



General Plant Safety



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Introduction

Overview

Working safely should be the concern of every individual. Safety includes protecting yourself and others from injury. While others - your employer, your family, governmental agencies, and insurance companies - are concerned for your well-being, you have the final responsibility for your safety in the workplace. Fulfilling that responsibility will not only protect you and others from painful injury, but will also prevent unnecessary damage to the equipment with which you work.

Objectives

The information, activities, and practices provided during this unit will enable you to:

1. State six negative attitudinal approaches toward workplace safety.
2. State three things you can do to show concern for safety in the workplace.
3. Name the areas of the body most frequently injured in the workplace.
4. Identify the human factors that contribute to workplace safety.
5. State the six basic steps in job preparation.
6. Identify six categories of safety equipment and clothing.
7. Identify the four classes of fires and approved fire extinguishers for each class.
8. Describe the three main causes of injuries involving rotating or movable-action machinery.
9. Describe the purpose of the OSHA Hazard Communication Standard, safety information requirements, chemical labeling and Material Safety Data sheets.
10. Describe the proper use of ladders.
11. Describe proper lifting methods.

In this unit there are three sections you will be studying, one of which has four parts. Three progress checks, in the form of brief quizzes, are spaced throughout the unit. Read the material thoroughly so that you can answer the questions correctly. These progress checks can then serve as review notes for the written unit test that you will take at the end of the unit. The instructor will give the written unit test and a performance test at the end of the unit.



Developing a Concern for Safety

There are two major factors in working safely:

1. Knowing what the hazards are and how to avoid them, and
2. Having the right attitude towards safety.

Of these two factors, the right attitude is the more important. Some of the difficulties involved in developing the right attitude in workers in a workplace are the following:

1. Workers are in a hurry and do not take the time to do the job safely.
2. Workers think accidents happen to other people but not to them.
3. Workers have the correct tool or equipment to use but knowingly use it improperly.
4. Workers take risks. They do not use the correct safety equipment even though it is available.
5. Workers have correct instructions or procedures to follow but consider them unnecessary.
6. Workers do not use available safety equipment because they feel it is uncomfortable or bothersome.

Attitude is defined as "a state of mind or feeling with regard to some matter." What, then, is the "right attitude" in the area of safety?

The right attitude towards your safety and that of others is one where you always assume responsibility to act in a manner which avoids or prevents accidents. It is common sense to avoid risking pain, suffering, and possible permanent disability when it can be prevented by attention to the rules of safety.

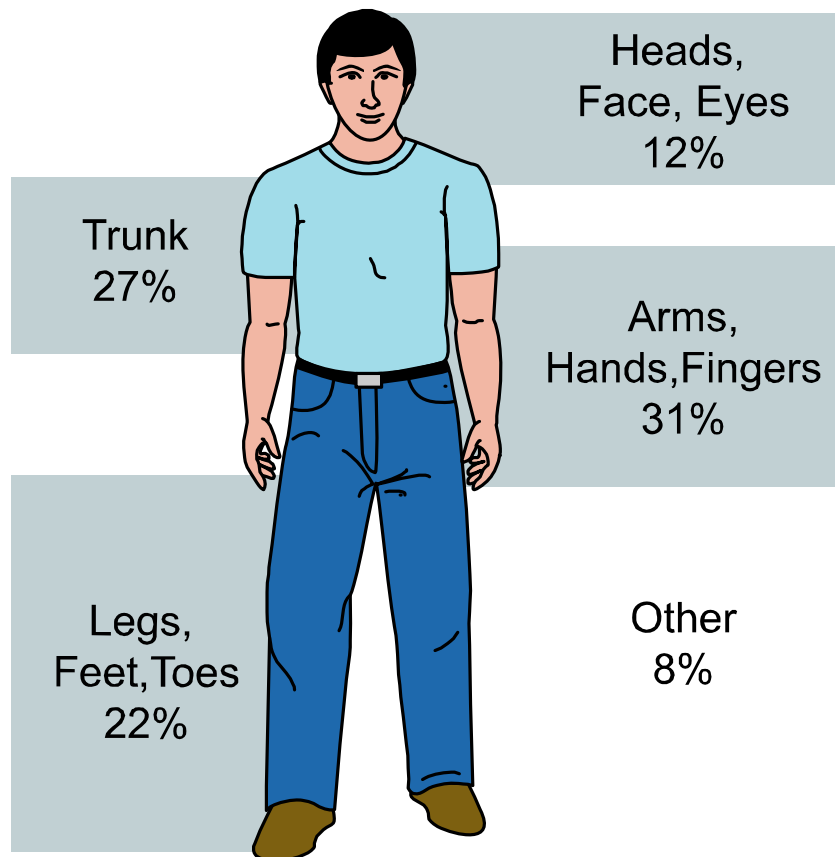
Companies provide fire extinguishers, first aid kits, hard hats, and other safety equipment for you to wear. In turn, companies expect you to show your concern for safety. Here are some ways that you can show your concern for safety:

