

INDUSTRIAL SAFETY AND HEALTH MANUAL

PLAINTIFF'S EXHIBIT

BELL-18

Bell Helicopter **TEXTRON**

Division of Textron Inc

BHT 00622

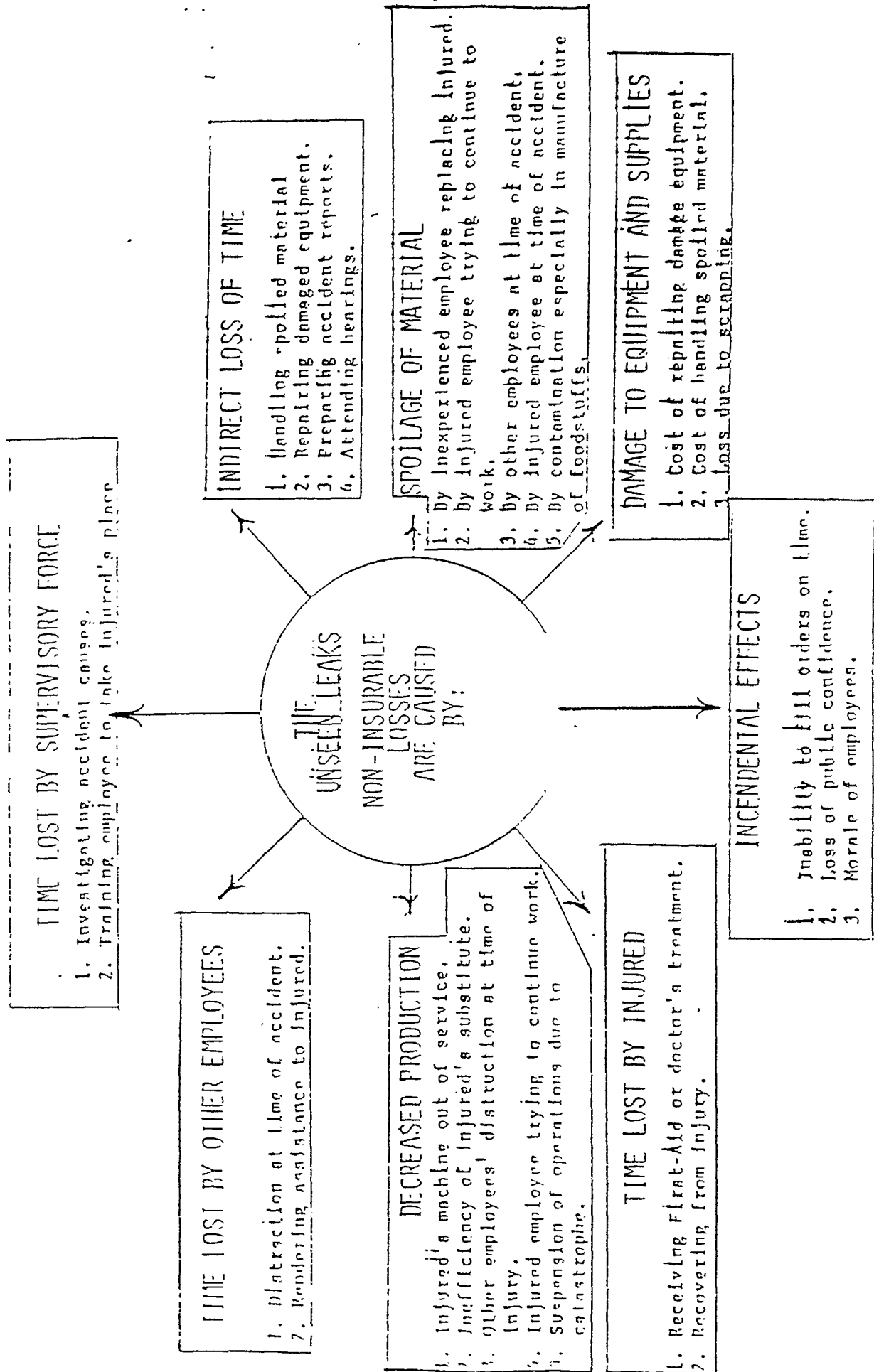
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INDUSTRIAL SAFETY AND HEALTH

- I. Introduction, Course Overview, Purpose
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CHART OF INDIRECT ACCIDENT COSTS



ACCIDENT EXPERIENCE
FROM 1967

YEAR	LOST TIME INJURIES	DAYS LOST	MANHOURS	FREQUENCY (Nr. Accidents x 1,000,000 ÷ nr. of man hours worked)			SEVERITY (Nr. days lost time x 1,000,000 ÷ nr. man hrs. worked)	
1967	184	2,806	21,261,745	8.70			132	
1968	153	2,235	20,873,406	5.20			106	
1969	96	7,562*	20,681,361	4.67			365	
1970	73	2,002	18,908,944	3.86			105	
1971	54	1,236	14,728,957	3.66			84	
1972	44	7,279*	13,154,824	3.34	<u>Incidence</u>		553	
1973	44	653	13,520,966	3.25	.310	4.58	48	
1974	62	761	16,895,922	3.66	448	5.30	45	
1975	72	1,112	19,493,978	3.70	499	5.11	57	
1976	72	1,184	18,153,286	3.90	391	4.30	65	
1977	51	797**	15,847,429	3.21	343	4.32	50	

*Fatality: Charged for 6,000 lost days for each fatality.
Had one fatality in 1969 and one in 1972.

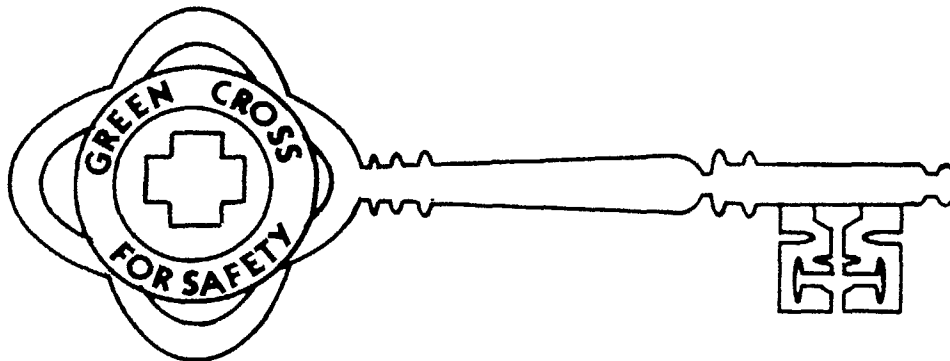
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INDUSTRIAL SAFETY AND HEALTH MANUAL

SAFETY AND HEALTH EDUCATION
IS THE



TO
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ISSUED BY: INDUSTRIAL SAFETY DEPARTMENT
TRAINING DEPARTMENT

Bell Helicopter **TEXTRON**

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"SAFETY AND THE SUPERVISOR"

Safety has always been high on the list of important things to keep in mind, and working conditions have become progressively safer as a result of continuing attention. The problem has been that conditions are rarely as safe as they can be, and the employee tends to become engrossed in his work, gets accustomed to the hazards, or he goes "unconscious" to his surroundings.

Most companies have taken the initiative and made the work environment safer, and they have provided safety programs to both educate employees and keep safety awareness alive and well. Some companies, and some conditions, however, fall short of keeping up with the times. To add to the situation of neglect, some employees violate safety requirements by not wearing safety glasses, respirators, hard hats, safety shoes, or whatever safety equipment is made available to protect him!

Who has the responsibility? Who must insist upon the employee wearing appropriate equipment or that guards be left on machines? Who determines that the air must be filtered to clean harmful particles from it? Who decides when vapors from this bath or that bath must be evacuated? The answer is that no one person does any of these things exclusively, but if the answer is "everyone" there is the probability that no one is really responsible! Besides, a safe environment and equipment cost money--lots of money!

Enter the Federal Occupational Safety and Health Act, the creator of what has come to be called OSHA. The law requires each employer under the Act to A. furnish to his employees a place of employment free from recognized hazards to their safety or health, and, B. to comply with safety standards issued by the Department of Labor.

That may be a step forward, but those standards are actually only minimum standards! They will not achieve optimum safety performance or environmental health conditions. There are areas in which we should do more than the minimum.

Each employee has the duty to comply with safety and health standards, but it must be remembered that the employer has the responsibility to assure that he does.

Enter the Supervisor: The supervisor's responsibility to effectively supervise both production and safety now takes on even greater importance. While part of the management team, the supervisor is that party having the over-the-shoulder association with employees doing the job. He has the oversight of all resources assigned to his function, including the human resource. The supervisor is the KEY MAN in accident prevention work--he is at the scene where the action takes place!

Now just who do you suppose gets to be responsible for reporting hazards, insisting that employees wear safety equipment, and keeping safety consciousness active in the minds of those he supervises?

Putting jest aside, however, the supervisor has the very serious responsibility for the people who work for him. While it is true that employees are not perfect, and there may even be some who seem "preoccupied" at times, each supervisor will eventually find that the employees are the very ones who can help him shoulder that serious responsibility. When they have been caused to feel responsible for the safety of themselves and of other employees--and they actually are--they can make the work place both safe and productive. Again, it is the supervisor who creates this condition and maintains the felt responsibility!

DEFINITION OF AN ACCIDENT

An accident is an unplanned or unscheduled event or happening, or it is that occurrence in a sequence of events which usually produces unintended injury, death, disease, illness or property damage.

A hammer may fall from a scaffold or shelf and cause neither injury nor property damage, but it is an accident. "Nearly" having an accident is an impossibility, because the degree of damage to who or what is not part of the definition.

We must remember that an unplanned or unscheduled event is an accident, and indicates that something went wrong or got out of control! The next time that hammer falls it may crush a skull or damage something of value. When it fell the first time, it was an accident. If it happens again and causes injury or damage, it is gross negligence!

Accident Costs:

Accidents cost money, and supervisors should know how to figure those costs. They can be broken down into two basic categories: (1) Direct, (2) Indirect.

DIRECT COSTS:

These include medical, compensation, and insurance costs. Many companies use only these three costs when figuring their accident bills, and when they do so, they fail to take into consideration the hidden and uninsured costs of accidents.

INDIRECT COSTS:

Indirect costs may be compared to the part of the iceberg below the surface of the water. Like the iceberg, indirect costs are significantly greater than the visible costs just as the hidden part of the iceberg is greater than what is seen.

Indirect costs include property damage, time spent in writing up and investigating the accident, lost production and cost of wages lost, paid-for time lost by workers who were not injured. (Employees who stopped work to assist or watch.) There would also be the cost of wages paid for time lost by the injured worker, cost of overtime, wage cost caused by decreased output of injured worker after return to work and the cost of training a new worker in case a replacement is necessary.

Other Losses from Accidents:

Accidents often destroy efficiency, at least for a while, but they also tend to lower that something we call morale. There is also the bad public relations within the community to say nothing about those who look to the supervisor of the injured asking--maybe not verbally--what could he have done that might have prevented the injury accident? Another loss involves reputation. People do not desire to work for a company that has accidents frequently, nor do they desire to work for companies that seem unconcerned about employee safety.

It boils down to the fact that the tasks and duties--the very activities-- performed by the supervisor are connected with safety and the prevention of accidents, some directly and some indirectly.

The KEY MAN must be safety conscious first if the people are to feel responsibility for safety awareness!

SOME HISTORY ON THE SAFETY MOVEMENT

As the industrial age began making itself felt in this country, the work force within the industrial communities grew numerically. The number of injury accidents, some of them pretty horrible examples, began to increase as well. Point: The injured workers, many of them permanently disabled, were becoming wards of the state. Disabled workers were becoming so numerous by the turn of the century that it was a social issue.

In 1911, the State of Wisconsin passed the first compensation law. Essentially, it required that the companies provide some benefits for employees injured during the course of employment and as a result of the jobs being performed. Other states soon followed the Wisconsin example.

In that same year, there was a call for a national meeting on the subject of safety. That call came from an organization made up of the work force, the Association of Iron and Steel Electrical Engineers. That conference was held in Milwaukee in 1912, and called for another to be held in New York the following year. The National Safety Council was formed at the second Cooperative Safety Congress.

The first step taken by companies was the safeguarding of machinery, since most injuries seemed to be a result of workers becoming mangled by unguarded machinery. Then came the realization that many accidents had little to do with unguarded machinery--though that was certainly a step in the right direction. Those companies striving to improve their safety records and save money being spent because of the new compensation laws discovered that they also had to train and supervise the workers if they were to prevent accidents!

You've probably guessed it! It seemed that the prevention of accidents boiled down to the relationship between the employee and the supervisor, and how effectively the supervisor taught, trained, and supervised. That relationship hasn't changed. The supervisor is still the KEY MAN to the whole idea of safety as well as production.

Accountability--that's vested responsibility--for safety and accident prevention is just like work scheduling and job assignments. The supervisor has the responsibility squarely upon his shoulders!

KNOW YOUR ACCIDENT PROBLEMS

There are three ways, according to the National Safety Council, that a supervisor can use to locate trouble spots:

1. Personal Observation (slippery spots on the floor, overflowing trash cans, poor housekeeping, unsafe acts, etc.).
2. Job Studies (use of guards on grinding wheels, blocking off a danger area, better materials handling, etc.).
3. Inspections (dust, fumes, vapors, hoists, ropes, chains, slings, hand and power tools, etc.).

Most unsafe conditions can be identified by having the initiative to look and the common sense to see what one is looking at. But let the supervisor be forewarned, because unsafe conditions can be abolished unendingly with only minor results. While the unsafe conditions must be eliminated, the partner in most accidents is the unsafe act.

Most accident causes have both conditions. The UNSAFE CONDITION and the UNSAFE ACT. The safety conscious supervisor will keep watch for both of these, and he will see that something is done about both.

Accident Investigation:

What is the first thing that the supervisor must do when there has been an accident? The answer may seem elementary, but it is vitally important. "To go the scene of the accident immediately."

That means right then--not after a phone call or a last sip of coffee--and without a moments delay. Why?

When there has been an accident, there is the fact that something has gone wrong, and management is responsible for the fact that something did go wrong--it doesn't matter that Sam or George, or someone else was at fault--You are responsible! There are at least three reasons, however, to answer that "Why?"

1. To see that first aid is administered, if needed.
2. To protect fellow employees and equipment.
3. To see that no changes are made after the accident to cover-up or whitewash the error.

To put it another way, the supervisor is there to do his job--leading, decision making, gathering facts, and representing the company.

Supervisors Duties at the Scene of the Accident:

We have discussed the reasons why the supervisor must go immediately to the scene of the accident, but there are some things that he should do while he is there.

1. Talk with the injured person, if possible. It is realized that sometimes the injured person is in such bad condition that the last thing he needs is a bunch of questions, but, on the other hand, he just might find things easier if he is able to talk to someone.
2. Question any witnesses.
3. Listen for clues in the conversations around you.
4. Encourage people to give ideas for preventing recurrence of the accident.
5. Study possible causes of the accident--unsafe acts and unsafe conditions.
6. Write a report. (The sooner the report is written after the facts are gathered and after the scene has been observed, the more likely the report will be to represent what actually occurred.)
7. Follow up to make sure conditions are corrected.
8. Publicize any corrective actions taken so all may benefit from the experience.

There are only a few of these that may be done later. Most are done right at the scene of the accident. Even taking corrective action may be done then and there when such action is not something like a new venting system.

While investigating an accident, the supervisor should keep these points in mind:

1. That most accidents involve both unsafe conditions and unsafe acts.
2. That the purpose of accident investigation is to prevent recurrence and not fixing of blame. Remember, you are fact-finding, NOT FAULT FINDING.

Measuring Safety Performance:

There are two basic ways of measuring safety performance. There are direct and indirect costs, and there are recordable injuries and illnesses. All companies are required to keep records of certain injuries and incidences on specific forms. These are normally kept by the safety department and are:

- A. Form 100 - Log of Occupational Injuries and Illnesses.
- B. Form 101 - Supplementary Record of Occupational Injuries and Illnesses.
- C. Form 102 - Summary of Occupational Injuries and Illnesses.

At Bell Helicopter, department managers receive a tabulation run showing these figures by department and facility. These are normally expressed as a rate computed by the use of a formula.

Supervisors should be concerned with a rate called INCIDENCE RATE, because this is one that most dramatically reflects the supervisory effectiveness in his prevention program.

A recordable incident is one that requires more than normal first aid. That means that someone with an injured finger may go to First Aid for a band-aid. If a band-aid takes care of the injury, that is not a recordable incident, but if the injury is such that it requires stitches, that is more than first aid, and it is a recordable incident.

The OSHA formula for computing the incidence rate is:

$$\frac{\text{Number of Recordable Injuries and Illnesses} \times 200,000}{\text{Employee Exposure Hours (Total man hours worked)}}$$

These figures are merely yardsticks for the supervisor to tell how effective he has been. In that sense, they are HISTORY. An accident prevention program needs more than history. It needs a tool for the supervisor to use in actively removing hazards and changing unsafe practices. Bell has a procedure that should support the "good common sense" and judgment. It involves a form

commonly called a "Write-Up" that is prepared by a team that actively seeks out unsafe practices and conditions. That write-up goes to each supervisor and each department manager having authority in the area in which the write-up is made. This aid to each supervisor is part of the effort to eliminate potential accident situations before an accident actually occurs.

It is easy for the supervisor to get caught up in the day's activities to the point that employee safety as a responsibility is found pretty far down the list of priorities. This is the same kind of thing--putting safety low on the priority list--that causes carelessness to enter the work environment. The pressure of tasks at hand take all of the concentration and attention, and it's easy to become careless in mental attitude about things like safety.

The point is that statistics only tell us how good or bad our safety awareness has become. Any safety program is for the people who are doing the work. They are the important resource and the reason for the existence of supervisors. It is reasonable, then, to state that accident prevention is the major topic of any safety emphasis, not statistical history in the form of numbers on a page.

The supervisor's responsibility extends to include keeping safety consciousness to the forefront, high on the list of priorities, and causing the people doing the work to maintain safety consciousness despite the press of work activities.

HUMAN RELATIONS

Background of Motivation:

Without going into the theories of motivation in an exhaustive manner, there are some basic principles aimed at direct application that the supervisor can use without delay. Our purpose here is to provide the supervisor with some thoughts to refresh what he may have already learned in his studies of human relations.

Principle number one is that it is easier to change the environment to the employees' motivational pattern than it is to change the employees! Does that raise the "hackles" on everyone's back? It isn't as radical as it may sound, but it is the truth. For example, it is much easier to provide a guard for a machine than it is to keep employees safe by telling them to be safe or to be careful. The effect is to change the environment instead of changing the employees.

If the employee, however, removes the guard from his machine, then there is a resistance to change problem. In other words, the employee must understand and care--and this is the job of supervision.

Four needs, we'll call social needs for the sake of simplicity, are: (1) Work has value, (2) Appreciation, (3) Sense of security, and (4) Belonging to a work group. (If you've studied Maslow, please don't be offended. These cover the range from safety through self-actualization, but let's clump them under social needs for the sake of expediency.)

Knowing That Work Has Value:

People strive for recognition. They want to feel important. It is easy for the supervisor to feel that everyone knows that what is being done has value, but the employee needs individual reassurance that the job he is doing is of value and that it is being done well. That brings us to the second.

Knowing That Work is Appreciated:

The genuine giving of credit when it is due is essential. It doesn't have to be praise--though that's good--it can be simple recognition. To belittle a man's work is to belittle the man. Praise works the other way.

It is, however, important to note that praise must be for good work only. It is never a mechanical gesture. Praise for work that is not well done is less than a hollow gesture, and is actually damaging to the relationship. True praise is more than

a slap on the back when it is for good work and is given sincerely. If you genuinely appreciate something, tell the one responsible. This is just as true in the area of safety as it is in the area of production.

A parallel is easy to draw. You know how you feel when you are roughly handled by your own supervisor, and your "own" employees are no different. Little is gained by criticism, but a results oriented discussion that is not personal in nature may be used more effectively than criticism. Conversely, praise may be personal--it should be.

Developing a Sense of Security:

A sense of security is essential. This is far more than good pay and a steady job. People want to know what is going on and what to expect in the future. People want to know what they are expected to do and how it is expected that it be done.

Preparation is essential to the feeling of security. A positive attitude is impossible at worst or a sham at best if there has been inadequate preparation! In the area of safety, that means that the supervisor must see that the employee is properly and thoroughly trained, i.e., prepared! Knowing how to avoid getting hurt, proper procedures, hazards to keep awareness of, and what protective clothing to wear are all things that the employee must know if he is to do a good job.

For a new employee, the new job is in itself a threat to his feeling of security. Things the supervisor takes for granted are, in reality, likely to be unknown by the new employee. A supervisor who takes care and gives attention to the little things can do much toward causing a new employee to feel at ease.

As for the rest of the employees, the very fact that the supervisor is aware, conscious, and concerned about safety improves the stature of the feeling of security in the area of safety. Additionally, it causes the employees to become individually aware and safety conscious--to feel responsible for their own safety and that of others. (On the negative side, if the supervisor doesn't care, neither will the employees!)

How we act, and how we speak is as essential to communication as what we say. If we genuinely don't care, that message overpowers whatever words to the contrary that we might say. WHAT WE REALLY FEEL SHOWS! (That means we must watch what we feel more than what we say. That eliminates the facade!)

Developing a Feeling of Belonging:

One of the basic human needs is to belong, to feel accepted by the group with which he works, plays, or whatever. We want to become involved in activities where we feel needed and wanted--valuable as a contributor to whatever group accepts us.

The work group is no different. It may not be a group chosen deliberately, but each member needs the rest of the members to get the job done. Such groups may be small or large, but they are usually less than twenty or more than three in number.

The need to belong is great enough that with few exceptions a member will conform to whatever the group thinks is appropriate. That means that if the group insists upon safety glasses or shoes being worn, the individual members will wear them.

It is a basic mistake, however, to forget that even team members need individual recognition. That is part of the belonging, to be recognized individually within view or earshot of the group to which one belongs. Calling the employees by their first names, and knowing about each individual is one very good way to enhance the feeling of belonging to the work group.

The safety posture can be helped considerably if the supervisor strives to get the safety consciousness high in the group priority of important things to remember. The results are sometimes spectacular and usually amazing.

It is well to remember that the employee must first feel that he belongs--is accepted and feels he has a valuable contribution--before he is motivated to care and take pride in being a part of the work group. It takes time to build positive motivation within a group, but one negative incident, personal criticism, or verbal castigation can bring about instant negative motivation. What may be worse is that the entire work group may side with the de-motivated or negatively motivated employee.

The feelings of belonging and worth are prerequisite...

The Role of Leadership:

The leader is the one out front, leading! Setting the example in attitude, purpose, and performance is only part of the job of leading. He must be an organizer, communicator of the first rank, in control of the emotional climate--his own first as well as that of others--fair, understanding, a good decision maker, a supporter of both management and the work force, and a host of other things positive and productive.

The guy in the back doing the pushing is not a leader. He cannot lead from a hindmost position where he must be if he is pushing. The guy in the back can see what is going on and spend a lot of time howling and shouting about it, but he always ends up eating the dust and wondering why he is always behind doing the dirty tasks.

Unfortunately, some confuse the two positions. Militarism has also been mistaken for leadership. The satisfaction that can be gained by both leaders and workers in the production environment

is not obtained by either pushing like the mule-skinner or acting like a Prussian Officer. The leader puts things in proper perspective and is aware of what is really important. He acts accordingly, and may even throw in a little wisdom to spice his objectivity and adult behavior.

He isn't after the credit, and he realizes that many or most of the good ideas come from the workers themselves, and is quick to give the credit where it belongs. His workers support him, because he supports the working human beings he leads.

Workers With Special Problems:

There is a fine line between the normal and the abnormal person. When a person crosses that abstract line and becomes what we consider abnormal, there is usually a reason. The supervisor may need to seek the help of the personnel department or the medical department. He may only need to listen to whatever is behind an emotional upset or conflict.

Whatever the case, the first thing a supervisor must be able to do is to recognize when a problem has gone beyond the ordinary. A general rule is that when emotionalism has gotten to the point that it is affecting the work or causing a mental pre-occupation that is unsafe, then the condition may connote a worker with a special problem.

Patience and tact may not work in such instances, but the supervisor must avoid becoming emotionally "hooked" by the employee. This means that the supervisor must remain the leader. It doesn't mean that he must give in to the whims of problem employees, but neither does it mean that he can become as "mean, onery, and stubborn" as the distraught employee.

It is well to remember that helping is not advising, directing, warning, threatening, criticizing, lecturing, humoring, or such similar "natural" tendencies. These things block communication, and they usually fail to help. Helping is usually listening and encouraging the emotional employee to reach conclusions himself. It may involve using the right questions at the right time, but the idea is to get the problem out where it can be evaluated and dealt with.

The emotional employee is dangerous to himself, his fellow workers and the physical materials around him. He is the safety hazard, and it is up to the supervisor to be able to spot the condition and, hopefully, help the employee back into the real world of reason, safety, and productively.

If the worker is beyond coming back, the supervisor is still the leader, and he must do whatever is necessary to bring about the orderly working condition!

Accident Proneness:

While it is true that there are some who may have earned that label, the supervisor should avoid using the term or writing it in the employee's record. While some do seem to have more than their share of accidents, it may be because of insufficient knowledge or skill, a temporary emotional state, or simply a lack of training. Even coordination is learned.

The true accident prone person is one who has the unconscious drive to self-destruction as a result of buried guilt feelings or some other severe mental depression not evident on the surface. It is impossible for the supervisor to identify such a mental condition, must less prove it.

It is better to avoid the term altogether and concentrate upon safety training, use of safety equipment, safe practices, and overall safety consciousness.

Note: The accident prone individual--the one who has those unconscious tendencies to self-destruct--usually overcomes the problem (or succeeds in the effort).

The Alcohol and Drug Problem:

Alcoholism is one of the most rampant diseases plaguing modern man. It is a factor in at least 50 percent of all fatal automobile accidents, and it costs industry billions of dollars each year. Most companies have written policies, and some have programs aimed at dealing with all kinds of drug abuse, including alcohol. Besides knowing the company policy, there are some things the supervisor should do:

1. All employees should know the company policy on alcohol and drug usage.
2. Educate yourself and your employees.
3. Identify the problem people.
4. Show them that you care.
5. Handle them and the information about them confidentially.

MAINTAINING INTEREST IN SAFETY

Hazard control is management's responsibility. Top management formulates policy. The supervisor interprets it and makes it a reality to the workers. The supervisor is accountable for carrying out management policies in every way--and to the line employees, the supervisor is the company. The supervisor seeks to develop good attitudes in his people. He trains them in safe workmanship. He tries to convince them that management is sincerely interested in

safety. He repeatedly emphasizes that he expects safe conduct. These approaches are primarily problems in communications--problems in getting through to people. Communication means much more than tacking up posters, passing out rule books, and talking about safety. Success depends upon the attitudes of both supervisor and employee, as well as top management.

Developing Good Employee Attitudes:

1. Train them in safe workmanship, and convince them that you care during the process.
2. Convince employees that top management is sincerely interested in safety.
3. Emphasize safe conduct, continuously and consistantly.
4. Develop and use interest getting techniques to encourage safe work practices and implement the safety program.

Promoting Safe Workmanship:

1. Form a safety committee.
2. Institute an inspection program.
3. Use posters--effectively.
4. Use bulletin board material.
5. Conduct contests.
6. Use special purpose reminders.
7. Use offbeat ideas.
8. Use a suggestion system.

Employee Committees:

Employee committees are one of the best ways to create an interest in safety. There are, however, some techniques that make committees work more effectively.

Nine fundamental principles contributing to the success of safety committees:

1. A need must exist within the department to which the employee safety committee can make a contribution.
2. Although the supervisor delegates various functions to the committee he should retain the responsibility for departmental safety.

3. To carry out its assignments (inspecting, observing practices, investigating, and making recommendations), the committee must be given proper instructions, goals, and target dates.
4. The supervisor must communicate with members of his department. He should not use the committee as a buffer.
5. All committee recommendations should receive careful consideration. If something can be implemented immediately, it should be. If there is to be a delay, communicate the reasons. If the decision on implementation is negative, an explanation should be made to the committee.
6. Committee agenda should be limited to safety matters.
7. Committee membership should be rotated so that over a period of time all will have an opportunity to serve.
8. Written minutes of all meetings should be kept.
9. Meetings should be held regularly as scheduled. Attendance must be required and kept as a matter of record.

Occasionally, a top management representative should be invited to a committee meeting.

OFF THE JOB SAFETY:

It has long been realized that off-the-job injuries cost more money than on-the-job injuries. For example, in 1971 for every one fatality occurring on-the-job, there were five occurring off-the-job. The point is, simply, that any workable safety program includes safety in the home, on the road, and in other activities such as boating, swimming, etc.

If it is impractical to develop a home safety program, the supervisor should remind the work force that the same kinds of hazards exist at home as exist on the job. He might ask them to list some of the items around the home as a part of the regular safety training sessions. The idea? A continuing reminder.

INSTRUCTING

INSTRUCTING FOR SAFETY AND INDUSTRIAL HYGIENE

Instructing for Safety:

People do unsafe things because:

1. They are unaware that what they are doing is wrong.
2. They misunderstand instructions that are given.
3. They do not consider the instructions to be important.
4. They are not given specific instructions.
5. They find it awkward to follow the instructions.
6. They deliberately disregard instructions.

Call it teaching, training, instructing, or communicating, but it all boils down to the fact that every supervisor must be effective at teaching if he is to be effective at the job of supervision.

One of the most important factors to remember is that whatever word you choose, teaching is tied directly to learning, and learning is seen as a change in behavior, belief, attitude, or reaction. To get that change is an endless job for the supervisor, and when it is recognized and applied, the supervisor soon realizes the importance of a teaching fundamental, TEACHING ISN'T TELLING. "I told him not to do it that way or he would get hurt!"

"I told you so's" are hollow and ineffective words, because they have come too late, and because they betray an erroneous belief that telling is enough. As often as not, they are tragic words spoken into nothingness, a futile and feeble attempt to sooth one's own feelings of guilt while doing absolutely nothing for the victim of disobedience.

Accident prevention occurs before the accident takes place. Should someone perform an unsafe act, it means that understanding has not occurred. Even carelessness is a result of one or more of the six items listed at the beginning of this section.

An example of this is that you have been told that the responsibility for safety is the supervisor's. You may or may not have believed that, but before the idea does any good at preventing accidents, the supervisor must feel that the responsibility is his. At that point, the learning has been successful as far as that one concept is concerned. Since it is a foundation concept, the actions can be build upon it.

Job training should as a matter of inclusion address safe and unsafe practices, and, often, the supervisor has someone other than himself do the actual training. The supervisor must assure that the one appointed can, in fact, do an excellent job of it.

That brings a cold and sobering fact into the picture; not everyone has the patience or technique to be an effective trainer. It also brings about another idea, that if the supervisor finds himself falling short of the teaching goal, he can find someone who can and wants to do the job. That person may be a good candidate for promotion should an opening arise.

Starting the New Employee:

The new employee is a good person with whom to start doing the job right and doing the right job! It begins with the consideration that he is new, feeling insecure, and unaccepted--as yet--by the work group. He may or may not be ignorant of the job he is expected to do, but he isn't ready to do the job until he understands the correct practices expected within the department and the personal "check-out" is completed. There are three basic steps to the process: Orientation, On-the-Job Training, and Over-the Shoulder Coaching.

Orientation: Basically, this is a familiarization process that gets the new employee acquainted with the area, the people with whom he will work, and the company/departmental policies, practices and procedures. This includes making him feel as welcome as possible in his new environment, because this enables him to concentrate more completely upon the things he is expected to do--and do safely. Put yourself in his place, and try to remember when you were in a similar situation. A little personal consideration that made you feel welcome and valuable went a long way in causing you to want to do the best job possible. Words, words, and more words won't do the job, but what the supervisor does coupled with the explanation of things important to the new employee make for a smoother and safer transition and higher productivity, sooner.

On-the-Job Training:

On-the-job training (OJT) is widely used because the trainee can be producing while he is being trained. Whether the supervisor does the instructing himself or has someone else do the teaching, the training should be carefully planned and organized.

In too many cases, on-the-job training is a "hit or miss" procedure where the trainee is told to follow another worker around and learn his job. In situations of this type, the worker may be too busy to do any training, or may not know good training procedures. He may even be reluctant to train another to do his work.

Remember, it is the supervisor's responsibility to make sure the person doing the training can, in fact, train. While there are many methods with which to train a new employee, one of the old standards is JIT, Job-Instruction-Training. It is a four step method:

1. Preparation - occurs before any training actually begins, and includes decisions about the objective of the training (what is the employee expected to do after the training, and how well), who is to do it, outlining preparation, materials to be used, place, time for the other three steps, and the acquisition of all equipment and materials. Done well, this phase makes the actual job of training much easier. "The man with the plan wins."
2. Presentation - No more than five or six new points should be presented at one time. If a job consists of more than five or six parts, it can be organized into two or more units for instruction.

The instructor should both show and tell the learner how the job is done, beginning by doing the job himself. The technique frequently used is to do the job as it is normally done and then do it step-by-step explaining carefully and naming tools as the job is done. The learner must be as nearly in the position to do the job himself as possible so that he sees it from the proper perspective. The "show and tell" part of the operation is only the beginning, however.

3. Application - The learner takes over and goes through the operation slowly, explaining what he is doing and naming the tools just as the instructor did. Prompting may be necessary. If, after prompting, the learner is unable to go ahead on his own, the instructor goes back and does step 2 again. He should avoid over-prompting, however. During the application phase, the instructor should avoid touching any equipment or materials, as this is the phase in which the learner is learning to do the entire operation. To avoid temptation, the trainer may find it necessary to keep his hands in his pockets or locked behind his back.

As soon as the learner can do the entire job without prompting, the instructor has him do it one more time to fix the operation in his mind. He should, then, be ready for -

4. Testing - The learner does the job without explaining and the instructor observes and corrects if necessary. The learner gains speed and develops smoothness but not at the expense of performance.

If the learner seems unsure or makes mistakes, the instructor asks him to do the job slowly and explain the steps as he goes along (step 3). If the learner does a good job, the instructor should make it a point to tell him so! A sincere compliment is a great motivator and it isn't painful to the giver.

Safe practice and procedure, of course, should be an integral part of the whole JIT process. Safety must be learned while the job is being learned. Application of safe practices is just as important--maybe more so--as learning the job.

The important "follow-up" phase is similar to coaching, but it is more to assure both the teacher and the learner that things are going as they should. The follow-up phase is tapered off as the assurance is deemed positive.

Over-the Shoulder Coaching:

Over-the-shoulder coaching, done correctly, is one of the most flexible and direct methods. It can be used with a new employee if the job is simple or if he shows pre-knowledge of the operation. It may also be used with seasoned employees taking on a new job or an unfamiliar part of the operation.

Under the guidance of a qualified person having the patience, time and desire to help others, coaching is successful because of its direct and personal nature. While it is less formal than JIT, it must be done in the same friendly and helpful manner.

JOB SAFETY ANALYSIS

It has been said that the need for learning never ends. This applies to whatever age or position one happens to have, and the industrial setting is no exception.

Job Safety Analysis is normally applied to jobs that are neither broad nor narrow, but it is applied to jobs with the worst accident experience.

The technique of making a job safety analysis involves these steps:

1. Selecting the right man to observe.
2. Briefing him on the purpose.
3. Observing him perform the job while breaking it into basic steps.
4. Recording each step in the breakdown.
5. Checking the breakdown with the man who was observed.

For breaking down the job into tasks and recording the safety analysis data, there is a form available from the Safety Department, "Job Safety Analysis Training Guide." Another form available is, "Job Analysis Work Sheet." Both are useful tools for a Job Safety Analysis (JSA).

The final step in a JSA is to develop a recommended safe job procedure to prevent occurrence of potential accidents. The principal solutions are:

1. Find a new way to do the job.
2. Change the physical conditions that create the hazards.
3. To eliminate hazards still present, change the job procedure.
4. Try to reduce the necessity of doing a job, or at least the frequency that it must be performed. This is particularly helpful in maintenance.

LESSON PLANS

Lesson plans, in addition to standardizing training, help the instructing person to do several things.

1. Present material in proper order.
2. Emphasize material in relation to its importance.
3. Avoid omission of essential material.
4. Run classes on schedule.
5. Provide for trainee (student) participation.
6. Increase his (the instructor) confidence, especially if he is new to the idea of teaching.

The following is an example of an arrangement for a lesson plan or "Guideline." They are the blueprint for presenting the material, and are sometimes even called guidelines. They are not necessarily rigid and unchanging (as are some blueprints), but may be altered to fit the needs of a particular student group.

1. Title: Must indicate clearly and concisely the subject matter to be taught.
2. Objective:
 - A. Should state what the trainee should know or be able to do at the end of the training period.
 - B. Should limit the subject matter.
 - C. Should be specific.
 - D. May be divided into major and several minor objectives for each session.

Note: Some guidelines are written with a section called, "Expected Outcomes," following the Objectives. It is usually a list of performance items following a statement like, "Upon completion of this course, the student will be able to: (followed by the list of things he should be able to do).

3. Training aids: should include such items as actual equipment or tools to be used, plus charts, slides, movies, etc.
4. Introduction:
 - A. Should give the scope of the subject.
 - B. Should tell the value of the subject.
 - C. Should stimulate thinking on the subject.
5. Presentation:
 - A. Should give the plan of action (what is going to happen to the student group during the course).
 - B. Should indicate the method of teaching to be used--lecture, lecture/discussion, demonstration, or a combination.
 - C. Should contain suggested directions for instructor activity ("Show Chart," "Write key words on chalk-board," "Use viewgraph's 6 through 14," etc.).
6. Application: Should indicate, by example, how trainees will apply the material--problems worked, work group discussions, etc.
7. Summary:
 - A. A restatement of main ideas and points.
 - B. A tying of loose ends, including job application stimulation.
 - C. A strengthening of any "weak" areas.

