PROJECT MINERVA

MANAGEMENT EDUCATION FOR SAFETY AND HEALTH

Selected Case Studies

DIVISION OF TRAINING AND MANPOWER DEVELOPMENT
National Institute for Occupational Safety and Health
Cincinnati, Ohio 45226

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INTRODUCTION

This packet contains 12 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 to 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 extravagant 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 hazard can result with 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.

Low Morale in the Print Shop--A printing company was operating at a financial loss attributed, in part, to poor workmanship. Much of the problem lay in low morale to which an unsafe and unhealthy working environment contributed. The case illustrates the potential impact of safety and health upon individual worker productivity.

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.

The Man Who "Kept on Truckin'"--This case involves a truck driver who experienced two late-night accidents due to fatigue. The heart of the problem is the conflict between certain company policies and the driver's family needs. The case provides students an opportunity to examine the impact of various operating and personnel policies upon employees and their long-term safety and health.

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. David Thelen, Robert A. Taft Laboratory
DHHS PHS CDC NIOSH, 4676 Columbia Parkway, Cincinnati, OH 45226

CASP HISTORY SUMMARIES

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. 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 users of its products.

BRANDON ELECTRIC 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.

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.

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.

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.

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.

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 haybaler 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.

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.

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.

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.

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 2-1/2 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 stream.

As they were driving along the trail, Allie Wiggins 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. Wiggins who took one look and shouted to her husband, "Stop quick!" While neither Mr. or Mrs. Wiggins 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 dissapated 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 2-1/2 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 2-1/2 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 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. 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 survivial 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.

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 distribute it to some 18,000 homes in the county.

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 pri-

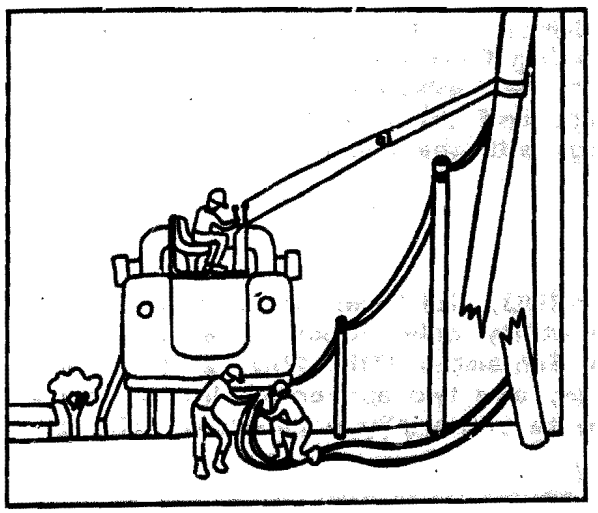
vate right-of-way some 4-1/2 miles from the county road. A digger derrick truck and a bucket truck were dispatched for the pole removal operation. In order to reach the pole, it was necessary to cut back some brush and fell some small trees on either side of the private road--which may help explain why 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 energized.

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 hose 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 Electic 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 heirarchy 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 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 ELECTRIC

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 the 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 workmen's 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 worker's compensation, resulted in a marked change in Brandon's experience rating and subtantial hike in its worker's 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 accidents, 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 $1610.

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 managment 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 consuitants, (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 requisite competence.

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 50s, 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 that malignant tumors (including angiosocoma) 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 Standards (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 angiosocoma. OSHA responded by proposing a permanent regulation requiring "no detectable" worker exposure to vinyl choride. 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 was 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 sufficiently 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 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 PCV 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 breath 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 PCV, citing evidence from studies associating all three incidents with high PCV exposures.

In their suit, the workers claimed that both Mid-America and Sterling had been aware of the hazards represented by PCV since 1974 and had neither made a significant attempt to correct the problem nor notified their employees as to the hazard represented by PCV. While they admitted their exposure to PCV 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 a 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 woud 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 OHSA 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 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 defendants' 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.