- Observe and recognize unsafe conditions and situations,
- Decide how to handle the situation safely, and
- Take the necessary precautions to avoid injury to yourself and others.



Accidental Injuries and their Causes

Recent statistics gathered by the National Safety Council show that work accidents injure more than 2,000,000 people each year. Of these accidents in a recent year, 12,500 were fatal. Eighty thousand resulted in some kind of permanent disability. Figure 1 gives a breakdown of what parts of the body are injured in these accidents. As might be expected, arms, hands, and fingers are the most frequently injured parts.



Parts of Body Injured in Work Accidents

What causes the workplace accidents that bring about these injuries? Are they caused by hazards, by people, or by a combination of the two?

One company has compiled statistics from their manufacturing plants in this country for several years. This information shows that 95% of the accidents reported were caused by errors of individuals. Heading the list of errors is the category "Position and Actions of People."

Cause	Percent of Accidents
Position and actions of people	44
Improper use of tools and equipment	40
Incorrect Procedures	11
Causes other than by people	4
Lack of order, illness	1

Causes of Accidents

As you can see, simply having hands, feet, or body in the wrong position and using the wrong actions accounted for 44% of the accidents. Improper use of tools, machines, and protective equipment caused 40% of the injuries. Only 5% were caused by anything other than human error.

If statistics were kept and analyzed for accidents in your workplace, would they show different results? Statistics such as these tend to blame individuals for accidents. While some of us may feel that is unfair, if we fail to identify the real causes of accidents, we cannot begin to prevent them. If individuals are making the errors, they can learn to correct their actions. The next section contains information to help you do that.



Progress Check #1

1. Statistics from the National Safety Council for a recent year showed that of the 2,000,000 people injured in work accidents that year _____ fatalities resulted from these accidents.
2. Statistics on workplace accidental injuries published by the National Safety Council show the most frequently injured parts of the body are the _____, _____, and _____.
3. The study referred to in this unit which analyzed the causes of accidents showed that _____% were caused by errors of individuals.
4. The same study showed that leading the list of individual errors was _____ and _____.
5. One of the most important factors in personal safety is _____.
6. What are at least three things you can do to show your concern for safety in the workplace?
 - a. _____
 - b. _____
 - c. _____

Notes:



Practicing Accident Prevention

"An ounce of prevention is worth a pound of cure." Accident prevention is not a spectator activity; it requires your active participation, your active prevention. Information to allow you to effectively construct your own personal accident prevention plan is presented in four general categories:

1. Preparing to do the job.
2. Choosing the correct safety equipment and clothing.
3. Maintaining a safe work area.
4. Avoiding unsafe practices.

