insurance company's offer.

The result was an unreimbursed loss of $200,000. Based upon income after reopening of the restaurant, they estimate that it took between 9 and 12 months of operation to generate the revenues needed to produce $200,000 income after expenses and taxes. In Mike's words, "Because of a couple of damn sprinklers, we've had to run this restaurant for nothing during this whole year!"

Question

Failure to insure that the entire restaurant was adequately sprinkled is an obvious and costly oversight. What specific errors on the part of management contributed most to this oversight?

THE ATHENIAN RESTAURANT FIRE

Teaching Notes

This case study is fraught with errors on the part of management. The specific errors that contributed most to the fire are the ones discussed below.

1. Steven's apparent assumption that the odds were against fire breaking out in the unsprinkled area.

Accidents are, by their nature, unpredictable events. They rarely happen when and where expected (if they were expected, steps would be taken to prevent them). The idea that the odds are against an accident occurring in an unprotected area assumes that there is no cause and effect relationship between failure to take preventive measures and the occurrence of an accident. Fortunately, such is often the case. However, it occasionally happens that the very factors that keep a preventive step from being taken are the ones that lead to an accident. For example, a supervisor may complain "we can't keep the floor clean because the men keep tracking oil in," not recognizing that the presence of oil is precisely the reason that the floor must be cleaned.

In this case, Steven did not have the area of the cupola checked out to see if it presented an unusual fire hazard before deciding to delay installation of sprinklers. If he had done so, he would have discovered that it was the presence of the ventilation system that necessitated a different type of sprinkler head. Indeed, the very thing that prevented adequate fire protection also increased the level of hazard.

2. Mike's assumption that the sprinkler system made it unnecessary to install circuit breakers or fuses.

Counting on one safeguard to make another one unnecessary is a common error. It is unwise to disregard a manufacturer's recommendations concerning fusing or grounding without consulting a qualified individual. In this case, he probably would have been reminded that the objective of a fire prevention program is to prevent fire in the first place. While a sprinkler would put out a fire, it would also be very likely to cause some damage to goods stored in the attic.

3. The failure of the Agnos brothers to follow up on completion of the sprinkling system once the restaurant had opened.

Opening the restaurant as quickly as possible in order to realize some income was understandably the first priority of the Agnos brothers. Having sunk their life savings into the restaurant, they can be forgiven for their preoccupation with getting into operation. Nevertheless, one would have thought that sometime during the almost six-month period between the opening of the restaurant and the fire, Steve would have had occasion to think about the incomplete sprinkler system or Mike to think about the unfused ventilation system. It is quite possible that the fact that the restaurant, in their mind, was "fully insured" gave them a false sense of security. Had the fire inspector spotted the gap in protection and declined to give the Athenian restaurant the rating it sought, the situation probably would have been quickly corrected.

4. The lack of any systematic loss control "program" to protect the safety of their investment.

There is little doubt the Agnos brothers will be particularly alert to the hazard of fire. They have probably combed the premises for any possible source of fire. But what about other accidents, such as a kitchen helper cutting his hand, a delivery man sliding on a wet floor, or a customer swallowing a chip off a broken glass? No one in the management structure, which consists primarily of the Agnos brothers seems attuned to safety concerns or knowledgeable in the ways and methods with safety problems.

What the brothers should have learned from the fire is the need for a broad safety and health program to reduce the chances of other costly mishaps. Such a program would include:

- Appointing one or more members of the staff to take cognizance of various aspects of safety, e.g., facilities, kitchen operations, food preparation, etc.
- Obtaining, or encouraging the staff to obtain information from the Occupational Safety and Health Administration and the National Institute for Occupational Safety and Health concerning safety and health hazards most commonly found in restaurants.
- Requesting advice from carriers of their fire, worker's compensation, and public liability policies concerning identification and correction of hazards (recognizing that this does not relieve the restaurant of the primary responsibility).

BRANDON ELECTRICAL COOPERATIVE

Case Study

The Brandon Electrical Cooperative of Brandon County, Kentucky, was involved in an accident resulting in severe burns to three linemen who were engaged in removing one of the Cooperative's utility poles. One of the linemen is yet to recover full use of his legs.

The Company

Brandon Electrical Cooperative was established in 1947 to provide electrical power to homeowners, primarily farmers, in those portions of Brandon County not able to obtain service from any of the power generating and transmission companies within the county because of their remote location. Brandon purchases power from Midvane Power and Light and distributes it to some 18,000 homes in the country.

A medium-size cooperative, Brandon has 56 employees. Approximately half of these are "outside" employees, who provide service to customers (installation, service and meter reading) as well as construction and maintenance of power distribution lines. Remaining personnel include (1) inside operations personnel, (2) clerical personnel who keep accounts, prepare bills, and handle correspondence, and (3) warehouse and custodial personnel.

Control of Brandon is exercised by a nine-person board of directors elected by the members (subscribers) of the cooperative. A general manager reports to the board and is responsible for day-to-day management of the company. Other management personnel include an assistant manager, an electrical engineer, an operations superintendent and four supervisors.

The responsibility for safety is assigned to the operations superintendent. At present, this position is occupied by Roger Ormes, who joined Brandon in 1956 as an apprentice lineman and has worked his way up through the organization to the position of operations manager. While he is responsible for safety, he has had no formal instruction in the subject. Up to the time of the accident, his activities in meeting his safety responsibility was largely limited to (1) securing posters from the National Safety Council and displaying them within the co-op, (2) preparing reports on lost work-time accidents and interviewing those involved to see if any remedial steps are in order, and (3) including subjects of safety upon occasion in his weekly meetings with the supervisors.

The Accident

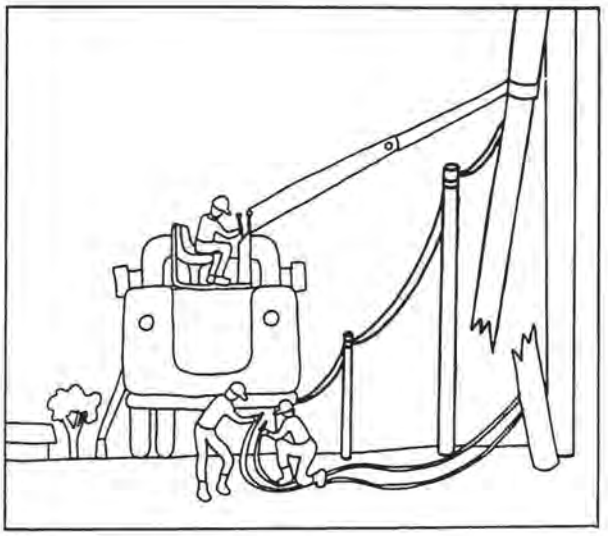
In September 1983, the Brandon Electrical Cooperative was in the process of replacing utility poles following a county-wide inspection program. On the morning of September 17th, 1983, a line crew consisting of a foreman, journeyman lineman, and two apprentice linemen were assigned to replace a pole considered to be potentially hazardous. The pole was located on a private right-of-way some 4½ miles from the county road. A digger derrick truck and a bucket truck were dispatched for the pole removal operation. In order to reach the pole, it was necessary to cut back some brush and fell some small trees on either side of the private road—which may help explain why the pole was not removed earlier. By the time the men and equipment reached the site, they were tired and some two hours behind schedule. They were determined to forge ahead quickly in order to help make up for lost time. It was necessary to change the pole with the one-phase 7200-volt power line energizer.

The first step in removal was to disconnect the power line from the old pole. This was done by the journeyman lineman using the bucket truck. Because the pole was surrounded by a heavy growth of trees, he was only able to move the phase wire approximately three feet from the pole. The guy wire was released from its anchor and left attached to the top of the pole. The ground wire was found to be missing from the bottom quarter of the pole. The neutral wire was down.

Once the power line had been removed and the guy wire released, the two apprentice linemen attached the derrick to the pole and attempted to pull out the old pole. The first attempt was not successful. The foreman and one of the apprentices then attached a hydraulic pole jack to the pole. The pole jack succeeded in raising the pole approximately one foot out of the ground.

At this point, one of the hydraulic hoses attached to the pole jack disengaged. The foreman and the apprentice were not able to reconnect the hose. They then took the hoses back to the digger-derrick truck and connected them to the pole tamper to see if the problem lay with the hoses or the pole jack.

While the foreman and the journeyman were connecting the hoses to the pole tamper, the foreman called out to the other journeymen to make one more attempt to pull the pole out. On this try, the pole broke at the point where the steel cable from the derrick was wrapped around it. The pole shot upwards and, being top-heavy, fell against the power line.



Because the ground wire was still attached, it became energized as did, in turn, the cable wrapped around the pole, the boom of the digger-derrick truck, to which the cable was attached, and the entire digger-derrick truck. Since the truck was not grounded, the foreman and the apprentice standing at the back of the truck and touching the hose connections took the full force of the 7200-volts.

The operator of the digger-derrick truck realized he was in trouble the minute the pole broke and fell against the power line. He immediately released the pull on the cable, allowing the pole to fall. Fortunately, it fell free of the power line. Equally fortunately, the foreman and the apprentice in contact with the truck were wearing rubber gloves and rubber shoes. For this reason, they were not immediately electrocuted, and survived. The two men were burned badly on the hands and feet. Indeed, both gloves and shoes themselves were badly burned. The apprentice was partially paralyzed and collapsed immediately.

The Consequences

An emergency ambulance call was placed immediately and both injured men were rushed to the hospital. Both were treated for severe electrical burns about the hands and feet. The foreman was discharged from the hospital after a week but was unable to return to work until two weeks after the accident. While he was able to handle his supervisory duties, he was unable to participate in any of the physical labor engaged in by the line crew for almost six months after the accident. During this time, it was necessary to supplement the crew with an additional apprentice.

The apprentice who was injured had not recovered full use of his legs as of one year after the accident. He is able to walk only with the aid of two canes. It has been impossible for him to return to the line crew. Being somewhat paternalistic, and believing in a shared responsibility for the accident, Brandon Electrical

Cooperative has agreed to retrain the apprentice lineman for another position within the organization—one that will allow him to move as far up in the hierarchy as members of the line crew.

Because Brandon Electric Cooperative is a very close-knit group, the accidents and resulting injuries cast a pall over the work force for several weeks. A great deal of time was spent at all levels within the organization attempting to determine the cause of the accident and who was to blame.

Safety Violations

The line crew clearly violated a number of company safety regulations, including the following:

Grounding—All equipment is to be grounded when working in the vicinity of energized power lines in order to prevent just the type of injury that occurred.

Stripping Poles—All poles are to be stripped of ground wires, guy wires, and any other metal in order to keep them from becoming conductors should they come in contact with a power line.

Clearing Area—The area around the poles is to be cleared of brush, trees, branches, and any growth that would interfere with movement of the equipment, isolation or any other safety precautions.

Insulation—All power lines in the vicinity of the area in which a pole is to be removed are supposed to be completely covered in order to prevent metal-to-metal contact.