INDUSTRIAL HYGIENE

There are three basic categories of industrial hygiene problems: Chemical, Physical, and Ergonomics. While we can study each of these in a superficial way, we must remember that these are highly complex categories, and that there are reference books available in the Safety Department that specify the dangers of specific chemicals and other hazards in great detail.

The purpose here is to examine the three categories in a general way while using common and potential problems as examples and for illustration.

CHEMICAL:

The first category is chemical. Chemical compounds in the form of liquids, gases, mists, dusts, and vapors may cause problems by inhalation (breathing), by absorption (through direct contact with the skin), or by ingestion (eating or drinking).

Inhalation is the major exposure to chemical compounds and results by their being breathed after becoming airborne. Contaminants that can be inhaled into the lungs can be physically classified as gases, vapors, and particulate matter. Particulate matter can be further classified as a dust, fume, smoke, aerosol, or mist.

Absorption can occur quite rapidly if the skin is cut or abraded; intact skin, however, offers a reasonably good barrier to chemicals. Unfortunately, there are several compounds that in either liquid or gaseous form, or both, may be absorbed through intact skin. Some are absorbed by way of the hair follicles and others dissolve in the fats and oils of the skin.

Some samples of these are the alkaloids; phenols, lead acetate, lead oleate, salts of lead, antimony, arsenic, bismuth, and mercury. Nitrobenzene, toluene, aniline, and nitroglycerine may all be absorbed through the skin in direct fashion. These are the dangerous, but there are others that can have extremely toxic effects: Triorthocresylphosphate, tetraethyl lead, and parathion plus most of the related organic phosphates.

Some solvents, though not as hazardous as those just mentioned, may be absorbed and create problems. Some of these are benzol, toluol, and zylol. Usually, anything that can dissolve and remove the skin oils, leaving the skin dry, can also be of damage to the skin as well as being potential blood contaminants.

The important thing to remember is that employees may not know the absorption hazards without such warnings being communicated to them. Protective gloves and other such clothing should be made readily available, but it is important that the employees receive instructions on their use.

Ingestion would, at first, seem to be less of a problem, because people do not ordinarily eat or drink harmful chemicals knowingly. It is possible, however, for such things as lead oxide to be taken into the system by allowing eating or smoking in the area where such is present. Serious problems result, and it is necessary that complete and regular wash-ups be a part of the normal job activity.

Physical Classification of Airborne Materials:

Dusts: Solid particles generated by handling, crushing, grinding, rapid impact, detonation, and the breaking apart by heating (decrepitation) of organic and inorganic materials such as rock, ore, metal, coal, wood, and grain.

Dusts do not tend to flocculate (aggregate) except under electrostatic forces. They do not diffuse in air, but settle under the influence of gravity.

Dust may range in size from 0.1 to 25 microns. (1 Micron is equal to 1/10,000 cm or 1/25,000 in.)

Fumes: A fume is formed when a solid, such as a metal, is turned into a gaseous state or vapor and condenses in cool air. A solid particle results and is extremely fine--usually less than 1.0 micron. In most cases, the hot material reacts with the air to form an oxide. Lead oxide forms when heating lead, and iron oxide results as a fume from arc welding.

Gases and vapors are not fumes, despite the erroneous use of the term by newspaper reporters and broadcasters who tend to use the term indiscriminately and incorrectly.

Smoke: Carbon or soot particles less than 0.1 micron in size. It results from incomplete combustion and usually contains water droplets as well as dry particles. Water is a by-product of combustion but water is also attracted to smoke particles. Rain clouds and other clouds are mostly a result of water forming with such carbon particles until the particle becomes heavy enough to fall. Tobacco smoke is such a wet particle of carbon and is about 0.25 microns in size.

Aerosols: Liquid droplets or solid particles dispersed in air that are small enough to remain dispersed for a period of time.

Mists: Mists are suspended liquid droplets generated by condensation from the gaseous state to the liquid state or by breaking up a liquid into a dispersed state. It is formed when a finely divided liquid is suspended in the atmosphere. Examples are the oil mist produced during cutting and grinding operations, acid mists from electroplating, acid or alkali mists from pickling operations, paint spray mist from spraying operations, and the condensation of water vapor to form a fog or rain.

Gases: Normally formless fluids which occupy the space or enclosure in which they are confined. They can be changed to the liquid or solid state only by the combined effect of increased pressure and decreased temperature.

Examples of gases are: welding gases, internal combustion engine exhaust gases, and air.

Vapors: Vapors are the gaseous form of substances that are normally in the solid or liquid state at room temperature and pressure.

A vapor can be changed back to the solid or liquid state either by decreasing temperature or increasing pressure. Vapors diffuse much the same as gases.

Live steam is an invisible vapor, but we usually see the hot mist created by the steam as it cools in contact with air of lower temperature. Most vapors are formed by the process of evaporation and do not condense readily as does steam. Low boiling point liquids such as solvents volatilize readily just as water will volatilize (evaporate) readily without application of heat.

The breathing of a gas vapor or mist usually depends upon the solubility of the substance that is airborne. For example, ammonia, formaldehyde, sulfuric and hydrochloric acids are very soluble in water. These are readily absorbed in the upper respiratory track and do not penetrate deeply into the lungs. The quick irritation usually causes the rapid exit of the victim, reducing the damage potential.

Compounds that are insoluble in body fluids cause considerably less pain, however, and penetrate deeply into the lungs. The insoluble compound presents a very serious hazard in that it can be present and not be recognized before serious damage has been done. The immediate danger from these compounds in high concentrations is acute edema or, possibly later, pneumonia or circulatory impairment. Nitrogen Oxide and Ozone are examples.

Some compounds do not follow the general solubility rule, being only partly soluble in water and yet very irritating to eyes and mucus membranes. Lung damage and even death can result under the right conditions. An example is acrolein.

SOLVENTS:

The widespread industrial use of solvents can cause major problems. The supervisor can assist the hygienist and safety professional in helping to maintain control over exposure. Since most spray painting booths and degreasing tanks are ventilated and exhausted, there is not ordinarily any great hazard. The hazard usually exists from the use of small amounts of solvents in unvented areas or where the employee works directly with the solvents.

It is useful to remember that it is not the amount of solvent that is used in a given area but the amount a person can inhale. A solvent should be issued only after it is known how and where it is to be used, thus assuring safe and proper usage.

Nomenclature can also be misleading. For example, "benzine" is sometimes confused with "benzene," a completely different solvent. Some commercial grades of benzine may contain benzene as a contaminant. Labels should tell what precautions are necessary when the solvents are used.

The severity of hazard in the use of organic solvents depends upon the following factors:

1. How the solvent is used.
2. Type of job operation (determines how the workers are exposed).
3. Work pattern.
4. Duration of exposure.
5. Operating temperature.
6. Exposed liquid surface.
7. Ventilation efficiency.
8. Evaporation rate of solvent.
9. Pattern of air flow.
10. Concentration of vapor in workroom air.
11. Housekeeping.

The toxicity of the solvent itself is only a part of the problem. The conditions of its use--who, what, how, where, and how long--determine potential hazard of solvents.

The term, "safety solvent," should be mentioned because the meaning is misleading. Some safety solvents are called such because some users consider it to be free of fire or toxicity hazards. Other safety solvents are called such because they are safe to use on most surfaces without damaging whatever it is being used on. Certain cold cleaners, usually halogenated hydrocarbons and petroleum hydrocarbons, may be safe to use in that they are effective, low in toxicity, and inexpensive but have low flash and fire points.

When using a so-called safety solvent, the supervisor should know what the properties of the solvent are and not assume it to be safe to the using employees.

PARTICULATES:

Fibrous materials, dust particles must usually be smaller than 5 microns in order to enter the alveoli of the lungs. A few particles larger than 10 microns may enter the lungs, but most are trapped somewhere enroute.

A person with normal eyesight can see, or at least detect, dust particles as small as 50 microns. This means that dust that is small enough to enter the inner processes of the lungs is so small that it requires a microscope to see it. Dust conditions are NOW SEEN as one of our most serious hazards in the industrial environment.

In order for particulate matter to become airborne, some form of energy is required. A solid or liquid particle of fairly large mass will be thrown for long distances when ejected from their source at high velocity, but there is a point where the particle is too small to overcome the resistance of air. The kinetic energy (which is one-half the mass times the square of the velocity) is too small and forward velocity simply cannot be maintained. When this happens, the particle remains suspended in the mass of air and moves with the air currents. These suspended particles may be inhaled and are thereby a definite health hazard.

Nonmetallic dusts, for example, cause a number of occupational diseases. Silica and asbestos dusts are examples of dangerous substances. Silicosis, for example, is an occupational disease caused from inhaling silica dust. Fortunately, the danger of lung disease from the grinding wheel itself disappeared when the natural sandstone wheel was replaced with the corborundum wheel and the Alundum wheel.

Processes in which inorganic materials are crushed, ground, or transported are potential sources of dust.

Fumes are actually particulate in nature, but of an extremely fine character. Welding, metalizing, and other hot operations produce fumes, some of which can be harmful. Arc welding volatilizes metal which condenses--as the metal or its oxide--in the air around the arc. The rod coating also produces fumes. Because they are extremely fine, they are readily inhaled.

While iron pigment in the lungs appears to have no effect in producing illness or disability, its presence shows on X-rays so as to indicate silicosis. The general purpose 6010 rod contains silicon as part of its coating as well as other materials. Since this coating is melted and deposited, there is some vapor that results in the immediate area, and there is the potential hazard of silicon deposits. Additional hazard results when welding iron painted with red lead or galvanized.

When pouring brass, zinc fume and sometimes lead are present in concentrations sufficient to be hazardous. A non-specific disease can result and is called "metal fume fever," or "brass ague." Molten lead, zinc, and other heavy metals always produce fume and must be ventilated or exhausted.

Fortunately, soldering operations do not usually require exhausting because the temperatures involved are too low to create fumes at a dangerous level. Molten tanks of solder, however, do produce dangerous fumes and they must be properly vented. The lead oxide, called dross, is dangerous if it is mechanically dispersed into the air and can cause severe lead poisoning.

PHYSICAL AGENTS

This, the second category of environmental factors or stresses, involves problems relating to such things as noise, radiation of several kinds, and temperature and pressure extremes. It is important that the supervisor be alert to the hazards because they may have immediate or cumulative effects upon the health of the employees he supervises.

Noise:

Noise may be defined as "unwanted sound" and is a form of vibration which may be conducted through solids, liquids or gases. Exposure to noise has been considered more seriously in recent years than previously. Besides interference with communication by speech, there are both psychological effects and physiological effects. The factors influencing the effect of noise exposure are not all known, but the following are significant to the supervisor:

1. Variation in individual susceptibility.
2. The total energy of the sound.
3. The frequency distribution of the sound.
4. Other characteristics of the noise exposure such as whether it is continuous, intermittent, or made up of a series of impacts.
5. The total daily time of exposure.
6. The length of employment in the noisy environment.

Of course, the partial loss of hearing is the most obvious hazard from excessive noise, but sound energy and exposure time are a complex relationship. That means that there are no really firm, hard and exact rules to govern at what point noise becomes a hazard to hearing. There are, however, some criteria to govern the point at which hearing in the speech frequency range may become damaged. OSHA has published a table of permissible exposures showing criteria for what is known as the "Threshold Limit Values" for noise. See table III, following:

TABLE III	
PERMISSIBLE EXPOSURES	
Duration per Day Hours	Sound Level dB(A) *
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
¾	107
½	110
¼	115-C**
*Sound level in decibels as measured on a standard level operating on the A-weighting network with slow meter response.	
**Ceiling Value	

There are three non-technical rules of thumb that may be more useful to the supervisor than a decibel table.

1. If it is necessary to speak in a very loud voice to shout directly into the ear of a person in order to be understood, it is likely that the exposure limit for noise is being exceeded.
2. If employees tell you that they have head noises and ringing noises in their ears at the end of the work day, they are being exposed to too much noise.
3. If employees complain that speech or music sounds muffled to them after leaving work but sounds fairly clear in the morning when they return to work, there is no doubt about their being exposed to noise levels that can eventually cause a partial loss of hearing that can be permanent.

The supervisor can prevent excessive exposure to noise by working closely with the engineering personnel in attempting to reduce noise levels. If the noise cannot be reduced by engineering means, the supervisor can resort to administrative controls, whereby he rotates employees so that the time they spend in a noisy area does not exceed a specified limit. If this is not feasible, or if engineering controls cannot be installed for a long period of time, the supervisor must enforce the wearing of ear protection devices. In this respect, as with all aspects of safety, he must set a good example.

Ionizing radiation: This is alpha, beta, and gamma radiation, radiation strong enough to disrupt atomic structure by it's passage through the atomic structure. It literally hits the atoms in the path with such force that electrons or protons (atomic particles), are knocked from their places changing the atom from its normal state into an "ion." This changes the character of the atom, and if it happens to be in a cell of human tissue, the cell is either destroyed or becomes "different" to the point that its function is altered; i.e., cancerous, should the cell begin to multiply itself to the destruction of normal cells around it.

Gamma radiation is highly penetrating and comes from radioactive materials and X-rays. What tissue will be damaged depends upon the energy and the relative sensitivity of the tissue.

Alpha and beta radiation, while not as penetrating as gamma, may be more dangerous in that destruction occurs when dust enters the body by means of mouth, nose or other opening.

Under ordinary circumstances, the alpha and beta particles are stopped by the skin, but once inside the body, their close range destruction continues silently and undetected until serious illness results.

The supervisor must assure that standard practices of cleanliness and prohibitions against smoking and eating in the dust area are obeyed and become habitual. In some cases, there may be prohibitions against sitting, or there may be an extreme requirement for protective clothing and showering frequency. Cells that have been ionized soon die or change their character. The resultant cancer or radiation sickness easily justifies seemingly extreme safety requirements and precautions.

X radiation is produced by high potential electrical discharge in a vacuum. This is the highly penetrating type of radiation of which most of us think when we see the warning signs about radiation. When there is X-ray inspection of parts, we know to provide shielding, protective cubicles, or assure temporary evacuation of the area in which the X-ray is used.

Unfortunately, X radiation is produced by a large number of devices. Any device that employs vacuum chambers in which 10,000 or more volts of electrical current is discharged emits X-rays. Many of the common CRT (Cathode Ray Tube) applications produce hard radiation that penetrates most materials. Much of this type of equipment is manufactured with adequate shielding. (An example is the color TV you may have in your own home.)

Even with shielding, there may be distance requirements that are mandatory during the operation of equipment. Employees tend to forget, and it is the job of the supervisor to assure that safety standards are followed--even by employees so enchanted by their work that they forget the necessary precautions. Radiation, after all

is not visible; it cannot be felt, and there is no noise produced by it. The effects of a large overdose of radiation, however, can be felt. (A prickly tongue, bleeding at body openings, nausea or vomiting, and low grade fever are some results that may be felt.)

In considering long range effects of penetrating radiation, such as X radiation, standards are--at best--guesses. We do know that living at high altitudes such as Denver, Colorado, subjects people to penetrating radiation of cosmic origin, and the amounts are greater than those encountered when undergoing dental and medical X-ray examinations. The concentrations, however, are different, and so may be the cell ionization. Overexposure to radiation from low-voltage X-ray equipment usually results first in dermatitis of the hand. It is characterized by a rough, dry skin, a wartlike growth, and dry, brittle nails. Continuing exposure results in bone destruction. There is some evidence that continued exposure to levels used in inspection activity may cause retinal damage that remains largely undetected until many years later when retinal detachment and blindness occurs. It is not conclusive evidence, but illustrates the doubt, ignorance, and inconclusiveness of what is actually known. Point: Exposure to no hard radiation is far better than exposure to radiation even within the so-called "safe" limits.

Nonionizing Radiation:

Electromagnetic radiation has varying effects on the body, depending largely on the particular wavelength of the radiation involved.

Low frequency: The longer wavelengths--including power frequencies, broadcast radio, shortwave radio--can produce general heating of the body. The health hazard from these radiations is very small, however, since it is unlikely that they should be found in intensities great enough to cause significant effect.

Microwaves have wavelengths of 3 m to 3mm (100 to 100,000 mega Hertz, MHz). They are found in radar, communications, and diathermy applications. Microwave intensities may be sufficient to cause significant heating of tissues.

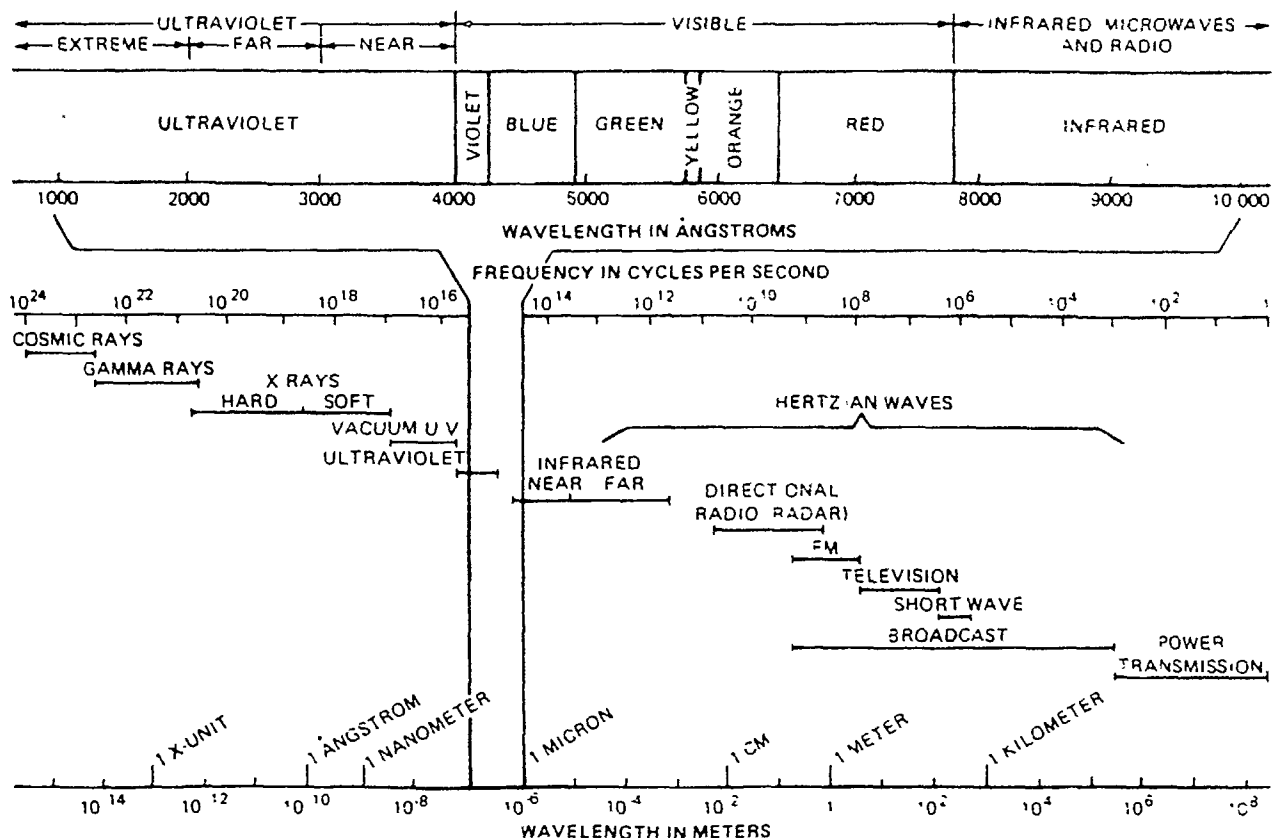
Effect is related to wavelength, power intensity, and time of exposure. Generally, the longer wavelengths will produce a greater temperature rise in deeper tissues than the shorter wavelengths. However, for a given power intensity there is less subjective awareness to the heat from longer wavelengths than there is to the heat from shorter wavelengths because of its absorption beneath the body's surface.

An intolerable rise in body temperature, as well as localized damage, can result from an exposure of sufficient intensity and time. In addition, flammable gases and vapors may ignite when they are inside metallic objects located in a microwave beam.

Power intensities for microwaves are given in units of watts per sq cm. Areas having a power intensity of over 0.01 watt per sq cm should be avoided. Microwaves, like X-rays, are subject to suspicion, since their long-term effects are largely unknown. Short term effects are due mostly to heating of the cell tissue starting at the inside and moving outward. (A microwave oven cooks a roast from the center, outward to the surface of the cut. Unpeeled potatoes can explode, because the moisture in the center is heated past the boiling temperature and builds steam pressure at the center of the potato until it bursts through the uncooked portion surrounding it--explosively).

Exposure to microwaves does the same thing to the human body as is done to the roast in the microwave oven. It cooks from the inside outward destroying the inside organs and tissue before the nerve endings in the skin are even warned.

How about damage to the DNA molecular chain in the nucleus of the cells? Can a small amount, such as from a traffic radar unit, change the chain structure, causing the cell to change character and die or become malignant? We don't know. It does heat instantly and from the inside to the outside...



The electromagnetic spectrum, encompassing the ionizing radiations and nonionizing radiations (expanded portion and right). Top portion expands spectrum between 10^0 and 10^{10} m.

In such areas as exceed the 0.01 watt per sq cm power "standard" dummy loads should be used to absorb the energy output while equipment is being operated or tested. If a dummy load cannot be used, adjacent populated areas should be protected by adequate shielding. Fortunately, microwave shielding is usually effective, even with high power applications.

Infrared radiation does not penetrate below the superficial layer of the skin, so that its only effect is to heat the skin and the tissue immediately below it. Thermal burns are the chief hazard, and such are negligible in most cases, since conventional sources of infrared radiation are limited weak, and offer little exposure extremes. Infrared radiation is not visible.

Visible radiation and ultraviolet radiation, like infrared, are stopped by the skin and penetrate only a small distance below it. Surface heating of the skin is the primary effect.

Ultraviolet radiation, however, is out of the visible spectrum, and the effects of the ultraviolet waves are much more violent than are those of the visible or infrared. A severe burn can be produced with absolutely no warning, and damage to the lens of the eye can be produced by excessive exposure. Since the light is not visible to the eye, exposure can quickly become excessive without the knowledge of the victim.

Electric arcs and anti-bacterial UV devices are the chief sources of intolerable intensities of ultraviolet waves, and protection should be provided.

Protective shielding from ultraviolet radiation is not as simple as may be supposed, however, because what is opaque to visible light may offer no barrier whatever to UV. Conversely, what is no barrier to visible light can effectively block ultraviolet. Glass is a good example of an effective UV shield that allows visible light to penetrate. Colored plastic sheet, on the other hand, blocks visible light while ultraviolet passes through unhindered.

Florescent lighting produces a good amount of ultraviolet radiation, but the glass tube effectively blocks most of the UV wavelength from the work environment. Most florescent bulbs have been developed to allow just the right amount to get through. There is a requirement for some ultraviolet waves. Office workers and workers in factories lighted only with florescent bulbs were the first to suffer from the lack of UV. Modern bulbs, however, are designed to emit the right amounts--something less than strong sunlight contains.

Sunlight is the most common exposure to the ultraviolet spectrum, and people who spend most of their time in direct sunshine develop tumors on some areas of exposed skin. These may become malignant. Cresols and other compounds cause the skin to become extra sensitive to the ultraviolet wavelengths causing the need for special protection for outdoor workers who are exposed to such chemicals as the cresols. (Creams/Clothing)

Visible radiation: Light must be adequate to provide for good vision, but not so bright as to cause glare. Work efficiency and quality require that adequate amounts of normal light be present.

What is good lighting? Many factors help produce it: color of the light, direction and diffusion, and amount. The nature of illuminated surfaces is important. A dark gray, dirty surface may reflect only 10 or 12 percent of the incident light, while a light colored, clean surface may reflect more than 90 percent.

Excessively bright lighting, usually producing glare, and shadows, and dim lighting are all detrimental to employee health and productivity. Problem: Some jobs require contrast lighting. A solution to this need, however, is to provide a good quality diffused light and provide lamps to cast shadow where desired for the required contrast.

Lasers: "Light Amplification by Stimulated Emission of Radiation," or, "LASER," is the term applied to light of a single color, or wavelength, that has been collimated, i.e., caused to travel with all waves nearly parallel to each other and in the same direction. The term reflects the earlier instrument called a "MASER," which used microwaves instead of light, but functioned in the same manner.

The Laser as we normally find it emits a relatively low power beam of concentrated light that is of only one color and does not "fan" out like a normal beam of light. It is used in a variety of ways but it can still be as dangerous to the eye as the more powerful industrial beams used in cutting or microwelding operations.

The high power beam has obvious dangers. Anything potent enough to drill a hole in a diamond almost instantly or slice a piece of steel as if it were butter is something that requires caution. The danger of the lower powered beam, however, lies in the seemingly harmless nature of its appearance and low potential. The human eye has the ability to focus a laser beam as it does normal light by use of the lens of the eye. Both corneal and retinal damage can result by getting one's eye in the path of a mild powered laser beam. The lens, for example, focuses the beam upon the retinal nerve area much as a magnifying glass can focus a beam of sunlight to a small dot of extremely high temperature and brightness. In the case of the laser beam, the direction of entry can place the beam in concentrated form directly upon the optic nerve bundle causing permanent blindness. Direct viewing of the laser should, therefore, be avoided.

The work area should contain no reflective surfaces; even highly polished furniture or mirrors can reflect the laser beam with very little loss in intensity. Such a direct "flash" of laser

light directly into the eye is much more dangerous than that of the welder's arc. There are numerous factors that affect the amount of damage and source of laser exposure, but those who work with lasers require special training concerning the hazards. The work area should never be easily accessible so that anyone could blunder into the laser work area.

TEMPERATURE EXTREMES

General experience shows that extremes of temperature affect the amount of work that a man can do and the manner in which he does it. The body processes are so designed that they can operate only within a very narrow limit of temperature, and the natural cooling and heating defenses of the body are such that they respond quickly and continuously.

The temperature extremes are the problems. The body can sweat only so much to promote cooling before limits are exceeded and it can generate heat for body warmth only to the limits of biological assimilation.

Sweating: Sweating is the most important of the temperature regulating and heat dissipating process. With no stress, resting and at normal temperature, the body loses about one quart of water per day. Since evaporation is as rapid as excretion, it is not seen.

Under the stress of heavy work at high temperature, the body loses about a gallon of water every four hours. Salt is lost to the amount of 150 to 190 grains. Under these conditions, both salt and water must be replaced. If conditions are humid, evaporation is less and cooling may be impaired.

Assuming that salt must be replaced is a dangerous thing. Salt tablets may not be required, and their use may actually be dangerous unless adequate water combined with high perspiration rate exists. (We normally have more salt in our modern diets than we need.)

Heatstroke, heat cramps or heat exhaustion may result when the natural cooling capacity is exceeded by conditions. All require treatment and are a result of an excessive heat condition. Prevention of such conditions must be the concern of supervisors of "hot" areas of labor.

Heat controls, reflective shields, cooling fans, air conditioning, cool drinking water, salt tablets, and frequent "breaks" are all possible precautions. When air conditioning is not feasible, reducing heat at the source will often be more effective than trying more cooling fans or insulation.

(For someone who is overheated, but not yet a victim of stroke, cramps or exhaustion, the ancient "construction worker" remedy may work. Pouring or running cold water over the wrists where the veins and arteries run can offer temporary but rapid relief. "Cooling the blood" is the goal, and there may be some validity to it. Blood moves from the wrist area to the heart in less than twenty seconds, under normal circulation.)

Atmospheric pressures have long been recognized as important in the consideration of occupational hazards. Caisson work dating back to 1850 demonstrated the ill's and hazard potential of working under greater than normal pressures.

The main effect, decompression sickness (bends) is caused by tiny bubbles of nitrogen being liberated in joint areas and under muscles when pressure is lessened. Nitrogen is forced into solution in the blood under high pressure conditions, but becomes gaseous upon the relieving of pressure; the tiny pockets of gas cause great pain and sometimes tissue damage as they expand like balloons. Such bubbles in the brain usually cause death, but, fortunately, the nitrogen is usually in a gaseous form in the joint and muscle areas.

The solution has traditionally been to decompress slowly, giving the nitrogen time to release through respiration without collecting as expanding pockets of gas.

Deep-sea divers may receive a mixture of oxygen and helium to avoid nitrogen saturation, but carbon dioxide may act as a narcotic under extreme pressures unless the oxygen content is kept quite high.

Other pressure related problems involve inner ear blockages when pressures are not equalized within the ear. The eustachian tube may be blocked and prevent the pressure from equalizing. Sinus congestion, ruptured ear drums, and loss of hearing are problems.

Reduced pressure can cause similar problems, especially at high altitudes, but it is complicated by a lack of oxygen. Oxygen levels should be increasingly higher up to 100 percent, but the pressure must also be kept equal to the 8,000 foot level or less.

Oxygen deficiency can cause death, brain damage, and loss of consciousness, but when the deficiency is minor, the effect is much like intoxication. (Also a stage that exists when the level is fatal, just before loss of consciousness) Euphoric, "who cares," responses are typical and coupled with laughter, lack of coordination and judgmental error--including the lack of concern about imminent death.

Assuming a safe return to normal pressures before death occurs, the headache that results is similar to the intoxication "hangover."

ERGONOMICS

The third category of environmental factors can be called ergonomic. It involves human reaction to monotony, fatigue, repeated motion, and repeated shock.

The term literally means the customs, habits, and laws of work. It goes beyond productivity, health and safety. It includes consideration of the total physiological and psychological demands of the job upon the workers.

In the broad sense, the benefits which can be expected from designing work systems to minimize physical stress on workers are:

- More efficient operation
- Fewer accidents
- Lower cost of operation
- Reduced training time
- More effective use of personnel

The human body can endure considerable discomfort and stress and can perform many awkward and unnatural movements--for limited periods of time. When, however, unnatural conditions or motions are continued for prolonged periods, the physiological limitations of the worker may be exceeded. To ensure a continually high level of performance, work systems must be tailored to human capacities and limitations.

Biotechnology is the term that applies to the engineering for the best ergonomic environment, and the problem areas of concern are:

- ...Strictly biomechanical aspects, the consideration of stress on muscles, bones, nerves, and joints.
- ...Sensory aspects, the consideration of eye fatigue, color, audio signals, and the like.
- ...External environment, such as lighting, glare, temperature, humidity, noise, atmospheric contaminants, and vibration.
- ...The psychological and social aspects of the working environment.

Information obtained from studying these factors can be translated into tangible changes in the work environment.

Mechanical Vibration:

While most of us have experienced the numbing sensation of holding some vibrating tool for too long a period, this is a mere prelude to what doing the same kind of thing day in and day out can do. Irritation, emotional outbursts, disruptive or defiant behavior, and a number of other "bad" results can be traced to nerve-jangling vibrations that are part of a given job.

An extreme of this kind of thing is a condition known to stone-cutters as "dead fingers" or "white fingers," and occurs mainly on the fingers used to guide the stone cutting tool. The circulation becomes impaired, and the fingers become white and lose sensation as though mildly frostbitten. Warming for long periods of time usually restores the circulation and feeling, but some have been forced to seek another kind of employment.

The condition is produced by vibrations while the fingers are held in a strained position. The condition is aggravated and accelerated by chilling, such as by the air exhaust of the tool. Prevention is much better than treatment, and such simple things as deflecting the cool air from the tool exhaust so it does not chill the hand does much to prevent the condition. Keeping the hands warm does even more.

The same condition is now known to exist in many other types of work environments involving such tools. Air hammers such as used in scarfing and chipping in the metal trades are an example. A little prevention is well worth the effort in production alone.

Repeated motion:

Repetitive motions or repeated shocks like those in sorting and assembling jobs often cause irritation of the tendon sheath of the hands and arms. Inflammation, often known as tendonitis, can result and it is as painful as well as disabling. Another term for it is "tenosynovitis," and the treatment is often long in duration involving rest and diathermy. Prevention, of course, is much better than treatment.

For example, in the printing industry, cases of some hands and wrists were prevented by lowering the surface of the jogging tables two inches so that the hands and wrists could fall into a relaxed position at the end of each motion.

The point is that employees should be closely watched so that if they show any signs of soreness in the backs of the hands, wrists, forearms, or shoulders, they can be transferred temporarily to other work or the job can be changed slightly to reduce the strain.

Biological Stresses:

This is the fourth and final category of environmental factors, and is of a biological nature. It is related to problems with animal handling, insects, molds, fungi bacteria, and grain dusts. While Bell does not involve itself in such activities as a general rule, the employees may become involved as in leisure activities or in the pursuit of establishment of retirement goals. An employee who becomes ill because of off-the-job activities is just as much a loss as if he became ill because of the job.

Most of the ills from handling grain, animals, and fodder come from breathing the dust of contaminated materials or areas. Safety in this area involves dust protection and checking of animals. Cotton fiber dust, fish handling, and animal slaughter may also be hazardous. Brucellosis (undulant fever) has long been known as an infection caused by drinking unpasteurized milk from cows suffering from Bang's disease.

THRESHOLD LIMIT VALUES

Chemical compounds cause problems mostly because they end up inside the body. An open container of carbon tetrachloride is not a problem until someone stands over it and breathes the vapor. It may not be a problem, even then, if sufficient air has diluted the vapor to ten parts of carbon tetrachloride per million parts of air (ppm). These limits are called Threshold Limit Values (abbreviated TLV).

The basic idea of TLV's is fairly simple, and they refer to the airborne concentration of substances thought to be hazardous when certain limits are exceeded day after day. Conversely, the TLV refers to the limits of some four hundred substances that can be safely breathed day after day in the work or other environment without hazard or nuisance.

There is also a ceiling value established for these substances that must not be exceeded at any time during the normal work day.

The hygienist uses special terminology to express such conditions. One frequently seen is ppm. Another is mmgs/M^3 , which means milligrams per cubic meter.

One part per million doesn't mean much to the average person--as a figure--because it is difficult to conceive of what a million parts of anything looks like. One way of looking at it is, one inch in sixteen miles, or one cent in \$10,000. These represent examples of one ppm. Another example would be, an ounce of salt in 62,500 lbs of sugar equals one ppm contamination, or one part per million.

Dermatitis:

Causes of occupational skin diseases are classified in these ways:

1. Mechanical agents--friction, pressure, trauma.
2. Physical agents--heat, cold, radiation.
3. Chemical agents--organic and inorganic. These are subdivided according to their action on the skin as primary irritants or sensitizers.
4. Plant poisons--several hundred plants and woods can cause dermatitis. The best known example is poison ivy.
5. Biological agents--bacteria, fungi, parasites.

There are two general types of skin reaction: primary irritation dermatitis and sensitization dermatitis. The first type has nothing to do with allergy, and either prolonged exposure to low concentrations or short exposure time to high concentrations can cause the primary dermatitis. Sensitization is caused by exposure, and may be associated with primary irritation dermatitis, but after sensitization occurs, even small amounts of the material may cause symptoms.

Some substances produce both types of dermatitis. Examples are organic solvents, formaldehyde, and chromic acid.

Occupational acne often results from such things as cutting fluids, and it all starts when the skin becomes irritated from contact with the oil. Dirty oil, worker carelessness, and use of germicides in the fluid increase the possibility of occupational acne.

To reduce the possibility, keep machines and areas around them clean. Change cutting fluid at regular intervals. Have employees use protective creams or gloves, apron, or face shield. Encourage employees who work in these areas to shower at the end of each shift. They should use warm water, mild soap and a soft brush.

Industrial hygiene controls: The supervisor should be aware of the various kinds of controls that are used to maintain a good healthy working environment. General methods of controlling harmful environmental factors or stresses include the following:

1. Substitution of a less harmful material for one which is dangerous to health.
2. Change or alteration of a process to minimize worker contact.
3. Isolation or enclosure of a process or work operation to reduce the number of persons exposed.
4. Wet methods to reduce generation of dust in operations such as mining or quarrying or any other dust producing operation.
5. Local exhaust at the point of generation and dispersion of contaminants.
6. General or dilution ventilation with clean air to provide a safe atmosphere.
7. Personal protective devices, such as special clothing, and eye and respiratory protection.
8. Good housekeeping, including cleanliness of the workplace, waste disposal, adequate washing and eating facilities, healthful drinking water, and control of insects and rodents.
9. Special control methods for specific hazards, such as reducing of exposure time, film badges and similar monitoring devices, continuous sampling with preset alarms, and medical programs to detect intake of toxic materials.

10. Training and education to supplement engineering controls.

As a supervisor, you play a very important part in making sure that controls are effective. You must observe and study process changes, process enclosures, use of wet methods, local exhaust ventilation and general ventilation very carefully and systematically.

In fact, you, the supervisor, are the key man as far as safety is concerned. You may not be an industrial hygienist, but there are no controls that will work without your help and guidance. Your observations and suggestions are no less important than his.

PERSONAL SAFETY EQUIPMENT

There are work hazards that simply cannot be eliminated. The hazard is part of the job and can't be engineered out of it. If there is a personal safety equipment that allows the worker to safely do the job, then the job can continue to exist in it's present form. Another solution is automation that allows the existing hazard to be contained in some way, but this is expensive and often impossible.