Preparing to Do the Job

Plant jobs vary as to the number of different tasks required per day. In some assignments, most of the tasks are done repeatedly. In others, a wide variety of tasks are done; however, some of them are not done often. There can be danger in either type. When we do things again and again, a habit forms. We quit thinking and start doing things automatically, letting our minds wander. Preparation for the job starts with recognizing the four human factors that contribute to plant safety:

1. Knowledge.
2. Skill.
3. Physical condition.
4. Positive attitude.

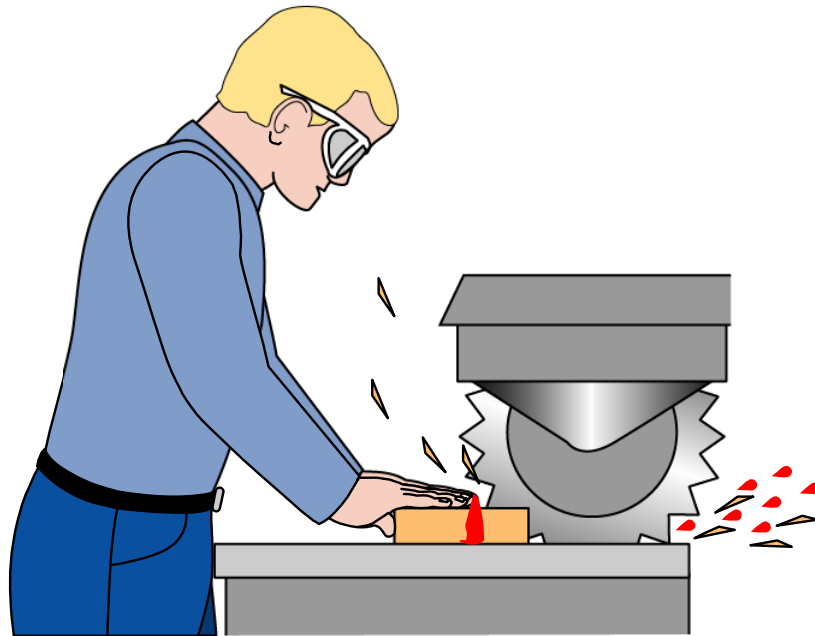
Knowledge

A large number of plant accidents occur because of lack of knowledge. Adequate safety knowledge includes the following:

- How to recognize a hazard.
- How to reduce or avoid the hazard.
- How to handle or control the hazard.
- How to avoid creating hazards for other workers.

Most people know a power saw, such as the one shown in the illustration, is dangerous. Whether it is a table saw or a radial-arm saw, the rotating blade is extremely hazardous to fingers, hands, and arms. Most instructions on the use of this equipment warn you extensively about this danger. They also warn you that the blade can throw objects being sawed out of the machine if the blade binds.

Job instructions sometimes fail to include all the hazards people have learned through experience. Workers have to learn through experience in what direction the blade throws objects and how to keep the blade from binding.



Rotating Blade Equipment is Hazardous



Skill

To develop skills requires practice. A person may know how something is to be done, but skill comes with practice. It is when you do things those first few times that you need to be the most cautious. Take the time to make your actions and movements planned and deliberate. Over time, those carefully thought-out actions will become ingrained into your work habits.

Again, it is when you are doing things for the first time or doing them differently than you have done them before that you need to be most alert to hazards. Examine the job thoroughly for hazards before you start. Have a plan to avoid the hazard if possible. If avoidance is not possible, know how to minimize your risks.

Physical Condition

Any temporary physical condition that reduces your normal capacity to perform increases the possibility of accidents. The condition might range from drowsiness due to lack of sleep or medication to a bandaged hand or finger. The effect of either is the same. It reduces your capacity to perform. When you have such a temporary handicap, you should change your procedures so that no new hazards result from your limitations.

Positive Attitude

Remember that attitude affects safety. When you build safety observation into your job preparation, you are on the road to a positive attitude.