These violations of company safety practices are also violations of Federal and State occupational safety and health regulations. The State agency that investigated the accident cited Brandon for all four of the violations noted.

Part of the failure to ground the truck, strip the poles, clear the work area, and cover the power lines might seem attributable to haste resulting from the effort to make up for lost time getting to the site. However, interviews with the line crews revealed that these precautions were seldom observed. While employees knew of the precautions, they had become progressively lax in their observance of them over the years. Since there had never been a mishap resulting in injury, they had tended toward the belief that the precautions were unnecessary. There was no apparent effort by management to follow up to see if the safety precautions were being observed.

Problems

1. Identify as many as possible of the sources of dollar loss to the company resulting from the accident. You need not estimate the amount of loss—just the sources.
2. If you were assigned the responsibility of taking steps to reduce the likelihood of future accidents by line crews, what would you do? Consider all the steps that would prevent all categories of accidents, not just the repetition of the same accident (which is very unlikely to reoccur).

BRANDON ELECTRICAL COOPERATIVE

Teaching Notes

1. Identify as many as possible of the sources of dollar loss to the company resulting from the accident. You need not estimate the amount of loss—just sources.

The purpose of this question is to help students gain an appreciation of the magnitude of dollar loss associated with violations of safety practices and resulting accidents. While students can't be expected to know the costs associated with each source of loss, they can at least identify the sources. The instructor can supply the actual costs as indicated below. Discussion should, at a minimum, include the following:

Medical Bills—While Brandon is insured under workers' compensation, there were approximately $2500 in out-of-hospital treatment expenses for the apprentice lineman that were picked up by the company.

Insurance Premiums—The cost of medical bills and disability payments, while borne by workers' compensation, resulted in a marked change in Brandon's experience rating and substantial hike in its workers' compensation insurance premiums—approximately $1500.

Lost Work Time—By far the greatest expense was the lost work time. Sources of loss include the following:

Foreman—Was out of work for ten days at a total cost of $1,723 (including salary, fringe benefits, and overhead costs).

After returning to work he was only partially effective and required the addition of an apprentice to the line crew. During the six months this was required, the costs amounted to $6,375.

Apprentice—The apprentice was out of work for one year, during which he continued to receive full pay. The total personnel cost was $12,750. Upon return, he had to be retrained for another position, involving a cost of $736 in salary and $465 in training time by supervisors and other workers.

Line Crew—The line crew lost the rest of the day in which the accident occurred and most of the following day being interviewed by management, representatives of the State Occupational Health and Safety Administration, and others. All told, lost work time came to a total of $553.

Management—Lost management time includes the time devoted to investigating the accident, processing paperwork, dealing with employee questions and so on. The estimated cost of this lost time was $4,263.

Morale—There is no telling how much time was lost due to the low morale that prevailed for several days after the accident. However, company officials conservatively estimate $1,500.

Equipment Damage—Considerable damage was sustained by the derrick, the hydraulic hoses, and the pole jack, including fused wire, burned-out electrical components, scorched fabric, etc. The repair bill came to $876.

Fines—Brandon was cited for violation of State occupational safety and health standards, including failure to ground trucks, use of hydraulic hoses that were not non-conducting, failure to exercise proper precaution to prevent poles from coming into contact with energized equipment, and allowing employees on the ground to come into contact with the equipment that was adjacent to energized lines. Fines totaled $1,610.

These losses total $34,851. It is estimated that, in order to recover these unreimbursed expenses without increasing electric rates to its subscribers, Brandon would have to add 346 new subscribers (over and above what would ordinarily be added).

2. If you were assigned the responsibility of taking steps to reduce the likelihood of future accidents by line crews, what would you do? Consider all the steps that would prevent all categories of accidents, not just a repetition of the same accident (which is very unlikely to reoccur).

The simple issuance of regulations covering safety precautions in removal of poles will not, as noted in the question, suffice to prevent other types of accidents. More general steps to be taken include the following:

Training—A combination of pre-service and in-service training should be instituted to acquaint all employees with the reasons underlying safety precautions. Almost all safety precautions will be violated from time to time. Failure of the violations to result in accidents will tend to encourage future violations. One way to prevent this is to acquaint employees with the hazards that precautions are designed to avoid and the possible consequences of failure to employ the precautions. Printed materials and films are available from OSHA and NIOSH describing hazards, precautions, and possible consequences.

Supervisor Training—Supervision is the front line of safety. If supervisors are convinced of the need for safety precautions, their concern will spread to those they supervise. If they are not convinced, neither will be the workers they supervise. Supervisor training must include not only the topics discussed in connection with worker training, but scheduled periodic meetings to review problems in obtaining compliance with safety precautions or near-accidents and their causes, etc.

Safety Committee—Management-labor safety committees have proven valuable in helping management formulate policies that are more conducive to safety. An example of a safety-related policy issue would be the establishing of schedules and the authority of supervisors to vary schedules where attempts to meet them would encourage unsafe practices (as was the case in the example described).

Organization—Assigning responsibility for safety to the operations manager may create a conflict of interest in that the prime responsibility of this individual is to see that work gets done as quickly and as economically as possible. This is a typical problem. Placing the responsibility for safety within the operating function has the advantage of putting it in the hands of the individuals who are in the best position to influence safety within the organization. However, safety often has a lower priority than what was perceived as more urgent, operational concerns. For this reason, many organizations remove responsibility for safety policy from operational departments and place it at a staff level.

Expertise—The management of safety requires the same level of technical competence as the management of other functions such as the management of personnel and the management of finance. Obviously the individual currently responsible for the management of safety lacks this competence. Alternative means of supplying it include (1) engaging the services of safety consultants, (2) finding other individuals in the organization having a background in occupational safety, and/or (3) allowing the incumbent safety manager to participate in educational programs to acquire the required site competence.

DEFECTIVE EXHAUST SYSTEM

Case Study

A family was driving a four-wheel-drive recreational vehicle in one of the national parks when a passenger was overcome by carbon monoxide and suffered permanent brain damage. The family sued the manufacturers for $2.8 million, claiming the design of the exhaust system was faulty.

The Accident

The Wiggers family was driving through the Nez Perce National Park in Montana. Their transportation was a four-wheel-drive, all-terrain recreational vehicle, which they used for summer outings, fishing trips, ski trips, and for handling the heavy winter snows of their hometown, Bismarck, North Dakota.

On the day of the accident, they were following a trail into a remote area of the park. They came to a point where the trail crossed a stream, or to be more exact, the stream crossed the trail. The water was about 2½ feet deep. Because of the vehicle's high clearance, Mr. Wiggers concluded they could easily ford the stream. About half way across, the right-front wheel sunk into a rut and it took several minutes of rocking back and forth before they were able to get out of the rut and reach the far side of the stream.

As they were driving along the trail, Allie Wiggers noticed that her four-year-old sister, Carley, was asleep. The somewhat bluish color of Carley's skin told her that something was wrong. She mentioned it to Mrs. Wiggers who took one look and shouted to her husband, "Stop quick!" While neither Mr. or Mrs. Wiggers knew exactly what the problem was, they suspected it might be carbon monoxide poisoning and immediately opened the windows. They then drove back along the trail, across the stream, and to a telephone on the main road. They called Park Service headquarters and were directed to an emergency medical station where an effort was made to revive Carley. When the young girl regained consciousness, she was driven to the nearest hospital.

The Cause

Within a few weeks after the incident, it became apparent that Carley had suffered brain damage. She was not able to speak coherently and her coordination was greatly impaired. The doctors offered little hope of her recovery.

Mr. Wiggers consulted an automotive engineer at the state university, who examined the vehicle's exhaust system for possible leaks. He found none. When Mr. Wiggers explained the circumstances immediately preceding Carley's loss of consciousness, the engineer asked to take the vehicle in order to make some tests. A week later he reported that he had found what he thought to be the cause of the problem.

It seems that when running in water over two feet deep, the exhaust, instead of being dissipated behind the vehicle, collects in the wheel well from which it slowly seeps into the vehicle. The wheel well is located in the area where Carley was resting. The several minutes it took for the vehicle to extricate itself from the rut in the stream was enough to render Carley unconscious.

The Lawsuit

The Wiggers brought suit against the manufacturer of the vehicle for a faulty exhaust system design. They sought $2.8 million to provide custodial care for Carley over the rest of her life.

The manufacturer claimed that the exhaust system employed a common design and that there was nothing basically wrong with it. He maintained that Carley's injury occurred because Mr. Wiggers elected to drive through 2½ feet of water, a use of the vehicle that was never anticipated and for which the exhaust system was not designed.

In rebuttal, Mr. Wiggers produced a full-color advertising brochure, prepared by the manufacturer, showing the vehicle fording a stream approximately the depth of that crossed by the Wiggers family. He claimed that the brochure made it appear as though the vehicle was intended for just such an application.

The court ruled in favor of Mr. Wiggers, awarding the $2.8 million sought. The verdict was appealed on the grounds that strict liability did not make the manufacturer responsible for such abnormal uses of a vehicle as driving through 2½ feet of water. The appeals court upheld the original verdict. It ruled that a manufacturer of a vehicle that was advertised as an all-terrain vehicle might well be deemed by the owner to be safe to be driven through deep water. If such was not the case, adequate warning should be supplied. In the particular case at hand, a brochure showing the vehicle operating in deep water certainly implied that such a use of the vehicle was acceptable and safe.

The Loss

Two million dollars of the claim was covered by product liability insurance. The manufacturer had to absorb the remaining $800,000. In addition, he sustained two additional costs:

- To guard against future suits, the manufacturer had to undertake a direct mail and media campaign to warn all owners of the vehicle model in question of the danger of operating in deep water. In all, this campaign cost the company $250,000.
- As a result of the adverse publicity growing out of the law suit and the media campaign, sales of the vehicle dropped off almost 20%. Since recreational vehicles represented the major product line of the manufacturer, this was a serious loss. While they continued to manufacture the vehicle, they decided it was advantageous to market it under a new name. This meant launching a new advertising program. The loss of sales and subsequent advertising campaign represented an estimated loss of over $4 million.

Question

What management errors were made by the manufacturer? Explain your answers.

DEFECTIVE EXHAUST SYSTEM

Teaching Notes

The purpose of this exercise is to show the effect the design and marketing of a product can have upon the safety and health of its users and, indirectly, upon the financial health of the manufacturer of the product. Management made errors in both the design and marketing of the product. While they are not uncommon errors, they are the type of error that has cost industry billions of dollars. These losses can be prevented by a better understanding on the part of management of its responsibility toward the uses of its products.

Design Errors

Whether the manufacturer cared to admit it or not, the design of the exhaust system was faulty from the start. A vehicle that is intended as an off-road, all-terrain vehicle must be capable of being operated safely uphill, downhill, across hills, through brush, and in deep water. While a competent design engineer might have not foreseen the possibility that exhaust might collect in the wheel well of the vehicle, a comprehensive test program would have certainly revealed it. Management erred in not requiring a product testing program that subjected the product to all of the conditions under which it might reasonably be used. A vehicle whose major virtue is its ability to handle a wide variety of conditions should certainly be tested under a wide variety of conditions.