There are two million disabling injuries every year, of which 14,100 are fatal, and about 90,000 result in some permanent impairment. We can safely assume that personal safety equipment used would effectively reduce the number of disabling injuries. The critical part of the problem seems to not be in providing the safety equipment, but, rather, in getting the employees to either use the equipment at all or to use it properly. The pressure of such a responsibility falls directly upon the shoulders of the supervisor--who should be adequately backed by company policy, even to disciplinary recourse for extreme cases.

A word needs to be said, however, about controlling the hazards. Too many of us will provide safety equipment when the work hazard can be controlled to the point that safety equipment is no longer needed. Safety equipment should not be used as a substitute for hazard control. Safety equipment is for use in situations that preclude the elimination of hazards.

Hazard control through the use of safety equipment:

In cases where the use of personal safety equipment is necessary, there are some basic "do's" for the supervisor:

- A. Be familiar with required standards and the Occupational Safety and Health Act requirements.
- B. Be able to recognize hazards.
- C. Be familiar with the best safety equipment available to protect against these hazards.
- D. Know the procedures for supplying the equipment.
- E. Know how to maintain and clean the equipment.
- F. Develop an effective method for persuading all employees to dress safely and to wear the proper protective equipment when they should.

The supervisor is responsible for following up on the use of such equipment. When persons do not see the need or purpose for using such equipment, the supervisor is the key man who must get them to recognize the need for it.

The supervisor is responsible for following up on the use of such equipment. When persons do not see the need or purpose for using such equipment, the supervisor is the key man who must get them to recognize the need for it. A simple and straightforward, "Use it!" is not getting the job done. It is much more effective if the employee uses such equipment because he understands the need for it and is willing to make using it a regular habit. Of course, that means that the supervisor must know and understand personal safety equipment so as to effectively explain it to his employees. So, adding to the list of "do's," are these:

- G. Above all else, wear the same equipment required of the workers.
- H. Assure that all equipment conforms to standards where they apply.
- I. Know the company policy regarding this equipment and the rules covering violations for not wearing it.

General Body Protection:

There is practically no part of the human body that we do not have to provide equipment for today. This includes:

Hair	Face	Arms, hands, fingers
Head	Ears	Legs, feet, toes
Eyes	Lungs	Torso

Protection of Eyes:

Eye protection is probably the most important to you, the key man, because sight is our most prized possession. Next to our hands and fingers, our eyes are probably the most vulnerable. There are many types of safety glasses, and, at Bell, they are furnished for those regularly working in hazard areas. These types include:

Spectacles	Chemcial goggles
Spectacles with side shields	Dust goggles
Cover goggles	Melter's goggles
Cut-type goggles	Welder's goggles

Frames must also be considered as to type of material. There are metal frames, acitrate frames (not cellulose nitrate), rubber frames and plastics of many types. It is suggested that if there is some doubt about which type to use, the BHT Safety Department be contacted for clarification.

Head Protection:

Those of you who must provide head protection, must also make the proper selection. There are safety hats, safety caps, and head-gear made of laminated plastic, glass fiber, and aluminum alloy.

Some headgear doesn't meet any of the standards, while some meet the ANSI Standard Z89.1-1969, they do not meet Z89.2-1971 specifications for dielectric strength. "Bump Caps," which are quite popular today, must not be considered safety caps at all. They offer no protection against falling objects, and are for bumping hazards only. Fortunately, the BHT safety department has provided for the proper headgear according to the hazard area, but if there is any doubt or if there has been some change, contact them for clarification.

Respiratory Protection:

It is important that some supervisors have knowledge of respiratory equipment, but it is important that the selection of the proper kinds of equipment be left to the industrial hygienist or a qualified safety director. You, as the key man, however, should have an understanding of the basic differences in the equipment.

Mechanical Filter Respirators--for nuisance dusts and pneumoconiosis-producing dusts.

Chemical Cartridge Respirators--for concentrations of some vapors and gases.

Gas Masks--Canisters are identified by color for type of exposure.

Hose Masks--for working in atmospheres of dangerous concentrations of dust, mist, vapors, gases or insufficient oxygen.

Air Line Respirators--for atmospheres not immediately dangerous to life.

Self-contained Breathing Apparatus--for hazardous atmospheres with oxygen deficiencies.

Hands and Fingers:

Because material handling is one of the most serious problems in industry today, it will be discussed as a separate problem, but we must give some consideration to hand and finger protection in this section on personal equipment. In the area of gloves and mitts, we find them being made of almost every type of material. There are gloves made of leather, cotton, asbestos, linen, plastic, rubber, plastic-coated fabrics, wool, terry cloth, and numerous other kinds. The supervisor should be aware that gloves could be a hazard in and of themselves. It is necessary for the key man to be aware of where they should not be allowed as well as where they might offer protection.

Electricians gloves should be tested regularly for dielectric strength. A slight wearing of the material or a small hole could be the pathway for a fatal electric shock when dealing with very high voltages, and could cause electric shock and/or burn injuries at the very least.

In addition to gloves and mitts, we have hand pads, hand leathers, palm guards, and finger stalls. There are also many types of protective creams to protect the skin. If the supervisor feels that there might be a need for gloves, creams, or other kind of protective equipment for hands or fingers, he should contact the safety department for information and equipment supply. There are seven points that should be remembered:

1. Engineering design is the most effective way to control hazards.
2. Supervisors must be able to recognize hazards and know what equipment is required.
3. In order to have an effective program there should be an efficient way to issue, clean, and maintain the equipment.
4. The program must be sold to the employees on the basis of need.
5. The supervisor must be able to overcome objections.
6. The safety policy must be in writing and there should be rules concerning violations.
7. Protective equipment should conform to standards where they apply.

Personal equipment should not be considered a first line of defense. Elimination of the hazard should be the first consideration. Personal protective equipment may, however, be the last resort short of not doing the job at all!

GOOD HOUSEKEEPING:

Under the Williams-Steiger Occupational Safety and Health Act, each employer is required to maintain a safe and healthful place of employment which is free of all reasonable hazards. More specifically, each of the various subparts of the Act usually carry specific housekeeping recommendations for the type of operations they govern--the principal ones being for Aisles and Passageways.

One of the many responsibilities of the supervisor is to see that the housekeeping standards as established by top management are maintained. Few people would disagree with the statement that a clean work place is a safer, more efficient and better place to work than one that is not clean.

Poor housekeeping contributes to three major problems for the supervisor:

1. Costly or increased accidents.
2. Fire or fire hazards.
3. Reduction or lower production.

This is only part of the negative side of the picture. There are many reasons for poor housekeeping, but the best way to prevent sloppy conditions from developing is for the supervisor to insist upon a clean workplace without becoming dictatorial about it. A better way is to explain the benefits as well as the hazards involved. Taking the positive side of the issue, the supervisor can hope to gain the following if good housekeeping practices are maintained.

1. Reduced operating cost.
2. Increased production.
3. Improved production control.
4. Conserve material and parts.
5. Save production time.
6. Better use of space.
7. Improves traffic flow or permits faster traffic.
8. Reduce accident frequency.
9. Generate higher employee morale.
10. Reduce fire hazard.

To get the good housekeeping that can help in so many ways:

1. The supervisor must set a good example.
2. Assign each employee specific housekeeping responsibilities.
3. Develop routine departmental inspection.
4. Provide for trash disposal and removal.
5. Be sure flammable solvents are kept and stored in approved containers.
6. Encourage employees to report conditions that contribute to the disorder.
7. Review accident records noting those that involve poor housekeeping.

People are prone to let the things that can ride until later do exactly that. It is the easiest thing to leave trash under a work table--it takes effort to get it out. Using a window for just a while often turns the window into a permanent storage area. It isn't that people are not well-intentioned, but only that there is the line of least resistance that most of us take. Personal discipline is needed to overcome this tendency, and it takes a supervisor who is alert and on his toes to keep the place in order. It isn't a matter of being "hard-nosed" about the matter, but the supervisor has to demonstrate that he really cares before the employees begin demonstrating that they also care.

Color Marking for Safety:

Industry used color in four ways:

- ...For plant interiors and general equipment.
- ...For marking hazards and identifying particular equipment.
- ...For identifying content of piping systems.
- ...For accident prevention signs.

THE SAFETY COLOR CODE FOR MARKING PHYSICAL HAZARDS

RED--Fire, danger, stop.

Identifies fire protection equipment and apparatus including exit signs, wall marking and supports on which extinguishers are mounted, flammable liquid containers (except shipping containers), on which the name of the contents should be stenciled.

Danger signs and lights at barricades, temporary obstructions, and temporary construction sites.

Emergency stop bars on machines like rubber mills, wire blocks and flat work ironers, stop buttons for electric switches.

YELLOW--Caution for marking physical hazards.

Identifies hazards that may result in slipping, falling, tripping, caught in-between, and bumping into objects.

For attracting attention--solid yellow, yellow with black stripes, or yellow and black checks. (Use the combination that creates the most attention.)

Handrails, guard rails, or top and bottom treads of stairways, low beams, pipes, and crane blocks. Exposed edges of platforms, pits, and walls.

Mobile equipment (construction or materials handling) and industrial locomotives--black and yellow stripes.

GREEN--Safety and first aid equipment location.

First aid and safety equipment (like deluge showers). Stretchers, gas masks, and safety bulletin boards.

Other locations connoting "safety" rather than "hazard."

BLACK AND WHITE--Traffic and housekeeping.

ORANGE--Dangerous parts of machines and electrical equipment.

Dangerous parts of machines that are exposed when enclosure doors are open or guards removed.

Energized equipment which may cut, crush, shock, or otherwise injure. Inside of movable guards, safety starting buttons, or exposed edges of cutters, gears, pulleys, sheaves and the like.

BLUE--Operation warnings.

Barriers, flags, tags, and other cautions against starting, using or moving machinery or equipment undergoing repair or being serviced. These should be placed conspicuously at the starting points or power sources or valves of machinery, such as elevators, tanks, ovens, mixers, or boilers, and on scaffolds and ladders.

The 1971 standard recommends that yellow replace blue.

PURPLE--Radiation hazards.

Containers of radioactive materials. Rooms, areas, or equipment that is contaminated with radioactive materials.

Radioactive materials disposal and storage areas.

Signal lights that indicate radiation-producing machines in operation.

Yellow is used in combination with purple for tags, labels, signs, and floor markers.

The color code for piping systems is a simplified plan to classify and identify pipeline contents. The basic colors are much the same as those in the Safety Color Code, Z53.1. The code, however, does not apply to underground pipes, electrical conduit, or to pipes carrying solids suspended in either gas or air.

The color code for pipe contents is as follows:

TABLE VIII	
IDENTIFICATION OF PIPELINE CONTENTS BY COLOR	
<i>Material Classification</i>	<i>Color</i>
Fire protection materials.....	red
Dangerous materials.....	{ yellow orange green white
Safe materials.....	{ black gray aluminum
Protective materials.....	bright blue
Source: American National Standard A13.1, <i>Scheme for the Identification of Piping Systems.</i>	

MATERIALS HANDLING AND STORAGE

Materials handling is a job that almost every worker in industry performs. It may be his sole duty, part of his regular work, done mechanically, or by hand. Manual handling of material increases the possibility of injuries and adds to the cost of the product.

Since things have to be handled in every stage of production, the subject of materials handling is important to almost everyone. It accounts for about 23 percent of all occupational injuries, and the most susceptible parts of the body are the hands and fingers, feet and toes, and back and groin (hernia). Strains to almost any muscle or tendon are possible, and account for lost productivity even when not serious enough to require medical attention.

Slipping, falling, climbing injuries, and being crushed by falling or slipping material are all potential hazards that can be nullified greatly by training and continued emphasis. This is the job of the supervisor, the key man, to assure that training and emphasis are part of the regular work environment. Unsafe work practices may be spotted easily by the alert supervisor, and include improper lifting, carrying too heavy a load, incorrect gripping, failing to observe proper foot or hand clearances, and failing to wear proper equipment.

To gain insight into your materials handling injury problem, ask yourself the following questions about your present operating practices:

1. Can the job be engineered so that manual handling will not be necessary?
2. How do the materials being handled (such as chemicals, dusts, rough and sharp objects) hurt the people doing the handling?
3. Can employees be given handling aids, such as properly sized boxes, adequate trucks, or hooks, that will make their jobs safer?
4. Will protective clothing or other personal equipment help prevent injuries?

These are by no means all the questions that should be asked, but they are a beginning.

The largest number of injuries occur to fingers and hands. People need instruction if they are to avoid the "natural" ways of picking objects up or putting them down. The following are a few pointers that you can give them:

1. Inspect materials for slivers, jagged edges, burrs, rough or slippery surfaces.
2. Get a firm grip on the object. (No matter how hurried you may feel at the moment, work will stop completely when the object slips and breaks or slips and breaks part of you.)

3. Keep fingers away from pinch points, especially when setting down materials.
4. When handling lumber, pipe, or other long objects, keep hands away from the ends to prevent them from being pinched.
5. Wipe off greasy, wet slippery, or dirty objects before trying to handle them.
6. Keep hands free of oil and grease.

In most cases, gloves, hand leathers, or other hand protectors have to be used to prevent hand injuries, but their use must be controlled if they are to be worn around moving machinery. When handling wire or strap bound materials, eye protection and heavy gloves should be worn. If dust is a problem or if the material handled is toxic, effective respirator equipment should be worn.

Sometimes handles or containers with handles can be provided, such as a basket with stout handles or carrier handles for batteries. They are well worth their costs in the effort toward preventing accidents.

LIFTING AND CARRYING:

People also need training in handling heavy objects. Before employees are assigned to jobs requiring heavy or frequent lifting, they should be physically suited for the job. The supervisor is the key man, and it should be remembered that a person's lifting ability is not necessarily indicated by his height or weight. Be sure to instruct properly. If he knows how, a man can lift considerable weights without injury or strain. Take the time.

Employees should be cautioned to consider the size, weight, and shape of objects to be carried. Never lift more than can be handled comfortably. If necessary, get help.

Never carry a load that you cannot see over or around. Make sure the path of travel is clear, and use the six-step procedure. Remember, setting an object down is the reverse of lifting it, but that momentum of heavy objects can pinch fingers not endangered when picking it up.

SIX-STEP LIFTING PROCEDURE:

1. Keep feet parted--one alongside, one behind the object.
2. Keep back straight, nearly vertical.
3. Tuck your chin in.
4. Grip the object with the whole hand.
5. Tuck elbows and arms in.
6. Keep body weight directly over feet.

When bulky objects are to be handled or when objects are to be carried on the shoulder:

1. To place an object on a bench or table--First set the object on edge and push it far enough onto the support to be sure it will not fall. Release it gradually as you set it down. Move it in place by pushing with the hands

and body from the front of the object. This method prevents fingers from getting pinched.

2. To raise an object above shoulder height--Lift the object first to waist height. Rest the edge of the object on a ledge, stand or hip. Shift hand position so object can be boosted after knees are bent. Straighten out knees as object is lifted or shifted to the shoulders.
3. To change direction--Lift the object to carrying position, and turn the entire body, including the feet. Do not twist your body. In repetitive work, the person and the material should be positioned so that the person will not have to twist his body when moving the material.
4. If the object is too heavy to be handled by one person--Get help. When two or more men are handling the same object, one man should "call the signals." All the men on the lift should know who this man is and should warn him if any one of the crew is about to relax his grip.

Handling specific shapes:

Boxes or cartons are best handled by grasping them at alternate top and bottom corners and drawing a corner between the legs. Bags or sacks are grasped in the same manner as boxes. If the sack is to be raised to shoulder height, the procedure for raising heavy objects should be used. (#2)

Barrels and drums. Men need special training to handle barrels and drums safely.

If two men are assigned to upend a full drum, they should use the following procedure:

1. Stand on opposite sides of the drum and face each other.
2. Grasp both chimes (rolled edges at both ends of the barrel) near their high points. Lift one end; press down on the other.
3. As the drum is upended and brought to balance on the bottom chime, release the grip on the bottom chime and straighten up with the drum.

When two men are to overturn a full drum, they use this procedure:

1. Make sure they have enough room. Cramped quarters can result in badly injured hands.
2. Both stand near each other, facing the drum. They grip the closest point of the top chime with both hands. Resting their palms against the side of the drum, they push until the drum balances on the lower chime.
3. They step forward a short distance, and each man releases one hand from the top chime in order to grip the bottom chime. They ease the drum down to a horizontal position until it rests solidly on its side.

While there is a procedure for one man to handle a drum, it is safer to use barrel and drum lifters that are commercially available. When rolling a drum, directional change should be made by gripping the chime, not kicking it with the feet.

Drum weights can be deceptive, and serious injury can result if proper care is not taken. For example, a 55-gallon drum of polyurathane weighs 480 pounds, exclusive of the drum. Putting that kind of weight into motion requires both procedure and proper planning in order to stop the motion when and where desired.

Long objects, like ladders, lumber, or pipe, should be carried over the shoulder. The front end should be held as high as possible to prevent its striking other employees, especially when turning corners. When two or more carry an object, they should place it on the same shoulder, i.e., right or left, and keep in step.

EQUIPMENT FOR HANDLING

Hand tools are made for specific jobs or materials, and they should be used for their specific purposes only.

The crowbar is one of the most common hand tools, and it comes in various shapes and sizes. An assortment should be kept handy, and selection should be covered in employee training. This is to assure the proper size is used for a given job.

Since they are prone to slip, an employee should never work astride a crowbar. He should position himself so that he will not be pinched or crushed if the bar should slip or the object move suddenly. The bar should be kept in good repair, never dull or broken, and have a good "bite."

It is important that when not in use that the bars be kept on a rack or otherwise placed so it cannot fall upon or trip someone.

Rollers are used for moving heavy or bulky objects. It is not uncommon for workers to crush fingers or toes between the rollers and the floor. Caution should be instilled, but it is better if the workers are taught to use a sledge or bar to change direction of the object. (Not the hands or feet). Unnecessary turns should be avoided by making sure rollers are properly placed before moving is started. Never use compressed gas cylinders as rollers.

Handles of tongs and pliers should be offset so the user will not pinch his hands and fingers.

Hooks. Hand hooks used for handling material should be kept sharp so that they will not slip when applied to a box or other object.

The handle should be strong and securely attached and shaped to fit the hand. The handle and the point of long hooks should be bent on the same plane so that the bar will lie flat when not in use and not constitute a tripping hazard. The point of any hook should be shielded when not in use.

Shovels. Shovel edges should be kept trimmed, and handles should be checked for splinters. Workers should wear safety toe shoes with sturdy soles. They should have their feet well separated to get good balance and spring in the knees. The leg muscles should take much of the load.

To reduce the chance of injury, the ball of the foot--not the arch--should be used to press the shovel into clay or other stiff material. If the instep is used and the foot slips off the shovel, the sharp corner of the shovel may cut through the workman's shoe and into the foot.

Dipping the shovel into a pail of water occasionally will help keep it free from sticky material. Greasing or waxing it will also prevent some kinds of material from sticking. When not in use, shovels should be stood against a wall or kept in racks or boxes.

HAND TRUCKS:

Two-wheeled hand trucks look as though they should be easy to handle, but there are safe procedures that must be followed.

1. Keep the center of gravity of the load as low as possible. Place heavy objects below lighter objects.
2. Place the load well forward so the weight will be carried by the axle, not by the handles.
3. Place the load so it will not slip, shift, or fall. Load only to a height that will allow a clear view ahead.
4. Let the truck carry the load. The operator should only balance and push.
5. Never walk backwards with a hand truck.
6. When going down an incline, keep truck ahead. When going up, keep the truck behind.
7. Move trucks at a safe speed. Do not run. Keep truck constantly under control.

A truck designed for a specific purpose should only be used for that purpose--a curved bed truck should only be used for handling drums or other circular materials, and a horizontal platform truck for handling gas cylinders.

Foot brakes may be installed on wheels of two-wheeled trucks so that operators need not place their feet on the wheel or axle to hold the truck. Handles should have knuckle guards.

Four-wheeled truck operation follows rules similar to those for two-wheeled trucks. Extra emphasis should be placed on proper loading, however. They should be evenly loaded to prevent their tipping. Four-wheeled trucks should be pushed rather than pulled, except for a truck that has a fifth wheel and a handle for pulling.

Trucks should not be loaded so high that operators cannot see where they are going. If there are high racks on the trucks, two operators should move the vehicle. Handles should be placed in

protected places on the racks or truck body so that passing traffic, walls, or other objects will not crush or scrape the operator's hands.

Contents should be arranged so they will not fall or be damaged in case the truck or the load is bumped.

General precautions: Truckers should be warned of three main hazards: A. Running wheels off bridge plates or platforms, B. Colliding with other trucks or obstructions, and C. Jamming their hands between the truck and other objects.

When not in use, trucks should be stored in designated areas, not in aisles or other places where they would be a tripping hazard or traffic obstruction. Trucks with drawbar handles should be parked with the handles up and out of the way. Two-wheeled trucks should be stored on the chisel with handles leaning against a wall or the next truck.

Powered hand trucks: The use of a powered hand truck, controlled by a walking operator, is increasing. The principal hazards of this truck are: A. The operator can be caught between the truck and another object, and B. Collisions with other objects.

The truck should be equipped with a dead-man control. There should be wheel guards, and an ignition key that can be taken out when the operator leaves the truck.

Most operators must be trained. Operation by unauthorized persons should be prohibited, and training should include operating instructions given in the truck manufacturer's manual.

General instructions include:

1. Do not operate the truck with wet or greasy hands.
2. Lead the truck from right or left of the handle. Face direction of travel. Keep one hand on the handle.
3. When entering an elevator, back the truck in to keep from getting caught between the handles and the elevator walls. Operate the truck in reverse whenever it must be run close to a wall or other obstruction.
4. Always give pedestrians the right of way.
5. Stop at blind corners, doorways, and aisle intersections to prevent collisions.
6. Never operate the truck faster than normal walking pace.
7. Only handle flammable or corrosive liquids when they are in approved containers.
8. Never ride the truck, unless it is specifically designed for the driver to ride.
9. Never permit others to ride on the truck.
10. Do not indulge in horseplay.

These general rules for operators of powered hand trucks should also be followed by operators of power trucks.

General rules for driving powered industrial trucks in most operations are as follows. (For each operation, a specific set of rules should be drawn up.)

1. All traffic regulations must be observed, including authorized plant speed limits.
2. Safe distances must be maintained. Approximately three truck lengths from the truck ahead and truck must be kept under control at all times, so that an emergency stop, if necessary, can be made in the clear distance ahead.
3. The right of way shall be yielded to ambulances, fire trucks, and other vehicles in emergency situations.
4. Other trucks traveling in the same direction must not be passed at intersections, blind spots, or other dangerous locations.
5. Drivers are required to slow down and sound horns at cross aisles and other locations where vision is obstructed. If forward view is obstructed, because of the load being carried, drivers are required to travel with the load trailing.
6. Railroad tracks must be crossed diagonally whenever possible, and parking within 8 ft of the center of the nearest railroad track bed is prohibited.
7. Drivers are required to look in the direction of travel, and to keep a clear view of the path of travel at all times. Never back up without looking.
8. Grades are to be ascended or descended slowly and loaded trucks must be driven with the load upgrade on grades in excess of 10 percent. Unloaded trucks must be operated on all grades with load engaging means downgrade. On all grades, load and load-engaging means shall be tilted back if applicable and raised only as far as necessary to clear the road surface.
9. Under all travel conditions, truck must be operated at a speed that will permit it to be brought to a stop in a safe manner. Drivers are required to slow down for wet and slippery floors and stunt driving and horseplay are not to be permitted.
10. Dockboards or bridgeplates are to be driven over carefully and slowly and only after they have been properly secured. Their rated weight capacity must never be exceeded.
11. Approach elevators slowly and stop at least 5 ft from gate. Obey elevator operator's signals, enter squarely and only after the elevator is properly leveled. Once on the elevator, neutralize the controls, set the brakes, shut off power, and then step off the truck.
12. While negotiating turns, speed must be reduced to a safe level by means of turning the hand steering wheel in a smooth, sweeping motion. When maneuvering at a very low speed, the hand steering wheel must be turned at a moderate even rate.
13. Never run over loose objects on the roadway surface.
14. Only stable or safely arranged loads shall be handled and caution must be exercised when handling off-center loads which cannot be centered.

15. Only loads within the rated load capacity of the truck shall be handled, and long or high (including multiple-tiered) loads which may affect capacity must be adjusted.
16. Load-engaging means must be placed under the load as far as possible and the mast shall be carefully tilted backward to stabilize the load.
17. Extreme care must be exercised when tilting the load forward or backward, particularly when high tiering. Tilting forward with load-engaging means elevated is not permitted except to pick up a load. Elevated loads must not be tilted forward except when the load is in a deposit position over a rack or stack. When stacking or tiering, only enough backward tilt to stabilize the load shall be used.
18. When operating in close quarters, keep hands where they cannot be pinched between steering controls and projecting stationary objects. Keep legs and feet inside the guard or the operating stations of the truck.
19. Do not use the reverse control on electric trucks for braking.
20. Park trucks only in designated areas—never in an aisle or doorway, or obstructing equipment or material. Fully lower the load engaging means, neutralize the controls, shut off the power, and set the brakes. Remove the key (or connector plug) when leaving a truck unattended. If the truck is parked on an incline, block the wheels.

Depending on its use, a power truck should have a dead-man control, and should be equipped with guards, such as hand enclosure guard or a canopy guard. A lift truck should also have upper and

No power truck should be used for any purpose other than that for which it has been designed. A forklift, for example, should never be used as an elevator for employees who would find it convenient in changing light fixtures or stacking materials. An exception would be if the forklift were equipped with a safety pallet with standard railing and toeboards.

When internal combustion engine trucks are operated in enclosures, the carbon monoxide should not exceed a time-weighted average of concentrations over 50 ppm for an eight-hour exposure. The atmosphere must contain a minimum of 19 percent oxygen, by volume. (Normal content is 20.8 percent)

Many companies equip their fuel-powered trucks with catalytic exhaust purifiers to burn the carbon monoxide before it reaches the atmosphere. When operating trucks in locations where there are explosive or inflammable mixtures possible, it must be approved and marked for such areas.

Loads: Operators should be told to refuse unstable loads as well as refusing to operate with an overload. Human beings are not authorized as part of a load and should not be permitted to ride unless there is a specific seat designated for passenger use. Drivers must refuse "hitch hikers."

It is the responsibility to assure that loads as well as the vehicle can be safely driven under objects causing low clearance. If either load or vehicle will not clear, an alternate route must be taken or the obstacle removed prior to passage.

Floors: Floors on which power trucks are used must be kept in good repair. They should have a load capacity adequate for the truck and its load. The combined weight of the heaviest truck and load should not exceed one-fifth the design strength of the floor. A conservative safety factor provides an adequate margin of protection to offset possible miscalculation due to inadequate structural data, misinformation about age, condition of floor members, and type of floor. The 5:1 ratio is not extremely conservative.

Dock plates must be securely fastened down to prevent walking, be in good repair, and strong enough to support five or six times the weight of the heaviest load.

CONVEYORS:

While BHT uses very few conveyor systems, there are some to be found in packaging and storage areas. The most common types are the shute and roller types using gravity to power cartons, etc., into motion. While the overhead sections are normally furnished with necessary guard rails to prevent the conveyed materials from falling to the floor, it is important that operators be cautioned to see to any repairs promptly.

The chief hazard is the catching of a hand or finger between the rollers and a box or crate. Some companies have a warning system that operates whenever the roller or shute conveyor is in operation.

A belt type conveyor powered by electric motors is frequently used to convey materials to an upper storage area and could be a problem while in operation if someone should get hand or finger caught by the moving belt. This is why the "authorized personnel only" signs are on the doors of such areas. Operating persons should assure that the area is not trespassed by unauthorized persons, especially when the powered belt is in operation.

Actually there are very few precautions that need be mentioned concerning such conveyor systems, but carelessness and haste do cause accidents even with seemingly harmless systems like roller or belt conveyors. "Common sense" is the prime safety precaution, but it is the job of the supervisor to see that it is used and that carelessness doesn't result from familiarity with a seemingly safe system. (This precaution applies to almost every aspect of manufacturing operations.)

Cranes: All crane operations use the standard hand signals for movements and emergency shutdowns. No operator who is unfamiliar or uncertified should either operate a crane or direct the movements from the ground.

There are boom, gantry, and overhead traveling cranes, and the standard signals for each must be followed while either directing or operating. Electric overhead cranes are the most common in the BHT plants; therefore, the safety rules for operating electric overhead cranes are as follows:

1. Only a regularly authorized operator should use a crane.
2. When on duty, he should remain in the crane cab ready for prompt service.
3. Before traveling, make certain the hook is high enough to clear all obstacles.
4. Under no circumstances may one crane bump another.
5. Examine the crane at every shift for loose or defective gears, keys, runways, railings, warning bells, signs, switches, sweep brushes, cables and other parts. Report defects. Keep the crane clean and well lubricated.
6. No one should go to the top of a crane without first opening the main switch, placing a warning sign on it, and locking it out. He should unlock the switch and remove the sign promptly when he comes down.
7. After completion of a repair job, make sure that bolts, tools, and other materials have been removed so that damage to machinery will not result when the crane is started and so that nothing can fall off the crane. Keep tools, oil can, and other loose objects in a box provided for the purpose.
8. Do not carry a load over men on the floor. Sound a gong or siren when necessary. Men must not ride the load or the crane hook.
9. If power goes off, move controller to "off" position until power is again available.
10. See that the fire extinguisher on the crane is kept in good condition and if used that it is refilled.
11. Never let an operator run a crane if he is not physically fit to do so or if he is ill.
12. Do not drag slings, chains, or cable. After the load is taken off, do not move the crane until the hook is lowered and the hook-on man has hooked the chain or cable.
13. Be sure the operator knows that if he is asked to move something he thinks is unsafe, that he check with his supervisor first.
14. Be sure that when an operator leaves the cage, that he leaves the main switch open. A magnetic crane must be empty and its controller turned off.
15. When an outside crane is parked at the end of a shift, the brake should be set or the crane chained to the track.
16. The operator should know that if his crane fails to respond correctly he should call the supervisor. Attempting to get out of difficulty by repeated operation may make the condition worse, not better.

RAILROAD ENGINES, HIGHWAY TRUCKS AND MOTORIZED EQUIPMENT:

Operation of this equipment requires special training, using manufacturer's manuals and other detail information. For this portion, should a requirement for such an operator arise, the supervisor should be certain that an experienced driver or operator is available, certified and authorized. The safety department should be contacted for assistance should the need for training arise or should a question of competence come to bear.

ROPES, CHAINS, AND SLINGS:

There are special safety precautions that apply to using ropes, rope slings, wire rope, chains and chain slings, and storing chains. The supervisor should know the properties of the various types used and the precautions both in use and maintenance.

Fiber Ropes: Fiber rope is used extensively in handling and moving materials. The rope is usually made from manila (abaca), sisal, hemp, or nylon. Manila or nylon ropes give the best uniform strength and service. Other types may be adaptable to special uses. Sisal and hemp are not as satisfactory as manila because their strength varies in different grades. Sisal is about 67 percent as strong as manila; hemp about 50 percent as strong, but more resistant to atmospheric deterioration.

Manila rope is yellowish with a somewhat silvery or pearly luster. Sisal rope is also yellowish but often has a green tinge and lacks the luster of manila. Its fibers tend to splinter and it is rather stiff. See the table in this section for safe loads and breaking strengths.

Splicing a rope is the best way to fix a break or lengthen a rope. A proper splice will retain approximately 80 percent of the rope's strength, while a knot will retain only about 50 percent.

Rope should be inspected at least every 30 days, more often if it is used to support scaffolding on which men work. The following procedure will assist in the inspection of rope:

1. Check for broken fibers and abrasions on the outside.
2. Inspect fibers by untwisting the rope in several places. If the inner yarns are bright, clear, and unspotted, the strength of the rope has been preserved to a large degree.
3. Unwind a piece of yarn 8 inches long and 1/4 inch in diameter from the rope. Try to break this with your hands. If the yarn breaks with little effort, the rope is unsafe.
4. Inspect rope used around acid or caustic daily. If black or rusty brown spots are noted, test the fibers as described in steps 1, 2 and 3. Discard all ropes that fail.
5. As a general rule, rope that has lost its pliability or stretch, or in which the fibers have lost their luster and appear dry and brittle, should be viewed with suspicion and replaced with new rope. This is particularly important if the rope is used on scaffolding or for hoisting where, if the rope breaks, workers may be injured or property may be damaged.

Rope slings should be made of manila only because of the required high tensile strength. Hooks, rings, and other fittings must be properly spliced and the sling load must be reduced by one-half after the sling has been in use for six months even though the sling shows no sign of wear.

Damaged rope should be destroyed. Substitutions may be wire rope in some applications, and should be subject to the same maintenance and scrutiny as fiber ropes. There are, however, some differences.

TENSILE STRENGTH AND WEIGHT OF SYNTHETIC AND NATURAL FIBER ROPE

SIZE IN INCHES		NYLON		POLYESTER		POLYPROPYLENE		3-STRAND NATURAL FIBER		
Diameter	Circumference	Pounds per 100 feet	Tensile Strength (lb)	Pounds per 100 feet	Tensile Strength (lb)	Pounds per 100 feet	Tensile Strength (lb)	Pounds per 100 feet	Tensile Strength (lb)	
									Manila	Sisal
3/16	3/16	1.0	1,000	1.2	1,000	0.70	800	—	—	—
1/4	3/8	1.5	1,650	2.0	1,650	1.2	1,250	2.0	600	480
5/16	1	2.5	2,550	3.1	2,550	1.8	1,900	—	—	—
3/8	1-1/8	3.5	3,700	4.5	3,700	2.8	2,700	4.1	1,350	1,080
1/2	1-1/4	5.0	5,000	6.2	5,000	3.8	3,500	—	—	—
5/8	1-1/2	6.5	6,400	8.0	6,400	4.7	4,200	7.5	2,650	2,120
3/4	1-3/4	8.3	8,000	10.2	8,000	6.1	5,100	—	—	—
7/8	2	10.5	10,400	13.0	10,000	7.5	6,200	13.3	4,400	3,520
1	2-1/4	14.5	14,200	17.5	12,500	10.7	8,500	16.7	5,400	4,320
1-1/8	2-1/2	17.0	17,000	21.0	15,500	12.7	9,900	—	—	—
1-1/4	2-3/4	20.0	20,000	25.0	18,000	15.0	11,500	22.5	7,700	1,540
1-1/2	3	26.0	25,000	30.5	22,000	18.0	14,000	27.0	9,000	7,200
1-3/4	3-1/4	29.0	28,800	34.5	25,500	20.4	16,000	—	—	—
1-7/8	3-1/2	34.0	33,000	40.0	29,500	23.7	18,300	36.0	12,000	9,600
2	3-3/4	40.0	37,500	46.3	33,200	27.0	21,000	41.8	13,500	10,800
2-1/8	4	45.0	43,000	52.5	37,500	30.5	23,500	—	—	—
2-1/4	4-1/2	55.0	53,000	66.8	46,800	38.5	29,700	60.0	18,500	14,800
2-3/8	5	68.0	65,000	82.0	57,000	47.5	36,000	74.4	22,500	18,000
2-1/2	5-1/2	83.0	78,000	98.0	67,800	57.0	43,000	89.5	26,500	21,200
2-7/8	6	95.0	92,000	118	80,000	69.0	52,000	108	31,000	24,800
3	6-1/2	109	106,000	135	92,000	80.0	61,000	125	36,000	28,800
3-1/8	7	129	125,000	157	107,000	92.0	69,000	146	41,000	32,800
3-1/4	7-1/2	149	140,000	181	122,000	107	80,000	167	46,500	37,200
3-3/8	8	168	162,000	205	137,000	120	90,000	191	52,000	41,600
3-7/8	8-1/2	189	180,000	230	154,000	137	101,000	215	58,000	46,400
4	9	210	200,000	258	174,000	153	114,000	242	64,000	51,200
4-1/8	10	263	250,000	318	210,000	190	137,000	299	77,000	61,600
4-1/4	11	316	300,000	384	254,000	232	162,000	—	—	—
4-3/8	11 1/2	—	—	—	—	—	—	367	91,000	72,800
4-7/8	12	379	360,000	460	300,000	275	190,000	436	105,000	84,000

Recommended Factors of Safety: Nylon 9. Polyester 9. Polypropylene 6. Manila 5. Sisal 5.

These specifications of weight, circumference and strength for the synthetic ropes have been derived from tests made in accordance with the "Cordage Institute Standard Test Methods for Synthetic Fiber Ropes" dated November 10, 1960; revised December 8, 1965. They represent the Cordage Institute specifications (adopted January 13, 1966).

Tensile Strength figures are "Average." Minimum will be 5% below "Average."
Pounds per 100 feet are "Average." Maximum weight 5% above these figures.

CHAINS AND CHAIN SLINGS:

Alloy steel chain, approximately twice as strong as the same size wrought iron chain, has become the standard material for chain slings.

A major advantage is that it is suitable for high temperature applications--up to continuous operation temperatures of 800 F. This is the highest temperature for which continuous operation is recommended and requires a 30 percent reduction in regular working load limit. Chain, however, may be used for intermittent service at temperatures up to 1,000 F but only at 50 percent of the regular working load limit.

While an alloy steel chain should never be annealed when the chain is being serviced or repaired, a wrought iron chain should be annealed periodically. Chain slings should be purchased as slings from the manufacturer and should be sent back to the factory for repair. Such a manufacturer will supply the limits and approved working maximums. The table below, however, may be used in estimating chain strength.