Job Preparation

While the human factors are primary in job safety, the job itself and the environment in which it will be done are also important factors. There are six basic steps in general job preparation:

- Study the job before starting. Determine what tools, machinery, and materials will be required for the job.
- Determine what hazards are involved. Select the appropriate safety equipment and clothing to protect you from these hazards.
- Examine the work area itself. Do hazardous conditions exist? Are there conditions such as very hot surfaces within reach? Are floors naturally slippery due to high humidity? Will you be working above other people?
- Locate emergency equipment such as fire extinguishers and first-aid kits.
- Know where fire alarms are.
- Learn where electrical power switches are located for the machinery you operate. Then, should an accident occur, you will be prepared to act quickly to shut off power.



Choosing the Correct Safety Equipment and Clothing

As part of your job preparation, you identified the hazards you could encounter. Once you have identified them, you will know what type of clothing to wear and what kind of safety equipment you need.

Safety equipment provides protection from normal hazards. When things go wrong and the unexpected happens, safety equipment can help prevent injury.

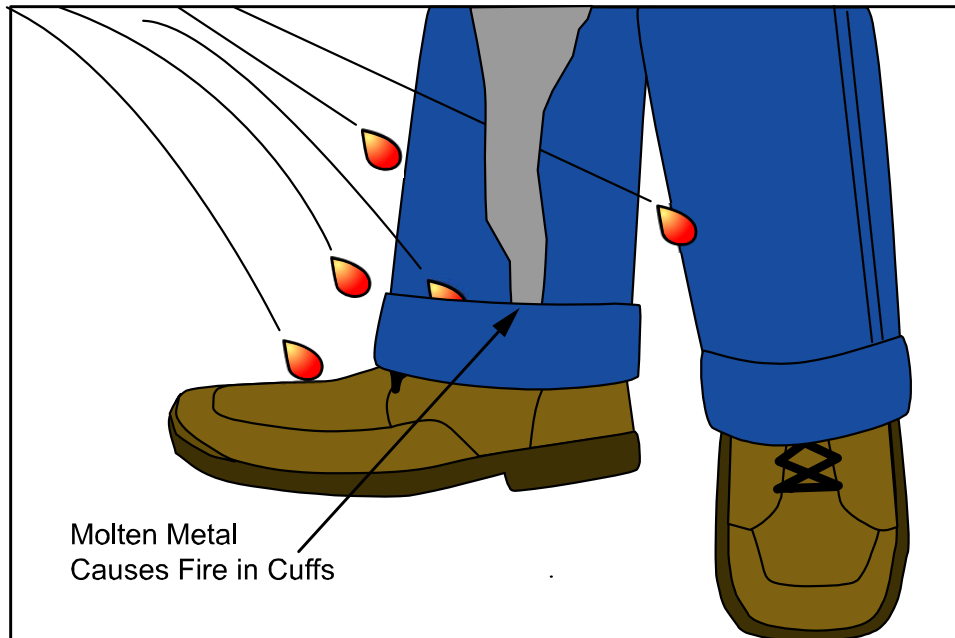
There are six categories of clothing and safety equipment that you should know about:

- Clothing suitable for industrial work
- Head coverings
- Eye and face protection
- Hand and arm protection
- Hearing protection
- Lung and breathing protection

Types of Clothing Suitable for Industrial Work

Clean, well-fitted, and well-maintained clothing is a must. Poorly-fitted work clothing, such as pants and sleeves that are too long, may cause you to trip or to get entangled in moving machines. Ties and scarves can get caught in rotating machinery and cause serious injury.

Shirt and blouse sleeves should be buttoned. You should wear short-sleeved shirts if you operate hand and/or power tools. Pant legs should be long enough to cover the tops of work shoes. Cuffs in pant legs are dangerous because they can be snagged and may cause you to fall. Fires can result from molten metal or other ignited material falling into cuffs.



Cuffs in Trouser Legs Can Be Dangerous

The type of job to be done will determine the safest clothing for you to wear.