A DEFECTIVE MOPED THROTTLE

Case Study

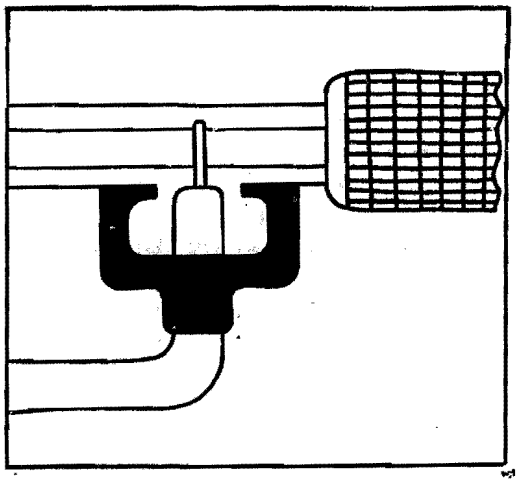
On July 18, 1983, Buddy and Tommy McKane were taking turns riding their father's moped around the cul-de-sac at the end of the street on which they live. When it was Buddy's turn, he pedaled up to speed to start the engine. Then Tommy heard him shout something like "I can't stop it". Instead of turning 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.

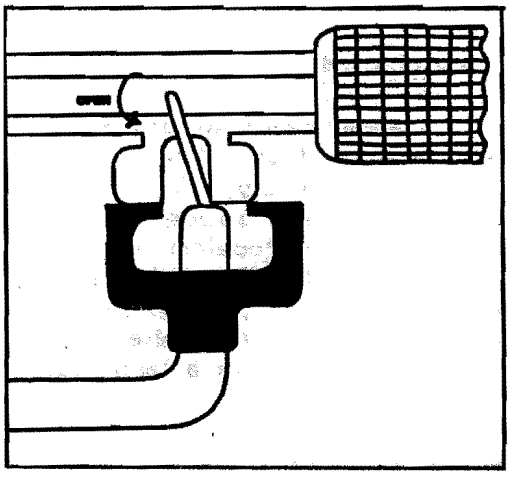
The Moped Manufacturer

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 complaint 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 nonexistant. 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 straightahead 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 driver's 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 payment of damages. Within one month after being advised of the suit, Cyclon filed for 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 $3.6 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 inability 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 coolly 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.

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.

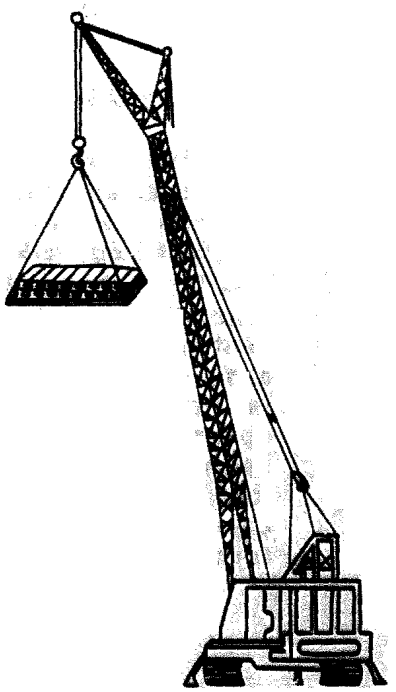
The Construction Operation

The Stearman Company of Des Moines, Iowa, is a 35-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 ranged 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 were experienced in their 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 repositioned 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 oscilate 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, worker's 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 other 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 was 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

Teacher 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 overinvolved 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.

- 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 & Cornell has never had a formal safety training program. The personnel manager is reponsible 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 half a 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 & Cornell 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	3
Strain, sprain	83
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

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

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 propective 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/ over-exertion." 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 the sheer number of accidents would suggest. They are by far the leading source of worker's 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 intances 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 Replacment--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--Machines where there is open access to moving parts, workmen are often injured when they accidently 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.

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[1] Accidents involving automobiles are recorded as traffic accidents rather than occupational accidents.

Another way of reducing loss associated with minor injuries is by having some portion of the work force qualified in administering first aid. While a 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.

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.