WORKING LOAD LIMITS AND BREAK TEST LIMITS
FOR ALLOY STEEL CHAIN*

Nominal Size of Chain Bar in Inches	Working Load Limits in Pounds	Minimum Break Test in Pounds
1/4	3,250	10,000
3/8	6,600	19,000
1/2	11,250	32,500
5/8	16,500	50,000
3/4	23,000	69,500
7/8	28,750	93,500
1	38,750	122,000
1 1/8	44,500	143,000
1 1/4	57,500	180,000
1 3/4	67,000	207,000
1 1/2	79,500	244,000
1 3/4	94,000	325,000

*Source: *Specification for Alloy Steel Chain*. American Society for Testing and Materials. A-391-58. The strengths for wrought iron chain is slightly less than half these figures.

Load and wear: Chains should never be overloaded--the working load limit and break test limit for alloy steel chain is given in the table that follows:

CORRECTION TABLE FOR THE REDUCTION
OF WORKING LOAD LIMITS OF CHAIN DUE TO WEAR*

NOMINAL ORIGINAL CHAIN SIZE, INCHES		REDUCE WORKING LOAD LIMITS OF CHAIN BY THE FOLLOWING PER CENT WHEN DIAMETER OF STOCK AT WORN SECTION IS AS FOLLOWS:		
		5 Per Cent	10 Per Cent	Remove from Service
¼	0.250.....	0.244	0.237	0.233
⅜	0.375.....	0.366	0.356	0.335
½	0.500.....	0.487	0.474	0.448
⅝	0.625.....	0.609	0.593	0.559
¾	0.750.....	0.731	0.711	0.671
⅞	0.875.....	0.853	0.830	0.783
1	1.000.....	0.975	0.949	0.895
1 ¼	1.125.....	1.100	1.070	1.010
1 ½	1.250.....	1.220	1.190	1.120
1 ¾	1.375.....	1.340	1.310	1.230
1 ½	1.500.....	1.460	1.430	1.340
1 ¾	1.625.....	1.590	1.540	1.450
1 ¾	1.750.....	1.710	1.660	1.570
1 ¾	1.875.....	1.830	1.780	1.680
2	2.000.....	1.950	1.900	1.790

*From American National Standard B30.2, *Safety Code for
Cranes, Derricks, and Hoists.*

Some of the principal causes of chain failure are:

1. Embrittlement caused by cold working of the metal surface.
2. Failure of the weld.
3. Repeated severe bending or deformation of the links.
4. Metal fatigue.
5. Brittleness caused by defects in the metal.
6. Tensile failure—full elongation of the links.

Safety latches should be standard on hooks used on chain slings. Hooks should be made of forged or laminated steel.

Note: A broken chain should never be spliced by inserting a bolt between two links nor should one link be passed through another and a nail or bolt inserted to hold them. USE: Before making a lift, the men should make sure that there are no kinks, knots, or twists in the chain. The load should be lifted slowly and uniformly and care should be taken to make sure that the chain is securely on the hook and not just over the tip. Never hammer a link over the hook as this will stretch both hook and chain causing premature weakness.

When lowering a crane load, brakes must be applied smoothly, without jerking.

Each chain should be tagged to indicate its load capacity, date of last inspection, date of purchase, and the type of material from which the chain is made. It must not, however, be stamped upon the chain links as this causes stress points and weakening.

Chain attachments must be made of the same material to which they are fastened. Hooks should be made of forged or laminated steel, and they must be replaced if they have a permanent set greater than 15 percent of the normal throat opening.

Chain is best stored in racks inside dry buildings that have a fairly constant temperature. Racks and bins should be so constructed that air will circulate around the chain and keep it dry.

Heavy chain should always be lifted with power equipment, as attempting to lift it by hand may cause injury to the employee.

MATERIAL STORAGE

Good material storage procedures result in many of the same benefits as good housekeeping:

1. Higher efficiency.
2. Reduced waste.
3. Lower costs.
4. Higher morale.
5. Fewer accidents.
6. Higher production rates.

Aisle must be kept clear of material and it is essential to assure that fire exits are never blocked--even temporarily. Similarly, no material may be allowed to block access to fire extinguishers or violate any fire codes by being piled too close to sprinkler heads. (Minimum of 18 in., but 24 to 36 inc. is recommended.) If no sprinkler heads are installed, there is a 3 ft. minimum required for hose and passage clearance between material and ceiling.

The key to proper storage is planning. Both temporary and permanent storage should be neat and orderly, and planning storage minimizes the handling necessary to bring materials into production, as well as remove finished products from production to shipping.

Crated and packaged materials are usually in various sizes, using steel strapping, wire, and a variety of other securing means. Since steel strapping is sharp along the edges and usually under tension, care should be used in both moving and storing such containers. (The trend toward using metric sizing for packaging should eliminate some of the current problems in stacking and storing containers. Standardization of dimensions allows for even stacking and standardizing of shelf dimensions.)

Some materials require special precautions:

Acid carboys: Best handled with special equipment such as carboy trucks. Before anyone handles carboy boxes, the boxes should be inspected for rusty nails that may have been overly weakened by the acid action. The wood of an acid carboy can also be weakened making special care in handling necessary.

Storage areas for acid carboys and caustic sodas must be well lighted, and the material must be grouped and well separated to assure that mistakes are not made by employees acquiring such chemicals. Acid should be siphoned from their bottles with special equipment. Using the suction from a vacuum pump is best but bulbs or ejectors may be used. Pouring by hand or starting pipettes or siphons by mouth suction should never be permitted. All containers must be clearly labeled. Should a label become dimmed or ruined in any fashion, new and appropriate labels must be affixed to the carboy.

Drum storage is best accomplished by using racks wherein the drums can be stored on their sides and drained by spicots safe from vehicular traffic. Upper levels may be piped downward, thus allowing stacking of horizontal drums.

Drums containing inflammables should be grounded to a copper ground cable or wire by grounding straps affixed to drum pipes.

Separate sections for drum storage should be planned so that different categories may be clearly separated, thus avoiding error in either storing or withdrawing materials.

Storage areas for liquid chemicals should be well ventilated. Natural ventilation is better than mechanical because the system may fail. The floor should be made either of concrete or some other resistant material treated to reduce absorption of the liquids. The floor should be pitched toward one or more drains that are corrosion resistant and easily cleaned.

Where caustics or acids are stored, handled, or used, emergency showers and eyewash fountains must be available. Men should be provided with chemical goggles, rubber aprons, boots and gloves. A combination eyewash fountain and emergency shower is one solution to the problem. Your job is to make sure that such equipment works when it is needed. This means it should be tested at regular intervals.

ADDITIONAL PRECAUTIONS for handling hazardous liquids:

1. Wear proper protective equipment.
2. Keep floors clean. Do not allow them to become slippery.
3. Drain siphons, ejectors, and other emptying devices completely before removing them from carboys.

4. To dilute acid, always add it to water, never add water to acid. Add the acid slowly and stir constantly with a glass implement.
5. In case of an accident give first aid: flush burned areas with lots of water. Call a doctor immediately.
6. Do not force hazardous chemicals from containers by injecting compressor air. The container may burst, or the contents may ignite.
7. Do not try to wash or clean a container unless its label specifically requires that it be cleaned before it is returned.
8. Do not store hazardous chemicals in glass or other containers near heat or steam pipes or where strong sunlight will strike them. The contents may expand and may cause a fire or explosion. Bottles may concentrate sunlight to ignite a fire in nearby combustibles.
9. Do not stir acids with metal implements.
10. Do not store chemicals or solvents in dark or poorly lit areas. The wrong chemical may be selected.
11. Do not pour corrosives by hand from a carboy.
12. Do not move a carboy unless it is securely stoppered and wired.

Storage of gas cylinders and other kinds of materials has, fortunately, received special attention at BHT, and there are procedures and specified locations for most storage of hazardous materials. However, the responsibility is still that of the supervisor to assure that all storage is done properly. If there are any questions or if any doubt has been found in either method or procedure of storage, the safety department should be contacted immediately.

Assistance is a mere telephone call away, and there is no risk so small that help should not be sought. Materials storage and handling, remember, is responsible for 23 percent of the accidents. It is a complex subject, and there are many rules and regulations. It would be difficult for any one person to master them all, but all are expected to use common sense and a telephone when there is the need.

There will always be the problem of judgment and carelessness to confound the supervisor. Careful training and attitude development can go a long way in nullifying the thing we call the human error. It is still your responsibility!

GUARDS

GUARDING MACHINES AND MECHANISMS

When we consider the responsibility each of us has for making the work environment as safe as possible for the work force, we find that there are really only two things or categories which we can actively influence. There is the training, including the continuing attitudinal influence, and there is the condition that makes an accident possible or probable. If we can remove the hazardous condition, we have reduced the probability of an accident occurring.

Most of us have chuckled at Murphy's first law that says, "If anything can go wrong, it will!" In the business of accident prevention the humor of the law seems to have a hollow ring to it. Sometimes the federal regulations seem to echo the philosophy of it. The truth of the matter is that we must remove the condition that will allow an accident to occur, or, eventually, someone will have that accident and fulfill the irony of Murphy's Law.

This is what guarding machines and mechanisms is really all about. Guards eliminate that condition wherever possible that would allow possible access to moving components.

Their importance to the employees is obvious when one considers that nearly one-fifth of all permanent partial disabilities are from machinery accidents. Besides the problem created for the injured human being, there is the work problem created for the supervisor. Such accidents often remove the worker from the job entirely or for long periods of time. This is not being cold or heartless to consider the work problem. It is a real and practical problem to be faced, because the work must go on despite the fact that other employees may feel reluctant to operate a machine that has injured or maimed a fellow worker.

When equipment is shut down for any unscheduled reason, production capacity and cost of operation are directly affected.

When an employee is injured while operating unguarded machines or equipment, production capacity and cost of operation are again affected.

Five major problems arise:

1. Injured employees must be replaced.
2. Good replacement may not always be available.
3. The company must hire and train new employees.
4. Production is reduced.
5. There may be a bad psychological effect on other employees.

Reinforcement of a law much more applicable than Murphy's is hereby indicated, "Accident prevention is much more effective than employee replacement!"

A good supervisor should be able to recognize exposures on machinery and equipment that need safeguarding. He should also recommend the type of guarding necessary to prevent employee contact. Of course, in the event of special problems, the supervisor should contact the safety department for help. Problem: We may remove the potential accident condition by guarding, but the education part must also be considered. There have been instances--even at BHT--in which employees have either removed or altered guards for the convenience of easier operation. "Whose responsibility is it to see that guards remain in place and are appreciated by employees?" Again, the supervisor is the Key Man!

THE POSITIVE SIDE OF GUARDING

The following is a partial list of the benefits received through effective guarding:

1. It complies with federal and state regulations.
2. There may be an improvement in production through the elimination of previously necessary caution on the part of the operator.
3. Operator fear is removed.
4. There is a resultant improvement in quality.
5. It shows Management is sincere about safety.
6. Employees contribute to the safety program when their guarding suggestions are employed.
7. Improves employee morale.
8. Prevents damage to equipment.
9. Prevents damage to material in process.

There are more, and it would not be entirely honest to not acknowledge that some kinds of guards may hinder the production process. It is well worth the loss, however, especially when one tries to place a value upon his own hand that has been lost. It is well worth any probable loss of time when the lost time in hiring and training a new employee is considered.

PRINCIPLES OF GUARDING

Guarding is frequently thought of as being concerned only with the point of operation or with the means of power transmission. Although guarding these hazards is required, guarding can also prevent injuries from other causes, both on and around machines and from equipment and damaged material.

Guards or barriers can protect against and prevent injuries from these sources:

1. Direct contact with exposed moving parts of a machine--either points of operation on production machines (such as power presses, machine tools, or woodworking equipment) or power transmitting parts of mechanisms (such as gears, pulleys, and sheaves, slides, or couplings).

2. Work in process, such as pieces of wood that kick back from a power rip saw, or metal chips that fly from tools or from abrasive wheels.
3. Machine failure which usually results from lack of preventive maintenance, overloading, metal fatigue, or abuse.
4. Electrical failure which may cause malfunctioning of the machine, or cause electrical shock or burn.
5. Operator error or human failure caused by distraction, worry, zeal, anxiety, misunderstanding, indolence, deliberate chance-taking, anger, illness, fatigue, and so on.

Positive prevention of injury-producing accidents on machinery can be assured through the installation of safeguards or through engineering revision and redesign. Injury-producing accidents are inevitable where equipment with dangerous moving parts is operated without guards or with incomplete or ineffective guards.

The experience of more than six decades of organized accident prevention has demonstrated that it is unwise to rely entirely on education and training of the operator or upon operator cooperation. Many factors affect a person's attitude and judgment, and even his ability to concentrate. Even a skilled person who is disturbed by mental, emotional or physical problems cannot pay strict attention to his production responsibilities and cannot give his best efforts.

Definitions

These definitions will clarify the terms

- *Danger zone (pinch point)*. A point at which a person can get caught between (a) the moving parts of a machine, (b) moving and stationary parts, or (c) material and moving parts. It does not describe hazards caused by tooling at the point of operation of a power press.
- *Exposed to contact*. An object or moving part is located in a place where part of a person's body can come into contact with it and be injured.
- *Device (point of operation)*. A term used in metal stamping operations to designate a machine control or attachment that allows the operator access to the point of operation for loading or unloading dies. It (a) restrains the operator from inadvertently reaching into the point of operation, (b) prevents normal operation until the operator's hands are removed, or (c) pulls the operator's hands from the point of operation as the dies close.
- *Guard*. A barrier that prevents entry of the operator's hands or fingers into the point of operation. ANSI Std. B11.1-1971, *Safety Requirements for Construction, Care, and Use of Mechanical Power Presses*, reserves the use of the word "guard" exclusively for referring to barriers designed for safeguarding at the point of operation. Therefore, the word "safeguard" is used for a barrier or cover that protects other danger zones. "(Safe)guard" refers to either.
- *Interlock*. A device that interacts with another device to govern succeeding operations in the same or an allied machine or equipment.

- *Pinch point.* See "Danger zone."
- *Point of operation.* That part of a machine where stock is actually placed and kept during blanking, shaping, or other operation, including such other parts as may offer a hazard to the operator's inserting or manipulating stock or material.
- *Prime mover.* An engine used as a source of power. It may be steam, gas, oil, or air operated. Electric motors and steam or hydraulic turbines are included.
- *Securely fastened.* When something is so well secured that it cannot be moved or removed under normal or reasonably foreseeable conditions.

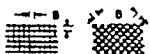
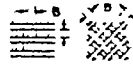
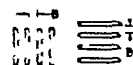
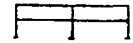
Guard design: To be generally acceptable, a guard should -

1. Conform to applicable American National Standards and to the requirements of OSHA and/or the state inspection department having jurisdiction.
2. Be considered a permanent part of the machine or equipment.
3. Afford maximum positive protection, not only for the operator but also for passerby.
4. Prevent access to the danger zone or point of operation during operation.
5. Now weaken the structure of the machine.
6. Be convenient. It must not interfere with efficient operation of the machine, cause discomfort to the operator, or complicate the job of cleaning the area around the machine.
7. Be designed for the specific job and specific machine. Provisions must be made for oiling, inspection, adjusting, and repairing of the machine parts.
8. Be resistant to fire and corrosion. Be easy to repair.
9. Be strong enough to resist normal wear and shock and durable enough to serve over a long period with minimum maintenance.
10. Not be a source of additional hazards, such as splinters, pinch points, sharp corners, rough edges, or other injury sources.

If possible, a safeguard covering rotating parts should be interlocked with the machine itself so that the machine cannot be operated unless the safeguard is in place. On some equipment this may be required by OSHA.

STANDARD MATERIALS AND DIMENSIONS FOR MACHINERY SAFEGUARDS

Size of Filler Materials

Material	Clearance from Moving Part at All Points (inches)	Largest Mesh or Opening Allowable B (inches)	Minimum Gauge (U.S. Standard) or Thickness	Min. Height of Guard from Floor or Platform Level (ft, in.)
 Woven Wire	Under 2 2-4 4-15	$\frac{3}{8}$ $\frac{1}{2}$ 2	No. 16- $\frac{3}{8}$ in. No. 16- $\frac{1}{2}$ No. 12-2	8-0* 8-0 8-0
 Expanded Metal	Under 4 4-15	$\frac{1}{2}$ 2	No. 18- $\frac{1}{2}$ in. No. 13-2	8-0 8-0
 Perforated Metal	Under 4 4-15	$\frac{1}{2}$ 2	No. 20- $\frac{1}{2}$ in. No. 14-2	8-0 8-0
 Sheet Metal	Under 4 4-15	...	No. 22 No. 22	8-0 8-0
 Wood or Metal Strips Crossed	Under 4 4-15	$\frac{3}{8}$ 2	$\frac{3}{8}$ in. wood or No. 16 metal	8-0
 Wood or Metal Strips Not Crossed	Under 4 4-15	$\frac{1}{2}$ the width One width		
 Plywood, Plastic or Equivalent	Under 4 4-15	...	$\frac{1}{4}$ in. $\frac{1}{4}$ in.	8-0
 Standard Railing	Min 15 Max 20	...	...	3-6

* Guards for rotating protruding objects should extend to a minimum height of 9 ft from the floor or platform.

From American National Standard B15.1, *Safety Code for Mechanical Power-Transmission Apparatus*.

- POINT-OF-OPERATION PROTECTION

Type of Guarding Method	Action of Guard	Advantages	Limitations	Typical Machines on Which Used
<i>Enclosures or Barriers</i>				
Complete, simple fixed enclosure	Barrier or enclosure which admits the stock but which will not admit hands into danger zone because of feed opening size, remote location, or unusual shape.	Provides complete enclosure if kept in place. Both hands free. Generally permits increased production. Easy to install. Ideal for blanking on power presses. Can be combined with automatic or semiautomatic feeds.	Limited to specific operations. May require special tools to remove jammed stock. May interfere with visibility.	Bread slicers Embossing presses Meat grinders Metal square shears Nip points of corrugating rubber, paper, textile, and other rolls Paper corner cutters Power presses
Warning enclosures (usually adjustable to stock being fed)	Barrier or enclosure admits the operator's hand but warns him before danger zone is reached.	Makes "hard to guard" machines safer. Generally does not interfere with production. Easy to install. Admits varying sizes of stock.	Hands may enter danger zone—enclosure not complete at all times. Danger of operator not using guard. Often requires frequent adjustment and careful maintenance.	Band saws Circular saws Cloth cutters Dough brakes Ice crushers Jointers Leather strip-pers Rock crushers Wood snappers
Barrier with electric contact or mechanical stop activating mechanical or electric brake	Barrier quickly stops machine or prevents application of injurious pressure when any part of operator's body contacts it or approaches danger zone.	Makes "hard to guard" machines safer. Does not interfere with production.	Requires careful adjustment and maintenance. Possibility of minor injury before guard operates. Operator can make guard inoperative.	Dough brakes Flat roll ironers Paper box cornerstayers Paper box enders Power presses Rubber and paper cal-enders Rubber mills
Enclosure with electrical or mechanical interlock	Enclosure or barrier shuts off or disengages power and prevents starting of machine when guard is open; prevents opening of the guard while machine is under power or coasting. (Interlocks should not prevent manual operation or "inching" by remote control.)	Does not interfere with production. Hands are free; operation of guard is automatic. Provides complete and positive enclosure.	Requires careful adjustment and maintenance. Operator may be able to make guard inoperative. Does not protect in event of mechanical repeat.	Dough brakes and mixers Foundry tumblers Laundry extractors, driers, and tumblers Power presses Tanning drums Textile packers, cards

Type of Guarding Method	Action of Guard	Advantages	Limitations	Typical Machines on Which Used
<i>Automatic or Semiautomatic Feed</i>				
Nonmanual or partly manual loading of feed mechanism, with point of operation enclosed	Stock fed by chutes, hoppers, conveyors, movable dies, dial feed, rolls, etc. Enclosure will not admit any part of body.	Generally increases production. Operator cannot place hands in danger zone.	Excessive installation cost for short run. Requires skilled maintenance. Not adaptable to variations in stock.	Baking and candy machines Circular saws Power presses Textile pickers Wood planers Wood shapers
<i>Hand Removal Devices</i>				
Hand restraints	A fixed bar and cord or strap with hand attachments which, when worn and adjusted, do not permit an operator to reach into the point of operation.	Operator cannot place hands in danger zone. Permits maximum hand feeding; can be used on higher-speed machines. No obstruction to feeding a variety of stock. Easy to install.	Requires frequent inspection, maintenance, and adjustment to each operator. Limits movement of operator. May obstruct work space around operator. Does not permit blanking from hand-fed strip stock.	Embossing presses Power presses
Hand pull-away device	A cable-operated attachment on slide, connected to the operator's hands or arms to pull the hands back only if they remain in the danger zone, otherwise it does not interfere with normal operation.	Acts even in event of repeat. Permits maximum hand feeding; can be used on higher speed machines. No obstruction to feeding a variety of stock. Easy to install.	Requires unusually good maintenance and adjustment to each operator. Frequent inspection necessary. Limits movement of operator. May obstruct work space around operator. Does not permit blanking from hand-fed strip stock.	Embossing presses Power presses
<i>Two-Hand Trip</i>				
Electric	Simultaneous pressure of two hands on switch buttons; in series actuates machine	Can be adapted to multiple operation Operator's hands away from danger zone.	Operator may try to reach into danger zone after tripping machine Does not protect against mechanical repeat unless blocks or stops are used	Dough mixers Embossing presses Paper cutters Pressing machines
Mechanical	Simultaneous pressure of two hands on air control valves, mechanical levers, controls interlocked with foot control, or the removal of solid blocks or stops permits normal operation of machine	No obstruction to hand feeding Does not require adjustment. Can be equipped with continuous pressure remote controls to permit "inching" Generally easy to install	Some trips can be rendered unsafe by holding with toe arm, blocking or tying down one control thereby permitting one-hand operation Not used for some blanking operations	Power presses Washing machines

POINT-OF-OPERATION PROTECTION—Continued

Type of Guarding Method	Action of Guard	Advantages	Limitations	Typical Machines on Which Used
<i>Miscellaneous</i>				
Limited slide travel	Slide travel limited to 1/4 in. or less; fingers cannot enter between pressure points.	Provides positive protection. Requires no maintenance or adjustment.	Small opening limits size of stock.	Foot power (kick) presses Power presses
Electric eye	Electric eye beam and brake quickly stop machine or prevent its starting if the hands are in the danger zone.	Does not interfere with normal feeding or production. No obstruction on machine or around operator.	Expensive to install. Does not protect against mechanical repeat. Generally limited to use on slow speed machines with friction clutches or other means to stop the machine during the operating cycle. Can be circumvented	Embossing presses Power presses Rubber mills Squaring shears Press brakes
Special tools or handles on dies	Long-handled tongs, vacuum lifters, or hand die holders which avoid need for operator's putting his hand in the danger zone.	Inexpensive and adaptable to different types of stock. Sometimes increases protection of other guards.	Operator must keep his hands out of danger zone. Requires unusually good employee training and close supervision.	Dough brakes Leather die cutters Power presses Forging hammers
Special jigs or feeding devices	Hand-operated feeding devices of metal or wood which keep the operator's hands at a safe distance from the danger zone.	May speed production as well as safeguard machines. Generally economical for long jobs.	Machine itself not guarded; safe operation depends upon correct use of device. Requires good employee training, close supervision. Suitable for limited types of work.	Circular saws Dough brakes Joiners Meat grinders Paper cutters Power presses Drill presses

Built-in Safeguards:

The best guard or barrier is the one provided by the manufacturer of the machine. They are designed as an integral part of the machine and are not makeshift; they are durable and are strong enough to do the job. An advantage is that it looks like it is part of the machine and not an unattractive add on that could be removed since it doesn't look like part of the machine to start with.

The additional cost of safeguards designed and installed by the manufacturer is usually less than the cost of installing guards after a machine has been purchased. Another advantage is that a built-in guard may strengthen a machine or act as an exhaust duct or oil retainer. In short, it may serve some other functional purpose, thereby simplifying the design and reducing the cost of the machine.

Most machinery today cannot be sold without the safeguards being in place or designed as part of the machine, but there are many old pieces of machinery still around that are good, workable machines but need guards installed. It, again, is the supervisor's responsibility to see where and what kind of guards are needed to make the machine as safe as possible.

SAFEGUARDING MECHANISMS:

The following questions should be asked:

1. Is there a materials handling hazard?
2. Are limitations of a person's manual effort--lifting, pushing and pulling--recognized?
3. Is the design of existing or proposed guards based on physiological factors and human body dimensions?

All physical or design features of a production machine and the work-place should be evaluated as though the machine were an extension of man's body and could only do what the man wants it to do.

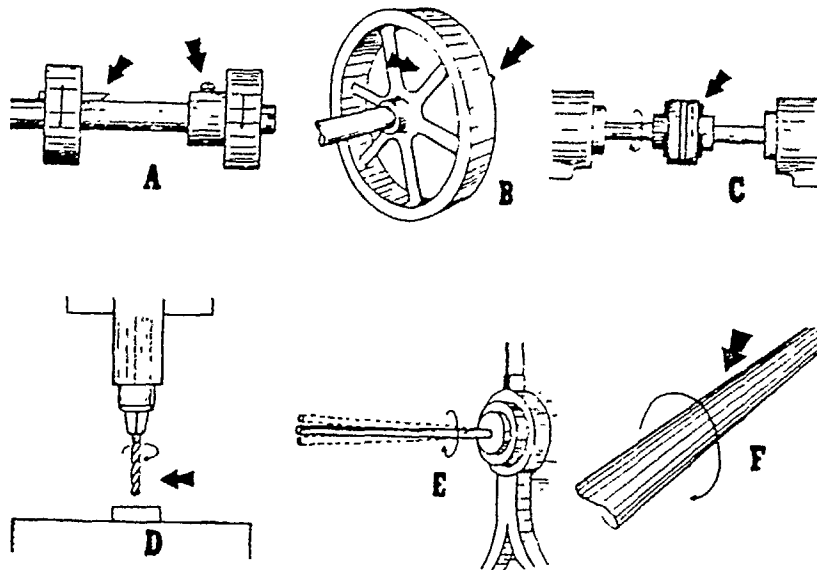
To match the machine to the operator, consider the following factors:

1. The work place. Machines and equipment should be arranged so the operator does a minimum amount of lifting and traveling. Use of conveyors and skids to feed raw stock and chutes or gravity feeds to remove finished stock should be considered.
2. The work height. The work station should be of optimum height in relation to stand up or sit down method of operation, whichever is used. The proper height and type of chair or stool must be determined. Elbow height, actually, is the determining factor in minimizing worker fatigue. In general, an effective work level is 41 in. from floor to work surface with a chair height from 25 to 31 inches.
3. Controls. Machine speed and "On-Off" controls should be readily accessible. Position and design of machine controls--such as dials, push buttons, and levers--are important. Controls should be standardized on similar machines. Then operators can be switched back and forth, as necessary, and still be protected.
4. Materials handling aids should be provided to minimize manual handling of raw materials and in-process or finished parts, both to and from machines. Overhead chain hoists, belt or roller conveyors, and work positioners are typical examples.
5. Operator fatigue at a machine station usually results from a combination of physical and mental activities. It is not always the result of energy expenditure alone. Excessive speed up, boredom from monotonous machine operations and awkward work motion or operator position also contribute.

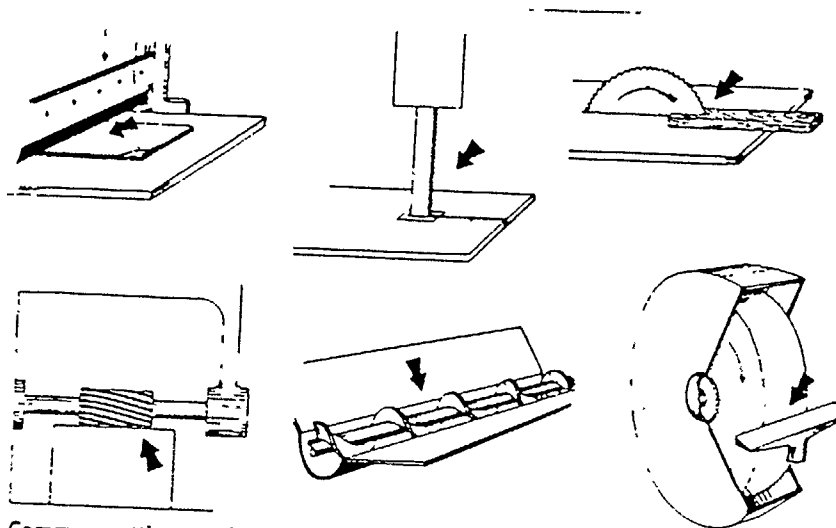
6. Excessive noise is more than just an annoyance. It can be a real occupational hazard if it caused permanent hearing damage. Methods of protecting operators were mentioned in a previous section.

There are certain basic mechanisms which, if exposed, always need safe guarding:

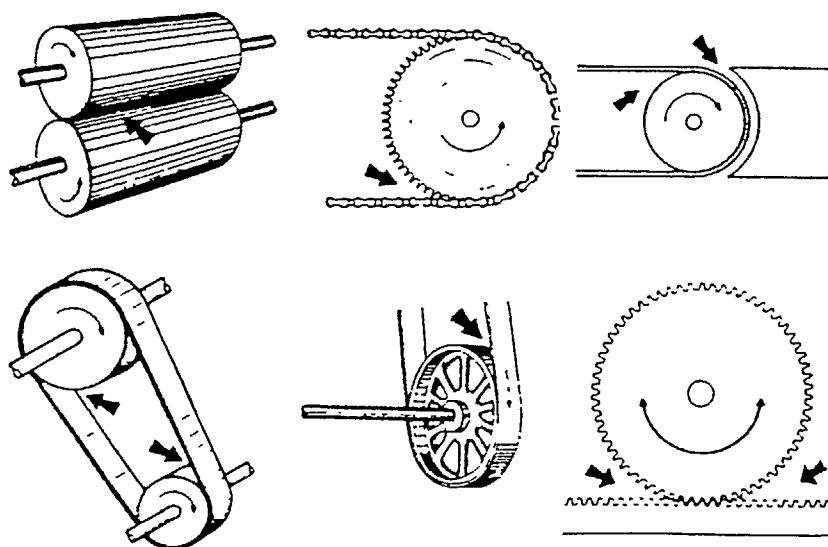
1. Rotating mechanisms.
2. Cutting or shearing mechanisms.
3. Inrunning nip points.
4. Screw or worm mechanisms.
5. Forming or bending mechanisms.



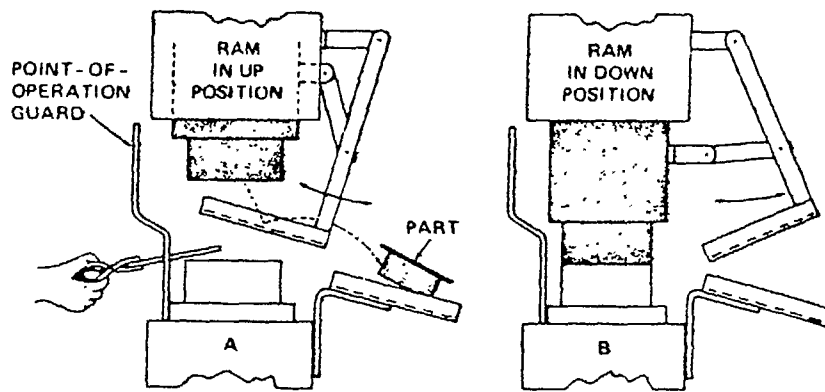
Rotating mechanisms can seize and wind up loose clothing, belts, hair, and the like. They should, therefore, be guarded. Left to right, they are (A) projecting key and setscrew, (B) spokes and burrs, (C) coupling bolts, (D) bit and chuck, (E) turning bar stock, and (F) rotating shaft.



Common cutting or shearing mechanisms. Protection should be provided for all variations of such hazards.



Typical inrunning nip points that require guarding



Approximately 80 percent of all power press accidents occur on secondary operations. Feeding can be made safe by adequate guarding of the point of operation, combined with gravity unload with mechanical-action chute. When ram goes up (A), formed part is knocked out and next blank is loaded. Mechanical-action chute moves out of the dies with downstroke of press (B).

Primary and secondary operations

Power press operations consist of primary operations and secondary operations.

In primary operations, the operator is not required to place his hands between the punch and the die. Examples are blanking, piercing, corner cutting, and other operations on long strip stock or in processing a large part. Primary operations should have die enclosures or fixed barrier guards.

In secondary operations, a preshaped part is further processed by being placed in a nest under the upper die. These operations include coining, drawing, and forming. Secondary operations, which account for some 80 percent of all power press accidents, should have the most effective protection within the limitations of the die—if possible, automatic or semiautomatic feeds and ejection and some form of protective guard.

Wherever possible, high-production or long-run dies should be guarded individually. This procedure saves the time involved in setup, and a permanent guard will not be detached or lost.

EXAMPLES OF GUARD TYPES AND THEIR USES:

1. Enclosures or barriers: Type of guard: Complete simple fixed enclosure. Its action: Admits the stock or raw materials but will not admit hands into the danger zone. Advantages: Provides complete enclosure if kept in place. Limitations: Specific operations, may require special tools, may interfere with visibility. Types of machines on which used: Bread slicers, metal square shears, power presses. This is only a partial list.
2. Automatic or semiautomatic feed: Guard type: Nonmanual or partly manual loading of feed mechanism, with point of operation enclosed. Guard action: Enclosure will not admit any part of the body. Advantages: Generally increases production. Limitations: Requires skilled maintenance, excessive installation cost for short runs. Machines on which used: Baking and candy machines, power presses, woodworking machines and so forth.
3. Hand removal devices: Restraints, pull-away devices. Guard action: Keeps or lifts hands out of the danger zone. Advantage: Acts even in event of repeat, easy to install. Limitations: Hands must be in normal positions for device to be effective, possible interference with feeding stock. Machines on which used: Hand-feed platen presses, power presses and so forth.
4. Two-hand trip: Guard type: Electric, mechanical. Guard action: Simultaneous pressure of two hands on switch buttons. Advantages: Can be adapted to multiple operations, no obstruction to hand feeding. Limitations: Does not protect against mechanical repeat unless blocks or stops are used. Machines on which used: Embossing presses, paper cutters, power presses, to name just a few.
5. Miscellaneous: Includes electric eye, limited slide travel, special tools or handles on dies, and special jigs or feeding devices.

These are just a few considerations for the five slide travel, special protection. You should study these guarding applications and become familiar with them and apply them to your machinery and equipment.

Safe practices:

There's been much comment upon guards, their necessity, the fact that even experienced employees cannot be careful enough all the time to avoid un-guarded machinery, and about the need for constant vigilance to assure guards remain in place.

The fact is that machine operators need training and reminders to assure that the guards do their intended job. In addition, employees who do not themselves operate machinery, but who work in the machine areas, also should receive instruction in basic safe practices.

Positive procedures should be established to prevent misunderstandings, and the supervisor should enforce the following safe work practices:

1. No guard, barrier, or enclosure should be adjusted or removed for any reason by anyone unless that person has specific permission from the supervisor. For that permission, he must have been specifically trained to do this work, and machine adjustment is considered a normal part of his job.
2. Before safeguards or other guarding devices are removed so that repairs or adjustments can be made or equipment can be oiled or otherwise serviced, the power for the equipment must be turned off and the main switch locked out and tagged.
3. No machine should be started unless the safeguards are in place and in good condition.
4. Defective or missing safeguards should be reported to the supervisor immediately.
5. Employees should not work on or around mechanical equipment while wearing neckties, loose clothing, watches, rings or other jewelry.

Maintenance:

Guards for equipment should be inspected for condition, tightness, and positioning by supervisors and maintenance personnel, but the operator should be so trained and his attitude such that he regularly checks guards in the interest of his own safety and of those around him.

For such things as regular maintenance and oiling, the maintenance people should be charged with the responsibility of replacing any guards removed before leaving the job. It is still, however, the responsibility of the supervisor to assure all guards are correctly in place and doing their job.

The best plan is a system of frequent, regularly spaced inspections. The goal is to eliminate accidents before they happen. Again, the ounce of prevention...

HAND AND PORTABLE POWER TOOLS

A major responsibility of the supervisor is teaching employees to properly use hand and power tools.

Hand and portable power tools are used to some degree in almost every occupation. They are often a chief source of minor injury. These tools account for about 6 percent of all disabling injuries ranging from hypodermic needle punctures of hospital employees, to amputation of fingers, arms and legs of loggers using power chain saws.

To be effective, a program to reduce tool injuries must include training in four basic safe practices.

1. Select the right tool for the job.
Do not permit unsafe practices, such as striking hardened faces of hand tools together--such as using a carpenter's hammer to strike another hammer, hatchet or metal chisel--or using a file for a pry. Equally dangerous is using a wrench for a hammer and pliers instead of a proper wrench.
2. Keep tools in good condition.
Tools that have deteriorated to these conditions should not be used until repaired to meet factory specifications--bits, or broken handles, hammers with loose heads, dull saws, deteriorated cords on electric tools or broken plugs. While this list could be extended to include many such examples, one special precaution stands out. The supervisor is responsible to assure improper or removed grounding systems do not exist.
Note: The use of double insulated and air driven tools causes much of this problem to be inconsequential at BHT, but grounded tools are occasionally used, requiring that the supervisor maintains alertness to the problem.
3. Use tools properly.
This requires training of employees in the proper use of tools, but, since all people are creative, it also requires that some training be given on how tools should not be used.
4. Store tools in a safe place.
For example, some tools--like power-operated hand tools--should be kept in locked cabinets. Certain specialized tools require special care and serve longer and better with special storage--special reamers, drills, and machining tools have low tolerance to being tossed into a common bin. They require individual and padded storage.
At BHT, there is some centralized tool control, particularly for high cost tools. The system is good, and is widely used in other industries. It is the job of the supervisor to keep the system working and assure that employees do not defeat the system. (Keeping an adequate supply of these tools helps to assure they are not hidden because of the difficulty of getting the tool the next time it is needed.)