Marketing

The claims made for products have often surpassed the capabilities of the products themselves. And the world at large has generally accepted a small amount of exaggeration as being an element of survival in a competitive world. However, where exaggerated claims result in injury or illness, the world is far less tolerant. Courts have increasingly held manufacturers liable for injuries and illnesses that occur when a product is used in the way it has been marketed. In the present case, management allowed the vehicle to be marketed as capable of fording streams without verifying that such could be done safely.

In a well-managed organization, marketing can actually enhance product safety by identifying, through market research and the insight of the marketing staff, the things that consumers want to be able to do with a product. If that information is properly channeled into the design process, the result can be the improved reliability, durability, and safety of the product. In the present instance, the marketing department apparently had at least an inkling that owners would want to operate the vehicle in deep water. This should have alerted management to see that the product test program included a test for the ability of the vehicle to be operated in water, whether or not they ultimately decided to feature this ability in their marketing of the product.

A DEFECTIVE MOPED THROTTLE

Case Study

On July 18, 1983, Buddy and Tommy McKane were taking turns riding their father's moped around the cul-de-sac at the end of the street on which they live. When it was Buddy's turn, he pedaled up to speed to start the engine. Then Tommy heard him shout something like "I can't stop it." Instead of turning around the cul-de-sac, Buddy drove right up on the lawn and ran into the brick facing on a neighbor's house. Upon impact, he went over the handlebars and his head struck the house. As a result of the accident, Buddy suffered extensive brain damage and will probably require custodial care the rest of his life.

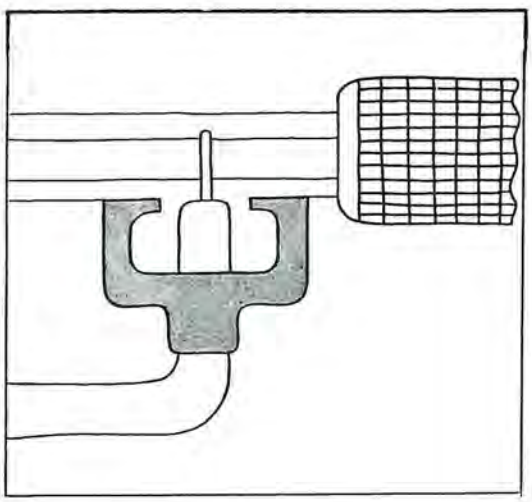
The Moped Manufacturer

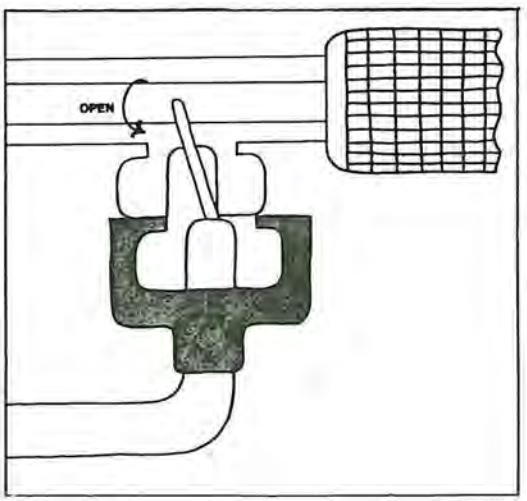
The moped on which the accident occurred was manufactured by the Cyclon Company, a 25-year old company known primarily for the manufacture of 10-speed bicycles. In early 1980, following the fuel shortages of 1979 and a period of sharply rising prices, the Cyclon Company decided to go into the manufacture of mopeds. However, by 1981, easing fuel prices and a general recession caused a marked drop in the moped market.

The Throttle Problem

In December of 1981, the Cyclon Company received a formal complaint concerning the design of the throttle on its moped. The Cyclon moped employed a twist grip throttle similar to that used on most motorcycles. A cable extended from the twist grip down between the front forks to the carburetor on the engine. The cable was anchored to the handlebar at the throttle end by a plastic snap fitting. The complainant claimed that the cable could easily be pulled off the fitting by simply pulling downward on the cable assembly.

When the cable was pulled down, the throttle would be opened, causing the engine to accelerate. Unless the cable were perfectly aligned with the bore in the fitting into which it fit, attempts to close the throttle would cause the cable to bind on the fitting, making it impossible to close the throttle. The harder the operator twisted on the handgrip, the more the cable would bind on the fitting.





The only way to close the throttle when it stuck was to twist the grip toward the "open" position allowing the cable to drop downward. If the cable then happened to be aligned with the bore in the throttle housing, the throttle could be closed. Sometimes it would take three or four attempts before the cable was aligned with the bore allowing the throttle to be closed.

The Cyclon management consulted their design engineers about the problem. The design engineers agreed that the problem described in the complaint could occur. However, the way the cable was routed along the handlebars down between the front forks, a downward pull on the cable would be very unlikely. It seems that in the case of the complaint, the cable had been replaced by a local mechanic and was improperly routed leaving enough slack in the cable for an object to slip between the handlebar and the cable and pull it down.

Management inquired as to whether it would not have been better to employ a screw-on fitting rather than a snap fitting thus eliminating any possibility of the cable being pulled downward. The engineers agreed but pointed out that they were constrained to design a vehicle that could be produced cheaply, in order to undersell other mopeds on the market. The cost of screw-type fittings were three times that of snap-ons.

Since the Cyclon Company was considering discontinuing the manufacture of mopeds, no design change seemed in order. The cost of retrofitting existing mopeds would have been prohibitive, at least for a company in the financial condition of Cyclon. Moreover, most of the vehicles they had manufactured were still in dealer showrooms and whether they would ever be sold was questionable. Management's answer to the complaint was simply that, if the cable were properly routed; the danger of the throttle being locked open was nonexistent. They decided they could not be held responsible for improper routing of cables as a result of repair.

The Accident

A week prior to the accident, Mr. McKane had taken the moped to the bicycle shop from which he had obtained it complaining that the cable was not working freely. The owner of the shop diagnosed the problem as a kink in the cable and suggested that it be replaced. In the process of replacing the cable, the repairman, instead of routing the cable along the handlebar and between the front forks, routed it more or less directly to the carburetor. As a result, when the handlebars were turned to the right, shortening the distance between the throttle and the body of the moped, the throttle cable hung down in a large loop. Neither Mr. McKane nor the two boys noticed it.

Just prior to the accident, Tommy had gotten off the moped and turned it over to Buddy. Buddy, as noted previously, pedaled the moped to a speed of about 10 mph to start the engine. He then moved about 200 feet down a straightaway leading to a circle making up the cul-de-sac. He had reached a speed of approximately 20–25 mph when he reached the circle. Instead of turning around the circle, he continued in a straight path riding up on the grass, across the sidewalk, across the lawn, and into the side of the house, some 70 feet from the edge of the street.

The Lawsuit

Mr. McKane initiated a lawsuit against the Cyclon Company for $1.2 million to cover medical expenses and to provide care for Buddy McKane throughout the rest of his life. In the lawsuit, he claimed that the accident was caused by a defective throttle design which allowed the throttle to become stuck in the open position. He claimed that inability to close the throttle caused Buddy to continue in a straight path into the side of the house.

The Plaintiff's Case

Buddy himself was unable to offer any explanation as to the cause since he is unable to speak coherently. In support of his claim that the stuck throttle caused the accident, Mr. McKane offered the following:

- Buddy's shouting that he was unable to stop the moped.
- Buddy's failure to turn at the end of the cul-de-sac, which an expert witness attributed to inability to reduce speed sufficient to make the turn.

- The fact that the cable, routed in the way it was, could easily be pulled downward causing the throttle to lock open.

On the last item, Mr. McKane was unable to furnish any evidence as to how the cable was pulled downward in the first place. However, he demonstrated that in mounting the moped, it would have been possible for Buddy's foot to have become entangled in the cable as he threw his leg over the moped. Until the engine started, he would not have known that the throttle was locked in an open position.

Mr. McKane's suit contended that the Cyclon design was hazardous, pointing to both the previous complaint and the fact that other manufacturers employed screw-type fittings to anchor the cable to the handgrip. Mr. McKane claimed that Cyclon knew the design was hazardous and failed either to correct the hazard or warn owners of it. He also claimed that Cyclon was negligent in failing to warn of the possibility of head injury when riding at 20 mph and to prescribe the wearing of a helmet. Had Buddy been wearing a helmet, he claimed, there would only have been a minor head injury, if any at all.

The Defendant's Case

Cyclon denied that the throttle design was defective or unsafe. They claimed that, so long as the throttle cable was properly routed, there was no danger. Since the cable was properly routed at the time the moped left the Cyclon plant, the vehicle was safe. They disclaimed responsibility for any unsafe condition that developed through the intervention of a third party (the mechanic) after the vehicle was sold.

The company also claimed that even with the stuck throttle, the moped could have been stopped:

1. The two handbrakes were powerful enough to have stopped the vehicle, even with the engine running at full throttle.
2. A "kill" switch mounted on the handlebar would have immediately cut off the engine.

They contended that these two "fail safe" systems were adequate protection against the stuck throttle and that Buddy's failure to use them was an error for which they could not be held responsible.

The Outcome

The court held Cyclon to be liable for damages resulting from Buddy's injury, and awarded the McKane's the $1.2 million dollars they were seeking. In holding Cyclon liable, the court pointed out the following:

- A prudent manufacturer could anticipate that a cable might be improperly secured or routed during repair and should have taken steps to prevent such an occurrence from placing the moped in a hazardous condition.
- The intervention of the mechanic, no matter how negligent, does not relieve Cyclon of liability since they could have foreseen the possibility of the cable's being misrouted during repair.
- Proper testing of the moped would have revealed the ease with which the cable could be pulled free and the difficulty in closing the throttle under those conditions.
- Having received a complaint of the stuck throttle, it was Cyclon's responsibility to at least attempt to notify owners and prospective buyers of the danger presented by an improperly routed throttle cable so that they could take care to prevent such a situation from arising.

The court rejected Cyclon's contention that Buddy's failure to use the brakes or kill switch to stop the vehicle could be considered an "error." They accepted the statement of an expert witness who pointed out that people, when faced with an emergency, cannot be counted upon to employ a procedure which they never had occasion to practice. Cyclon was responsible for creating the emergency in the first place and was not relieved of that responsibility by the fact that the person placed in the emergency did not respond in the way they would have preferred.

The court did not hold Cyclon responsible for advising the use of helmets. The state in which the accident occurred requires moped operators to be licensed drivers. The state manual, upon which all drivers are tested, advises the use of helmets for riders of all two-wheeled vehicles, mopeds included. The court considered the hazards to be generally well known.

The Consequences

In June 1983, Cyclon's public liability carrier cancelled the Company's coverage of mopeds. This meant that the Company was not insured against damage suits involving its mopeds currently in use (except for incidents arising before the policy was cancelled) or for the $3.6 million worth of unsold machines. No other carrier was willing to pick up the policy so long as the design flaw existed.