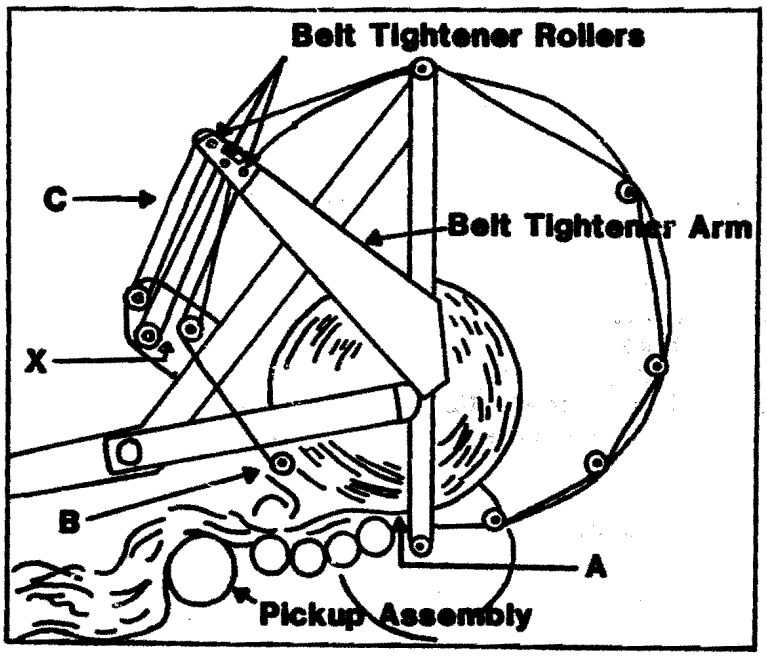
On the following day, Robinson's foreman and another hand took the baler apart. They found Mr. Bura's hand and forearm wrapped in a broken belt where the belt had wrapped itself around one of the rollers several times. The hand was two belt wraps away from the surface of the roller.

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 bull-whip. 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, a safety engineer, 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 claimed 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 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 interefere 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 to be 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 he 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 succed 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.

THE ATHENIAN RESTAURANT FIRE

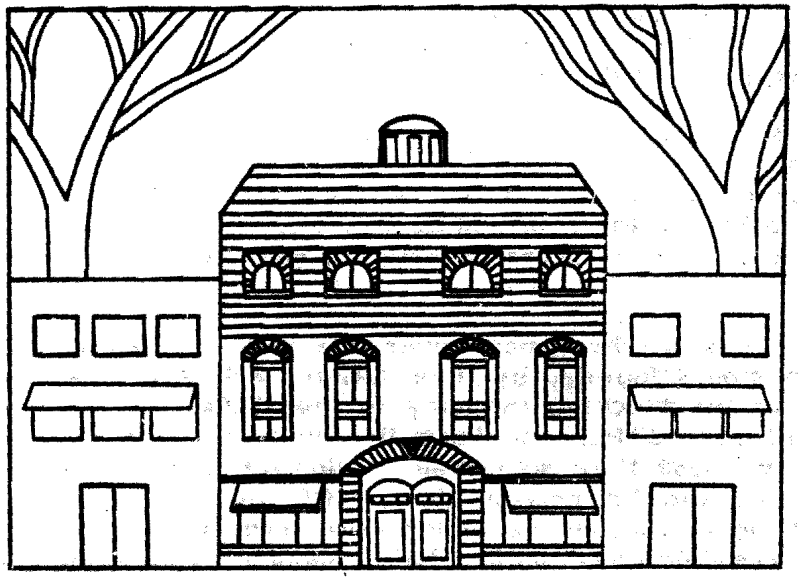
Case Study

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. pared in the kitchen is elevated by dumbwaiter to the dining r 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 served 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 Problems

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 obtainining 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.

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While the exterior of the mansion is of stone construction, the floors and joists 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 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 sprinkiers. 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 sprinkler 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 $200,00 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 Angos 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're 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.

3. 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 mangement structure, which consists primarly of the Agnos brothers, seems attuned to safety concerns or knowledgable 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 apsects 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 responsibilty).

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
Worker's 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% x $1,275)		- 128
Before-tax net cash flow		$3,772
Income tax		
Before-tax net cash flow	$3,772	
Depreciation ($8,800/10 years)	- 880	
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.

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 had 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 interefere 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 worker's 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--Adminstrative 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 Chalmers' worker's compensation premium. Of its premium, $1700 can be associated with liability for the injury to Bemis.

Question

Assume that you have been assigned by Chalmers' 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 students' 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 shorcomings in Chalmers' operations so far as safety is concerned. Overcoming these deficiencies would require action at the management level. Recommendations should address:

- o Training
- o Supervision
- o Operations
- o 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 Chalmers' 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 apporpriate 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.