Safety Clothing	Type of Job
Short sleeves	Power tools and machines
Long sleeves	Oxyacetylene welding and cutting
Leather sleeves and capes	Electric arc welding
Aprons	Bench and sheet metal
Rubber (plastic) aprons and gloves	Caustics, chemicals, pesticides or solvents

Fitting the Clothing to the Job



Feet and legs are particularly susceptible to injury. Smashed toes and bruised shins are common plant injuries. Protect your feet and legs by wearing long pants and leather shoes.

Covering	Type of Job	Protection From
Steel-toed shoes	Construction and fabrication	Toe injury
High-top leather shoes with heavy cushioned or leather soles	Hot metal and welding	Ankles and instep burns
Cushioned crepe soles	Standing on concrete	Foot fatigue, electric shock
Heavy industrial knit socks and leather soles	All	Foot and leg scrapes and burns
Rubber boots	Cleaning	Foot and leg burns, water, caustics and acids

Foot and Leg Coverings for Different Types of Jobs

Head Coverings

Of the various accidents which occur in industrial plants, the most serious involve injury to the head. Types of head protection include hard hats, bump hats, skull caps, and sweat bands. The selection and use of this equipment depends on the type of work being done.

Covering	Type of Job	Protection From
Hard hat	Construction and fabrication	Falling or moving objects
Bump hat	Machinery repair, heavy equipment	Cuts and bruises to scalp
Welder's skull cap	Welding and hot metal	Burns to hair and scalp
Sweat band	All	Perspiration in eyes and glasses

Fitting Head Coverings to Types of Jobs

Eye and Face Protection

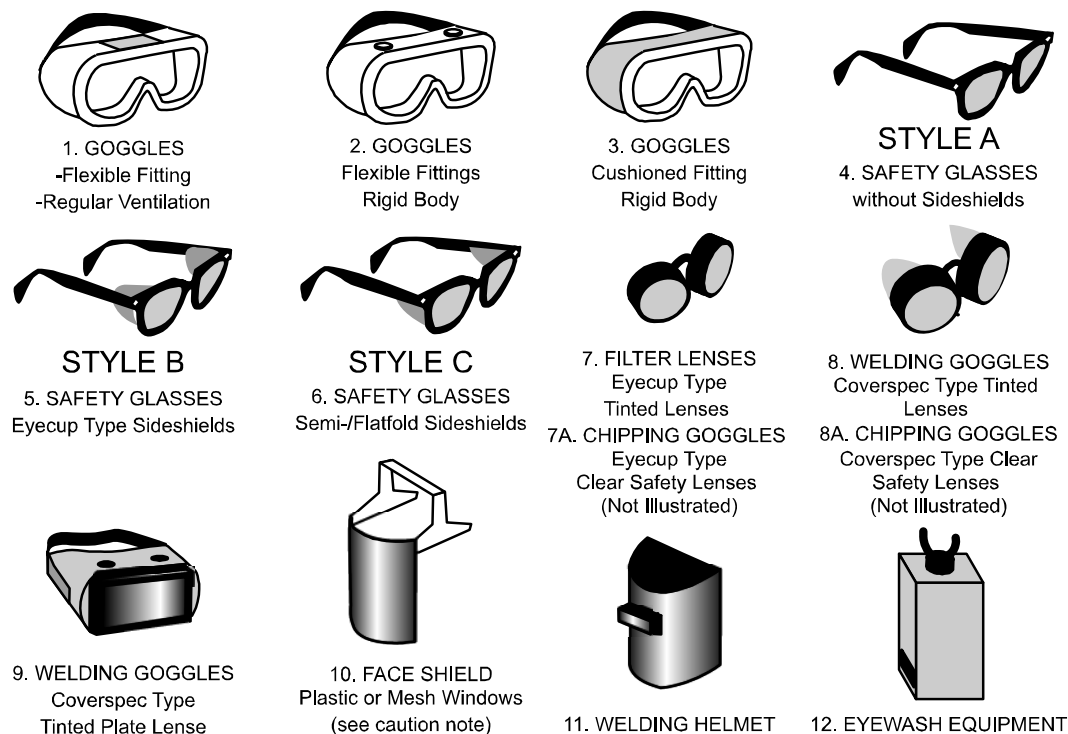
Loss of sight is probably the most disabling of all injuries. It not only limits us in our occupational capabilities, it strikes at the very heart of our quality of life. For these reasons, and because our eyes are one of our most fragile organs, they warrant maximum protection. There are many hazards to the eyes in any industrial environment. These include impact from small articles of hot or cold metals and chips of other materials discharged by machinery or tools. Excessive dust or other light particles may float in the air. Other possible eye hazards are numerous: acids, caustic liquids, and sharp objects are common in industrial plants, and some types of welding produce injurious light rays.