The cost of a recall program was estimated at $225,000 for the unsold vehicles and $375,000 for those currently in use (primarily because of the additional cost of advertising to reach owners). With the poor prospect of moped sales to begin with, and the adverse publicity resulting from the recall campaign, management decided that funds invested in a recall program could never be recovered. On November 14, 1983, Cyclon was notified of another accident involving a stuck throttle. The accident occurred on September 13 when an adult moped rider, attempting to slow down for traffic stopped at an intersection, was unable to close the throttle and crashed into the car ahead. He was catapulted over the car and sustained a broken spine. A structured settlement with a present value of $1.3 million was proposed.

In its precarious financial condition, Cyclon could barely manage the legal fees, let alone the damages. Within one month after being advised of the suit, Cyclon filed bankruptcy.

Questions

1. What role did the throttle design flaw have in putting Cyclon out of business?
2. What mistakes did the management of Cyclon make in its manufacture and marketing of mopeds? In each case, describe what they should have done. (Don't second guess; identify only those mistakes a truly prudent manufacturer would not have made.)

A DEFECTIVE MOPED THROTTLE

Teaching Notes

1. What role did the throttle design flaw have in putting Cyclon out of business?

The design flaw, and the subsequent accidents, certainly insured the downfall of the Company. It is true that, with $3.2 million worth of unsold vehicles, the Company's picture was not very encouraging. However, while they would have undoubtedly sustained a loss on their moped program, projected at $.5 to $1 million—there is a good chance they could have survived the crisis. They were managing to hold their own on their bicycle sales and needed only a slight upturn in the economy to offset the moped losses. However, the cost of either a recall program or claims against which they were uninsured eliminated any chance of recovery.

The Cyclon experience is not an unusual one. In recent years, many companies have filed for bankruptcy because of their liability to pay damages arising from product liability suits. Many of these companies, unlike Cyclon, were in very sound financial shape prior to the claims.

2. What mistakes did the management of Cyclon make in its manufacture and marketing of mopeds? In each case, describe what they should have done. (Don't second guess; identify only those mistakes a truly prudent manufacturer would not have made.)

Faulty Design

Management's first mistake was accepting a design that was potentially hazardous. It did not require extraordinary foresight to anticipate that the throttle cable could be pulled loose with a light downward force, given the design of the fitting, and that it could easily bind in such a way as to prevent the throttle from being closed. The Company was clearly banking upon the way the cable was secured to prevent its being pulled loose. It seems unwise to trust to chance when use of a screw-type fitting, would have all but eliminated any chance of the cables being accidentally pulled loose. Given the potential hazard to safe operation presented by any malfunction in either the throttle or the braking system, it would not seem that either of these systems would be good candidates for cost-cutting measures.

Product Testing

It is unlikely that any ordinary product testing program would have told management anything they didn't already know about the design problem. However, if they truly believe that inexperienced moped riders would respond to a locked throttle by cooly applying the brakes or using the kill switch, they could have tested the validity of this belief by locking the brake in an open position on an unwary neophyte rider (under conditions in which no injury could occur, of course). They would probably have found that most of the riders would continue to struggle with the throttle for some distance before it occurred to them to activate the kill switch or apply the brakes firmly.

User Information

Cyclon knew that the security of the throttle connection depended upon proper routing of the cable. At the very least, a warning should have been included in the literature provided with the vehicle. If this was not done at the outset, it certainly should have been initiated as soon as the first complaint about a sticking throttle was registered. It should also have been made to reach distributors to include information in vehicles as yet unsold and all repair shops. Had sufficient information been provided, the accident might have been prevented. Even if an accident had occurred, at least the court might have ruled in favor of Cyclon.

Recall

Whether a recall campaign should have been lodged as soon as a complaint was received is debatable. Management can certainly be excused for not embarking upon such a costly step. After all, the court did not hold Cyclon liable because of the throttle design itself, but rather the design unaccompanied by any literature warning users against the potential hazard involved in not routing the throttle cable properly. The insurance carrier did not require a recall until after they had been required to pay a claim.

A HAY BALER ACCIDENT

Case Study

At 3:00 p.m. on November 12, 1983, a farmer baling hay near Hutchinson, Kansas, lost his left hand and forearm when it became entangled in the hay baler. He sued the manufacturer of the hay baler and was awarded $528,000 in damages.

The Accident

The farmer, Robert Bura, was working on the J.J. Robinson ranch near Hutchinson, Kansas, where he had been employed for several years. On the day of the accident, he was baling Sudex cane. He'd already baled 100 bales of cane when the baler suddenly stopped with a bale half made. He stopped the tractor with which he was towing the baler and turned off the engine. Since the baler was operated by a power takeoff from the tractor, turning off the tractor engine caused the baler to cease operation.

Alighting from the tractor, Mr. Bura visually inspected the baler. Nothing seemed to be wrong. He then turned on the tractor engine, and walked back to check the operation of the baler. Standing about two feet from the baler, he looked toward the belts to see whether or not they were slipping. He could see the rollers turning, but the belts were not moving. Two of the belts appeared to be smoking. He had been watching the operation of the baler for about ten seconds when suddenly he felt something strike his back and then felt himself being jerked into the machine. That was the last thing he remembered.

A few moments after the accident (as near as anyone can tell), Mr. Bura's son drove by and saw his father lying next to the hay baler. His left arm had been severed at the forearm and was bleeding profusely. Mr. Bura's son wrapped the stump of the arm in a cloth, placed his father in the back seat of the car and rushed him to the emergency room of the hospital.

On the following day, Robinson's foreman and another hand took the baler apart. They found Mr. Bura's hand and forearm wrapped in a broken belt where the belt had wrapped itself around one of the rollers several times. The hand was two belt wraps away from the surface of the roller.

Mr. Bura was at a loss to explain how his hand had been drawn into the baler. He claims that he was two feet away from the baler and at no time placed either of his hands inside the baler. The only explanation that he and others on the ranch could offer was that the belt, when it broke, flew out of the baler and wrapped itself around his arm in the manner of a bullwhip. When the belt became wound around the roller, it drew his arm inside the baler. The feeling of being "hit in the back" may have been the belt striking his back before it wound around his arm.

The Baler

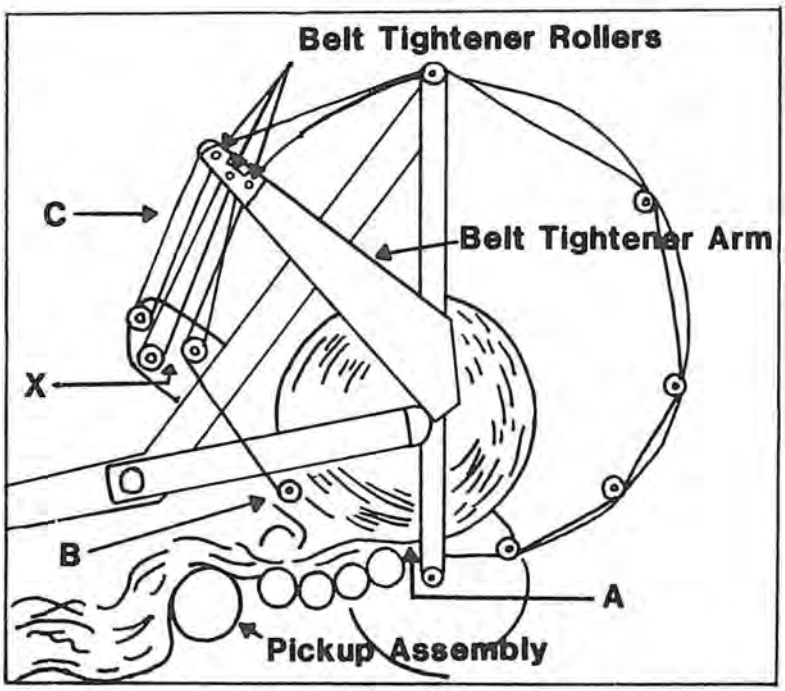
The baler was manufactured by Agritex, a manufacturer of farm equipment. The particular baler involved in the accident was manufactured in 1977.

The baler was a large piece of equipment, measuring approximately 13' in length, 10' in height, and 8' in width, and weighing approximately 4,000 pounds. The unit was powered by the tractor's power takeoff. Every step in the baling process, including forming the bale, wrapping it, and unloading it, is done while the operator is seated in the tractor seat.

The figure shows how the baler operates. As the baler moves (from right to left), material is picked up from the pickup assembly, and fed between the rollers into the baler. A series of nine 4"-wide belts across the width of the baler form the bales. Each belt, starting at point A, goes around the material to be baled, to point B. It then goes back and forth between three pairs of belt tightening rollers in area C. It then goes counterclockwise around the outside of the baler back to point A.

As a bale grows larger, increasing tension on the belt between A and B draws the pairs of belt tightening rollers closer together. Shortening the distance between the pairs of rollers compensates for the longer travel between points A and B. When the bale is fully formed, the rear of the baler at point A is drawn backward (increasing the size of the opening) between points A and B until it is large enough to let the bale drop out.

It appears that the left-most belt on the baler broke at the point at which the two ends of the belt were spliced together. All belts wear out eventually and most of them break at the splice. When the end wrapped around Mr. Bura's arm, it pulled it into the roller marked with an "X", around which the entire belt wrapped.



The Lawsuit

Mr. Bura sued Agritex for failure to install guards on either side of the baler to prevent belts from whipping outside the baler and from drawing things inside the baler. An expert witness testified that the appropriate type of guard could easily be mounted on the baler without interfering with its operation in any way. Indeed, a subsequent model of the same baler has guards installed to prevent just such accidents as occurred. Since the installation of guards is an accepted safety practice, the safety engineer claimd that the design of the Agritex baler involved in the accident was deficient. Mr. Bura entered a claim for $800,000 in damages, including medical bills and loss of income.

Agritex disputed the claim that its design was faulty. First, the company contended that the belt could not have come outside of the baler and drawn Mr. Bura's arm into the machine in the way that Mr. Bura had described. According to the company, no instance of such event having occurred has ever been reported. They claim that Mr. Bura, upon noticing that the belts were not moving, reached inside the baler to free the belt, and it was at that point that his hand became entangled in the belt. Agritex concluded that since the belt could not come out of the machine, no guard was required.

While Agritex admitted that a guard would have prevented a hand or anything else from being inserted into the baler, they claim it was not really necessary, since the moving parts of the baler were an "open and obvious danger." They pointed out that Mr. Bura was experienced in hay baling generally, and the use of the Agritex baler specifically, and was aware of the hazards. Indeed, it was established that he had warned his sons never to leave the tractor and approach the baler with the engines still running. Agritex claims that the accident resulted from Mr. Bura's negligence.

QUESTION

What is the validity of Agritex's contention that no guard was needed because of the obvious nature of the hazard represented by the rollers and moving belts?