Note: Employees' personal tools should be inspected and listed by the supervisor to assure both proper quality and state of repair.

Carrying tools: A good rule to live by is that workmen should never carry tools which in any way might interfere with the using of both hands freely on a ladder or when climbing on a structure.

There should be provided such things as a strong bag in which to carry the tools strapped to the person. The bag should be so rigged that it "rides" on the hip and cannot interfere with the climbing. An alternative might be to provide a bucket or similar container that could be used to raise and lower necessary tools by rope or cable.

Employees should be trained to discipline themselves to keep tools in such a container while working overhead. Mislaidd and loose tools are a hazard to both overhead and ground level workers.

Chisels, screw drivers, and pointed tools should never be carried in a workman's pocket. They should be carried in a tool box or cart, in a carrying belt, in a pocket tool pouch, or in the hand with points and cutting edges pointing away from the body.

Tools should be handed from one workman to another, never thrown. Edged or pointed tools should be passed, preferably in their carrying case, with the handle toward the receiver.

Workmen carrying tools on their shoulders should take special care to watch clearances, make corners cautiously, and reverse direction only after adequate clearing. (This is in the interest of protecting others who might be in the area.)

There are two major factors in assuring safe usage of hand and power tools. Training is, of course, the first factor, and is the responsibility of the supervisor. Keeping safety consciousness prominent by reminders, programs, rule adherence, and a progressive, positive diligence is the second. Again, this is the responsibility of the supervisor.

Maintenance and Repair

The tool room attendant or tool inspector should be qualified by training and experience to pass judgment on the condition of tools for further use. Dull or damaged tools should not be returned to stock. Enough tools of each kind should be on hand so that when a defective or worn tool is removed from service, it can be replaced immediately with a safe tool.

Efficient tool control requires periodic inspections of all tool operations. These inspections should cover housekeeping in the tool supply room, tool maintenance, service, number of tools in the inventory, handling routine, and conditions of tools.

Responsibility for such periodic inspections is usually placed with the department supervisor and should not be delegated by him to the employee.

When metal tools break in use, there are usually detectable causes: overheating or underheating of the forging or steel when it was being hardened and tempered, cracks from improper forging, improper quenching, incorrect angle of cutting edge, or steel of poor quality.

Defects such as these will usually be found in tools of inferior construction, which, because of breakage and inefficiency, are more expensive in the long run than are tools of good quality. Therefore, it pays to purchase tools of the best quality obtainable.

Hand tools receiving the heaviest wear, such as chisels, wrenches, sledges, star-drills, blacksmith's tools, and cold cutters, require frequent maintenance on a regular schedule.

Proper maintenance and repair of tools require adequate facilities: workbenches, vises, a forge or furnace for hardening and tempering, safety goggles, repair tools, grinders, and good lighting. Workmen especially trained in the care of tools should be in charge of these facilities, otherwise tools should be sent out for repairs.

Tempering tools

Tools, such as chisels, stamps, punches, cutters, hammers, sledges, and rock drills, should be made of carefully selected steel and heat-treated so that they are hard enough to withstand blows without excessive mushrooming, and yet not be so hard that they chip or crack.



Combined effects of low temperatures and use finally broke this grounding clamp

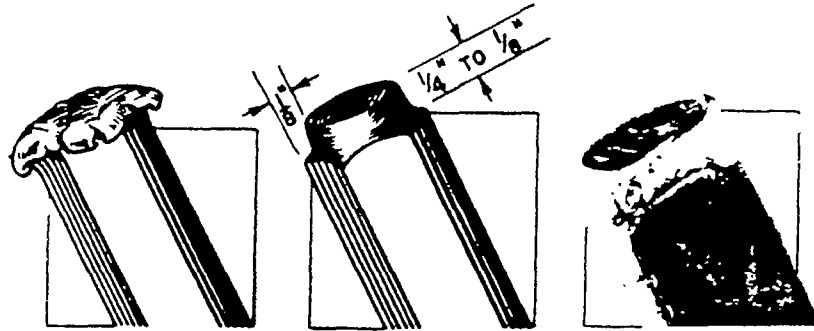
Hardening and tempering of tools requires special skills; therefore assign only experienced workmen. It is possible to temper a tool so that the surface is hard enough for cutting, yet the body is soft enough not to fracture.

Metal fatigue is a common problem in or near the polar regions. Metals exposed to sub-zero temperatures undergo "cold-soaking." A molecular change takes place that makes steel brittle and easily broken. Pneumatic impact tools, drill bits, and dies for threading conduit have their lives shortened.

Ferrous metals, including carbon steel, alloy steel, and cast iron, are characterized by decreased toughness and corresponding brittleness at low temperatures. Exceptions are the nine percent nickel-alloy steel and the chromium-nickel stainless steels.

Non-ferrous metals, such as aluminum and aluminum alloys

(nickel, copper and copper alloys, chromium, zinc and zinc alloys, magnesium alloys, and lead) are more resistant to low temperatures and are widely used in areas of extreme cold.



The hazard of burred heads can be reduced by safe-ending tools. This can be done by grinding or flame-cutting a shoulder on the tool and then bronze-welding it with a $\frac{1}{8}$ -inch rod.

Safe-ending tools

Tools, such as chisels, rock drills, flatters, wedges, punches, cold cutters, and stamping dies, should have heads properly hardened by a qualified workman. The hazard of burred heads can be reduced by use of a quick and economical procedure for safe-ending tools. A band of bronze is welded into a recess about $\frac{1}{8}$ in. deep by $\frac{1}{4}$ to $\frac{1}{2}$ in. wide that has been ground into the head of the tool.

Short sections of tight-fitting rubber hose can be set flush with the striking ends of chisels, hand drills, mauls, and blacksmith's tools to keep chips from flying, since they usually imbed themselves in the rubber sleeve.

Chisels, drift punches, cutters, and marking tools are available that are claimed not to spall or mushroom. This feature is attributed to a combination of alloys, plus scientific heat treatment.

Dressing tools

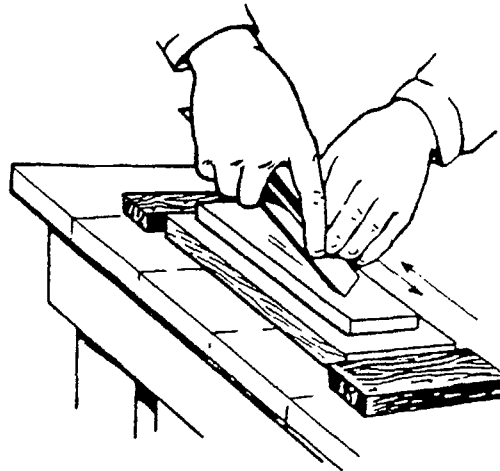
Tools require regular maintenance of their cutting edges or striking surfaces. In most cases, once the cutting or striking surfaces have been properly hardened and tempered, only an emery wheel, grindstone, or oilstone need be used to keep the tool in good condition.

Grind in easy stages. Keep the tool as cool as possible with water or other cooling medium.

Tools that require a soft or medium-soft head should be dressed as soon as they begin to mushroom. A slight radius ground on the edge of the head when it is dressed will enable the tool to stand up better under pounding and will reduce the danger of chips being knocked off.

A file or oilstone, rather than an abrasive wheel, is recommended for sharpening pike poles and axes.

A wood-cutting tool, because of its fine-cutting edge, should be sharpened on a grinder having a wheel recommended by the manufacturer for that type of tool. An oilstone set securely in a wood block



The correct way to whet a wood chisel or plane iron on a stone to produce a sharp cutting edge. The bevel should be placed on the stone with the back edge slightly raised.

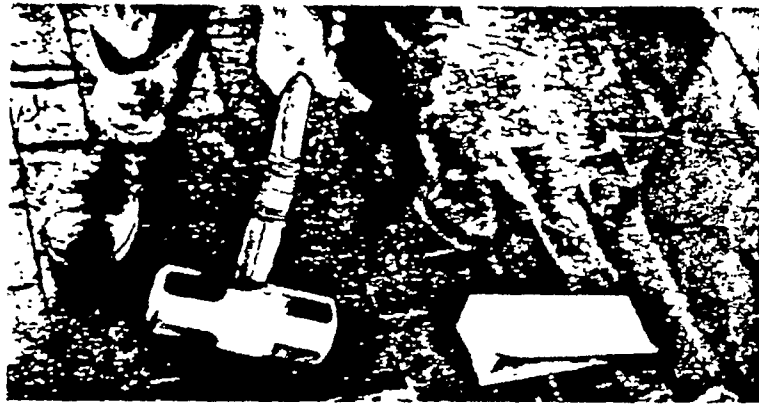
placed on a bench should be used to obtain a fine, sharp cutting edge. The oilstone should never be held in the hand because a slip off the face of the stone could cause a severe hand injury. Often a few finishing strokes on a leather strop will produce a keener edge.

Metal cutting tools, because they generally have greater body, can be dressed or sharpened (or both) on an abrasive wheel. Care should be taken that the tool does not overheat from too much pressure against

the wheel. The manufacturer's recommendations for type and kind of abrasive wheel should be followed. Each cutting edge should have the correct angle according to its use.

Handles

The handles of hand tools should be of the best straight-grained material, preferably hickory, ash, or maple, and should be free from



Tools with cracked or split handles are hazardous. Such handles should be replaced. Makeshift repairs, like winding wire or tape around a defective handle, should not be permitted. Through training and regular inspections, the supervisor should make sure men do not use tools in this condition.

slivers. Make sure that they are properly attached, because poorly fitted or loose handles are unsafe, may damage the material, and also make it difficult for the worker to control the tool.

No matter how tightly a handle may be wedged at the factory, both use and shrinkage will loosen it. Tool inspection should disclose damaged and loose handles. These should be removed from service and repaired, if feasible.

Use of Hand Tools

The misuse of common hand tools is a prolific source of injury to the industrial worker. In many instances, injury results because it is

assumed that "anybody knows how" to use common hand tools. Observation and the record of injury show that this is not the case.

Supervisors should study each job and train new and retrain old employees on correct procedures for using tools. Where employees have the privilege of selecting or providing tools, the supervisor should advise them on the hazard of the job and insist on the safest equipment for each job.

Supervisors should enforce all rules. They should frequently check the condition of tools to be sure that they are maintained and sharpened correctly and that guards are not altered or removed. The use and the condition of personal protective equipment should be checked frequently.

Specific rules should be adapted for using hand tools in each operation. So important is this training that considerable attention is given, in the following pages, to these safe practices.

Metal-cutting tools

Chisels. Factors determining the selection of a cold chisel are the materials to be cut, the size and shape of the tool, and the depth of the cut to be made. The chisel should be made heavy enough so that it will not buckle or spring when struck. For best results and for safety, flat and cape chisels should be ground so that the faces form an angle of 70 degrees for cast iron, 60 degrees for steel, 50 degrees for brass, and about 40 degrees for babbitt and other soft metals.

A chisel only large enough for the job should be selected so that the blade is used rather than the point or corner. Also a hammer heavy enough to do the job should be used.

Some workmen prefer to hold the chisel lightly in the hollow of the hand with the palm up, supporting the chisel by the thumb and first and second fingers. If the hammer glances from the chisel, it will strike the soft palm rather than the knuckles. Other workmen think that a grip with the fist holds the chisel more steady and minimizes the chances of glancing blows. Moreover, in some positions, this is the only grip that is natural or even possible. Hand protection can consist of a rubber pad, forced down over the chisel to provide a hand cushion.

When shearing with a cold chisel, the workman should hold the tool at the vertical angle that permits one bevel of the cutting edge to be flat against the shearing plane.



One of the recommended ways to hold a chisel—If hammer misses head of chisel, it will hit palm of workman's hand, not his knuckles.

Workmen should wear safety goggles when using a chisel and should set up a shield or screen to prevent injury to other workmen from flying chips. If a shield does not afford positive protection to all exposed employees, then glasses with side protection should be worn.

Bull chisels held by one man and struck by another require the use of tongs or a chisel holder to guide the chisel so that the workmen will not be exposed to injury. Both workmen should wear safety goggles and a safety hat. The man swinging the sledge should not wear gloves.

Tap and die work requires certain precautions. The work should be firmly mounted in the vise. Only a T-handle wrench or adjustable tap wrench should be used. Steady downward pressure should be used on the taper tap. Excessive pressure causes the tap to enter the hole at an angle or bind the tap, causing it to break. Too small a drill hole or lack of lubricant may also cause the tap to break. The hands should be kept away from broken tap ends. Broken taps should be removed with a tap extractor. If a broken tap is removed by using a prick punch or a chisel and hammer, the worker should wear safety goggles. When threads are being cut with a hand die, the hands and arms should be kept clear of the sharp threads coming through the die and metal cuttings should be cleared away with a brush.

TABLE XV SELECTOR FOR HACK SAW BLADES		
<i>Pitch of Blade (Teeth per Inch)</i>	<i>Stock To Be Cut</i>	<i>Explanation</i>
14	Machine Steel Cold Rolled Steel Structural Steel	The coarse pitch makes saw free and fast cutting
18	Aluminum Babbitt Tool Steel High Speed Steel Cast Iron	Recommended for general use
24	Tubing Tin Brass Copper Channel Iron Sheet Metal (18 gage or over)	Thin stock will tear and strip teeth on a blade of coarser pitch
32	Small Tubing Conduit Sheet Metal (less than 18 gage)	

Hack saws should be adjusted in the frame to prevent buckling and breaking, but should not be tight enough to break off the pins that support the blade. Install blade with teeth pointing forward.

The preferred blade to be used is shown in Table XV.

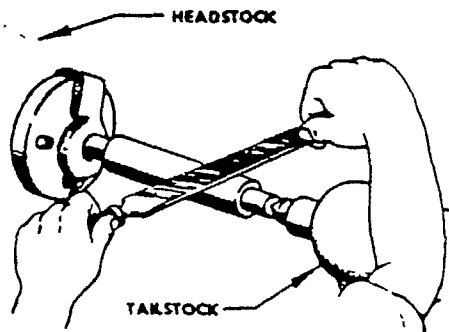
Pressure should be applied on the forward stroke, not upon the back stroke. If the blade is twisted or too much pressure is applied, the blade may break and cause injury to the hands or arms of the user.

Files. Selection of the right kind of file for the job will prevent injuries, lengthen the life of the file, and increase production. Inasmuch as the extremely hard and brittle steel of the file chips easily, the file should never be cleaned by being struck against a vise or other metal object—a file-cleaning card or brush should be used.

For the same reason a file should not be hammered or used as a pry. Such abuse frequently results in the file's chipping or breaking, causing injury to the user. A file should not be made into a center punch, chisel, or any other type of tool because the hardened steel may fracture in use.

The correct way to hold a file for light work is to grasp the handle firmly in one hand and use the thumb and forefinger of the other to guide the point. This technique will give good control and ensure better and safer work.

A file should never be used without a smooth, crack-free handle; otherwise, if the file should bind, the tang may puncture the palm of



Although filing on a lathe is not recommended (an accurately ground tool bit and careful workmanship will keep the amount of filing to a minimum), the recommended procedure is to grip the file handle in the left hand and use the right hand to hold the top of the file. Be sure arm is kept out of range of face plate and lathe dog or chuck.

the hand, the wrist, or other part of the body. Under some conditions, a clamp-on, raised offset handle may be useful to give extra clearance for the hands. Files should not be used on lathe stock turning at high speed (faster than three turns per file stroke) because the end of the file may strike the chuck, dog, or face plate and throw the file (or metal chip) back at the operator hard enough to inflict serious injury. To help avoid contact with the turning parts of the lathe, the operator should always cross file.

Tin snips should be heavy enough to cut the material so easily that the workman needs only one hand on the snips and can use the other

to hold the material. The material should be well supported before the last cut is made so that the cut edges do not press against the hands. When cutting long sheet metal pieces, push down the sharp ends next to the hand holding the snips.

Jaws of snips should be kept tight and well lubricated.

Workmen should wear safety goggles when trimming corners or slivers of sheet metal, because small particles often fly with considerable force. They should always wear gloves.

Cutters used on wire, reinforcing rods, or bolts should have ample capacity for the stock; otherwise, the jaws may be sprung or spread. Also, a chip may fly from the cutting edge and injure the user.

Cutters are designed to cut at right angles only. They should not be "rocked," hammered, or pushed against the floor to facilitate the cut because they are not designed to take the resulting strain. This practice will nick the cutting edges and result in future problems. A good rule is, "If it doesn't cut with ease, use a larger cutter or use a cutting torch."

Cutters require frequent lubrication. To keep cutting edges from becoming nicked or chipped, cutters should not be used as nail pullers or pry bars.

Cutter jaws should have the hardness specified by the manufacturer for the particular kind of material to be cut. By adjustment of the bumper stop behind the jaws, cutting edges should be set to have a clearance of 0.003 in. when closed.

Wood-cutting tools

Edged tools should be used so that, if a slip should occur, the direction of force will be away from the body. For efficient and safe work, edged tools should be kept sharp and ground to the proper angle. A dull tool does a poor job and may stick or bind. A sudden release may throw the user off balance or cause his hand to strike an obstruction.

Dressing of wood-cutting tools was discussed under that heading earlier in this chapter.

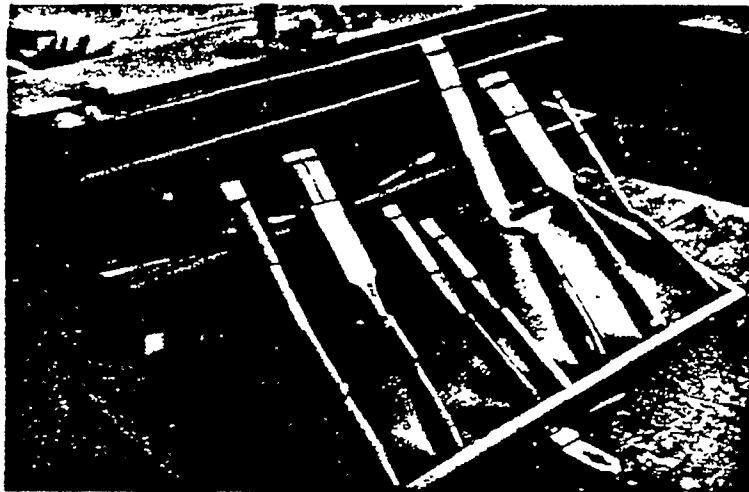
Wood chisels. Inexperienced employees should be instructed in the proper method of holding and using chisels. Handles should be free of splinters. The wood handle of a chisel struck by a mallet should be protected by a metal or leather cap to prevent its splitting.

The work to be cut should be free of nails to avoid damage to the

blade or cause a chip to fly into the user's face or eye.

The steel in a chisel is hard so that the cutting edge will hold, and is therefore brittle enough to break if the chisel is used as a pry.

When not in use, the chisel should be kept in a rack, on a work-



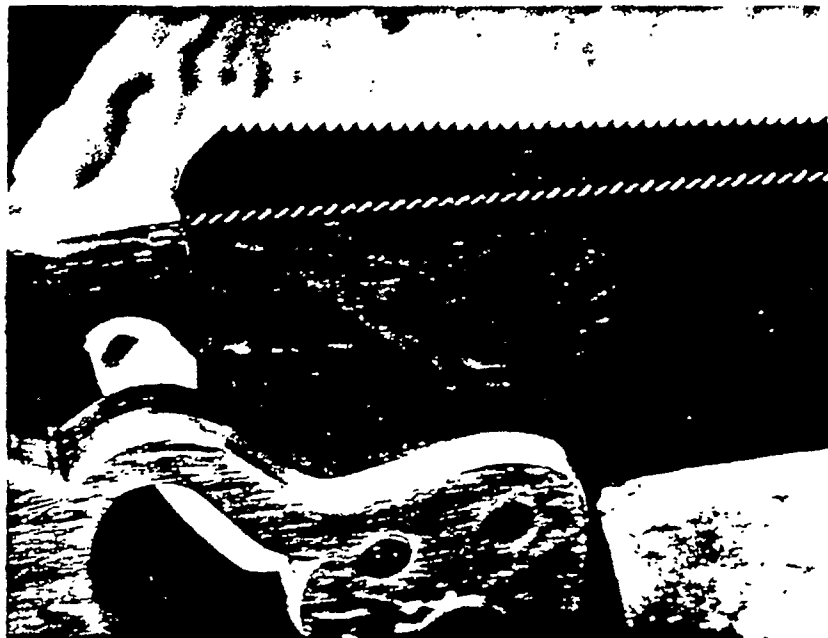
Metal, fiber, or heavy cardboard guards can be made to fit over sharp edges of tools. Tool boxes should be checked regularly to see that tools are stored with sharp edges protected.

bench, or in a slotted section of the tool box so that the sharp edges will be out of the way and not become damaged.

Saws should be carefully selected for the work they are to do. For fast crosscut work on green wood, a coarse saw (4 to 5 points per inch) should be used. A fine saw is better for smooth, accurate cutting in dry wood. Saws should be kept sharp and well set to prevent binding, and when not in use should be kept in racks.

Axes. To use an axe safely, workmen must be taught to check the axe head and handle, clear the area for an unobstructed swing, and swing correctly and accurately. Accuracy is attained by practice and proper hand hold—and good supervisory training. All others must keep a safe distance away.

A narrow axe with a thin blade should be used for hard wood, and a wide axe with a thick blade for soft wood. A sharp, well-honed axe yields better chopping speed and is much safer to use because it bites



Dull saws can be frustrating. In the rear is a saw that is in good condition. The one in front has been neglected—teeth are flattened, dull, and badly out of set.

into the wood. A dull axe will often glance off the wood being cut and strike the user in the foot or leg.

An axeman should make sure that he has a clear circle in which to swing his axe before he starts chopping. Also, he should remove all vines, brush, and shrubbery within the range, especially overhead vines that may catch or deflect his axe.

Axe blades should be protected with a sheath or metal guard wherever possible. When the blade cannot be guarded, it is safer to carry the axe at one's side. The blade on a single-edged axe should be pointed down.

Hatchets are used for many purposes and frequently cause injury. For example, when a workman attempts to split a small piece of wood while holding it in his hands, he may strike his fingers, hand, or wrist. Hatchets are dangerous tools in the hands of the inexperienced.

To start the cut, it is a good practice to strike the wood lightly with the hatchet, then force the blade through by striking the wood

against a solid block of wood.

Hatchets should not be used for striking hard metal surfaces, since the tempered head may injure the user or others by flying chips. When using a hatchet for cutting or for driving nails in a crowded area, workmen should take special care to prevent injury to themselves and other workers.

Using a hatchet to drive nails is a poor practice. If used, however, the face of a hatchet used for driving nails should be square. Some companies prefer to use a corrugated face to prevent nails from flying.

Miscellaneous cutting tools

Planes, scrapers, bits, and drawknives should be used only by experienced men. These tools should be kept sharp and in good condition. When not in use, they should be placed in a rack on the bench, or in a tool box in such a way that will protect the user and prevent damage to the cutting edge.

Knives are more frequently the source of disabling injuries than any other hand tool. In the meatpacking industry, hand knives caused more than 15 percent of all disabling injuries, which is more than caused by any other agency.

The principal hazard in the use of knives is that the hands may slip from the handle onto the blade or that the knife may strike the body or the free hand. A handle guard or a finger ring (and swivel) on the handle eliminates these hazards. Adequate guarding is important.

The cutting stroke should be away from the body. If that is not possible, then the hands and body should be in the clear, a heavy leather apron or other protective clothing should be worn, and, where possible, a rack or holder should be used for the material to be cut. Jerky motions should be avoided to help maintain balance. Be sure employees are trained and supervised. See picture on page 177.

Belt repairmen and other workmen who must carry knives with them on the job should keep them in sheaths or holders. Never carry a sheathed knife on the front part of a belt—always carry it over the right or left hip, toward the back. This will prevent severing a leg artery or vein in case of a fall.

Knives should never be left lying on benches or in other places where they may cause hand injuries. When not in use, they should be kept in racks with the edges guarded. Safe placing and storing of



1
Slice vegetables with a rocking motion, rather than chopping or hacking away. Hold the point of the chef's knife against the cutting surface. Fingers that hold the object should be curled back and in the clear.

knives is important to knife safety.

Ring knives—small, hooked knives attached to a finger ring—are used where string or twine must be cut frequently. Supervisors should make sure that the cutting edge is kept outside the hand, not pointed inside. A wall-mounted cutter or blunt-nose scissors would be safer.

Carton cutters are safer than hooked or pocket knives for opening cartons. They not only protect the user, but eliminate deep cuts that could damage carton contents. Frequently, damage to contents of soft plastic bottles may not be detected immediately; subsequent leakage may cause chemical burns, damage other products, or start a fire.

To cut corrugated paper, a hooked linoleum knife permits good control of pressure on the cutting edge and eliminates the danger of the blade suddenly collapsing as in the case of a pocket knife. Be sure hooked knives are carried in a pouch or heavy leather (or plastic) holder. The sharp tip must not stick out.

Supervisors should make certain that employees who handle

knives have ample room in which to work so they are not in danger of being bumped by trucks, the product, overhead equipment, or other employees. For instance, a left-handed worker should not stand close to a right-handed person; the left-handed person might be placed at the end of the bench or otherwise given more room. Workers should be trained to cut away from or out of line with their bodies.

Supervisors should be particularly careful about the hazard of employees leaving knives hidden under product, under scrap paper or wiping rags, or among other tools in work boxes or drawers. Knives should be kept separate from other tools to protect the cutting edge of the knife as well as to protect the employee.

Work tables should be smooth and free of splinters. Floors and working platforms should have slip-resistant surfaces and should be kept unobstructed and clean. If sanitary requirements permit mats or wooden duck boards, they should be in good repair, so workers do not trip or stumble. Conditions which cause slippery floors should be controlled as much as possible by good housekeeping and frequent cleaning.

Careful job and accident analysis may suggest some slight change in the operating procedure which will make knives safer to use. For instance, on some jobs special jigs, racks, or holders may be provided so it is not necessary for the operator to stand too close to the piece being cut.

The practice of wiping a dirty or oily knife on the apron or clothing should be discouraged. The blade should be wiped with a towel or cloth with the sharp edge turned away from the wiping hand. Sharp knives should be washed separately from other utensils and in such a way that they will not be hidden under soapy wash water.

Horseplay should be prohibited around knife operations. Throwing, "fencing," trying to cut objects into smaller and smaller pieces, and similar practices are not only dangerous but reflect inadequate supervision.

Supervisors should make sure that nothing is cut that requires excessive pressure on the knife—such as, frozen meat. Food should be thawed before it is cut or else it should be sawed. Knives should not be used as a substitute for can openers, screwdrivers, or ice picks.

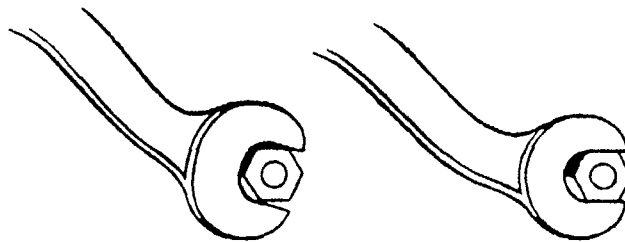
Ice picks. Serious hand injuries occur frequently when ice is held in the hand and breaks unexpectedly. To ensure safety in the use of an ice pick, first place the pieces of ice on a flat surface.

The handle of an ice pick should be flat or square, or have at least one flat surface to prevent the pick from rolling. Ice picks should be carried in sheaths or stored in a holder that covers the points, and should not be used as scribes or pin punches.

Torsion tools

Socket wrenches are safer to use than adjustable or open-end wrenches.

Open-end or box wrenches should be inspected to make sure that they fit properly and should never be used if jaws are sprung



Wrench jaws that fit (and are not sprung or cracked) prevent damage to the head of the nut, and are not likely to slip and cause injury to the user.

or cracked; when defective they should be taken out of service until repaired. It is dangerous to use a piece of pipe or a wrench for added leverage, or to use a wedge to make a wrench fit.

Socket wrenches give great flexibility in hard-to-reach places. The use of special types should be encouraged where there is danger of injury.

Adjustable wrenches are used for many purposes. They are not intended, however, to take the place of standard open-end, box, or socket wrenches. They are used mainly for nuts and bolts that do not fit a standard wrench. Pressure is always applied to the fixed jaw.

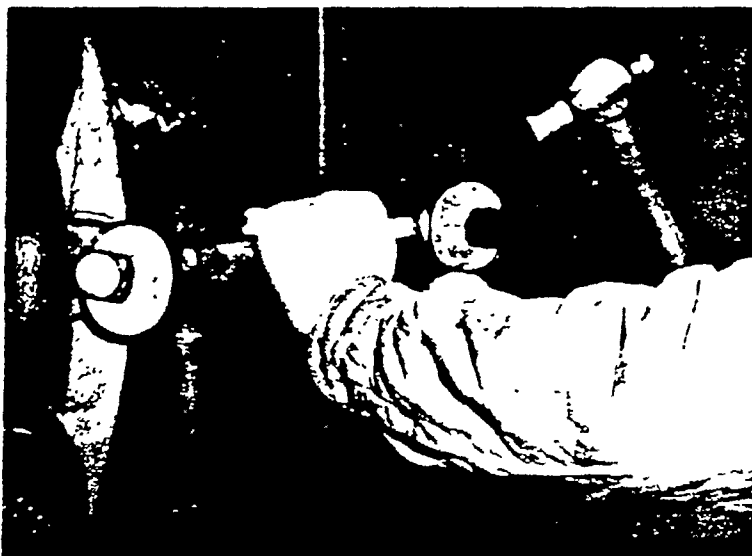
Pipe wrenches. Workmen, especially those on overhead jobs, have been seriously injured when pipe wrenches slipped on pipes or fittings, causing the men to lose their balance and fall. Pipe wrenches, both straight and chain tong, should have sharp jaws and be kept clean to prevent their slipping.

The adjusting nut of the wrench should be inspected frequently. If it is cracked, the wrench should be taken out of service. A cracked

nut may break under strain, causing complete failure of the wrench and possible injury to the user.

Using a wrench of the wrong length is also a source of accidents. A wrench handle too small for the job does not give proper grip or leverage. An oversized wrench handle may strip the threads or break the fitting or the pipe suddenly, causing a slip or fall.

A piece of pipe ("cheater") slipped over the handle to give added



The unsafe practice of using a hammer to force a wrench can result in serious injury if the wrench slips or breaks, and always damages the wrench by springing or spreading the jaws. Employees should be trained to select a wrench of the proper size for the particular application.

leverage also can strain a pipe wrench to the breaking point. The handle of every wrench is designed to be long enough for the maximum allowable safe pressure.

A pipe wrench should never be used on nuts or bolts, the corners of which will break the teeth of the wrench, making it unsafe to use on pipe and fittings. Also, a pipe wrench, when used on nuts and bolts, also damages their heads. A pipe wrench should not be used on valves, struck with a hammer, nor used as a hammer unless, as with specialized types, it is specifically designed for such use.

Tongs usually are bought, but some companies make their own to perform specific jobs. Often they are poorly designed—hands and fingers are pinched when the tongs are closed.

To prevent pinching, the end of one handle should be up-ended toward the other handle, to act as a stop. It is also possible to braze, weld, or bolt bumpers on the handles a short distance behind the pivot point so that the handles cannot close against the fingers.

Pliers. Side-cutting pliers sometimes cause injuries when short ends of wire are cut. A guard over the cutting edge and the use of safety glasses will help prevent eye injuries.

The handles of electricians' pliers should be insulated. In addition, the men should wear electricians' gloves if they are to work on energized lines.

Because pliers do not hold the work securely, they should not be used as a substitute for a wrench.

Special cutters include those for cutting banding wire and strap. Claw hammers and pry bars should not be used to snap metal banding material. Only cutters designed for the work provide safe and effective results.

Nail band crimpers make it possible to keep the top band on kegs and wood barrels after nails or staples have been removed. Use of these tools eliminates injury caused by reaching into kegs or barrels that have projecting nails and staples.

Pipe tongs should be placed on the pipe only after the pipe has been lined up and is ready to be made up. A 3- or 4-in. block of wood should be placed near the end of the travel of the tong handle and parallel to the pipe to prevent injury to the hands or feet in the event the tongs slip.

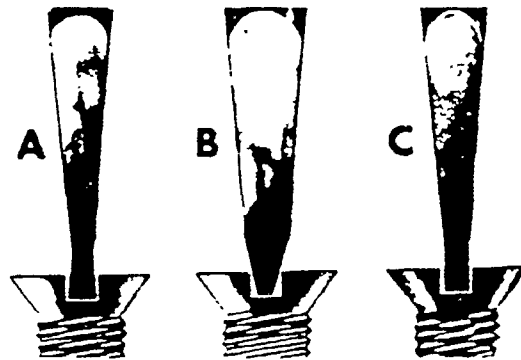
Workmen should neither stand nor jump on the tongs nor place extensions on the handles to obtain more leverage. They should use larger tongs, if necessary, to do the job.

Screw drivers. The screw driver is probably the most commonly used and abused tool. The practice of using screw drivers for punches, wedges, pinch bars, or pries should be discouraged. If used in such manner, they become unfit for the work they are intended to do. Furthermore, a broken handle, bent blade, dull or twisted tip may cause a screw driver to slip out of the slot and cause a hand injury.

Cross-slot (Phillips-head) screw drivers are safer than the square bit type, because they have less tendency to slip. The pressure on the

tip is more evenly distributed and results in less wear on the tip. The tip must be kept clean and sharp, however, to permit a good grip on the head of the screw.

A screw driver tip should fit the screw. A sharp square-edged



Screw driver bits with parallel sides shaped like in illustration C, or undercut slightly like in A, will grip the slot more securely than the bit shown in B.

bit will not slip as easily as a dull, rounded one, and requires less pressure.

The part to be worked upon should never be held in the hands: it should be laid on a bench or flat surface, or held in a vise. This practice will lessen the chance of injury to the hands if the screw driver should slip from the work.

No screw driver used for electrical work should have the blade or rivet extending through the handle. Also, both blade and handle should be insulated except at the tip.

Shock tools

A **hammer** should have a securely wedged handle suited to the type of head used. The handle should be smooth, free of oil, shaped to fit the hand, and of the specified size and length. Employees should be warned against using a steel hammer on hardened steel surfaces. Instead, a soft-head hammer or one with a plastic, wood, or rawhide head should be used. Safety goggles should be furnished and worn to protect against flying chips, nails, or scale.

The chipping or spalling of a hammer varies with four things:

1. The squarer the corners of the hammer the easier it chips.
2. The harder the hammer is swung the more likely it is to chip.
3. Chipping increases as the hardness of the object being struck increases.
4. The greater the angles between the surface of the object and the hammer face, the greater are the chances of chipping.

Selection of the proper hammer is important. One that is too light is as unsafe and inefficient as one that is too heavy.

Sledge hammers can have two common unsafe conditions: split handles and loose or chipped heads. Because these tools are used infrequently in some industries, the heads may become loose or chipped and the defect not be noticed.

Some companies place a steel band around the head and bolt it to the handle to prevent the head from flying off. The heads should be dressed whenever they start to check or mushroom.

A sledge hammer so light that it bounces off the work is hazardous, likewise, one too heavy is hard to control and may cause body strain.

Riveting hammers, often used by sheet metal workers, should have the same kind of use and care as ball peen hammers and should be watched closely for checked or chipped faces.

Carpenter's or claw hammers are designed primarily for driving and drawing nails. Their shape, depth of face, and balance make them unsuitable for striking objects, such as cold chisels.

The faces should be kept well dressed at all times to reduce the hazard of flying nails while they are being started into a piece of wood. A checker-faced head is sometimes used to reduce this hazard.

Eye protection is advisable for all nailers and all employees working in the same area, as in a shipping room, when blocking and bracing trucks or railway cars, or in carpenter shops and the like.

When a nail is to be drawn from a piece of wood, a block of wood may be used under the hammer head to increase the leverage.

Spark-resistant tools

So-called spark-resistant tools of nonferrous materials are sometimes advised for use where flammable gases, highly volatile liquids, and explosive materials are stored or used. The intensified sparks from steel

tools are capable of igniting substances such as gunpowder, lint, TNT, carbon disulfide, and ethyl ether.

In certain circumstances, steel coated with aluminum paint can emit sparks when struck with a metal striker (steel, brass, or spark-resistant alloys), and such sparks may ignite mixtures of flammable gases or vapors in air. The sparks are due to the thermite reaction between iron oxide and aluminum and are, therefore, produced only in the presence of iron oxide. The extent of this hazard depends on the nature of the surface covered and the nature of the paint, and it is increased if the painted steel is subjected to heat.

Nonferrous tools reduce the hazard from sparking but do not eliminate it. They need inspection before each use to be certain that they have not picked up foreign particles which could produce friction sparks, thereby obviating the value of these special tools.

Portable Power Tools

Portable power tools are divided into four primary groups according to the power source: electric, pneumatic, gasoline, and explosive (powder actuated). Several types of tools, such as saws, drills, and grinders, are common to the first three groups; whereas explosive tools are used exclusively for penetration work and cutting.

A portable power tool presents similar hazards as a stationary machine of the same kind, in addition to the risks of handling. Typical injuries caused by portable power tools are burns, cuts, and strains. Sources of injury include electric shock, particles in the eyes, fires, falls, explosion of gases, and falling tools.

The power cord should always be disconnected before accessories on a portable tool are changed, and guards should be replaced or put in correct adjustment before the tool is used again.