You must wear proper eye protection at all times in work areas where hazards are present.

Eye protection includes the following:

- Goggles
- Safety glasses
- Filter lenses
- Face shields
- Welding helmets, shields, and goggles
- Eyewash equipment

Select equipment for protecting your eyes and face that will offer the right kind of protection.



APPLICATION		
OPERATION	HAZARDS	PROTECTORS
Acetylene--Burning	Sparks, Harmful Rays,	7, 8, 9
Acetylene--Cutting	Molten Metal,	
Acetylene--Welding	Flying Particles	
Chemical Handling	Splash, Acid Burns, Fumes	2 (For severe exposure add 10)
Chipping	Flying Particles	1, 3, 4, 5, 6, 7A, 8A
Electrical (Arc) Welding	Sparks, Intense Rays	11, (in combination with 4, 5, 6, in tinted lenses, available)
Furnace Operations	Glare, Heat, Molten Metal	7, 8, 9, (For severe exposure add 10)
Grinding--Light	Flying Particles	1, 3, 5, 8, (For severe exposure add 10)
Grinding--Heavy	Flying Particles	1, 3, 7A, 8A, (For severe exposure add 10)
Laboratory	Chemical Splash	2 (When 10 in combination with 5, 6)
Machining	Flying Particles	1, 3, 5, 6, (For severe exposure add 10)
Molten Metals	Heat, Glare, Sparks, Splash	7, 8, (When 10 in combination with 5, 6, in tinted lenses)
Spot Welding	Flying Particles, Sparks	1, 3, 4, 5, 6 (tinted lenses available; for severe exposure add 10)

CAUTION:

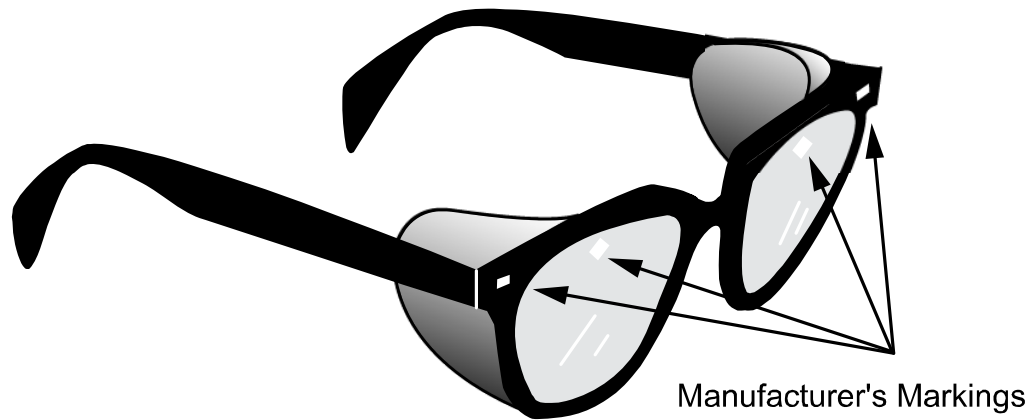
This Selection Chart offers general recommendation only. Final selection of eye and face protective devices is the responsibility of management and safety specialist. (For laser protection, refer to American National Standard for Safe Use of Lasers, ANSI Z136.1 - 1976.)