A HAY BALER ACCIDENT

Teaching Notes

This case is intended to illustrate the importance of applying all known safeguards to the design of a product. At the time the hay baler in question was designed, the use of safeguards to prevent access to mechanisms that could injure a user was well established. Such guards were installed on balers manufactured by competitors. Management chose to bypass a guard on the grounds that the danger of placing any part of one's person inside the baler was so obvious as to make a physical obstruction unnecessary.

Discuss the need to provide safeguards even when a danger is obvious. Then, go on to discuss the verdict of the court.

Need for Safeguards

The "obvious danger" criterion is appropriate to items in which the hazard is not only obvious but is also essential to use of the item. For example, a sharp edge of a carving knife is not only an obvious hazard but is essential to its effective use. For this reason, manufacturers of knives are not liable for cuts resulting from the improper use of their products.

In the case of the hay baler, the hazard of open access to the inner parts of the hay baler was not essential to its effective operation. In addition to expert testimony that a guard could easily be installed is the fact that Agritex began installing guards on hay balers manufactured after the model involved in the accident. Of course, from the mere fact that the manufacturer improves a design to provide a safeguard does not make the previous design itself deficient. However, the use of guards to prevent access by workmen to hazards such as the "nip points" between belts and rollers was a well-established practice at the time the model in question was manufactured and, as noted, such guards were installed on hay balers manufactured by competitors.

In short, a manufacturer cannot escape responsibility for protecting product users against hazards just because those hazards are obvious, so long as there is an available remedy that does not interfere with the effective use of the product.

The Verdict

The jury found that both parties had contributed to the accident. They held Agritex to be 66% at fault and Mr. Bura 34% at fault. They accepted the $800,000 damages claimed by Mr. Bura, resulting in a judgment against Agritex in the amount of $528,000.

Agritex appealed the verdict on the grounds that the judge should have directed a verdict in favor of the company. They held in their appeal that Mr. Bura's explanation of the accident, i.e., the belt pulling his arm into the machine, was so patently false that the case should not have gone to a jury. The appeals court, however, reaffirmed the original verdict. In doing so they pointed out the following:

- Which of the two explanations is correct—Mr. Bura's or the company's—is for a jury to decide.
- Even if Mr. Bura had inserted his hand into the mechanism, Agritex could be held liable for failure to provide a suitable guard.
- The fact that a hazard is obvious doesn't excuse the manufacturer from providing a guard if such can be done without adversely affecting operation of the equipment.

The Consequences

The award of $528,000 was paid by Agritex's public liability insurance carrier, as were the legal fees. However, the settlement was not without substantial cost to Agritex.

The biggest cost item resulted from the insurance company's decision, immediately after the original verdict was reaffirmed, to discontinue coverage of unguarded hay balers. In order to minimize the risk to the company of damages involving uninsured balers, Agritex launched, through its distributors and retailers,

an information program intended to reach all owners and users of unguarded balers. The information program contained:

- A warning not to reach inside the hay baler, or even stand close to it, while the engine supplying its power (e.g., tractor) is operating.
- An offer to install, without charge, guards on all unguarded balers.

The total cost of the hay baler accident to Agritex can be categorized as follows:

Information Program—The cost of the information program was approximately $68,000. This includes the cost of (1) identifying distributors, retailers, and known owners, (2) preparing public information material, and (3) doing a mail-out.

Installation—Recall programs are always expensive, and Agritex's is no exception. Retrofitting balers with guards will cost about $50 per machine—more than original installation would have. Agritex expects to succeed in recalling about two-thirds of the 3500 balers sold, which amounts to a little over $115,000 in retrofit costs.

Uninsured Balers—The 1100-plus unguarded balers will continue to be a threat to Agritex. Any damages growing out of injuries sustained on the balers would have to be paid for by Agritex. At present, the company doubts that it could even pay an award as high as that given Mr. Bura.

Company Time—The management of Agritex has invested uncounted hours in activities related to the baler accident, including time spent on the initial litigation (e.g., meeting with lawyers) and that devoted to designing and monitoring the public information and recall program. A conservative estimate is that at least $100,000 will have been spent on these activities.

PUNCH PRESS ACCIDENT

Case Study

A worker lost his right hand in a punch press when it descended unexpectedly while he was cleaning out metal scrap. Safety procedures designed to prevent such mishaps were not observed.

The Punch Press

The punch press involved in the accident was used by Chalmers Electronics in the manufacture of metal chassis for their radio and television equipment. Pieces of sheet metal are inserted into the press. The upper part of the press, or ram, descends and punches impressions and cutouts in the metal. The shapes of the impressions and cutouts are controlled by dies, one in the lower part of the press, and one in the ram. The same press was used in making a number of parts, the dies being changed for each part to be made.

After several cycles of punch press operation have been run, pieces of metal punched out of the sheet accumulate in the bottom of the press. They must be removed in order that new pieces of metal inserted into the press can be properly aligned.

Safety Devices

The hydraulic power system that drives the ram is capable of supplying 60 tons of pressure to punch impressions and cutouts in the sheet metal. To prevent injury, two safety devices are employed:

Dual Activation Buttons—The press may be activated by pushing buttons on each side of the press. Both must be pushed before the press will operate. The fact that the operator must use both hands to activate the press prevents activation while either hand is inside the press.

Pullbacks—When the hands must be used during the punching operation, the press may be operated by a foot pedal. Pullbacks are a pair of metal arms with cables that attach to the operator's wrists. When the press is activated, the metal arms and cable pull the operator's hands away from the point of operation.

Whatever activation system is used, buttons or foot pedal, is controlled by switches inside a locked control box located on the side of the press. The supervisor or "lead man" keeps the keys to the control box and switches between button and pedal operation as needed.

Decals are attached to the side and the face of the machine warning the operator not to operate the press with the pedal unless the safety guards are in place and properly adjusted.

The Accident

The injured employee was Irving Bemis. He began working at Chalmers on February 23, 1983. On the day of the accident, March 4, he was working on a punch press for the first time. He had been given instruction by Clayton Rogers, the "lead man" in the machine shop. It was Roger's job to instruct new employees on the proper operation of all equipment within the machine shop. Mr. Rogers ran two pieces of metal through the press and removed the debris. The demonstration took about three minutes.

At the time of the accident, the press was set up to operate with the foot pedal. However, no guard was attached to the machine. After about five hours of operation, Mr. Bemis had just finished punching out three pieces of material and had reached inside the press to remove scraps of metal. While his right hand was inside the press, the ram suddenly descended, crushing his right hand. He lost his index and next two fingers, while the remaining two fingers were partially crushed.

Causes of the Accident

The accident was thoroughly investigated by the Chalmers plant manager and a representative of the insurance company. The insurance company representative's report attributed the accident to:

- Unexpected and unintentional activation of the press.
- Failure of Bemis to employ the "pullbacks" provided.

Activation of the Press

What caused activation of the press was not determined for certain. Bemis claimed that he had not touched the foot pedal. His claim was supported by a co-worker, who just happened to be observing him at the moment the accident occurred.

According to several employees, the particular press with which Bemis was working "had problems." No one could recall an instance of a totally uninitiated cycle of operation such as described by Mr. Bemis. However, on several occasions, the press "double-tripped," meaning that the ram descended twice in rapid succession. This in itself was not hazardous since it would have been impossible for an operator's hand to be inserted in the machine in the 1/6th of a second between the two cycles. Nevertheless, the problem had been reported to Mr. Rogers.

Failure to Use "Pullbacks"

Mr. Bemis claimed not to have been told about the pullbacks. Mr. Rogers said that he always instructs the workers in the use of pullbacks, but admitted that he may have overlooked it in the case of Mr. Bemis. He also mentioned that punch press operators generally prefer to operate in the foot pedal mode without pullbacks because both the dual buttons and the pullbacks tend to interfere with their operation and slow them down. He has not prohibited this practice.

Accident Cost

Mr. Bemis' medical bills, and compensation for his disability, was covered by workers' compensation. However, Chalmers sustained a significant loss of unreimbursed work time. These work time losses break down as follows:

The Victim—It was three weeks before Mr. Bemis could return to work. Upon his return, an effort was made to retrain him in other jobs. This proved unsatisfactory, and he left a month after returning. Three weeks of lost time and another month of relatively unproductive activity represents a loss of approximately $2,000.

Co-workers—The accident caused a complete cessation of work for the remainder of the day among the 15 employees of the machine shop. About half of the second day was lost in discussions of the accident and interviews of co-workers by plant and insurance personnel. A conservative estimate of the cost of lost work time is approximately $900.

Administration—Administrative activities stimulated by the accident included (1) investigation of the accident, (2) processing of medical payments and insurance, (3) discussion of the accident and its causes by management. While the cost of lost administrative time is very difficult to estimate, a conservative estimate would be in the neighborhood of $2,000.

In addition to lost work time, the accident resulted in an increase in Chalmer's workers' compensation premium. Of its premium, $1700 can be associated with liability for the injury to Bemis.

Question

Assume that you have been assigned by Chalmer's management to identify "lessons learned" from the accident and to recommend changes that will prevent future accidents. Based upon what you know, what could you recommend?

PUNCH PRESS ACCIDENT

Teaching Notes

The student's answer to the question should focus upon action at the management level to improve the overall safety program. The Bemis accident reveals a number of shortcomings in Chalmer's operations so far as safety is concerned. Overcoming these deficiencies would require action at the management level. Recommendations should address:

- Training
- Supervision
- Operations
- Accident reporting

Training

The three minutes of instruction received by Bemis is totally inadequate for a potentially dangerous piece of equipment like a punch press. It points to a lack of any formal training policy or program. A set of training requirements should be established for each item of equipment operated and/or maintained by Chalmer's employees. This is particularly critical for equipment with the injury potential of a punch press. However, it is needed for all equipment items.

In addition to the potential danger involved, inability to operate and maintain equipment properly results in damage to equipment and products that far exceeds the cost of injuries. Most of these costs are hidden in repair bills and in products that are rejected or returned for defects.

Supervision

If the quality of supervision exercised by Mr. Rogers is any indication, Chalmers has a problem in this area. The punch press could have been converted from button to pedal operation only by Rogers or with his knowledge. He must have been aware of the importance of using the pullbacks. Yet he provided Bemis no instruction in use of the pullbacks, nor did he take any action when he saw that Bemis was operating the press without attaching pullbacks.

There is no way of knowing why Rogers didn't exercise more concern for his employees' safety. Since the safety devices interfere somewhat with the production operation, his failure to insist upon their use probably reflects priority of productivity over safety. This is not an uncommon occurrence. Unless management expresses a strong concern for safety, and evidences this concern in the way it monitors and evaluates supervisors, safety frequently will take a back seat to production.

Recommendations for improved supervision could include formal supervisor training in hazards and safety equipment as well as frequent meetings between supervisors and management to discuss safety problems and needs.