A tool should not be left in an overhead place where there is a chance that the cord, if pulled, will cause the tool to fall. The cord and the tool may be suspended by counterweighted rope or string which keeps the cord out of the operator's way and also counterbalances some of the weight of the tool and the cord. Power extension cords on the floor create a stumbling or tripping hazard. They should be suspended over aisles or work areas, where possible. The cord should be suspended in such a way that it will not be struck by other objects or

by material being handled or moved. An unexpected pull on the cord might cause the tool to jam or otherwise expose the operator to injury.

Do not hang power cords over nails, bolts, or sharp edges. Cords should be kept away from oil, hot surfaces, and chemicals.

Because of the extreme mobility of power driven tools, they can easily come in contact with the operator's body. At the same time, it is difficult to guard such equipment completely. There is the possibility of breakage because the tool may be dropped or roughly handled. Furthermore, the source of power (electrical, mechanical, air, or explosive cartridge) is brought close to the operator, thus creating additional hazards.

When using explosive cartridge equipment for driving anchors into concrete, or when using air-driven hammers or jacks, it is recommended that ear plugs, safety glasses, and/or face shields be used. All companies and manufacturers of portable power tools attach to each tool a set of operating rules or safe practices. These supplement the thorough training each powered tool operator should have received.

Power driven tools should be set in safe places and not left in areas where they may be struck by passers-by, and activated.

Selection

When you replace a hand tool with a power tool, you may be replacing a less serious hazard with a more serious one. Check with your safety professional to make sure the tools you select meet current safety standards. The tool manufacturer, too, can recommend the best tool to do the job you want. Don't just tell him the job you want accomplished, but also the material to be worked on, and the space available in the work area of your shop or plant. Tell if the operation is intermittent or continuous; too light a tool may fail or cause undue operator fatigue if used over an extended time.

Electric tools

Electric shock is the chief hazard from electrically powered tools. Types of injuries are electric flash burns, minor shock that may cause falls, and shock resulting in death.

Serious electric shock is not entirely dependent on the voltage of the power input. The ratio of the voltage to the resistance determines

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the current that will flow and the resultant degree of hazard. The current is regulated by the resistance to ground of the body of the operator and by the conditions under which he is working. It is possible for a tool to operate with a defect or short in the wiring, and the use of a ground wire protects the operator under all conditions.

Insulating platforms, rubber mats, and rubber gloves provide an additional factor of safety when tools are used in wet locations, such as in tanks or boilers and on wet floors.

Low voltage of 6, 12, 24, or 32 volts through portable transformers will reduce the shock hazard in wet locations.

Electric tools used in wet areas or in metal tanks expose the operator to conditions favorable to the flow of current through his body, particularly if he is wet with perspiration. Most electric shocks from tools have been caused by the failure of insulation between the current-carrying parts and the metal frames of the tools. Only tools in good repair and listed by Underwriters' Laboratories, Inc., should be used.

Double insulated tools. Protection from electric shock, while using portable power tools, has been described as depending upon third wire protective grounding. "Double insulated" tools, however, are available which provide more reliable shock protection without third-wire grounding. Paragraph 250-45 of the 1971 *National Electrical Code* permits "double insulation" for portable tools and appliances. Tools in this category are permanently marked by the words "double insulation" or "double insulated." Units designed to this category which have been tested and listed by Underwriters' Laboratories, Inc., will also employ the use of the UL symbol. Many U.S. manufacturers are also using the symbol



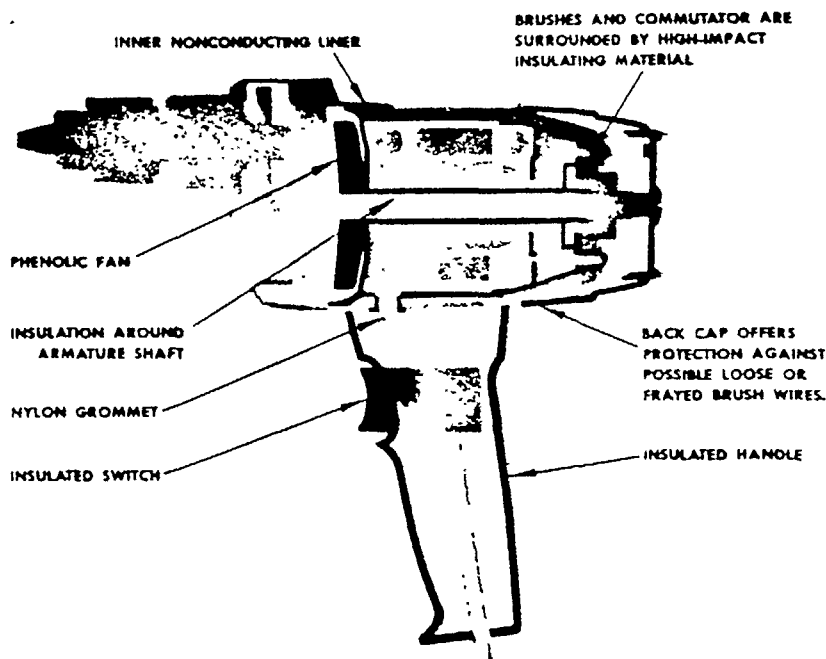
to denote "double insulation."

This symbol is also being widely used in most European countries.

This double insulated or all-insulated tool does not require separate ground connections; the third wire or ground wire is not needed and should not be used.

Failure of insulation is harder to detect than worn or broken external wiring, and points up the need for frequent inspection and thorough maintenance. Care in handling the tool and frequent cleaning will help prevent the wear and tear that cause defects.

Grounding of portable electric tools provides the most convenient way of safeguarding the operator. If there is any defect or short circuit inside the tool, the current is drained from the metal frame through a ground wire and does not pass through the operator's body. All electric power tools should be effectively grounded except the double insulated and cordless types. Grounded tools are as safe as double insulated or low voltage tools.



On a double-insulated, shock-proof electric tool, an internal layer of protective insulation isolates the electrical components from the outer metal housing.

The noncurrent-carrying metal parts of portable and/or cord- and plug-connected equipment required to be grounded may be grounded—either (a) By means of the metal enclosure of the conductors feeding such equipment, provided an approved grounding-type attachment plug is used, or (b) by means of a grounding conductor run with the power supply conductors in a cable assembly or flexible cord that is properly terminated in an approved grounding-type attachment plug having a fixed grounding contacting member. The grounding conductor may be uninsulated; if individually covered, however, it must be

finished a continuous green color or a continuous green color with one or more yellow stripes.

(c) By special permission, nonportable cord- and plug-connected equipment can be grounded by a separate flexible wire or strap, insulated or bare, that has been protected (as well as practicable) against physical damage

Electric cords should be inspected periodically and kept in good condition. Heavy-duty plugs that clamp to the cord should be used to prevent strain on the current-carrying parts if the cord is accidentally pulled. Employees should be trained not to jerk cords and to protect them from sharp objects, heat, and oil or solvents that might damage or soften the insulation.

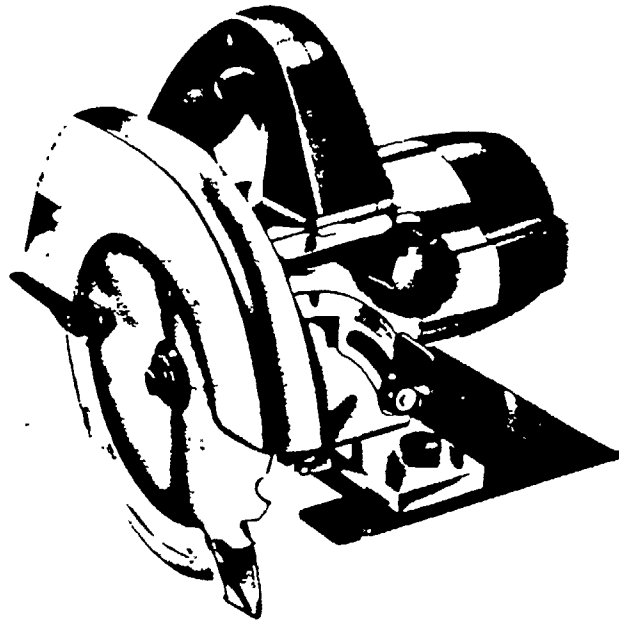
Electric drills cause injuries in several ways: a part of the drill may be pushed into the hand, the leg, or other parts of the body, the drill may be dropped when the operator is not actually drilling, and the eyes may be hit either by material being drilled or by parts of a broken drill bit. Although no guards are available for drill bits, some protection is afforded if drill bits are carefully chosen for the work to be done, such as being no longer than necessary to do the work.

Where the operator must guide the drill with his hand, the drill should be equipped with a sleeve that fits over the drill bit. The sleeve protects the operator's hands and also serves as a limit stop if the drill should plunge through the material.

Oversized bits should not be ground down to fit small electric drills; instead, an adapter should be used that will fit the large bit and provide extra power through a speed reduction gear; however, this again is an indication of improper drill size. When drills are used, the pieces of work should be clamped or anchored to prevent whipping.

Electric saws are usually well guarded by the manufacturer, but employees must be trained to use the guard as intended. The guard should be checked frequently to be sure that it operates freely and encloses the teeth completely when it is not cutting, and the unused portion of the blade when it is cutting.

Circular saws should not be jammed or crowded into the work. The saw should be started and stopped outside the work. At the beginning and end of the stroke, or when the teeth are exposed, the portable power hand-held circular saw operator must use extra care to keep his body and power cord out of the line-of-cut. The safest saws have a trigger switch to shut off power when pressure is released.



Lower movable guard of this portable electric saw always returns to the guarded position. Operator should keep his fingers away from the trigger when saw is not being used.

Abrasive wheels, buffers, and scratch brushes should be guarded as completely as possible. For portable grinding, the maximum angular exposure of the periphery and sides should not exceed 180 degrees and the top half of the wheel should always be enclosed. Guards should be adjustable so that operators will be inclined to make the correct adjustment rather than remove the guard. However, the guard should be easily removable to facilitate replacement of the wheel. In addition to mechanical guarding the operator should wear safety goggles at all times in case the wheel disintegrates.

The portability of a grinding wheel exposes it to more abuse than that given a stationary grinder. The wheel should be kept away from water and oil, which might affect its balance; the wheel should be protected against blows from other tools; and care should be exercised not to strike the sides of a wheel against objects or to drop the wheel. Cabinets or racks will help protect the wheel against damage.

The speed and weight of a grinding wheel, particularly a larger one, make it more difficult to handle than some other power tools. Since part of the wheel must necessarily be exposed, it is important that employees be trained in the correct way to hold and use the wheel so that it does not touch the clothes or the worker's body.

The wheels should be mounted only by trained workmen, with the wheels and safety guards conforming to American National Standard B7.1, *Safety Code for the Use, Care, and Protection of Abrasive Wheels*, now promulgated in OSHA regulations as § 1910.243(e). Grinders should be marked to show the maximum abrasive wheel size and speed. Abrasive wheels should be sound-tested (ring-tested) before being mounted.

Sanders of the belt or disk type cause serious skin "burns" when the rapidly moving abrasive touches the body. Because it is impossible to guard sanders completely, employees require thorough training in their use. The motion of the sander should be away from the body, and all clothing should be kept clear of the moving parts. Dust-type safety goggles or plastic face shields should be worn and, if harmful dusts are created, a respirator approved by the National Institute for Occupational Safety and Health (NIOSH) for the exposure should be worn.

Sanders require especially careful cleaning because of the dusty nature of the work. If a sander is used steadily, it should be dismantled periodically, as well as thoroughly cleaned every day by being blown out with low-pressure air—less than 30 psig. If compressed air is used, the operator should wear safety goggles or work with a transparent chip guard between his body and the air blast.

Because wood dust presents a fire and explosion hazard, keep dust to a minimum; sanders can be equipped with a dust collection or vacuum bag. Electrical equipment should be designed to minimize the explosion hazard. Fire extinguishers approved for Class C (electrical) fires should be available. Employees should be trained in what to do in case of fire.

Soldering irons are the source of burns and of illness resulting from inhalation of fumes. Insulated, noncombustible holders will practically eliminate the fire hazard and the danger of burns from accidental contact. Ordinary metal covering on wood tables is not sufficient because the metal conducts heat and may ignite the wood.

Holders should be designed so that employees cannot accidentally

touch the hot irons if they reach for them without looking. The best holder completely encloses the heated surface and is inclined so that the weight of the iron prevents it from falling out. Such holders must be well ventilated to allow the heat to dissipate, otherwise the life of the tip will be reduced and the wiring or printed circuit may be damaged. Also see NSC Data Sheet 445, *Hand Soldering and Brazing*.

Harmful quantities of fumes from lead soldering should not be allowed to accumulate. Local and federal regulations may require exhaust facilities if much lead soldering is done. Even if lead fumes are not present in harmful quantities, it is desirable to exhaust the nuisance fumes and smoke. Air samples should be taken to verify that the amount of lead in the air is not harmful.

Lead solder particles should not be allowed to accumulate on the floor and on work tables. If the operation is such that the solder or flux may spatter, employees should wear face shields or do the work under a transparent shield.

Air power tools

Air hose. An air hose presents the same tripping or stumbling hazard as do power cords on electric tools. Persons or material accidentally hitting the hose may unbalance the operator or cause the tool to fall from an overhead place. An air hose on the floor should be protected against trucks and pedestrians by two planks laid on either side of it or by a runway built over it. It is preferable to suspend hoses over aisles and work areas.

Workmen should be warned against disconnecting the air hose from the tool and using it for cleaning machines or removing dust from clothing.

Accidents sometimes occur when the air hose becomes disconnected and whips about. A short chain attached to the hose and to the tool housing will keep the hose from whipping about if the coupling should break. Air should be cut off before attempting to disconnect the air hose from the air line. Air pressure inside the line should be released before disconnecting.

A safety check valve installed in the air line at the manifold will shut off the air supply automatically if a fracture occurs anywhere in the line.

If kinking or excessive wear of the hose is a problem, it can be



Safety glasses saved the left eye of this plane overhaul mechanic. While he was using a pneumatic screwdriver to install the plate, the screwdriver tip broke and struck the left lens of his safety glasses. The lens was chipped, but the mechanic's eye was unharmed.

protected by a wrapping of strip metal or wire. One objection to armored hose is that it may become dented and thus restrict the flow of air.

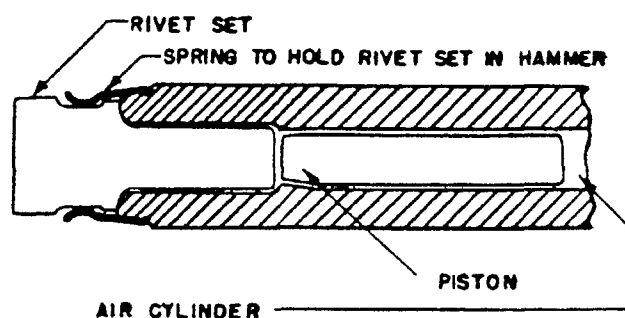
Air power grinders require the same type of guarding as electric grinders. Maintenance of the speed regulator or governor on these machines is of particular importance in order to avoid over-speeding the wheel (runaway).

Regular inspection by qualified personnel at each wheel change is recommended.

Pneumatic impact tools, such as riveting guns and jackhammers, are essentially the same in that the tool proper is fitted into the gun and receives its impact from a rapidly moving reciprocating piston driven by compressed air at about 90 psig pressure.

Two safety devices are needed. The first is a trigger located inside

the handle where it is reasonably safe from accidental operation. The machine operates only when the trigger is depressed. The second is a device to hold the tool in place so that it cannot be shot accidentally from the barrel.



A spring clip, like the one shown here, should always be used to prevent a rivet set from falling from a hammer.

On small air hammers not designed to use this device, use a spring clip to prevent the tool and piston from falling from the hammer.

It is essential that employees be thoroughly trained in their proper use. A safety rule to impress on all operators of small air hammers is *Do not squeeze the trigger until the tool is on the work.*

Air-operated nailers and staplers. The principal hazard from these tools is the accidental discharge of the fastener. In such instances, the fastener can become a dangerous projectile and inflict serious injury at considerable distance. Operators should be trained in the use of these tools and must follow the manufacturer's operating instructions.

In the use of all pneumatic impact tools there is, of course, a hazard from flying chips. Operators should wear safety goggles, and, if other employees must be in the vicinity, they should be similarly protected. Where possible, screens should be set up to shield persons nearby where chippers, riveting guns, or air drills are being used.

Eye protection should be provided when using electric saws, grinding wheels, buffers, scratch brushes, and sanders.

Two chippers should work away from each other, that is, back to back, to prevent face cuts from flying chips. Workmen should not point a pneumatic hammer at anyone, nor should they stand in front of operators handling pneumatic hammers.

Handling of heavy jackhammers causes fatigue and may even cause strains. Jackhammer handles should be provided with heavy rubber grips to reduce vibration and fatigue, and operators should wear safety shoes to reduce the possibility of injury should the hammer fall.

Many accidents are caused by breaking of the steel drill because the operator loses his balance and falls. Also, if the steel is too hard, a particle of metal may break off and strike him. The manufacturer's instructions for sharpening and tempering the steel should be followed.

FILE PROTECTION

FIRE PROTECTION

Apple pie, motherhood, fire protection programs--They hold in common the thought that few could be against them. Unfortunately, there are supervisors whose actions, or lack of actions, serve to defeat fire protection programs. Oh, it isn't a purposeful or malicious defiance, but, rather, a kind of apathy that simply allows such programs to fade into obscurity--until the first disastrous fire.

Certainly, most programs have a competent and highly knowledgeable fire chief to be in charge of fire protection, but he simply cannot be everywhere at once. Even with a competent fire department to back him up, there is no way the program can get along without the people closest to the problem, the supervisors.

While the subject of fire prevention and fire fighting may be a complex and specialized study, there are general principles that we should all know and apply. When there is a special problem or a question, the fire chief can fill in what we don't know.

Applying principles and calling upon the expertise of the fire chief when he is needed depends, however, upon two assumptions:

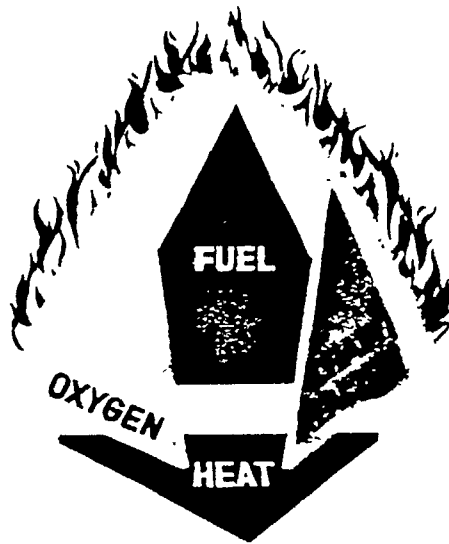
1. The supervisor cares and knows basic protection,
and
2. The supervisor stays alert and aware of fire protection needs and leads his employees to be as alert, knowledgeable, and aware as himself.

While the list of horror stories about fire, death, injury, and total destruction is overly long, it is not the purpose of this handout to use them. Rather, it is the purpose to provide basic information to supervisors to help them support the BHT fire protection effort.

FIRE CHEMISTRY

The supervisor's approach to fire prevention and control problems should begin with an understanding of basic fire chemistry. Every ordinary fire (one that does not produce its own oxygen supply) results when a substance (fuel) in the presence of air (oxygen) is heated to a critical temperature, called the "ignition temperature."

For years, the principle of extinguishment has centered around the "fire triangle." The removal of any of the three sides would usually extinguish the fire. (Fuel, oxygen, or heat) There is, however, another side that causes the triangle to become a pyramid--the fire's chemical chain reaction.



The figure of a pyramid is used, because the four sides touch showing a relationship necessary for fire to exist. Removal of any of the sides breaks that relationship. Let's put that into practical application. Principles are worth very little unless they can be applied usefully.

To extinguish a fire, one or more of the following steps should be taken:

Oxygen

1. Exclude the air by smothering (like: shutting the lid over a tank of burning solvent with foam) or by dilution (such as: replacing the air--with its supporting oxygen--with some gas that cannot support combustion, such as carbon dioxide).

Fuel

2. Remove or seal off the fuel by mechanical means, or divert or shut off the flow of burning liquids or gases.

Heat

3. Cool the burning material below its ignition point with a suitable cooling agent (hose streams or water extinguishers).

Chain Reaction

4. Interrupt the chemical chain reaction of the fire (using dry chemical extinguishing agents).

A supervisor who understands the fire pyramid is in a position to improve and extend his fire prevention and control method.

Determining Fire Hazards

This is an area wherein the fire chief can be of assistance. He can show the supervisor fire hazards and recommend possible solutions. It becomes the supervisor's responsibility to remove the hazards and maintain the "clean" condition in his area.

To assist the supervisor, the following, sample, check list is provided:

FIRE PREVENTION CHECK LIST	
ELECTRICAL EQUIPMENT	
☐ No makeshift wiring	☐ Fuse and control boxes clean and closed
☐ Extension cords serviceable	☐ Circuits properly fused
☐ Motors and tools free of dirt and grease	☐ Equipment approved for use in hazardous areas (if required)
☐ Lights clear of combustible materials	☐ Ground connections clean and tight
☐ Safest cleaning solvents used	
FRICTION	
☐ Machinery properly lubricated	☐ Machinery properly adjusted and/or aligned
SPECIAL FIRE-HAZARD MATERIALS	
☐ Storage of special flammables isolated	☐ Nonmetal stock free of tramp metal
WELDING AND CUTTING	
☐ Area surveyed for fire safety	☐ Combustibles removed or covered
	☐ Permit issued
OPEN FLAMES	
☐ Kept away from spray rooms and booths	☐ Portable torches clear of flammable surfaces
	☐ No gas leaks
PORTABLE HEATERS	
☐ Set up with ample horizontal and overhead clearances	☐ Safely mounted on noncombustible surface
☐ Secured against tipping or upset	☐ Not used as rubbish burners
☐ Combustibles removed or covered	
HOT SURFACES	
☐ Hot pipes clear of combustible materials	☐ Soldering irons kept off combustible surfaces
☐ Ample clearance around boilers and furnaces	☐ Ashes in metal containers
SMOKING AND MATCHES	
☐ "No smoking" and "smoking" areas clearly marked	☐ No discarded smoking materials in prohibited areas
☐ Butt containers available and serviceable	
SPONTANEOUS IGNITION	
☐ Flammable waste material in closed, metal containers	☐ Piled material cool, dry, and well ventilated
☐ Flammable waste material containers emptied frequently	☐ Trash receptacles emptied daily
STATIC ELECTRICITY	
☐ Flammable liquid dispensing vessels grounded or bonded	☐ Proper humidity maintained
☐ Moving machinery grounded	
HOUSEKEEPING	
☐ No accumulations of rubbish	☐ Premises free of unnecessary combustible materials
☐ Safe storage of flammables	☐ No leaks or drippings of flammables and floor free of spills
☐ Passageways clear of obstacles	☐ Fire doors unblocked and operating freely with fusible links intact
EXTINGUISHING EQUIPMENT	
☐ Proper type	☐ In working order
☐ In proper location	☐ Service date current
☐ Unobstructed	☐ Personnel trained in use of equipment
☐ Clearly marked	

Causes of Fire

Understanding the causes of fire is helpful in identifying, explaining, and removing hazards. We sometimes tend to ignore certain warnings because we fail to understand the potential. Let's look at a few of the more common ones and see how they apply.

Spontaneous combustion: We have all heard of the term, and most understand its meaning, but do we actually know how it happens. It has to do with the fire pyramid, but how does it work?

Let's take the common example of "oily rags" in the garage. We might say, "Oh, that's obvious. When the summer sun heats the garage, the temperature reaches a point where the rags suddenly burst into flame!" This is a true statement, but it isn't the whole truth. Even the hot summers of Texas rarely heat a garage to such temperatures, though they certainly help the rise to the necessary temperature (heat).

The fact is that oil will combine with oxygen at normal kinds of temperatures. This oxidation of the oil and the cellulose in the rags causes a rise in temperature. A hot garage merely helps the process we call oxidation to occur more rapidly. The point is that the oxidation is a chemical reaction that produces heat on its own. The rags in the center of the pile are insulated by the others, and the heat cannot escape. This allows the oxidation to occur even more rapidly (even when the temperature is mild in the garage). The trapped heat increases the rate of oxidation, and more heat is produced and trapped to further increase the oxidation rate. More heat, more oxidation; more oxidation, more heat.

The garage may be a cool seventy degrees, but the rag at the center of the pile has reached a hundred and seventy. You know the rest... When the rag at the center reaches the ignition temperature, the smoldering stops and the whole pile of oily rags bursts violently into flame, igniting anything around it that is capable of burning--wood, fuel vapors, etc.

Point: You are a supervisor plagued by a constant supply of oily rags. How do you prevent spontaneous combustion? You can get rid of the heat generated by oxidation by turning the piles of rags periodically to prevent heat build-up. Another way is to exclude available oxygen by placing the rags in a closed, metal container. Should the ignition temperature be reached, there still isn't enough oxygen to support flame.

Explosive Vapors: Have you ever ignored the signs around fuel tanks and aircraft about "No smoking, open flames, or vehicles with catalytic converters within 'X' (number of) feet"?

If you have, your employees have probably copied your behavior, and it is probably because you didn't know about vapors that travel in just the right air mixtures for explosion for long distances

from the source. What's more, they may be narrow bands of vapor only a few inches in diameter that your nose can't detect because the narrow band is nowhere near your nose. The heat from a cigarette is enough to ignite the right mixture of air and gasoline even though you may have seen people extinguish a cigarette in liquid gasoline! (Of course, the person who does that sort of thing will eventually find the right mixture to destroy himself and anyone nearby.)

Certain, seemingly strange, rules have been established in many companies because of the danger of explosive vapors. Have you ever heard the rule: "Never put smokes in empty drink bottles"? No, it isn't because the coke bottles aren't washed before re-use! The reason is that some people find coke bottles to be convenient containers for solvents, gasoline, and other volatile liquids. The fact that the liquid has been drained from the bottle before it was placed in the rack is the very action that increases the hazard. The explosive mixture trapped in the bottle may be so perfect that the eight to nine hundred degrees of a cigarette is more than enough to touch-off what is now a very real bomb! The right mixture of gasoline and air is literally three times more powerful than TNT! Acetone, alcohol, and many of the other solvents make bombs of pop bottles just as effectively.

If you feel that the rule should be about using pop bottles instead of not putting cigarettes in them, you have a point. The problem, however, cannot be solved by a rule. New employees may have "always used bottles for just a little bit of solvent." One bottle gets back to the rack as a bomb, but the one who puts the cigarette into it will never know who violated the rule, nor will he care! The employee standing fifty feet away will care, however, because he will be the one who is slashed by the hundreds of tiny pieces of glass traveling at the speed of a bullet!

Can you support the rules concerning vapors? Employees and supervisors must be the ones to support the fire safety rules, because the fire chief is only one person.

SOURCES OF IGNITION IN INDUSTRIAL FIRES

SOURCES OF IGNITION (Descending order of frequency)	EXAMPLES	PREVENTIVE MEASURES
Electrical equip- ment	Electrical defects, generally due to poor maintenance, mostly in wiring, motors, switches, lamps, and hot elements.	Use only approved equipment. Follow <i>National Electrical Code</i> . Establish regular maintenance.
Friction	Hot bearings, misaligned or broken machine parts, choking or jamming of material, poor adjustment.	Follow a regular schedule of inspection, maintenance, and lubrication.
Foreign substances	Tramp metal, which produces sparks when struck by rapidly revolving machinery (a common cause in textile industry).	Keep foreign material from stock. Use magnetic or other separators to remove tramp metal.
Open flames	Cutting and welding torches (chief offenders). Gas and oil burners. Misuse of gas-line torches.	Follow established welding precautions. Keep burners clean and properly adjusted. Do not use open flames near combustibles.
Smoking and matches	Dangerous near flammable liquids and in areas where combustibles are used or stored.	Smoke only in permitted areas. Use prescribed receptacles. Make sure matches are out.
Spontaneous ignition	Deposits in ducts and flues. Low-grade storage. Industrial wastes. Oily waste and rubbish.	Clean ducts and flues frequently. Remove waste daily. Isolate stored materials likely to heat spontaneously.
Hot surfaces	Exposure of combustibles to furnaces, hot ducts or flues, electric lamps or irons, hot metal being processed.	Provide ample clearances, insulation, air circulation. Check heating apparatus before leaving it unattended.
Combustion sparks	Rubbish-burning, foundry cupolas, furnaces and fire-boxes, and process equipment.	Use incinerators of approved design. Provide spark arresters on stacks. Operate equipment carefully.
Overheated materials	Abnormal process temperatures. Materials in driers. Overheating of flammable liquids.	Have careful supervision and competent operators, supplemented by well-maintained automatic temperature controls.
Static electricity	Dangerous in presence of flammable vapors. Occurs at spreading and coating rolls or where liquid flows from pipes.	Ground equipment. Use static eliminators. Humidify the atmosphere.

Adapted from *Factory Mutual Record*

STANDARDS AND CLASSES

The following charts provide the basic information on classes of fires, color codings, and extinguisher traits and fire class requirements for their use.



Class A—Fires in ordinary combustible materials, such as wood, paper, or clothing, where the quenching and cooling effects of water or of solutions containing large percentages of water are of prime importance.



Class B—Fires in flammable liquids, greases, and similar materials, where smotherings or exclusion of air, and interrupting the chemical chain reaction is most effective.



Class C—Fires in or near live electric equipment where the use of a nonconductive extinguishing agent is of first importance. The material that is burning is, however, either Class A or Class B in nature.



Class D—Fires that occur in combustible metals such as magnesium, lithium, and sodium. Special extinguishing agents and techniques are needed for fires of this type.

Recommended colors as described in the Federal Color Standard Number 595 are:

Class A—Green, No. 14260

Class B—Red, No. 11105

Class C—Blue, No. 15102

Class D—Yellow, No. 13655

FIRE EXTINGUISHER/AGENT CHARACTERISTICS

SUITABLE FOR USE ON TYPE OF FIRE	AGENT CHARACTERISTICS	Available Sizes	Horizontal Range	Discharge Time
REGULAR OR ORDINARY DRY CHEMICAL ★				
 	Basically Sodium Bicarbonate. Discharges a white cloud. Leaves residue. Non-freezing.	1 to 30 lbs.	5 to 20 ft.	8 to 25 Sec.
MULTIPURPOSE DRY CHEMICAL ★				
  	Basically Ammonium Phosphate. Discharges a yellow cloud. Leaves residue. Non-freezing. Some extinguishers utilizing this agent do not have an "A" rating — however, they are designated as having "A" capability.	2 to 30 lbs.	5 to 20 ft.	8 to 25 Sec.
OR				
  				
CAPABILITY				
PURPLE-K DRY CHEMICAL ★				
 	Basically Potassium Bicarbonate. Discharges a bluish cloud. Leaves residue. Non-freezing.	2 to 30 lbs.	5 to 20 ft.	8 to 25 Sec.
KCL DRY CHEMICAL ★				
 	Basically Potassium Chloride. Discharges a white cloud. Leaves residue. Non-freezing. Potassium Chloride/Urea	2 to 30 lbs. 11 to 23	5 to 20 ft. 15 to 30	8 to 25 Sec. 20 to 31
CARBON DIOXIDE				
 	Basically an inert gas that discharges a cold white cloud. Leaves no residue. Non-freezing.	2½ to 20 lbs.	3 to 8 ft.	8 to 30 Sec.

★ NOTE: Available in stored pressure or cartridge operated types.

FIRE EXTINGUISHER/AGENT CHARACTERISTIC

SUITABLE FOR USE ON TYPE OF FIRE	AGENT CHARACTERISTICS	Available Sizes	Horizontal Range	Discharge Time
HALOGENATED AGENT				
	Basically halogenated hydrocarbons. Discharges a white vapor. Leaves no residue. Non-freezing.	2½ lb.	4 to 8 ft.	.8 to 10 Sec.
WATER ▲				
	Basically tap water. Discharges in a solid or spray stream. (May contain corrosion inhibitor which leaves a yellow residue.) Protect from freezing!	2½ Gal.	30 to 40 ft.	1 Minute
ANTI-FREEZE SOLUTION				
	Basically a Calcium Chloride solution to prevent freezing. Discharges a solid or spray stream. Leaves residue. Non-freezing	2½ Gal.	30 to 40 ft.	1 Minute
LOADED STREAM				
	Basically an alkali-metal-salt solution to prevent freezing. Discharges a solid or spray stream. Leaves residue. Non-freezing.	2½ Gal.	30 to 40 ft.	1 Minute
FOAM				
	Basically water and detergent. Discharges a foamy solution. After evaporation, leaves a powder residue. Protect from freezing.	10 oz.	10 to 15 ft.	24 Sec.
DRY POWDER SPECIAL COMPOUND				
	Basically Sodium Chloride or Graphite materials. Agent is discharged from an extinguisher in a solid stream or is applied with a scoop or shovel to smother combustible metal. Leaves residue. Non-freezing.	30 lbs.	5 to 20 ft.	.25 to 30 Sec.

▲ NOTE: Pump tanks available.

Courtesy Fire Equipment Manufacturers' Association, Inc., Mt. Prospect, Ill. 60056.

SUBJECT INDUSTRIAL DEFENSE AND DISASTER CONTROL		DATE 10-29-76	NUMBER 12.203.2	S P 1
		SUPERSEDES 12.203.1	PAGE OF 1 1	
ISSUED BY: INFORMATION SYSTEMS	PREPARED BY: R.F.H.	APPROVED BY: <i>J. F. H.</i>		

In accordance with requirements of the Department of Defense controls and procedures for safeguarding personnel, property and classified material in event of disaster, or threatened disaster, must be established in writing for the guidance of Company personnel.

It is the purpose of this Standard Practice Instruction to fix responsibilities for the issuance of, and compliance with, such detail operating instructions as are necessary to satisfy requirements of Bell Helicopter Textron and the Department of Defense.

A. The Industrial Security Department is responsible, within the guidelines of Government Industrial Defense Regulations and Company requirements, for establishing and enforcing Industrial Defense and Disaster Control measures necessary to safeguard personnel, property and classified materials and information.

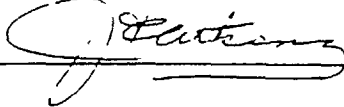
1. The Industrial Security Department will prepare, distribute and maintain a Company Industrial Defense and Disaster Control Plan.
2. The Industrial Defense and Disaster Control Plan will define specific responsibilities and detail instructions applicable to Bell Helicopter Textron facilities. The Industrial Security Department will submit any proposed revision or change to the Plan to Information Systems for concurrence to insure that compatibility is maintained between the Industrial Defense and Disaster Control instructions and established Standard Practice Instructions.

- BHT 00759

STANDARD PRACTICE INSTRUCTION



BELL HELICOPTER COMPANY

SUBJECT FIRE PREVENTION AND PROTECTION		DATE 10-29-76	NUMBER 12.204.1
		SUPERSEDES 28.101.3	PAGE 1 OF 7
ISSUED BY. INFORMATION SYSTEMS	PREPARED BY. R.F.H.	APPROVED BY. 	

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I. INTRODUCTION

The safety of personnel and the protection of Company and Customer property from loss by fire is vital to the continuity of operations and growth of the Company. Every employee is responsible for this. The prime responsibility, however, rests with Bell Helicopter Textron (BHT) Fire Department. This department also has other related duties, such as responsibility for all fire protection equipment; provision of an adequate water supply for fighting fires; inspection of all plants for fire safety; recommending the removal of fire hazards; and, maintaining a Volunteer Fire Force.

This procedure outlines the functions of various departments at BHT in fire protection and prevention, and is applicable at all plants.

II. GENERAL

- A. The terms "Fire Chief" and "Fire Department" as used in this procedure refer to the BHT Fire Chief and the BHT Fire Department unless specifically designated otherwise.
- B. All fire emergencies regardless of nature or size shall be immediately reported to the Fire Department.
- C. During a fire emergency, the first paid BHT fireman arriving on the scene shall be in charge and will be responsible for directing the activities of all fire fighting operations until he is relieved by the Fire Chief. This authority is over BHT firemen, Volunteer firemen, municipal fire departments, and all other people at the scene of the fire.
- D. First aid fire fighting equipment has been placed in locations to serve specific areas and shall not be moved without the approval of the Fire Department.
- E. A Volunteer Fire Force under the direction of the Fire Department is maintained at BHT. This Volunteer Fire Force consists of employees from various departments, trained in the use of fire fighting equipment to assist the regular BHT firemen as directed.
- F. In the event of a fire emergency, the Guards and the Maintenance Department will also assist the Fire Department as directed.

BHT 00760

STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 10-29-76	INSTRUCTION NO. 12.204.1	
	SUPERSEDES 28.101.3	PAGE 2	OF 7

- G. Fire Protection System equipment will not be placed "out of service" without prior approval of the Fire Chief or Manager of Industrial Security.
- H. All fire lanes, roadways and aisles will be maintained clear of obstructions at all times.