Operations

The punch press used by Chalmers is a curious device. To prevent the device from being activated while the operator's hands are inside the press, the manufacturer employed dual activation buttons and pullbacks. Yet, it allowed the safeguard to be subverted by lack of an interlock that would have prevented the pedal from activating the press when the pullbacks were not in use. The blame for this situation must be attributed to management. It had as options:

- Purchasing a different punch press with a truly foolproof point of operation guard.
- Installing an interlock to prevent operation in the pedal mode without attachment of pullbacks.
- Locking the punch press permanently in the dual activation mode.

A more concerned and insightful management might have gone one step further and installed devices that would cut off power to the press while the operator's hands were inside. This would not only prevent

accidents due to activating the press at the wrong time, but any accidents due to the "spontaneous" activation claimed by Bemis.

An appropriate recommendation would be that management establish a policy of examining all equipment items for appropriate safeguards at the time of and subsequent to their purchase.

Reporting

There is evidently no formal procedure for reporting such incidents as the "double-tripping" of the punch press reported by several employees. Apparently Mr. Rogers decided that no action was necessary, since double-tripping by itself would not result in injury. Had it been reported, however, someone technically qualified might have recognized double-tripping as a symptom of a malfunction that could ultimately lead to some other problem, such as the spontaneous activation claimed by Mr. Bemis.

An appropriate recommendation would be institution of a policy requiring (1) immediate reporting of any malfunctions, (2) immediate inspection to see if the malfunction is potentially dangerous, and (3) insuring that any equipment with potentially dangerous malfunctions are immediately placed out of service.

PURCHASE OF GRINDING MACHINES

Case Study

A small products fabrication company is considering the replacement of its 12 grinding machines with new, semi-automatic machines that will speed up the production process. The safety director has recommended that the new machines be equipped with plastic shields that will prevent flying particles from striking the operators of the machines. He pointed out that, last year, there were 29 injuries to operators of grinding machines attributable to flying particles. He estimates that 90% of these could have been avoided with the installation of plastic guards.

Benefits and Costs

In considering the purchase of new grinding machines, the company's procurement manager had the following estimates of costs and benefits.

- The semi-automatic machines will cost $8,000 per unit.
- Installation of guards will cost an additional $800 per machine.
- Each machine will last ten years and have no salvage value thereafter.
- Depreciation is on a straight-line basis.
- The annual additional productivity from the new machines, without guards, is estimated at $4,000 per machine.
- Because a guard interferes somewhat with the operation of the machine, the estimated annual additional productivity of the machine with guard is estimated at $3,900.
- Income will be taxed at a rate of 50%.
- Annual costs of accidents for unguarded machines is as follows:

Cost Item	*Cost*
Workers' Compensation (estimated share of liability)	$4,531
Medical Payments (first aid, medical bills)	5,355
Lost time:	
Injured worker	3,347
Administration (supervisor, personnel department)	640
Co-workers (estimated)	333
Production loss (estimated):	
Interruption of work by the accident	449
Reduced output of replacement worker	242
Reduced output of returning worker	406

Question

Based upon the information just provided, is the installation of guards on the new machines a good investment?

In answering this question, determine the average annual percent return on each machine. Compare the annual percent return of guarded machines with unguarded machines.

PURCHASE OF GRINDING MACHINES

Teaching Notes

To determine the advisability of purchasing new machines, and whether to purchase them with or without guards, students were asked to calculate the average annual percentage return on a per-machine basis. These values may be calculated as follows:

Grinding Machine Without Guard

Additional cash revenue		$4,000
Accident costs (15,303 ÷ 12 machines)		−1,275
Before-tax net cash flow		$2,725
Income tax		
Before-tax net cash flow	$2,725	
Depreciation ($8,000/10 years)	−800	
Taxable income	$1,925	
Income tax (50%)		963
After-tax net cash flow		$1,762

Annual percent return of a $1,762 net cash flow on an initial investment of $4,000 = 17.6% ($4,000 ÷ $1,762 = 4.54, which corresponds to 17.6% in a Table of Present Value).

Grinding Machine With Guard

Additional cash revenue		$3,900
Accident costs (10% × $1,275)		−128
Before-tax net cash flow		$3,772
Income tax		
Before-tax net cash flow	$3,772	
Depreciation ($8,800/10 years)	−800	
Taxable income	$2,892	
Income tax (50%)		1,446
After-tax net cash flow		$2,326

Annual percent return of $2,326 net cash flow on an initial investment of $8,800 = 28% ($8,800 ÷ $2,326 = 3.11, which corresponds to 28% in a Table of Present Value).

In making the calculations shown, accident costs were obtained by adding up the individual costs in the table provided to the students and dividing by the number of machines to obtain a cost per machine. This worked out to be an estimated $1,275 per machine, based upon previous years' experience. Accident costs for a grinder with a guard would be 10% of the cost of guarded machines, since the guard is expected to reduce accidents by 90%. This works out to $128 per machine.

Annual average percent return per machine is obtained by dividing the annual after-tax net cash flow by the initial investment and entering a Table of Present Value with the resulting quotient. The results, as indicated, show an average annual return of 17.6% for the grinders without guards and 28% for grinders with guards. It is evident that the reduction in accident costs achieved by installation of the guards more than makes up for the increased cost of the guards and the slight decrease in productivity. The grinder with guard is clearly the better purchase.

SAFETY PROGRAM IN THE HIGHWAY CONSTRUCTION INDUSTRY

Case Study

As road construction slumped in the late 70's and early 80's, a large northwest highway construction firm sought to reduce its costs. One of the cost areas attacked was accidents. With the help of the state safety agency, an analysis was made of accidents and safety hazards. A safety program was instituted to reduce the number and severity of accidents.

The Company

Anderson & Connell is a large highway construction firm based in Portland, Oregon, with highway construction projects in the states of Oregon, Washington, Idaho, California, and Nevada. The company employs some 240 people. Revenues for 1982 were $36 million. This down by $3.2 million from the year before, and $12.6 million from the peak year, 1977.

With the reduction in its volume of business, Anderson & Connell was forced to cut the size of its work force, which approached 290 employees in 1977. However, with the prospect of increased highway maintenance, funded by the nickle-a-gallon gasoline tax passed in 1982, the company was anxious to retain as much of its experienced work force as possible, and to keep its inventory of operating equipment as close to its current level as possible.

Accident Costs

In examining costs for the year, 1982, an analysis of those resulting from accidents was made with the assistance of a representative from the State Safety Regulation Bureau. The results may be summarized as follows:

No. of lost-work-time accidents	83
No. of individuals involved in accidents	190
No. of lost workdays	1,495
Costs:	
Wages, lost work time	$148,902
Medical bills paid	74,639
Administrative time	51,485
Total uninsured costs	$275,026
Workers' Comp. Premiums	142,398
Total accidents costs	$417,424

These were only the readily identifiable costs and did not include such "intangible" costs as:

- Time lost, work time or other time of other employees until the injured worker returns or is replaced.
- Supervisory and management time spent dealing with the accident (e.g., investigation).
- Company overhead on lost work time.

These additional costs easily brought the total cost of accidents up to well over half a million dollars.

Safety Program

Anderson & Connell has never had a formal safety training program. The personnel manager is responsible for preparing and maintaining accident reports. However, no use has ever been made of these reports. They are there solely to satisfy state occupational safety and health requirements. Their offices were visited by a state OSH inspector once, as was one of their work sites. They received about a half dozen citations

but paid less than $200 in fines. The personnel manager expressed the opinion that "it's probably a lot cheaper to pay the fines than to follow around everybody trying to prevent the kind of violations they found."

Despite the lack of a formal safety program, Anderson & Connell has not had a fatal accident or an accident resulting in a permanent disability over the close to 15 years that accident records have been kept. They attribute their lack of really serious accidents to their policy of maintaining an experienced core of supervisors, rather than hiring new people for each job. They feel that their supervisors are very "safety conscious" and have the experience to be able to anticipate most job hazards and take steps to prevent accidents from occurring. Until the present cost reduction effort was launched, no one had expressed any concern about accidents.

Nature of Accidents

To help gain insight into the causes of accidents, an analysis was made of the characteristics of accidents as obtained from accident report forms. The results appear on the next page. Examine them carefully before attempting to answer the question.

ANDERSON & CONNELL
ACCIDENT EXPERIENCE
1982

Nature of Injury	
Foreign body in eye	12
Hernia	1
Poisoning	1
Burn, scald	5
Bruise, crush	45
Cut, scratch, puncture	24
Dislocation	1
Fracture	9
Inflammation, dermatitis	6
Multiple injuries	83
Strain, sprain	83
TOTAL	190

Accident Type	
Caught in, under, between	36
Exposed to temp. extremes	1
Fall on same level	11
Fall to different level	19
Lifting/overexertion	55
Slip (no fall)	4
Struck against	23
Struck by	35
Touched, absorbed, inhaled	6
TOTAL	190

Part of the Body	
Abdomen	4
Arm	17
Back	47
Chest	4
Eye	14
Finger	20
Foot	10
Internal body systems	3
Hand	18
Head, face, nose, ears	10
Joint	24
Leg	10
Neck	4
Toe	5
TOTAL	190

Source of Injury	
Animals, insects	4
Bldgs., environment, surfaces	25
Chemicals, minerals	10
Containers, boxes, barrels	17
Equipment, vehicles	55
Hand tools/powered/unpowered	29
Ladders, lifting devices	15
Machines, fire, smoke	11
People	1
Plants, vegetation	9
Scrap, debris, particles	14
TOTAL	190

Question

Based upon the accident information presented, what safety measures will have the greatest effect upon cost reduction? In answering this question, identify:

1. The most frequent types of accident.
2. The most likely causes of these accidents.
3. The steps most likely to remedy those causes.

SAFETY PROGRAM IN THE HIGHWAY CONSTRUCTION INDUSTRY

Teaching Notes

The safety measures provided by students should be specific to the type of accidents and injuries sustained by workers at Anderson & Connell. Such catch-all safety measures as "better training" or "closer supervision" don't evidence any use of the accident data.

The most common types of accidents, causes, and prospective remedies are described below.

Strains

The most frequent type of injury, as listed under "nature of injury" is strains and sprains, which accounted for 83 of the 190 accidents. Under "accident types," the most common type of accident involves "lifting/overexertion." It is likely that almost all of the "back" injuries involved strain. It is likely that many of the arm, joint, and leg injuries fall into the same category.

Because of the slow rate of recovery from strains, they generally account for an even larger share of lost work time than the sheer number of accidents would suggest. They are by far the leading source of workers' compensation claims. Yet, because they are less dramatic than other types of accidents, and often do not become fully debilitating until some time after the precipitating event, they tend not to be noticed by management. For this reason, efforts to correct situations leading to strain receive far less attention than the incidents of the particular injury would warrant.

Most instances of strain result from attempts to lift, push, or pull heavy objects. Sometimes the attempts involve improper techniques for lifting or moving the object. In other cases it is simply too heavy to be moved without equipment.

Steps that may be taken to reduce the incidence of strain, particularly back strains, include the following:

Training—Providing instruction in proper methods for moving heavy objects, including:

- Techniques for lifting, pulling, and pushing.
- Breaking large loads into several smaller loads.
- Use of appropriate equipment (e.g., dollies, forklifts).

Selection and Replacement—Some people should not be placed in jobs requiring attempts to move heavy objects. At a minimum, employees should be interviewed to screen out those who lack strength or have conditions likely to be aggravated by lifting or pulling, such as back problems, dislocations, "trick" knees, etc.

Supervision—Calling upon supervisors to observe procedures employed by workers and intervening when they are using improper techniques. A program of supervisor training is needed to convince supervisors of the importance of both the procedures and their role in enforcing them.

Information—Using posters and decals in areas where lifting takes place to acquaint and remind workers of proper methods.

Equipment

Under "source of injury," the category "equipment" is the largest source of accidents. Some of these are lifting accidents. But others probably involve the "caught in, under, between" type of accident and cause the "bruise, crush" type of injury. Causes of these accidents and ways of preventing them include the following:

Machinery—Where there is open access to moving parts, workmen are often injured when they accidentally place their hands or feet inside the machinery. This can be prevented by the use of machine guards to physically prevent access.

Vehicles—Many accidents involve trucks, forklifts, and other construction equipment.[1] Their incidence can be reduced by (1) use of mirrors to improve visibility, (2) avoiding vision-restricting loads, and (3) use of audible backing signals.

The various preventive measures described are best effected when equipment and vehicles are first purchased. Whoever is in charge of procurement needs to be aware of the potential hazards represented by different items and the safeguards available to overcome these hazards. It would also be worthwhile to have a consultant survey the existing equipment inventory to identify hazardous conditions requiring correction.

Surface Injuries

The category "cut, scratch, puncture" is the third most common type of injury. Many of these accidents could be prevented by requiring use of protective clothing when working around sharp objects. These include heavy-duty gloves, safety shoes, and making sure that the arms and legs are covered. A somewhat related injury is "foreign body in the eye," which can be almost entirely prevented by the use of safety glasses where cutting or grinding operations are going on.

The cost of providing protective clothing and equipment is small in comparison with the cost of injuries resulting from failure to provide the protection. Supervisors must also be trained in the importance of wearing protective equipment so that they will be more likely to enforce its use.

Another way of reducing loss associated with minor injuries is by having some portion of the work force qualified in administering first aid. While knowledge of first aid is desirable in dealing with any kind of accident, it is particularly useful in keeping minor injuries from becoming more severe. And, it is particularly desirable in the construction industry, where injuries typically occur at remote locations, some distance from treatment facilities.

Falls

Falls accounted for a total of (11 + 19 =) 30 accidents. Injuries from falls are quite common in the construction industry. Falling from a different level is obviously the more serious of the two categories of accidents. Actions that can be taken to prevent falls include:

- Putting railings on platforms and walkways
- Cleaning all walk surfaces of anything that could cause workers to slip or trip (e.g., oil, tools, snow, etc.)
- Providing foot scrapers for removal of mud, snow, etc.

[1] Accidents involving automobiles are recorded as traffic accidents rather than occupational accidents.

UNSTABLE CRANE

Case Study

A crane was lifting steel beams to the top of a building when it became unstable and turned over. While no one was seriously injured, the crane boom was heavily damaged, resulting in intensive loss and delay of schedule.

The Construction Operation

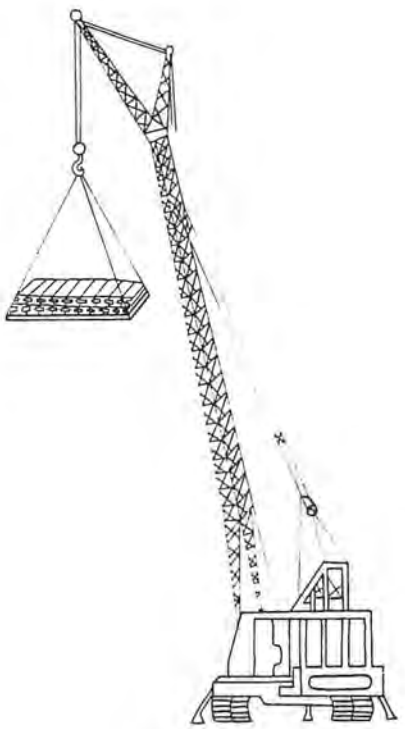
The Stearman Company of Des Moines, Iowa, is a 15-year old steel erection firm. A medium-size company, as steel erection firms go, it employed, on a regular basis, some 40 employees, including foremen, hook-on men, connectors, plumb-up men, a bolt-up crew, a deck crew, welders, and office personnel. The regular crew was augmented by as many as 30 temporary workers, brought on as the need required. Its annual revenues range from $1.25 million to $1.75 million over the past ten years.

The Accident

On September 13, 1982, Stearman was doing the steel work for a six-story college dormitory. Their work was nearing completion. A crane was lifting steel beams on the top of the building to form a platform upon which an air conditioning unit would rest.

The crane with which the work was being done was a self-propelled, tracked unit with a 180' boom. The crane was properly positioned for the operation. It had hydraulic outriggers on four sides and the outrigger pads were properly leveled. The crane was being operated by a crane operator and oiler, each of whom was experienced in his job. The crane operator had been employed by Stearman for the past ten years.

The accident occurred toward the end of the day. The last two loads of beams were to be hoisted and placed in a position approximately 80' from where earlier loads had been placed. It required that the boom be tilted at an angle that was close to the limit of safe operation.



Ordinarily, the crane would have been respositioned to permit the boom to assume a more vertical angle. However, it was late in the day, and there were only two more loads to lift. Moreover, the entire project was two months behind schedule and the crew was under considerable pressure to move quickly so that the concrete could be poured and the shell completed before cold weather set in.

Because the angle at which the boom would be positioned was still within a safe operating range, the crane operator agreed to lift the load without repositioning the crane. In doing so, he kept a careful eye on the "boom indicator" to make sure the boom's angle did not exceed what was safe. Dividing his attention between the boom indicator and the load, the crane operator allowed the load to get too close to the edge of the building and the beams struck the side of the building causing the cable to oscillate. The motion was transmitted to the boom, causing it to oscillate along its entire length. The result was that the crane became unstable and toppled over. When it did, the boom fell across two construction trailers parked at the construction site. The boom was so severely damaged as to be unsalvageable. One of the construction trailers was demolished and the other severely damaged. Fortunately, the crane operator was securely belted to his seat and did not sustain any injuries.

Accident Costs

The boom represented a $30,000 loss. Replacement of one trailer and repair of the other totalled $22,000. These losses were covered by insurance. However, the accident was not without its cost to Stearman.

On the day following the accident, Stearman management found that it would require a minimum of 30 days to obtain a replacement boom. In the meantime, the only solution was rental of a crane at $860 a day. While Stearman only had five days left on the dormitory job, they were scheduled to move immediately to a bank building construction site. This meant continuous rental of a crane until the replacement boom was obtained. Rental of the crane for 30 days (assuming the replacement boom arrived on time) totaled $25,500.

Because of the accident, the rental firm would only make the crane available to Stearman with its own operator ($125 a day) and oiler ($80 a day) for an additional $6,150. Rental cranes are in short supply during construction season, particularly in Des Moines, and Stearman had no alternative but to accept.

Safety Problem

Five days following the accident, Stearman was notified by its insurance carrier that its equipment, workers' compensation, and public liability insurance would be canceled unless the company took steps to improve its safety of operation. This was not Stearman's first crane accident. There had been three instances of cranes being toppled during the previous four years. While the earlier accidents were not as costly as the most recent one, they resulted from the unsafe work practices of Stearman employees. In all three accidents, the crane was being used to "walk" loads, that is, the load was hoisted and moved from one place to another by the crane operating on its tracked wheels. In this mode of operation, the outriggers cannot be used and the crane becomes very unstable. An outward swing of the load is enough to topple the crane. This is what happened in all three cases. And in all cases the accident caused delay in the work being performed.

Stearman has also experienced more than its share of injury accidents. Its accident severity rate (number of lost days per 200,000 hours of exposure) has averaged approximately 168 over the last year, over half again the industry-wide average.

Because of its accident history, and its record of delay in completing work, Stearman does not enjoy the best of reputations among construction firms. Stearman management believes that it has been a factor in several bids that Stearman has lost. While management has been concerned about accidents, it was not moved to examine their safety program until threatened with cancellation of insurance.

Question

What steps would you take, at the management level, to prevent accidents such as the one described. In your answer, try to outline elements of a general safety program rather than specific remedies to the problem of overturning cranes.

UNSTABLE CRANE

Teaching Notes

In reviewing this case study, it is important to help students to understand the need for a program that will address safety generally, not just prevent specific accidents from recurring. Coming up with "fixes" for yesterday's accidents will not prevent tomorrow's losses. Accidents are symptomatic of an underlying safety problem which must be addressed in its entirety if accident loss is to be reduced.

The following areas have been fruitful for reduction of work-related accidents.

Supervision

The front line of accident prevention is supervision, particularly where the work takes place at remote sites out of the direct control of higher management. A supervisor who is aware of the dangers involved in operating a crane near its limits of safety would have required that the crane be moved to an appropriate position before hoisting the last of the steel beams. Attempts to improve supervision would include formal training, to acquaint supervisors with job hazards and ways of dealing with them, as well as informal meetings where supervisors can share their experiences with safety problems and their resolutions.

Training

Workers cannot be expected to become fully acquainted with hazards of their jobs without some form of instruction. Because accidents are rare events, even the most experienced workers may not be fully aware of the hazards to which they are exposed. For example, the crane operator involved in the accident described may never have had an opportunity to learn the effect of an impact upon the crane's stability when stability is already marginal because of the boom angle. Workers who have been instructed in safe operating procedures are more likely to observe them if they know the hazards they are intended to prevent.

Selection

Technology has not yet found valid methods of distinguishing safe from accident-prone workers. However, research has shown a definite tendency for inexperienced workers to be over-involved in work-related accidents. This has encouraged many companies to establish a policy of employing only experienced workers in jobs involving potential danger.

Worker Protection

While some accidents involve worker error, it is often easier to protect workers against their errors than to try to eliminate the errors themselves. At construction sites, such protection includes (1) railings on stairs and elevated platforms to reduce the likelihood of falls, and (2) the use of audible signals to warn of danger (e.g., backing vehicles), (3) provision of safety equipment, including helmets, goggles, shoes, gloves, and (4) covered areas to protect workers from falling debris, tools, rain, or snow.

Accident Data

While safety programs must do more than address the accidents that have occurred in the past, a knowledge of those accidents can help reveal fundamental deficiencies in a safety program. Every accident should be recorded, along with information pertaining to its causes, the conditions under which it occurred, the characteristics of the work involved, location and equipment, and other associated variables. With the aid of computers, accumulated data can be analyzed to identify major trouble spots.