III. PROCEDURE

A. FIRE PREVENTION

1. Fire Department Responsibilities

- a. Provide for periodic inspections, checks and reviews of all BHT plants and facilities. Such inspections shall be made in conformance with state laws, codes, National Fire Prevention Association (NFPA) and Occupational Safety Health Act (OSHA), and related standards applicable to fire loss prevention.
- b. Make weekly inspections of all fire sprinkler systems which includes checks and tests on all sprinkler control valves, fire pumps and reservoirs. These and other items as determined by the Fire Chief must be checked on a Weekly Fire Prevention Form which is kept on file in the Fire Chief's office.
- c. Periodically inspect all first aid fire fighting equipment located in specific areas to determine that all units are in the proper places and have not been discharged, and that access to each unit is free and clear. If the wrong type fire extinguisher is found in an area, this fact with supporting evidence will be reported to the Fire Chief.
- d. BHT Firemen will conduct housekeeping inspection tours of various departments at unannounced times and make reports of such inspections to the Fire Chief. The inspecting fireman will inform the area supervisor at the time of the inspection of any corrections that are required or of any problems encountered.
- e. The Fire Chief will review the inspection reports and prepare a summary of the reports for the departments affected. He will send one copy of this summary report to the Manager of Industrial Security and one copy to the head of each department affected.
- f. The Fire Chief will counsel with the Plant Engineering Department on project work and plant construction, to make sure that proper fire loss prevention considerations are incorporated in such work. This applies to the design as well as the performance of the work.

STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 10-29-76	INSTRUCTION NO. 12.204.1	
	SUPERSEDES 28.101.3	PAGE 3	OF 7

- g. The Fire Chief will establish standards and specifications, with other management assistance as needed, for all items of equipment which have to do with fire loss prevention. He will also investigate new equipment and methods.
- h. In conjunction with the Training Department, the Fire Department will schedule and conduct training classes for Volunteer firemen. This training will be in the use of all types of fire fighting equipment used by BHT for aircraft and structural fires.

2. Functional Departments' Responsibilities

- a. It is the responsibility of each department head to see that a daily housekeeping inspection is made within his area. During this inspection particular emphasis should be placed on the handling and storage of flammable liquids, hazardous materials, housekeeping in general, obstructions in aisles, and all other items covered by NFPA and OSHA Standards. Any items that cannot be corrected will be reported to the Fire Chief. The adequacy of "No Smoking" areas will be noted and if it is evident that a new area is needed or that an existing area is not needed, the recommended change will be submitted to the Fire Chief for consideration.
- b. Functional Departments' Supervisors will:
 - (1) Conduct the operations of their departments so that preventable fires or explosions will not occur.
 - (2) Direct work within the guidelines of BHT Fire and Accident Prevention Standards (FAPS) and coordinate supplementing department instructions with Industrial Safety.
 - (3) Include proper directions for fire loss prevention in instructions for all work operations and processes where applicable.
 - (4) Make certain that each employee knows his duties in the event of an emergency. These duties may be as simple as prompt exit from the area, but in any event, supervisors shall see that employees know what and what not to do in any fire emergency.

3. Plant Engineering Department Responsibilities

- a. Know the plant's fire loss prevention standards in relation to NFPA, OSHA, and other applicable codes, and apply them in all new design and in all plant changes.

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	SUPERSEDES 28.101.3	PAGE 4	OF 7

- b. Control the work of outside contractors in the interest of fire loss prevention.
 - c. Consult with the Fire Chief on special requirements that must be met by an outside contractor. These requirements vary with the job and usually involve such items as:
 - (1) Possible isolation of the contractor's work site.
 - (2) Notification to the contractor of special hazards to be encountered in the plant processes or stored materials at or near the job site.
 - (3) The possible hazard that the contractor's work might present to the plant equipment, property and personnel.
 - (4) No-smoking requirements.
 - (5) The use of hot work (welding, etc.) permits.
 - (6) Control of contractor's employees and vehicles on the plant property.
 - (7) Movement and storage of construction equipment and materials where fire loss prevention is involved.
 - d. Insure that fixed facilities and structures are maintained in a condition to minimize loss by fire.
 - e. Make sure that the necessary elements of fire loss prevention are integrated with the operating instructions on all standard or repetitive operations, and that, through necessary training and follow-up, these instructions are observed.
4. Training Department Responsibilities
- a. Instruct all new employees on fire protection, assuring that they have read the rules and procedures contained in the "New Employee Booklet" during their orientation period.
 - b. Coordinate with the Fire Department in scheduling and conducting training classes for Volunteer firemen.

STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 10-29-76	INSTRUCTION NO 12.204.1	
	SUPERSEDES 28.101.3	PAGE 5	OF 7

B. FIRE PROCEDURE AT HURST, LOGISTICS, GLOBE AND ARLINGTON AIRPORT

1. Alarm

- a. To report a fire or emergency at the Hurst (Plant 1), Logistics (Plant 8), Globe (Plant 2) and Arlington Airport (Plant 6) sites, call the emergency number on the dial face of the telephone and give the exact location of the fire or emergency.
- b. The BHT fireman on duty will determine whether the reported fire can be handled locally or if the Volunteer firemen are needed.
- c. The BHT guard on duty is responsible for calling the Fire Chief and/or the Manager of Industrial Security. The Industrial Security Department will notify other departments as necessary.

2. Duties

- a. Before the BHT firemen arrive at the scene of the fire, anyone present may use the fire extinguishers available to try and control the blaze. (Caution should be exercised to make sure the fire extinguisher is the correct type for the fire.)
- b. Volunteer firemen in the vicinity of the fire will determine the class of the fire and use the type of first aid fire equipment required. If the fire is beyond first aid measures, the volunteers will assist the BHT firemen as necessary in fighting the fire. Under no circumstances will Volunteer firemen leave the scene of a fire unless released by the fireman in charge. Volunteer firemen, at the direction of the fireman in charge, will remove from, or protect at, the scene of the fire, any materials, tools, and machinery that are in danger. Care will be taken to avoid destroying evidence as to the origin of the fire.
- c. As soon as the first BHT fireman arrives at the scene of the fire he will take charge as outlined in paragraph II-C. He may call for outside aid when he determines that it is necessary.
- d. The Guards will establish and maintain fire lines at the area of the fire when directed by the fireman in charge. They will also evacuate employees from endangered areas.
- e. Maintenance employees who are on duty will report to the scene of the fire and assist in the shut down of utilities as necessary.

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	SUPERSEDES 28.101.3	PAGE 6	OF 7

3. Fighting the Fire

- a. The fireman in charge will determine the fire-fighting methods to be used. He will also determine if the Volunteer Force, the remainder of the Fire Department, or outside aid is required.
- b. Whatever means is at hand may be used by the fireman in charge to bring the fire under control. Any outside aid called in will be used in conjunction with the Volunteer Force, and the fireman in charge will release the various fire-fighting crews when they are no longer needed.

C. FIRE PROCEDURE AT BELL PLANTS 3, 4, 5, 7, 9, AND KENT WAREHOUSE

1. Alarm

- a. For Minor fires, the person making the discovery will call the guard on duty and the emergency number on the telephone.
- b. For Major fires, the person making the discovery will immediately call the emergency number and the Guard Gate who will call the applicable Municipal Fire Department as follows:

Plant 3 - Call Richland Hills Fire Department
Plant 4 - Call Ft. Worth Fire Department
Plant 5 - Call Grand Prairie Fire Department
Plant 7 - Call Hurst Fire Department
Plant 9 - Call Arlington Fire Department
Kent Warehouse - Call Fort Worth Fire Department

2. Duties

- a. Prior to arrival of the Municipal Fire Department, anyone present may use fire extinguishers to attempt to bring the fire under control.
- b. The arriving Municipal Fire Department will be directed immediately to the fire area.
- c. Upon his arrival, the BHT fireman will take charge of controlling the fire by directing the activities of the Municipal departments through the ranking Municipal Fire Officer.
- d. The BHT fireman in charge will not dismiss the Municipal Fire Departments until the fire is out and all probabilities of re-ignition have been eliminated.

STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 10-29-76	INSTRUCTION NO. 12.204.1	
	SUPERSEDES 28.101.3	PAGE 7	OF 7

- e. After declaring the fire out, the BHT fireman in charge will direct BHT employees in gathering all fire extinguishers used on the fire, and he will have them recharged.

D. FIRE LOSS REPORTS

A written Fire Loss report will be made by the Fire Chief on each fire occurring at Bell Helicopter Textron. The report will describe the cause, damage and circumstances surrounding the fire and whether the fire involved Government or Company property. When Government property is involved, a copy of the report will be sent to the Contracts Administration Manager. Fire Loss reports involving any property will be sent to the Manager of Industrial Security, the Army Safety Office and to other department heads as designated by the Manager of Industrial Security. Copies of all Fire Loss reports will be maintained in the Fire Chief's office.

STANDARD PRACTICE INSTRUCTION



BELL HELICOPTER COMPANY

SUBJECT FIRST AID		DATE 2-26-74	INSTRUCTION NO. 19.208.1	
		SUPERSEDES 27.101.1	PAGE 1 OF 6	
ISSUED BY MANAGEMENT ENGINEERING DEPARTMENT	PREPARED BY J. F.	APPROVED BY 		

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I. INTRODUCTION

The health of employees is important to Bell Helicopter Company (BHC), therefore, first aid is a service that is provided. The necessary controls and provisions for administering first aid, and the steps to be taken for employees returning from sick leave are contained in this Instruction. They are intended for the best interests of both the employees and the Company and are in no way intended to deny available medical attention to anyone.

II. - GENERAL

- A. The procedural steps of this Instruction will be followed insofar as practicable. In emergency first aid cases, immediate attention is given to the patient first, and completion of required forms and records is accomplished later.
- B. All forms and records called for in this Instruction must be completed even in those emergency cases where they are completed after the fact.
- C. Employees working at Kent Warehouse will report to Globe for first aid treatment and employees at other BHC plants which have no First Aid stations will report to Hurst for first aid treatment.
- D. Employees returning from an absence of 14 days or more due to illness or if they have had a surgical operation, must have a signed release from their physician allowing them to return to work.

III. PROCEDURE

A. ROUTINE VISITS TO FIRST AID

1. Employee

- a. Upon desiring or being required to visit First Aid, request a First Aid Authorization Pass, form 7816 55040, from supervisor.
- b. Go to First Aid and present First Aid Pass to the attendant. If at a Plant with no First Aid, use Employee Pass, form 7874 55484, to leave home plant and enter appropriate plant as supervisor directs.

STANDARD PRACTICE INSTRUCTION
BELL HELICOPTER COMPANY

DATE	INSTRUCTION NO	
2-26-74	19.208.1	
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27.101.1	2	6

- c. After treatment and receipt of copy of completed First Aid Pass from attendant, return immediately to work station and give copy of First Aid Pass to supervisor.

2. Supervisor

- a. When employee requests or is required to visit First Aid, initiate First Aid Pass in duplicate. Provide Employee Pass and direct employee to appropriate plant when home plant does not have First Aid.
- b. Upon employee's return, verify time out of First Aid on the First Aid Pass and file the Pass as required in the department.

3. First Aid

- a. Receive employee and treat in accordance with routine departmental practices.
- b. Complete First Aid Pass and return copy to employee.

B. EMERGENCY VISITS TO FIRST AID

1. Employee

Go to First Aid immediately without First Aid Pass if at a plant with First Aid. If at a plant with no First Aid, report immediately to supervisor and do as he directs. If supervisor is not available, have someone else call the Guards and/or First Aid.

2. Supervisor

- a. If at a plant with First Aid and the employee has already reported to First Aid, receive notification from First Aid and a copy of First Aid Pass stamped "emergency" and file it as required in department.
- b. If at a plant with no First Aid, immediately telephone First Aid at the appropriate plant and relate the emergency to them. Do as they instruct regarding ambulance or other method of transportation to First Aid or a hospital. Telephone the Guards as necessary for immediate first aid attention. Provide appropriate passes for the employee if time is available, but if not, telephone the Gate Guard and apprise him of the situation to avoid delay. Complete any required paperwork later.

STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 2-26-74	INSTRUCTION NO. 19.208.1	
	SUPERSEDES 27.101.1	PAGE 3	OF 6

3. First Aid

- a. When an employee arrives from same plant site in an emergency situation, administer treatment in accordance with emergency departmental practices and advise employee's supervisor of the situation. Complete a First Aid Pass, stamping "Emergency" in supervisor's signature block, and forward a copy to the employee's supervisor.
- b. When called by supervisor or other person from another plant informing of an emergency situation, instruct the caller as to the procedure to follow regarding an ambulance or other means of transportation to First Aid or to the hospital. Provide any other directions as required and as possible over the telephone.

C. TREATMENT OUTSIDE THE PLANT

1. First Aid

- a. After determining that an employee who has reported to First Aid requires treatment outside the plant, record this information on the First Aid Pass and retain it.
- b. Exchange employee's badge for a First Aid badge and give the employee an Employee Pass to permit him to leave the plant. Send duplicate copy of the Employee Pass to Timekeeping at end of day.
- c. When the employee returns from treatment outside the plant, return the employee's badge, pick up the First Aid badge, and give the employee a copy of the completed First Aid Pass to take to the supervisor.

2. Employee

- a. Receive First Aid badge and Employee Pass from First Aid attendant and go for outside treatment as directed.
- b. Upon return from outside treatment, surrender the Employee Pass to the Gate Guard, go to First Aid and exchange the First Aid badge for regular badge, receive a copy of the First Aid Pass, and return to work station.

STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 2-26-74	INSTRUCTION NO 19.208.1
	SUPERSEDES 27.101.1	PAGE OF 4 6

D. RETURN FROM SICK LEAVE

1. At Plants with First Aid

a. Employee

- (1) On return from an absence of three days or more due to illness, clock in on Medical Clock Card, form 7874 55518.
- (2) Take Medical Clock Card and report to Placement. If there is no Placement office at employee's home plant, or after release from Placement, report directly to First Aid.
- (3) After release from First Aid, report directly to supervisor and return Medical Clock Card to the "in" card rack.

b. First Aid

- (1) Check employee's Medical Clock Card for Placement signature. Call Placement to verify the employee's employment status if there is no Placement signature.
- (2) When employment is verified, examine employee in accordance with departmental practices and if satisfactory, return signed Medical Clock Card and direct the employee to report to supervisor.

c. Placement will verify the employee's employment and sign the Medical Clock Card or advise First Aid over the telephone of employee's employment status.

d. Supervisor, when employee reports from an absence of three days or more due to illness, will check the Medical Clock Card to make certain that First Aid and Placement have released the employee to return to work.

e. Timekeeping, in every instance, will call First Aid and notify them when a Medical Clock Card is found punched in with no First Aid signature.

STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 2-26-74*	INSTRUCTION NO. 19.208.1	
	SUPERSEDES 27.101.1	PAGES 5	OF 6

2. At Plants without First Aid

a. Employee

- (1) After clocking in on Medical Clock Card, report to supervisor.
- (2) Report to First Aid or start work as supervisor directs. If reporting to First Aid, return to work after release from First Aid and return Medical Clock Card to "in" rack.

b. Supervisor

- (1) When employee reports, telephone First Aid and relate the situation.
- (2) When directed by First Aid, instruct employee to report to First Aid or to go directly to work.

- * (3) If employee goes directly to work, sign Medical Clock Card and return it to the clock card rack.

- * c. Timekeeping will post the punch and mail the Medical Clock Card to First Aid. Upon return of the card from First Aid, file it in accordance with department practices.

d. First Aid

- (1) When supervisor calls, verify employee's employment with Placement and direct supervisor to instruct the employee to report to First Aid or to commence work, as the situation warrants.
- * (2) On receipt of employee's Medical Clock Card from Timekeeping, sign and return it to Timekeeping.
- (3) If employee reports in person, examine as required, return signed Medical Clock Card, and instruct the employee to report to supervisor.

STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 2-26-74*	INSTRUCTION NO 19.208.1	
	SUPERSEDES 27.101.1	PAGE 6	OF 6

3. When Neither First Aid Nor Placement are Open

a. Supervisor

- * (1) After employee clocks in and reports, allow the employee to commence work if he has a full release from his doctor, or if employee does not require a release and has a Medical Clock Card. Sign Medical Clock Card and return it to the clock card rack. Send doctor's release to First Aid.
- (2) If the employee does not have a full release nor a Medical Clock Card, direct employee to report to Placement and/or First Aid when those offices are open to obtain their approval prior to returning to work.

b. Employee will commence work or leave and report to Placement and/or First Aid when they are open, as directed by supervisor.

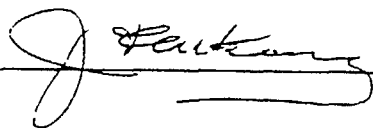
* c. Timekeeping will post the punch and mail the Medical Clock Card to First Aid. Upon return of the card from First Aid, file it in accordance with departmental practices.

* d. Upon receipt, First Aid will sign and return the Medical Clock Card to Timekeeping.

STANDARD PRACTICE INSTRUCTION



BELL HELICOPTER COMPANY

SUBJECT INDUSTRIAL SAFETY PROGRAM		DATE 10-29-76	NUMBER 19.205.4	S P I
		SUPERSEDES 19.205.3	PAGE 1 OF 5	
ISSUED BY: INFORMATION SYSTEMS	PREPARED BY: R.F.H.	APPROVED BY: 		

I. INTRODUCTION

In accordance with sound industrial practices, Bell Helicopter Textron (BHT) will establish and maintain a continuing Industrial Safety Program aimed at the prevention of incidents which may cause employee injury, illness, or disease, or incur damage to material resources.

II. GENERAL

- A. This Standard Practice Instruction outlines requirements and establishes responsibilities for the development, implementation, and compliance with such programs, procedures and practices as are necessary to prevent accidents and provide proper safety, health and sanitary conditions and devices in all facilities owned or operated by the Company.
- B. An effective Industrial Safety Program requires the coordination and integration of all departments' safety and health efforts. The program must also meet current Company needs and standards and those established by the Occupational Safety and Health Administrations of the Federal, State, and Local governments.
- C. The Safety Engineering Section of the Industrial Security Department has the overall responsibility for administering and coordinating the Industrial Safety Program in accordance with the applicable government standards and the provisions of this S.P.I.
- D. The Safety Engineering Section is responsible for issuing and maintaining the Fire and Accident Prevention Standards (FAPS) Manual, which contains instructions covering the application of Occupational Safety and Health Standards for use by all departments.
- E. The Safety Engineering Section monitors the Safety effort at BHT facilities, such as Amarillo, Van Nuys, and others; and when requested, acts in a Safety advisory capacity to Bell affiliates.

STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 10-29-76	INSTRUCTION NO 19.205.4	
	SUPERSEDES 19.205.3	PAGE 2	OF 5

III. PROCEDURE

A. INDUSTRIAL SAFETY COMMITTEE

1. An Industrial Safety Committee is established to monitor and guide the Industrial Safety Program. The committee consists of:

Vice President, Industrial Relations - Chairman
Director of Industrial Relations
Vice President, Operations
Director of Product Assurance
Chief of Medical Services
Director of Facilities
Manager of Industrial Security
Chief Safety Engineer - Secretary

2. The committee will meet quarterly and at the call of the chairman to:

- a. Review the Industrial Safety Program.
- b. Provide guidance on corrective measures for combatting accident trends as recommended by the Chief Safety Engineer.
- c. Provide guidance for maintaining and increasing interest in the Industrial Safety Program.

B. SAFETY ENGINEERING SECTION

Functions as a service unit to each department at all plants of BHT. As such, they will provide professional safety and health engineering capabilities and technical advice on safety and occupational health hazards and methods of controlling them. Specific responsibilities are:

1. Develop, establish, promote, and administer the BHT Industrial Safety Program at all plants.
2. Prepare and issue Fire and Accident Prevention Standards (FAPS) for inclusion in the manual.
3. Provide technical safety and health advisory services to top management, staff, and operating employees.

STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 10-29-76	INSTRUCTION NO 19.205.4	
	SUPERSEDES 19.205.3	PAGE 3	OF 5

4. Working with Plant Engineering, design protective equipment or safety devices for use on machines and plant equipment, and when necessary redesign the equipment to eliminate safety and health hazards.
5. Analyze standards, in terms of engineering concepts on which they are based, and apply these standards to meet specific situations.
6. Administer and conduct safety and health surveys at all plants on a scheduled basis with a minimum of once per week. Initiate corrective or preventive measures when required.
7. Secure and arrange to distribute posters, signs, and various communications pertaining to safety and health.
8. Conduct safety and health courses for supervisors and safety and health orientation lectures for all new employees.
9. Assist supervisors in the investigation of safety and health complaints, accidents involving personal injury, and property damage.
10. Recommend and arrange for the purchase of all items of personal safety and health equipment for the protection of employees.
11. Maintain records of occupational accidents and injuries in order to compile reports for submittal to management. Prepare and submit reports of industrial accidents and occupational illnesses and diseases as required by law and by the insurance carrier.
12. Maintain liaison with the Government Safety Officer at BHT and with federal, state, city and county safety and health officials.
13. Determine conformity to applicable standards of:
 - a. The Department of Defense
 - b. The U.S. Department of Labor
 - c. The Walsh-Healy Act
 - d. State, city and local safety and health codes and ordinances.

STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 10-29-76	INSTRUCTION NO 19.205.4	
	SUPERSEDES 19.205.3	PAGE 4	OF 5

14. Review plant modification and construction plans and specifications from Plant Engineering to determine if safety and health considerations are included or involved.
15. Dispense prescription safety glasses to those employees requiring glasses and whose work demands eye protection.
16. Monitor the program of inspection and load testing of hoists and cranes as established and performed by Plant Maintenance.
17. Authorize the shutdown of machines or equipment on which hazardous conditions exist by attaching a red tag. The red tag will remain on the machine until the situation is corrected to the satisfaction of the Safety Engineer.

C. ALL DEPARTMENTS

1. When issuing Departmental Instructions which supplement FAPS, coordinate such instructions through the Safety Engineering Section prior to their issuance.
2. Emphasize the compliance by all employees with FAPS and other basic rules of Safety in performing their job assignments.

D. SUPERVISORS

Supervisors have the inherent responsibility for taking the necessary action to eliminate or reduce accidents, to provide for the safety and health of personnel, and to protect equipment under their jurisdiction. This includes:

1. Making certain that applicable safety and health features are incorporated in machinery and equipment or other property being acquired, modified, and/or used within their area of responsibility.
2. The preparation and issuance of any internal directives and instructions that are necessary to implement established safety and health programs and procedures.
3. The utilization of applicable devices and services which are available through the Safety Engineering Section.
4. Reporting to responsible supervision and the Safety Office, any discovery of conditions which could be detrimental to the safety and/or health of employees.

STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 10-29-76	INSTRUCTION NO. 19.205.4	
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E. EMPLOYEES

Each employee is responsible for the observance of the basic rules of safety, hygiene and accident prevention in accordance with the standards established by the Company and Federal, State, and Local agencies. This includes:

1. Utilizing personal safety devices and other protective equipment provided by the Company.
2. Complying with all safety and health, sanitation, and fire regulations, procedures and practices.
3. Promptly reporting any hazardous conditions or other safety and health deficiencies to their supervision.

F. FACILITIES

1. Plant Maintenance will cooperate with Safety Engineering to the fullest possible extent by giving highest priority to correcting hazardous conditions when detected and reported.
2. In conjunction with Safety Engineering and Equipment Engineering, Plant Engineering will design safety guards and/or devices for use on plant equipment and machinery.
3. Plant Maintenance will establish and perform a scheduled program of inspection and load testing of all hoists and cranes used at all plants of BHT in accordance with Department of Labor standards.
4. Plant Engineering will coordinate modification and construction plans and specifications through the Chief Safety Engineer for compliance.

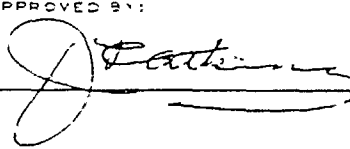
G. TOOL CRIBS

Issue items of personal safety equipment, other than prescription glasses, to those employees who require them.

STANDARD PRACTICE INSTRUCTION



BELL HELICOPTER COMPANY

SUBJECT FUELING AND DEFUELING		DATE 10-29-76	NUMBER 67.201.4	S P I
		SUPERSEDES 67.201.3	PAGE 1 OF 4	
ISSUED BY: INFORMATION SYSTEMS	PREPARED BY: R.F.H.	APPROVED BY: 		

I. INTRODUCTION

This Instruction defines procedures and responsibilities for ordering, storing and dispensing aircraft fuels. Storing and dispensing procedures will be implemented through detailed check lists and operating instructions with which the Chief Safety Engineer and Fire Chief concur.

II. PROCEDURE

A. FUEL STORAGE AREAS

1. Aircraft fuels will be stored in tanks which meet National Fire Protection Association requirements. Each tank and pump will be clearly labeled with the identity of the fuel it contains. Octane rated fuels will be identified with the octane rating. Hybrid types of fuels will be plainly marked with their identity.
2. All lines and valves for handling aircraft fuel will be identified where lines carrying different types of fuel are in the same fueling area.
3. Areas around fuel storage tanks will be marked off with either red lines, a fence or other recognizable markings. Each such area will be posted - "NO SMOKING OR OPEN FLAME WITHIN 50 FEET".
4. Personnel in and around fuel storage areas will be under the supervision of Airport Operations. Airport Operations Supervision will be responsible to assure that no one enters a fuel storage area except for business reasons. The conduct of personnel within fuel storage areas, especially regarding fire and other safety hazards, will be the responsibility of Airport Operations Supervision.
5. Aircraft may be fueled or defueled at the fuel storage tanks under the following conditions:
 - a. Dispensing equipment must be equipped with ten micron absolute filtering and water separation equipment.
 - b. Aircraft to be fueled or defueled at the fuel storage tanks will be towed into position.

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STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 10-29-76	INSTRUCTION NO 67.201.4	
	SUPERSEDES 67.201.3	PAGE 2	OF 4

B. ORDERING AND RECEIPT OF AIRCRAFT FUELS

1. Production Control will order aircraft fuels as required to maintain pre-determined amounts of fuel on hand. This predetermined quantity will be adjusted as necessary at the request of Airport Operations. Scheduling of deliveries will be in accordance with procedures established by Production Control and Procurement.
2. Receiving and Receiving Inspection functions will be accomplished in accordance with Standard Practice Instruction 25.200, "Receiving". Receiving Inspection will review certifications accompanying the shipment for compliance with requirements of the purchase order, and will examine the seals on the delivery truck or container to see that they are not broken. The inspector will refuse acceptance when the seals are broken. Product Assurance will perform a "clear and bright" test when conditions noted suggest contamination in incoming fuel. At remote facilities where Receiving functions are not normally maintained, Product Assurance will perform the Receiving function.

C. MAINTENANCE OF EQUIPMENT

1. Maintenance and repair of all stationary aircraft fuel handling equipment is the responsibility of the Maintenance Department. The fuel filter for each stationary fuel system will be changed at least annually, or when recommended by Product Assurance Records of current filter changes will be filed in the Maintenance office. Expedite action will be taken as required to repair out of service equipment.
2. The Maintenance Department will make an overall weekly check to a Check Sheet of the stationary fuel handling equipment and will maintain a file of previous Check Sheets. The current Check Sheet will be displayed on the equipment.
3. Maintenance and repair of all mobile aircraft fuel handling equipment is the responsibility of the Traffic Department. The fuel filter for each mobile fuel system will be changed at least annually, or when recommended by Product Assurance. Records of current filter changes will be filed in the Traffic Office. Expedite action will be taken as required to repair out of service equipment.
4. The Traffic Department will make an overall weekly check to a Check Sheet of all mobile aircraft fuel handling equipment and will maintain a file of previous Check Sheets. The current Check Sheet will be displayed on the equipment.

STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 10-29-76	INSTRUCTION NO 67.201.4	
	SUPERSEDES 67.201.3	PAGE 3	OF 4

5. The Fire Department will make a monthly inspection of each fuel truck and fuel storage tank to a check list. A monthly Fuel Equipment Inspection Report will be prepared for each truck and each tank, and forwarded to the Security Department for filing.

D. TRANSPORTATION OF AIRCRAFT FUELS

1. Airport Operations will furnish necessary aircraft mechanic drivers for fuel trucks operated within the confines of a plant area. The Traffic Department will be responsible for movement of fuel trucks between major plant areas.
2. Each aircraft mechanic driver must be instructed by his supervisor in the safe handling of aircraft fuel.

E. FUELING AND DEFUELING

Fueling and defueling operations will be conducted in accordance with Fire and Accident Prevention Standard, Number 47.

F. FUEL STORAGE INSPECTION

1. Accumulated Water Content
 - a. Plant Engineering will insure that all fuel storage tanks are properly identified with the maximum water content allowable.
 - b. Product Assurance and Airport Operations will jointly measure the accumulated water content level. These checks will be made monthly, or more frequently if the amount of water indicates need. If the accumulated water content exceeds the maximum allowable limit, the Maintenance Department will be notified to take the necessary steps to remove the excess water from the tank.
2. Product Assurance and Airport Operations jointly will make "clear and bright" tests of fuel samples at each source. These tests will be made monthly or more frequently as the amount of dirt and unabsorbed water indicates need. If a "clear and bright" test indicates a possible unsatisfactory condition, Product Assurance will request the Engineering Laboratories to perform tests for particulate matter and/or water contamination of the fuel.
3. Particulate matter tests and water contamination tests of fuel will be performed at six month intervals even though the "clear and bright" test is satisfactory.

STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 10-29-76	INSTRUCTION NO 67.201.4	
	SUPERSEDES 67.201.3	PAGE 4	OF 4

4. Product Assurance will notify Airport Operations when a helicopter fuel filter check shows contaminated fuel. Disposal of contaminated fuel will be as directed by Fire and Accident Prevention Standard, Number 47.

G. STORAGE OF FUELED AIRCRAFT IN HANGAR

1. Non-operational aircraft stored in a hangar will either have the fuel tanks completely full, or completely empty and purged.
2. Aircraft stored in a hangar on skid type landing gear in intimate contact with the floor need not be attached to grounding cables as the contact with the floor provides adequate grounding. Aircraft stored in a hangar on rubber, blocks, or any other support where intimate contact with the floor is not maintained must be attached to external ground cables.

H. STORAGE OF DEFUELED AIRCRAFT IN HANGAR

1. Defueled and purged aircraft may be stored in a hangar. Purging a fuel system (tanks & lines) from aviation fuels will consist of defueling and draining the system and flushing with lightweight lubrication oil, Stoddard solvent or other approved chemicals, with inert gas, or with compressed air. Detailed instruction for purging a fuel system will be prepared by Airport Operations Supervision and approved by the Chief, Fire Department. Deviations from these instructions will not be permitted without prior approval of the Chief, Fire Department.
2. The fuel tanks of aircraft in storage will be checked by the Fire Department at least once each week for explosive mixture during the storage period. (This will include ferry tanks).

I. CONTROL OF NO SMOKING AREAS IN AIRPORT OPERATIONS

1. Because of the extremely hazardous conditions resulting from fumes from aircraft fuel, all fueling areas, fuel storage areas, and areas containing fueled aircraft are "No Smoking" areas. In addition, any other areas so designated by the Fire Department in coordination with the Chief Safety Engineer and Airport Operations Manager will be controlled as "No Smoking" areas.
2. Supervision of Airport Operations will be responsible for enforcing "No Smoking". Because of the danger, there can be no exception to the "No Smoking" policy.
3. Any Guard or Fireman in the area will assist Airport Operations Supervision in enforcing the "No Smoking" control.

SUBJECT SEVERE WEATHER PROCEDURE		DATE 10-29-76	NUMBER 86.200.1	S P 1
		SUPERSEDES 86.100.4	PAGE OF 1 3	
ISSUED BY: INFORMATION SYSTEMS	PREPARED BY: R.F.H.	APPROVED BY: <i>[Signature]</i>		

BHT 00782

STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 10-29-76	INSTRUCTION NO 86.200.1
	SUPERSEDES 86.100.4	PAGE OF 2 3

- D. The primary BHT activities to be notified in the event of Severe Weather Warnings/Watches appear as Attachment 1 to this procedure.
- E. BHT facilities outside the Fort Worth/Dallas area will develop and publish procedures to assure that precautionary measures are taken to prevent property damage and injury in the event of severe weather.
- F. Good departmental housekeeping instructions will provide measures to assure adequate protection of government and Company property at all times. Continuous good housekeeping will minimize property damage in the event of severe weather. In addition, departmental instructions will include checking responsible areas for protection of property prior to Second Shift Operations, Weekends, Holidays, and Shutdowns.

III. PROCEDURE

- A. CONTROL TOWERS (Hurst, Arlington and Globe) - Hurst Tower is responsible to initiate/terminate a BHT Severe Weather Warning or Watch. If Hurst Tower is not in operation, the Hurst Guard Station will assume this responsibility.
 - 1. Alert airborne aircraft and recall or direct as required.
 - 2. Notify respective activities in accordance with Paragraph II, B, 1-4 and Attachment 1.
 - 3. When winds exceed 55 mph and all aircraft are accounted for, evacuate the tower.
- B. INDUSTRIAL SECURITY - Guard Stations - When the Hurst Tower is not in operation, the Hurst Guard Station is responsible to initiate/terminate a BHT Severe Weather Warning or Watch in accordance with Paragraph II, B, 1-4. This responsibility to initiate a BHT Severe Weather Warning/Watch will normally occur during Second and Third Shifts, Weekends, Holidays and Shutdowns.
 - 1. Notify activities in accordance with Attachment 1.
 - 2. Alert security personnel to detect and have removed, potential hazards to property or employees.
- C. AIRPORT OPERATIONS
 - 1. Move aircraft into hangars or tie down as required.
 - 2. Assure that all aircraft equipment, such as ground support equipment, doors, cowlings, protective covers, and windows are adequately secured.

STANDARD PRACTICE INSTRUCTION BELL HELICOPTER COMPANY	DATE 10-29-76	INSTRUCTION NO 86.200.1	
	SUPERSEDES 86.100.4	PAGE 3	OF 3

D. INDUSTRIAL SAFETY & FIRE DEPARTMENT

1. Monitor plant activity to assure the detection and elimination of potential hazards.
2. Advise supervisory personnel as to safety precautions to be observed.

E. TRAFFIC DEPARTMENT

Provide transportation to move aircraft, loose equipment and material under cover as the situation dictates.

F. MAINTENANCE

Take appropriate action to secure and protect facilities and equipment from possible severe weather damage.

G. PLANT ENGINEERING

1. Conduct a survey to assess damage, prepare repair estimates, and submit a report to the Manager, Manufacturing and the Insurance Representative when damage has occurred.
2. Obtain Work Orders and perform repairs as directed.

H. PRODUCT ASSURANCE

Inspect aircraft and components for damage and if necessary, submit an "Aircraft Damage Report", (Form 7878 55535) to the Manager, Manufacturing and the Insurance Representative.

I. ALL DEPARTMENTS

1. Advise personnel of the weather conditions and precautions to take.
2. Move loose equipment, tools and material inside or tie down such equipment to prevent flying object damage.
3. Close windows, doors, and withdraw to protected areas when directed by supervision.

SEVERE WEATHER WARNING NOTIFICATION DIRECTORYA. 1ST SHIFT (NORMAL WORK DAYS) OR WHEN HURST CONTROL TOWER IS IN OPERATIONResponsible for NotificationActivity Notified

HURST CONTROL TOWER

1. Hurst Pilots Office
2. Arlington Control Tower
3. Globe Control Tower
4. Hurst Airport Operations Manager
5. Hurst Guard Station
6. Chief of Flight Safety

HURST GUARD STATION

7. Manager, Manufacturing
8. Office - Vice President - Research and Engineering
9. Hurst Plant Maintenance Manager
10. Hurst Traffic Manager
11. Safety Engineer
12. Manager of Plant Engineering
13. Government Representative
14. Chief Telephone Operator

GLOBE CONTROL TOWER

15. Globe Pilots Office
16. Globe Airport Operations
17. Globe Guard Station

GLOBE GUARD STATION

18. Globe Factory Superintendent
19. Globe Plant Maintenance
20. Globe Experimental Hangar
21. Service Training School
22. Globe Flight Test
23. Test Cell Building

ARLINGTON CONTROL
TOWER

24. Arlington Pilots Office
25. Manager and Superintendent of Experimental Flight Test
26. Arlington Guard Station

B. 2ND AND 3RD SHIFTS (NORMAL WORK DAYS) HURST CONTROL TOWER NOT IN OPERATION

HURST GUARD STATION

1. Chief of Flight Safety
2. Arlington Guard Station
3. Globe Guard Force
4. Factory Night Supt. (2nd Shift)
5. Senior Airport Operation Supvr.
6. Senior Plant Supvr. (3rd Shift)
7. Plant Maint. Night Supvr.
8. Safety Engineer (2nd Shift)

SEVERE WEATHER WARNING NOTIFICATION DIRECTORYResponsible for NotificationActivity Notified

GLOBE GUARD STATION

9. Globe Control Tower
10. Globe Pilots Office
11. Senior Production Supvr.
12. Globe Supt. (Home)
13. Security Manager (Home)
14. Safety Engineer (Home)
15. Government Representative (Home)
16. Arlington Control Tower
17. Arlington Pilots Office
18. Arlington Manager and Superintendent of
Experimental Flight Test

C. SATURDAY, SUNDAY AND HOLIDAYS - HURST CONTROL TOWER NOT IN OPERATION

HURST GUARD STATION

1. Chief of Flight Safety
2. Arlington Guard Station
3. Globe Guard Station
4. Maintenance Personnel on Duty
5. Plant Maintenance Supt. (Home)
6. Manufacturing Manager (Home)
7. Plant Engineering Manager (Home)
8. Security Manager (Home)
9. Safety Engineer (Home)
10. Government Representative (Home)
11. Hurst Pilots Office or
12. Senior Airport Operations Supervisor when on
duty

GLOBE GUARD STATION

13. Globe Control Tower
14. Globe Pilots Office

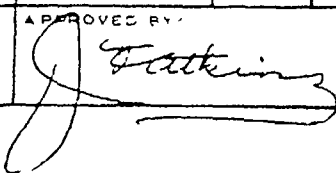
ARLINGTON GUARD
STATION

15. Arlington Control Tower
16. Arlington Pilots Office

MANAGEMENT DIRECTIVE



BELL HELICOPTER COMPANY

SUBJECT SAFETY PROGRAM		DATE 11-3-76	NUMBER 63	M D
		SUPERSEDES -	PAGE OF 1 14	
ISSUED BY INFORMATION SYSTEMS	PREPARED BY R.F.H.	APPROVED BY 		

I. POLICY

- A. Bell Helicopter Textron (BHT) has as a primary objective the protection of its employees and property from safety hazards. BHT's Safety Programs, in both Product/Flight Safety and Industrial Safety will be given the highest priority by management.
- B. BHT must maintain a strong Safety discipline and require each employee to be alert to Safety hazards and to strictly comply with established Safety procedures and practices.
- C. Bell's Safety Program is structured into the two broad categories of Product/Flight Safety and Industrial Safety. Product/Flight Safety encompasses Flight Operations Safety; Systems Design Safety; Armament Safety; the Product Safety Board; and Accident Investigation. Industrial Safety is comprised of Occupational Safety and Health, and Fire Prevention and Protection. Together, these activities form the overall Safety Program for Bell. To ensure the success of this Safety Program, each member of management will provide full support and promote safety within their respective areas of responsibility.
- D. Separate committees dealing with various aspects of the Safety Program will be established to oversee and provide direction for the effective implementation and operation of the overall program.
- E. Specific requirements of the total BHT Safety Program must be documented to permit an understanding of the safety performance required, to establish a basis for program review and evaluation, and to provide a means for monitoring performance and compliance.