THE VINYL CHLORIDE HEALTH HAZARD

Case Study

Three employees of a plastics manufacturer initiated a suit against their employer and the chemical company supplying the vinyl chloride used in the manufacturing process. They claimed that the companies had knowingly exposed them to health hazards resulting in debilitating diseases, which may prove fatal in at least one case. The defendants settled out of court for $3.2 million.

The Vinyl Chloride Hazard

Vinyl chloride is a gas consisting of ethylene and chlorine which can be converted by pressure and heat into a resin called polyvinyl chloride (PVC). At the present time, PVC is the second-most widely used plastic in the United States. Over $65 billion is spent in the manufacture of plastic products employing PVC.

The first inkling that vinyl chloride constituted a health hazard came from a group of Russian scientists who discovered workers engaged in processing PVC into finished products suffered an unusually high rate of bronchial and liver defects. In the 1950s, studies in several European countries showed that workers handling PVC were subject to a variety of skin and circulatory disorders. On the basis of these findings, the Manufacturing Chemists Association (MCA) recommended that exposures be limited to 500 parts of vinyl chloride per million parts of air (500 PPM).

In 1961, Dow Chemical discovered liver damage in laboratory animals exposed to 100 PPM of vinyl chloride and reduced exposure in its plants to 50 PPM. A study in the early 1970s associated the presence of vinyl chloride in the air with malignant tumors in test animals. Then in 1973, Dr. Cesare Maltoni of the Italian Institute of Oncology presented evidence of malignant tumors (including angiosarcoma) in the livers of rats exposed to levels of vinyl chloride as low as 250 PPM.

In August 1974, the National Institute for Occupational Safety and Health (NIOSH) reported that studies had found that death from liver cancer among workers exposed to vinyl chloride occurred 12 times more often than would normally be expected. On the basis of this finding, the Occupational Safety and Health Administration (OSHA) established an Emergency Temporary Standard (ETS) of 50 PPM. Only two weeks later, however, an independent laboratory found that mice exposed to vinyl chloride levels of even 50 PPM developed angiosarcoma. OSHA responded by proposing a permanent regulation requiring "no detectable" worker exposure to vinyl chloride. In 1975, this was relaxed somewhat to a ceiling of 1 PPM on a time-weighted average for eight hours, with a ceiling of 5 PPM for any 15-minute interval.

The Manufacturer

The three workers who initiated the lawsuit were employed by Sterling Products, a manufacturer of novelty items for the home and for automobiles. The firm was founded in 1913 and operated primarily as a mail order house. It was among the first manufacturers to recognize the potential of plastics and by the mid-1950s had converted almost entirely to the manufacture of plastic products. It also began to market its products through retail chains rather than mail order. During the 1950s and 60s business expanded rapidly. By 1970, the company employed some 415 workers in a newly-built plant. Its sales for the fiscal year 1970 were slightly over $20.7 million.

Sterling Products buys its polyvinyl chloride from Mid-America Chemical, a 50-year old firm located in Hammond, Indiana. The firm grew rapidly during World War II, primarily through the manufacture of butylene, a substance used in the production of artificial rubber. Throughout the 1950s and 60s, it gradually expanded into the development of a wide range of chemical products. Its gross revenues have consistently topped $40 million for each of the last five years.

Response to Health Hazard

The management of Mid-America first learned of the potential hazard posed by polyvinyl chloride through the Manufacturing Chemists Association in 1973. The information was passed along to all of the manufacturers to which it sold PVC. The management of Mid-America decided that the results were "not suffi-

ciently conclusive to warrant any change in the MCA-recommended standard of limiting vinyl chloride exposure levels to 500 PPM," a conclusion that was also passed along to its customers.

When OSHA established its proposed standard of "no detectable levels" followed by the permanent ceiling of 1 PPM and 5 PPM, both Mid-America and Sterling joined the large numbers of companies protesting the standard as being unrealistic. The posture of both companies was that exposure levels as low as those required simply could not be realized, and that substantial reductions from the 500 PPM level would be so costly as to put them in jeopardy of going out of business.

While actively resisting the OSHA standard, Sterling made some attempt to reduce exposure to vinyl chloride through more effective ventilation. However, no major changes in the production process were made. The company rejected a consultant's suggestion that workers be required to wear respirators as protection.

In 1979, at the instigation of the labor organization representing Sterling's plastic workers, an employee complained about the lack of safeguards to counteract the vinyl chloride health hazard. An inspector from the Occupational Safety and Health Administration took air samples and cited Sterling for failure to comply with OSHA standards. Sterling contested the citation on the grounds that (1) the presence of a health hazard was not adequately demonstrated, and (2) the standards posed by OSHA could not be met. Sterling was required to pay a total of $1500 in fines and to come up with a plan for controlling PVC exposure. At this point, Sterling management initiated a policy of requiring use of respirators as they attempted to reduce levels of PVC.

The Law Suit

In November of 1983, three Sterling employees filed claims against Sterling and Mid-America for a total of $3.2 million for disabling illnesses they claim resulted from exposure to vinyl chloride. One worker had a lung disorder making it impossible for him to breathe normally. The second worker's wife had suffered one miscarriage and one stillbirth. The third worker was diagnosed as having an inoperable angiosarcoma. All attributed their illnesses to their exposure to PVC, citing evidence from studies associating all three incidents with high PVC exposures.

In their suit, the workers claimed that both Mid-America and Sterling had been aware of the hazards represented by PVC since 1974 and had neither made a significant attempt to correct the problem nor notified their employees as to the hazard represented by PVC. While they admitted their exposure to PVC had predated the discovery of the health hazard, they claimed that immediate action to reduce vinyl chloride levels, and compliance with the OSHA standard once it was imposed, would have reduced the likelihood that their particular afflictions would have occurred. In response to the claim of Mid-America, Sterling, and others that OSHA standards could not be met, they pointed out that, as early as 1975, the Goodrich Company had reduced vinyl chloride exposures from 1 to 3 PPM in their various plants.

The defendants, Sterling and Mid-America, contended that the link between vinyl chloride and the workers' afflictions had never been conclusively proven. They claimed that, by complying with the MCA standards of 500 PPM, they were doing all that a responsible manufacturer could be expected to do. The cost of attempting to meet the OSHA standards, they maintained, would have been impossible to recoup through additional revenue. In the case of Sterling, which had no products other than those manufactured with PVC, the result would have been bankruptcy. Finally, they pointed out that all of the illnesses associated with PVC have involved people who had been working with the substance for great many years. They contended that the specific instances in question could have had their origins in the period prior to discovery of any link between the particular illnesses and vinyl chloride.

Problem

If you were on the jury hearing this case, how would you assess the liability of Sterling Products and Mid-America for the illnesses of the three workers? Consider the following issues and address each in your answer:

- The responsibility of the two companies to notify employees as to the hazard threat at the time a relationship between PVC and the various illnesses was discovered.

- The adequacy of data on the relationship between PVC and illnesses to justify attempts to reduce the level of vinyl chloride.
- The cost of meeting the OSHA standard.
- The relevance of the OSHA standard to the employees' claim.
- The duration of the workers' exposure before and after the hazard was discovered.
- The relevance of the ability of Goodrich and other companies to meet the OSHA standard.

THE VINYL CHLORIDE HEALTH HAZARD

Teaching Notes

The purpose of this case study is to help students to fully understand the responsibility of management to avoid conditions that will lead to illness on the part of employees who are manufacturing their products or ultimate users of the products. The past decade has been characterized by a quantum increase in the number of suits lodged against employers and manufacturers from illnesses resulting from unhealthful working conditions and products. Because of the extent of disability involved, and the numbers of workers affected, the costs to companies found to be liable are extremely large. Multimillion dollar awards are not uncommon. Several otherwise "healthy" companies have been forced into bankruptcy because of their inability to withstand claims arising out of illnesses to employees and customers.

The specific issues addressed in the questions are intended to help students understand the responsibilities of a business organization for preventing product- and work-related illnesses. The information is provided to help guide discussion of each issue.

Responsibility to Notify

A manufacturer is responsible for notifying prospective users of any potential risk in using the product. Mid-America notified Sterling Products management. However, the ultimate users are the employees. A warning should have been posted on PVC containers apprising anyone handling the product of the risk that such entails.

The duty to notify does not require conclusive proof of danger. Where there is an element of doubt involved, warnings should cite the evidence available, allowing users to decide whether the possible risk is worth taking.

Adequacy of Evidence

The fact that PVC workers have a much higher incidence of various diseases than others is not conclusive proof that PVC causes the illnesses. However, when it comes to health and safety standards, "weight of evidence" is a more appropriate criterion than conclusive proof. As OSHA stated when it imposed the permanent standard, "We cannot wait until indisputable answers. . .are available, because the lives of employees are at stake." The weight of evidence certainly pointed to a connection between PVC and the three health problems of the workers who initiated the suit.

Cost of Reducing Hazards

The long-held idea that hazards can be tolerated if the cost of eliminating them is too great is an idea that has been rejected increasingly by courts and the general public. First, they have become skeptical of manufacturers' claims that attempts to meet safety and health standards will put them out of business. Such rarely proves to be the the case (nor was it the case in meeting PVC standards). Second, there are generally some interim steps that can be taken without prohibitive costs, such as the use of respirators.

Relevance of Standard

Failure to meet a standard does not make a manufacturer or an employer liable for claims related to a purported hazard, nor does complying with standards absolve them of liability. However, courts are inclined to accept standards defining safe practice. Companies are not expected to be able to prevent all injuries and illnesses whatsoever to employees, customers, or users of its products. They are expected to make reasonable efforts to do so. Complying with a government standard is generally, though not always, considered evidence of a reasonable effort.

The role of standards as defining a reasonable effort only applies to those standards that have public acceptance. Standards established by an industry itself rarely have this acceptance unless they have been endorsed by some independent group. Otherwise they are likely to be viewed as self-serving. This is certainly the case where industry standards are in conflict with those developed by government or other independent agencies, as were the MCA standards after permanent OSHA standards had been established.

Duration of Exposure

It is quite possible that the employees' illnesses began prior to the discovery that PVC represented a health hazard. Certainly, neither Sterling nor Mid-America can be held responsible for failure to address a problem that no one knew existed. Had the companies attempted to eliminate the PVC hazard when it was first discovered, the court would have been likely to consider the illnesses to have resulted from pre-existing conditions, or at least conditions beyond the control of the companies. However, by failing to take action, the defendants left themselves vulnerable to the claim that the conditions arose, or were at least aggravated by exposure to PVC after the hazard had become known.

Relevance of Goodrich

The fact that Goodrich was able to reduce vinyl chloride exposure drastically, ultimately achieving the OSHA standard, seriously undermines the defendant's case that the OSHA standard was unrealistic. In evaluating the practices of a particular manufacturer, courts frequently use the practices employed by other manufacturers to define what is "reasonable." For example, in evaluating whether a manufacturer could have anticipated the need for a particular safeguard, they will frequently look to see if the safeguard is used by other manufacturers. It would have certainly been to the defendants' advantage to have consulted a cross section of manufacturers and users of PVC rather than simply listening to those who were actively resisting the standard.