II. RESPONSIBILITIES

A. PRODUCT/FLIGHT SAFETY

- 1. The Product/Flight Safety Program will be administered at staff level, under the direction of the Vice President of Research and Engineering. The Chief of Flight Safety is assigned responsibility for Product/Flight Safety for all operations and facilities of BHT. The Chief of Flight Safety will organize and administer an active accident prevention program to include safety functions and activities necessary to predict and control product hazards.

BHT 00787

MANAGEMENT DIRECTIVE BELL HELICOPTER COMPANY	DATE 11-3-76	INSTRUCTION NO 63	
	SUPERSEDES -	PAGE 2	OF 4

2. The Chief of Flight Safety will conduct necessary reviews and audits to determine compliance with BHT established procedures. He will issue a quarterly Safety performance report to the Vice President Research and Engineering, and the President. The report will include:
 - a. The results of the Safety program for the past quarter.
 - b. Any major deficiencies in the conduct of BHT's Safety Program.
 - c. Significant safety recommendations and changes for incorporation.
3. The Chief of Flight Safety is responsible for the preparation and maintenance of the Flight Operating Procedures Manual and will coordinate the following functions to assure appropriate interfacing of Safety communications and actions.

FLIGHT OPERATIONS SAFETY - Encompasses the operational functions of Flight Safety to assure adequate Pilot training and standardization, Pilot qualifications and records, and flight operating procedures.

SYSTEM DESIGN SAFETY - The application of engineering design principles to assure incorporation of design features to promote fail safe design, to assure crash worthiness and to prevent or control hazards within a given system.

ARMAMENT SAFETY - The review and coordination of armament design, installation, firing, and explosive handling criteria procedures.

PRODUCT SAFETY BOARD - A committee established to monitor the operations of BHT products to assure the highest possible level of product safety and to provide necessary safety changes and improvements to BHT products for reliability purposes.

ACCIDENT INVESTIGATION - Includes a pre-accident investigation plan and its application to determine cause and insure corrective action. This plan is described in an Aircraft Emergency SPI.

B. INDUSTRIAL SAFETY

1. Both the Occupational Safety and Health and the Fire Prevention and Protection categories of Bell's Industrial Safety Program will be administered at staff level under the direction of the Vice President of Industrial Relations.

MANAGEMENT DIRECTIVE BELL HELICOPTER COMPANY	DATE 11-3-76	INSTRUCTION NO 63	
	SUPERSEDES -	PAGE 3	OF 4

2. The Chief of Industrial Safety and the Fire Chief will be required to conduct necessary reviews and audits to determine compliance with BHT established procedures in their respective areas of responsibility. They will issue quarterly safety performance reports to the Vice President of Industrial Relations and the President. Each respective report will include:

- a. The results of their respective programs for the past quarter.
- b. Any major deficiencies in the conduct of each program.
- c. Significant safety recommendations and changes for incorporation in each program.

3. Occupational Safety and Health

The Chief of Industrial Safety is assigned the responsibility for occupational safety and health for all operations and facilities of BHT. The Chief of Industrial Safety will publish and maintain the Fire and Accident Prevention Standards (FAPS) Manual covering Industrial Safety at all BHT Facilities. The FAPS Manual establishes the safety criteria, standards, and procedures that are to be observed by all functional organizations.

4. Fire Prevention and Protection

The Fire Chief is responsible for providing active fire prevention programs and for maintaining fire protection equipment and trained personnel to minimize loss due to fire.

C. ALL DEPARTMENTS

Each Department is responsible for:

1. Promoting and sustaining BHT Safety interest and instilling a safety awareness in all employees.
2. Insuring that departmental training programs provide significant emphasis on Safety and that Department Instructions which implement FAPS or other safety standards are coordinated with the appropriate Safety function to provide an integrated, unified accident prevention program.

MANAGEMENT DIRECTIVE BELL HELICOPTER COMPANY	DATE 11-3-76	INSTRUCTION NO 63	
	SUPERSEDES -	PAGE 4	OF 4

3. The enforcement of Safety standards and encouraging personnel to report any degradation of Safety to Supervision.
4. Taking immediate action to correct safety deficiencies.
5. Designating a Safety Representative having an understanding of safe working practices to represent their organization in Company safety matters.

III. SAFETY PROCEDURES

Instructions covering safety at Bell are contained in Management Directives, Standard Practice Instructions and other Procedures Manuals. These documents define the requirements and responsibilities for the overall safety program at Bell. MD's, SPI's, and other procedure manuals directly applicable to Safety are listed in the attachment to this MD.

BHT SAFETY PROCEDURES

This MD and the following MD's, SPI's and Manuals contain Company policy and inter-departmental procedures covering Bell's Safety Program:

A. MANAGEMENT DIRECTIVES

MD 16	Occupancy During Production Flight Test - ~~Commercial Helicopters~~
MD 46	Product Safety Board
MD 51	Pilot Proficiency Requirements

B. STANDARD PRACTICE INSTRUCTIONS

SPI 10.213	Care of Company Owned and/or Company Operated Aircraft
SPI 10.216	Incorporation of Product Safety Board Requirements
~ SPI 12.200	Aircraft Emergency, Forced Landing or Crash
SPI 12.203	Industrial Defense and Disaster Control
SPI 12.204	Fire Prevention and Protection
SPI 19.205	Industrial Safety Program
SPI 19.208	First Aid
SPI 28.200	Airport Operations Regulations
SPI 67.201	Fueling and Defueling
SPI 81.207	Radio Communications
SPI 86.200	Severe Weather Procedure
SPI 86.201	Flight Operating Procedures

C. MANUALS

Flight Operating Procedures Manual - Department 86 Instructions governing Bell flight operations.

Fire and Accident Prevention Standards Manual - Procedures implementing Bell's Industrial Safety Program.

**Accident
Prevention
Handbook**

**For
All Employees**

Eastman Kodak Company **TEXTRON**

Bell Helicopter Textron, Inc. (BHTI)

**INDUSTRIAL SAFETY AND
HYGIENE DEPARTMENT**

DIAL 2146

Location:

**Plant 1
Building 2
Level 2**

This Handbook Is
The
Property Of:

1

EMERGENCY NUMBER DIAL 3333

**For Medical, Chemical And Fire
Have This Information Ready
Before Calling:**

1. Plant Number
2. Building Number
3. Level Number
4. Column Number
5. Type Of Emergency

INTRODUCTION

In 1970, Congress enacted the Occupational Safety and Health Act to protect this nation's most valuable asset, our human resources. The Occupational Safety and Health legislation provides safety and health standards to protect workers in places of business.

Each employer, under the Occupational Safety and Health Act, has the general duty to provide a safe place to work; and each employee has the duty to comply with the safety and health rules.

Cooperation in the Accident Prevention Program is the moral and legal obligation of each individual employee. This is demonstrated by:

- (a) Working safely on the job;
- (b) Having respect at all times for the safety of fellow employees;
- (c) Using knowledge and influence to prevent accidents;
- (d) Calling attention to unsafe practices and unsafe conditions;
- (e) Practicing good housekeeping (A place for everything, and everything in its place.);

- (f) Contributing ideas, suggestions and recommendations for the improvement of safety;
- (g) Having regard at all times for the safety equipment provided for employee use;
- (h) Wearing personal protective equipment as required by OSHA and BHTI;
- (i) Promptly reporting all injuries to your supervisor prior to going to the Medical Services Department or seeking outside medical care for Job Related Injuries.

4

FOREWORD

The prevention of accidents and injuries to the men and women of our company is a prime objective of management.

The key to a successful accident prevention program lies in the willingness of every employee to accept and carry out his or her responsibilities. Without that willingness, the most carefully planned accident prevention program for the conservation of human resources will achieve only partial success.

"PRODUCTION WITH SAFETY"

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Notes

HAZARD COMMUNICATION (RIGHT-TO-KNOW)

1. A written Hazard Communication (Right-to-Know) Program is available for you to review through the Industrial Safety and Hygiene Department. This program provides information regarding safe work practices associated with hazardous materials.
2. Specific components of this Right-to-Know Law allow for the provision of:
 - a. Material Safety Data Sheets (MSDS's)
 - b. Container labeling.
 - c. Specific training and availability of personal protective equipment in your work area.
3. Material Safety Data Sheets are available in your work area on microfiche format and are accessible 24 hours a day. Consult the Personal Protective Equipment Catalog for microfiche reader locations.
4. Each department is responsible for assuring that all containers are adequately labeled.

5. Labels can be ordered through the Personal Protective Equipment Catalog using the assigned material code catalog number for each specific chemical and/or product.

WALKING AND WORKING SURFACES HOUSEKEEPING

1. All places of employment, passageways, storerooms and service rooms shall be kept in an orderly and sanitary condition.
2. The floor of every workroom shall be maintained in a clean, and so far as possible, dry condition.
3. Storage is prohibited on roofs, offices or sheds without proper guard rails and an established capacity for the load on the roof.
4. All excavations, trenches, open manholes and other places into which a person might fall shall be adequately guarded. Proper warning lights shall be in place at night.

AISLES AND PASSAGEWAYS

1. Aisles and passageways shall be kept clear

and in good repair with no obstruction across or in aisles that could create a hazard.

PORTABLE AND STEP LADDERS

1. Use a ladder free from defects. Check portable ladders for safety shoes, damaged rails and damaged rungs.
2. Erect the ladder on secure footing. Make certain the surfaces are level, the top secured and bottom blocked.
3. Step ladders shall be fully spread and locked when in use.
4. Face the ladder when climbing. Dry off hands and feet before climbing. Stay off the top rung.
5. The ladder shall extend three feet above the surface you wish to reach.
6. Post warnings and have help on the floor when a ladder is near a door or in an aisle.
7. Get down to move a ladder. Do not over reach. Do not try to shift the ladder while you are on it.

8. Aluminum ladders shall not be used when working on or near electrical equipment.
9. The making and using of homemade ladders is not permitted.
10. All unsafe ladders shall be reported to your supervisor.

SCAFFOLDS

1. Guard rails and toe boards shall be used on all scaffolds over 10 ft. in height.
2. Do not move a scaffold when persons or materials are on it.
3. Scaffold wheels shall be equipped with locking devices and at least two wheels shall swivel.
4. Keep scaffold platforms clear of unnecessary material. Do not overload platforms.
5. Scaffolds shall be constructed in accordance with OSHA standards.

10

OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL

1. Report promptly to your supervisor and the Industrial Safety and Hygiene Department (ext. 2146) any indication of leaking gas, toxic atmospheres or other related health hazards.
2. In the event that emergency medical attention is required, dial ext. 3333 for assistance.
3. If a toxic atmosphere exists, leave the area immediately. Do not re-enter unless authorized by your supervisor and/or the Industrial Safety and Hygiene Department.
4. Protective apparel and devices shall be worn whenever a hazard exists and whenever directed by BHTI.

ENVIRONMENTAL POLICY

1. Never pour, flush or allow any substance to enter a sewer or storm drain unless you know it is allowed.

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2. All BHTI employees shall strictly adhere to internal policy and procedure as related to hazardous material, hazardous waste and hydrocarbon products.
3. BHTI Environmental Management group has established procedures for all common waste products. Handling or disposal procedures for new or unique waste products shall be obtained by calling ext. 5356.

GUIDELINES FOR A CLEAN ENVIRONMENT ARE:

1. Never pour, flush or allow any substance to enter a sewer or storm drain unless you know it is allowed.
2. Use only approved containers for waste collection and disposal.
3. The soil, asphalt or concrete surfaces are never approved as a site for waste or unwanted substances.
4. Report all leakage or minor spills to ext. 5356; report all major spills or emergencies to ext. 3333.

5. Remember, any unusable or spilled hazardous material (by definition) becomes a hazardous waste.

PERSONAL PROTECTIVE EQUIPMENT

1. The Personal Protective Equipment Catalog contains a listing of items approved by the Industrial Safety and Hygiene Department. Contact your supervisor or the Industrial Safety and Hygiene Department for assistance if necessary.
2. Approved eye protection shall be worn in accordance with OSHA and BHTI requirements.
3. Approved head protection shall be worn in accordance with OSHA and BHTI requirements.
4. Employees shall wear appropriate footwear that will provide adequate protection for each given work situation.
5. Employees shall wear hearing protection devices in accordance with OSHA and BHTI requirements.

6. Employees shall wear all other protective clothing in accordance with OSHA and BHTI requirements.
7. Report defective safety equipment to your supervisor immediately.
8. Employee owned equipment shall not be worn without prior approval from the Industrial Safety and Hygiene Department.

GENERAL ENVIRONMENTAL CONTROLS

1. Lavatories and showers shall be maintained in a sanitary fashion.
2. Vandalism of lavatory or shower areas shall not be tolerated.
3. Spitting on the walls, floors, work places or stairs of the plant shall not be tolerated.

MEDICAL AND FIRST AID

1. Report all work related injuries and illnesses to your supervisor as soon as they occur. If necessary, seek medical attention immediately (ext. 3333).

FIRE PROTECTION

1. Report fires immediately to the Fire Protection Department by dialing ext. 3333.
2. Circuits controlling electrical equipment or electrically driven machinery that are on fire shall be shut off by the regular operator of the equipment, an electrician or other persons authorized to shut down such equipment.
3. Know where fire extinguishers are located and how to use them.
4. After a fire extinguisher has been used, notify your supervisor, who will contact the Fire Protection Department. Never put a used extinguisher back in its holder.
5. Fire extinguishers must be kept in their designated places when not being used.
6. Fire extinguishers shall be kept free of obstructions and be readily visible.

MATERIAL HANDLING AND STORAGE

1. When stacking materials, make sure to pile

it so that it will not fall and so that it will not cause adjacent materials to fall.

2. Access to emergency devices, such as fire hydrants, extinguishers, control walks, electrical switch boxes, etc., shall be maintained at all times and shall not be obstructed by any material.
3. Piling shall not be higher than that established by department safety rules.
4. Designated passageways, stairways, walkways or aisles shall not be blocked or obstructed by any material.
5. Load material on cars, trucks or other vehicles so that no portion projects over the side or can fall off in transit.

CRANES/HOISTS

1. Do not stand or walk under loads suspended from cranes/hoists.
2. Do not stand or walk under the empty hook of a crane/hoist.
3. Do not go on any crane/hoist or crane/hoist runway for any purpose without permission

from the supervisor in charge, and then follow the procedure established for going on such cranes/hoists or such runways.

4. No one except those employees authorized or designated shall be allowed to operate cranes/hoists.
5. Crane/hoist operators shall see that workers are in the clear before making or placing a lift.
6. A crane/hoist operator shall not make a lift nor move a crane regardless of signals if someone is in a position to be injured.
7. Wire rope and chain slings shall not be knotted or twisted for lifting purposes, and shall be visually inspected each shift by employees using them.
8. Listen for the bell or other signaling devices, as their purpose is to warn you of the approach of the crane/hoist.
9. Workers shall not use their feet to hold cables or chains in place while a crane/hoist is being raised or lowered, or to steady or guide lifts.

10. Crane/hoist operators are responsible to the department in which they are assigned and will be supervised by the management of the department in which they are assigned.

11. When not in use, the crane/hoist shall be parked with all controls in the "Off" position, hook raised and the brakes set.

MACHINERY AND MACHINE GUARDING

1. In all cases where intermittent operation is practicable, stop and lock out machinery before attempting to lubricate, clean, inspect or repair it. Do not attempt to lubricate, clean, repair, inspect or operate a machine you do not understand.
2. Exercise extreme caution when repairing or testing any machinery, electrical apparatus or other equipment.
3. While electrically driven machinery is being repaired, the individual in charge of the job shall open and lock out the main switch that controls the electrical current to the unit if possible; otherwise, tag it in the "OPEN" position.

4. When more than one group is working on the same job, the individual in charge of each group shall lock out the main switch or valve with a separate safety lock and, in addition, shall lock out all main switches and supply valves that operate related parts of the unit being repaired.
5. The individual must anticipate the possibility of equipment starting to function in some abnormal manner, such as creeping, drifting, etc., and provision such as blocking shall be made to prevent such an occurrence.
6. Where there is danger from other moving machinery or equipment, proper protective devices, such as flags, signs, signal lights, observer, etc., shall be provided.
7. Do not turn on any electricity, gas, steam, oil or any other hazardous material or set in motion any machinery or equipment unless you are authorized to do so.
8. Proper signals and precautions shall be adopted to ensure that all persons who may be in dangerous places are plainly

warned and get into the clear before any machinery or equipment is set in motion.

9. Do not remove a danger or warning sign unless you placed it, and then not until the person protected by it is in the clear.
10. Locks or tags shall be removed only by the persons who place them.
11. Locks or tags shall never be removed until the individual in charge of the work has made certain that all persons are in a safe position.
12. Prior to turning on power, all operating controls shall be in the "OFF" position.
13. The individual in charge of the repairs standing in a safe position shall then signal the operator by prearranged signals that everyone is in the clear and the machinery may be placed in operation.
14. Inspect before using; if any tool, machine, piece of equipment or safety apparel is defective or in an unsafe condition, report it to your supervisor immediately.

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15. Machine guards and other safety devices are provided for your protection. Guards shall not be removed except for making repairs, lubricating, loading or unloading or cleaning, and then only by authorized persons. Guards shall be replaced before starting machinery.

HAND AND PORTABLE POWERED TOOLS AND OTHER HAND HELD EQUIPMENT

1. Inspect before using; if any tool, machine or piece of equipment is defective or in an unsafe condition, report it to your supervisor.
2. Do not alter or remove protective guards.
3. "Dead-man" controls such as a spring actuated switch, valve or other equivalent device shall not be altered and must always be operational.
4. Tools shall always be used with correct rating and capacity.
5. Properly grounded tools shall be the only tools used on any job.

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WELDING, CUTTING AND BRAZING

1. Follow rules for handling hazardous materials and compressed gas equipment. Refer to those sections of the handbook.
2. Follow correct procedures for opening regulators and shutting regulators off.
3. Valve protection caps shall be used on cylinders when moved from place to place.
4. Where carriers are provided for moving cylinders which are connected for use, capping shall not be required, but employees shall be responsible for seeing that cylinder valves are closed and pressure is released from regulators, hoses and torches.
5. Welders and Cutters shall close valves on oxygen and acetylene cylinders at the end of each work shift.
6. When transporting cylinders by crane or derrick, a cradle, boat or suitable carrier shall be used. Valve protection caps shall be in place.
7. Cylinders shall be secured in an upright position at all times. In storage, gas must

be separate from oxygen and empties from full ones.

8. Any hose or length of hose in which a flashback has occurred, shall be taken out of service and reported to the department supervisor.
9. Hose must be protected from becoming damaged.
10. Green rubber hose is for oxygen, and red rubber hose is for fuel gas.
11. Torches shall not be hung on cylinders, regulators or valves.
12. Torches must be lit with an approved torch lighter.
13. Never look at a welding arc with the naked eye. Use proper protective equipment.
14. Be sure that you have sufficient ventilation when welding in a confined space.
15. Wear non-oily clothing when performing welding operations.
16. Torches, including scarfing blow pipes, shall be free of oil and grease.

17. Make certain that all electric welding machines are properly grounded.

ELECTRICAL

1. Under no circumstances shall circuit breakers, limit devices or other safety devices be blocked or otherwise rendered inoperative.
2. Junction boxes, control boxes and all electrical enclosures shall be closed or adequately guarded.
3. All entrances to guarded locations containing live parts are to be marked with conspicuous signs specifically forbidding unqualified persons to enter.
4. All electrical equipment is to be properly marked and identified.
5. All electrical installations shall be properly grounded.
6. No flexible cords shall be used as a substitute for fixed wiring of a structure.
7. Aluminum, magnesium or metal ladders of

any type shall not be used for electrical repairs.

8. No storage in front of electrical equipment is permitted.
9. Protective equipment (fuse pullers, rubber gloves) shall be used for appropriate jobs.
10. Whenever a flexible cord is used, it shall be continuous in length without a splice. Worn or frayed electrical cords shall be removed from service.

MEANS OF EXIT

1. Every required exit, way of approach thereto, and way of travel from the exit to open space shall be continuously maintained free of all obstructions or impediments to full instant use in the case of fire or other emergency.

HAZARDOUS MATERIALS COMPRESSED GASES

1. Use oxygen, air or other compressed gases only for the jobs for which they were intended.

2. Compressed air hoses shall be equipped with low pressure safety air nozzles (less than 30 psi).
3. Do not clean your clothes with oxygen, air or other compressed gas; do not direct compressed gases against anyone-it may enter a person's body and injure or kill them.
4. Do not operate a hand or machine torch or any electrical welding equipment until you have been qualified to do so.
5. Always replace caps on full or empty cylinders of oxygen, air or other compressed gases after regulators have been removed.
6. Oxygen and other compressed gas line outlets shall be capped when not in use.
7. Oxygen, air or any other compressed gas cylinders shall be in racks or tied securely at all times, standing in a vertical position. In storage, gases must be separated from oxygen, and empties from full containers. These cylinders shall not be stored near stoves, radiators, furnaces or in areas

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where they will be subjected to high temperatures.

8. Oxygen, acetylene, fuel gas cylinders and delivery systems shall be maintained free of oil and grease.
9. Pressure shall be relieved on bases and regulators when equipment is unattended.
10. Acetylene cylinders shall always be stored vertically and used vertically with the valve end up. They shall not be allowed to lie flat.
11. Gas, oil and other lines or containers, which contain flammable material, shall be thoroughly purged and tested for explosion possibility using approved testing equipment before doing any burning or welding on such lines or containers.
12. In burning or welding, do not use as a work-bench or support any container which holds or previously contained a flammable material.
13. Flammable liquids shall be stored in properly marked containers which are certified for that particular flammable liquid.

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14. Rags or oily waste shall be properly stored and disposed of in accordance with the Environmental Management Department Policy.

GRINDING WHEELS

1. Before mounting a grinding wheel, check the maximum safe speed indicated on the wheel and on the machine. Speed indicated on the wheel should be equal to or more than the maximum spindle speed of the machine.
2. Before mounting a grinding wheel, visually check it for cracks and nicks.
3. If a grinding wheel has been dropped or struck a sharp blow, do not use the wheel.
4. Check wheel blotters and flanges frequently. Blotters shall adhere securely to the sides of the wheel. Flanges should have adequate undercutting and be true so as to grip the wheel evenly over the gripping surface.
5. Grinding shall not be done on a newly mounted wheel until one minute after it has reached maximum speed.

6. Hand grinders shall not be dropped, since this can cause cracks in the grinding wheel and/or bending of the spindle, which can cause the wheel to fracture.

GENERAL RULES FOR ACCIDENT PREVENTION

The following violations of Company Rules will be sufficient grounds for disciplinary action.

1. Disregard of safety rules or common safety or sanitation practices.
2. Horseplay, scuffling, fighting or throwing things on company premises.
3. Possession, drinking, using or being under the influence of habit forming drugs or alcoholic beverages on company premises at any time.
4. Employees driving motor vehicles of any kind on BHTI property in excess of posted speed limits. In the absence of posted limits, vehicles being operated at a speed in excess of 15 mph or too fast for existing conditions.

5. Riding on company vehicles or equipment without permission.
6. Possession of weapons, explosives, cameras or other prohibited property on company premises without expressed permission.

CLOTHING

Shorts, short-shorts, halter tops and muscle shirts do not provide adequate protection to you in our working environment and are, therefore, prohibited.

Sandals, moccasins and canvas shoes are not permitted in the plant. When safety toe shoes are not worn, sturdy footwear shall be worn.

Sunglasses are not to be worn in manufacturing areas unless authorized by the Industrial Safety and Hygiene Department.

CONCLUSION

Fundamentally, Accident Prevention is a way of life. It is the development of an attitude that permits us to think about the possibilities of accidents and then how to prevent them. It is impossible to believe that a person has a "safe attitude" if he/she thinks about safety for just a small portion of the day.

To be "safe", we must think about being alert through all our working hours, whether we are on the job, driving our car, at the beach, working at home or in any other activity that people are apt to be engaged in.

**THE PREVENTION OF ACCIDENTS IS
EVERYBODY'S RESPONSIBILITY!!!**

BELL HELICOPTER TEXTRON INC.

INDUSTRIAL SAFETY AND HYGIENE
DEPARTMENT

DEPARTMENT 12

PLANT 1

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INTER-OFFICE MEMO

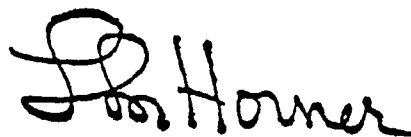
April 1988

MEMO TO: All Employees

One of the primary objectives of Bell Helicopter Textron Inc. is to provide a safe and healthy place to work for each of its employees. BHTI's safety program will be given the highest priority by management.

Enclosed is your personal copy of an Accident Prevention Handbook prepared by the Industrial Safety and Hygiene Department. I encourage you to read this booklet carefully and to keep it handy for future reference. Please sign the acknowledgement card found in the back of the booklet and forward it to the Safety Department as promptly as possible. Any questions regarding these practices should be directed to the Safety Department.

If each of us observe these health and safety practices and incorporate them into our daily work habits, we will ensure a safe and healthy working environment to the mutual benefit of all employees.



L. M. Horner
President

BHT 00810

**Accident
Prevention
Handbook**

**For
All Employees**

TEXTRON

Bell Helicopter Textron, Inc. (BHTI)

**INDUSTRIAL SAFETY AND
HYGIENE DEPARTMENT**

DIAL 2146

This Handbook Is
The

Property Of:

Location:

Plant 1

Building 2

Level 2

1

EMERGENCY NUMBER

DIAL 3333

For Medical, Chemical And Fire
Have This Information Ready
Before Calling:

1. Plant Number
2. Building Number
3. Level Number
4. Column Number
5. Type Of Emergency

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INTRODUCTION

In 1970, Congress enacted the Occupational Safety and Health Act to protect this nation's most valuable asset, our human resources. The Occupational Safety and Health legislation provides safety and health standards to protect workers in places of business.

Each employer, under the Occupational Safety and Health Act, has the general duty to provide a safe place to work; and each employee has the duty to comply with the safety and health rules.

Cooperation in the Accident Prevention Program is the moral and legal obligation of each individual employee. This is demonstrated by:

- (a) Working safely on the job;
- (b) Having respect at all times for the safety of fellow employees;
- (c) Using knowledge and influence to prevent accidents;
- (d) Calling attention to unsafe practices and unsafe conditions;
- (e) Practicing good housekeeping (A place for everything, and everything in its place.);

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BHT 00813

- (f) Contributing ideas, suggestions and recommendations for the improvement of safety;
- (g) Having regard at all times for the safety equipment provided for employee use;
- (h) Wearing personal protective equipment as required by OSHA and BHTI;
- (i) Promptly reporting all injuries to your supervisor prior to going to the Medical Services Department or seeking outside medical care for Job Related Injuries.

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FOREWORD

The prevention of accidents and injuries to the men and women of our company is a prime objective of management.

The key to a successful accident prevention program lies in the willingness of every employee to accept and carry out his or her responsibilities. Without that willingness, the most carefully planned accident prevention program for the conservation of human resources will achieve only partial success.

"PRODUCTION WITH SAFETY"

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Notes

HAZARD COMMUNICATION (RIGHT-TO-KNOW)

1. A written Hazard Communication (Right-to-Know) Program is available for you to review through the Industrial Safety and Hygiene Department. This program provides information regarding safe work practices associated with hazardous materials.
2. Specific components of this Right-to-Know Law allow for the provision of:
 - a. Material Safety Data Sheets (MSDS's)
 - b. Container labeling.
 - c. Specific training and availability of personal protective equipment in your work area.
3. Material Safety Data Sheets are available in your work area on microfiche format and are accessible 24 hours a day. Consult the Personal Protective Equipment Catalog for microfiche reader locations.
4. Each department is responsible for assuring that all containers are adequately labeled.

5. Labels can be ordered through the Personal Protective Equipment Catalog using the assigned material code catalog number for each specific chemical and/or product.

WALKING AND WORKING SURFACES HOUSEKEEPING

1. All places of employment, passageways, storerooms and service rooms shall be kept in an orderly and sanitary condition.
2. The floor of every workroom shall be maintained in a clean, and so far as possible, dry condition.
3. Storage is prohibited on roofs, offices or sheds without proper guard rails and an established capacity for the load on the roof.
4. All excavations, trenches, open manholes and other places into which a person might fall shall be adequately guarded. Proper warning lights shall be in place at night.

AISLES AND PASSAGEWAYS

1. Aisles and passageways shall be kept clear

and in good repair with no obstruction across or in aisles that could create a hazard.

PORTABLE AND STEP LADDERS

1. Use a ladder free from defects. Check portable ladders for safety shoes, damaged rails and damaged rungs.
2. Erect the ladder on secure footing. Make certain the surfaces are level, the top secured and bottom blocked.
3. Step ladders shall be fully spread and locked when in use.
4. Face the ladder when climbing. Dry off hands and feet before climbing. Stay off the top rung.
5. The ladder shall extend three feet above the surface you wish to reach.
6. Post warnings and have help on the floor when a ladder is near a door or in an aisle.
7. Get down to move a ladder. Do not over reach. Do not try to shift the ladder while you are on it.

8. Aluminum ladders shall not be used when working on or near electrical equipment.
9. The making and using of homemade ladders is not permitted.
10. All unsafe ladders shall be reported to your supervisor.

SCAFFOLDS

1. Guard rails and toe boards shall be used on all scaffolds over 10 ft. in height.
2. Do not move a scaffold when persons or materials are on it.
3. Scaffold wheels shall be equipped with locking devices and at least two wheels shall swivel.
4. Keep scaffold platforms clear of unnecessary material. Do not overload platforms.
5. Scaffolds shall be constructed in accordance with OSHA standards.

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OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL

1. Report promptly to your supervisor and the Industrial Safety and Hygiene Department (ext. 2146) any indication of leaking gas, toxic atmospheres or other related health hazards.
2. In the event that emergency medical attention is required, dial ext. 3333 for assistance.
3. If a toxic atmosphere exists, leave the area immediately. Do not re-enter unless authorized by your supervisor and/or the Industrial Safety and Hygiene Department.
4. Protective apparel and devices shall be worn whenever a hazard exists and whenever directed by BHTI.

ENVIRONMENTAL POLICY

1. Never pour, flush or allow any substance to enter a sewer or storm drain unless you know it is allowed.

2. All BHTI employees shall strictly adhere to internal policy and procedure as related to hazardous material, hazardous waste and hydrocarbon products.
3. BHTI Environmental Management group has established procedures for all common waste products. Handling or disposal procedures for new or unique waste products shall be obtained by calling ext. 5356.

GUIDELINES FOR A CLEAN ENVIRONMENT ARE:

1. Never pour, flush or allow any substance to enter a sewer or storm drain unless you know it is allowed.
2. Use only approved containers for waste collection and disposal.
3. The soil, asphalt or concrete surfaces are never approved as a site for waste or unwanted substances.
4. Report all leakage or minor spills to ext. 5356; report all major spills or emergencies to ext. 3333.

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5. Remember, any unusable or spilled hazardous material (by definition) becomes a hazardous waste.

PERSONAL PROTECTIVE EQUIPMENT

1. The Personal Protective Equipment Catalog contains a listing of items approved by the Industrial Safety and Hygiene Department. Contact your supervisor or the Industrial Safety and Hygiene Department for assistance if necessary.
2. Approved eye protection shall be worn in accordance with OSHA and BHTI requirements.
3. Approved head protection shall be worn in accordance with OSHA and BHTI requirements.
4. Employees shall wear appropriate footwear that will provide adequate protection for each given work situation.
5. Employees shall wear hearing protection devices in accordance with OSHA and BHTI requirements.

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6. Employees shall wear all other protective clothing in accordance with OSHA and BHTI requirements.
7. Report defective safety equipment to your supervisor immediately.
8. Employee owned equipment shall not be worn without prior approval from the Industrial Safety and Hygiene Department.

GENERAL ENVIRONMENTAL CONTROLS

1. Lavatories and showers shall be maintained in a sanitary fashion.
2. Vandalism of lavatory or shower areas shall not be tolerated.
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3. Know where fire extinguishers are located and how to use them.
4. After a fire extinguisher has been used, notify your supervisor, who will contact the Fire Protection Department. Never put a used extinguisher back in its holder.
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3. Do not go on any crane/hoist or crane/hoist runway for any purpose without permission

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5. The individual must anticipate the possibility of equipment starting to function in some abnormal manner, such as creeping, drifting, etc., and provision such as blocking shall be made to prevent such an occurrence.
6. Where there is danger from other moving machinery or equipment, proper protective devices, such as flags, signs, signal lights, observer, etc., shall be provided.
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8. Oxygen, acetylene, fuel gas cylinders and delivery systems shall be maintained free of oil and grease.
 9. Pressure shall be relieved on bases and regulators when equipment is unattended.
 10. Acetylene cylinders shall always be stored vertically and used vertically with the valve end up. They shall not be allowed to lie flat.
 11. Gas, oil and other lines or containers, which contain flammable material, shall be thoroughly purged and tested for explosion possibility using approved testing equipment before doing any burning or welding on such lines or containers.
 12. In burning or welding, do not use as a work-bench or support any container which holds or previously contained a flammable material.
 13. Flammable liquids shall be stored in properly marked containers which are certified for that particular flammable liquid.

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14. Rags or oily waste shall be properly stored and disposed of in accordance with the Environmental Management Department Policy.

GRINDING WHEELS

1. Before mounting a grinding wheel, check the maximum safe speed indicated on the wheel and on the machine. Speed indicated on the wheel should be equal to or more than the maximum spindle speed of the machine.
2. Before mounting a grinding wheel, visually check it for cracks and nicks.
3. If a grinding wheel has been dropped or struck a sharp blow, do not use the wheel.
4. Check wheel blotters and flanges frequently. Blotters shall adhere securely to the sides of the wheel. Flanges should have adequate undercutting and be true so as to grip the wheel evenly over the gripping surface.
5. Grinding shall not be done on a newly mounted wheel until one minute after it has reached maximum speed.

6. Hand grinders shall not be dropped, since this can cause cracks in the grinding wheel and/or bending of the spindle, which can cause the wheel to fracture.

GENERAL RULES FOR ACCIDENT PREVENTION

The following violations of Company Rules will be sufficient grounds for disciplinary action.

1. Disregard of safety rules or common safety or sanitation practices.
2. Horseplay, scuffling, fighting or throwing things on company premises.
3. Possession, drinking, using or being under the influence of habit forming drugs or alcoholic beverages on company premises at any time.
4. Employees driving motor vehicles of any kind on BHT property in excess of posted speed limits. In the absence of posted limits, vehicles being operated at a speed in excess of 15 mph or too fast for existing conditions.

5. Riding on company vehicles or equipment without permission.
6. Possession of weapons, explosives, cameras or other prohibited property on company premises without expressed permission.

CLOTHING

Shorts, short-shorts, halter tops and muscle shirts do not provide adequate protection to you in our working environment and are, therefore, prohibited.

Sandals, moccasins and canvas shoes are not permitted in the plant. When safety toe shoes are not worn, sturdy footwear shall be worn.

Sunglasses are not to be worn in manufacturing areas unless authorized by the Industrial Safety and Hygiene Department.

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CONCLUSION

Fundamentally, Accident Prevention is a way of life. It is the development of an attitude that permits us to think about the possibilities of accidents and then how to prevent them. It is impossible to believe that a person has a "safe attitude" if he/she thinks about safety for just a small portion of the day.

To be "safe", we must think about being alert through all our working hours, whether we are on the job, driving our car, at the beach, working at home or in any other activity that people are apt to be engaged in.

THE PREVENTION OF ACCIDENTS IS EVERYBODY'S RESPONSIBILITY!!!

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I hereby acknowledge receipt of the Accident Prevention Handbook.

NAME PRINTED _____

CLOCK NO. _____

SIGNATURE _____

DATE _____

This receipt is to be kept on file in the Industrial Safety and Hygiene Department.
Return this card to Department 12, Plant 1.