NOTE:

Face shields alone do not provide adequate protection.
Plastic lenses are advised for protection against molten metal splash.
Contact lenses alone do not provide eye protection in the industrial sense and shall not be worn in a hazardous environment without appropriate covering safety eyewear.

Equipment for Face and Eye Protection

There is a difference between safety glasses and ordinary prescription glasses. If you wear ordinary prescription glasses, wear goggles over them. Prescription safety glasses are available that the Food and Drug Administration (FDA) has approved as meeting impact-resistance tests. Safety glasses, both prescription and nonprescription types, are marked with the manufacturer's symbol on both the lenses and the frames.

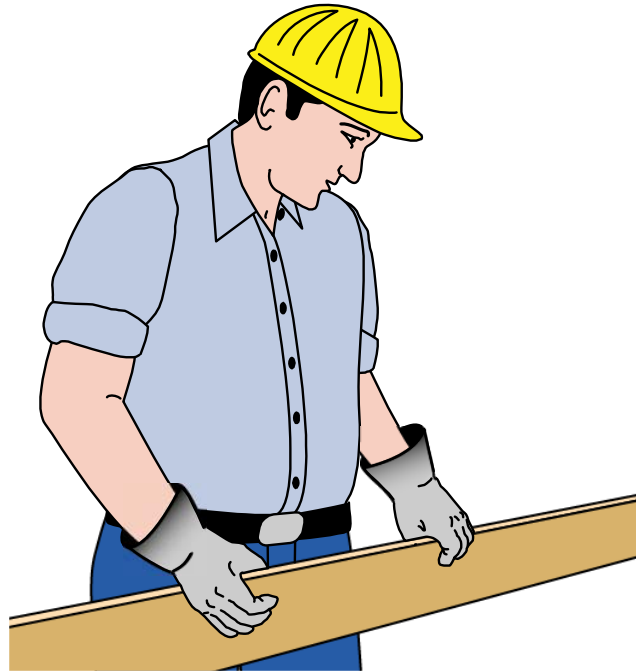


Safety Lenses Have Manufacturer's Markings

Hand and Arm Protection

Accident statistics show that over 30 percent of work injuries involve fingers, hands, and arms. Most of these injuries are from cuts, splinters, bruises, burns, sprains, and broken bones. Use of the following types of hand-safety wear can help prevent these types of injuries:

- Wear leather or vinyl-coated gloves when handling lumber and metals. Wood and lumber products nearly always have splinters. Construction metal, regardless of size and shape, may have sharp edges and chips.



Protect Your Hands with Gloves

- Wear gauntlet-type welder's gloves when welding and cutting. These gloves protect hands and arms from intense heat, hot metal, sparks, and flame. They also protect you from ultraviolet light rays and electric shock when you do arc welding.
- Wear approved gloves (mittens) when handling hot metals. Whenever there is danger of molten metal splashing or coming in contact with the hands or forearms, wear heat-insulated gauntlet gloves or mittens.

- Wear rubber or approved plastic-treated gloves when handling acids, caustics, and cleaning solvents. Guard against severe chemical burns and the danger of absorbing dangerous chemicals into the body through the skin.

CAUTION!

Do not wear gloves when operating rotating machinery of any kind. The gloves could become caught in revolving parts and pull a finger, hand, or arm into the machine, resulting in serious injury.

Hearing Protection

Exposure to loud blasts, high-level, and/or long-term noises can cause injury to the ears. Use ear protection in the form of ear muffs or ear plugs in environments of excessive noise.



Noise Can Hurt the Ears

Use of the proper ear protection can reduce dangerous noise to a tolerable level. Cotton in the ear canal is worthless as a noise reducer. Generally, ear muffs give more protection than ear plugs. They are also easy to put on and remove. Where muffs might interfere with other safety head wear such as hard hats or safety glasses, ear plugs might be the best choice. When used properly, they do provide satisfactory protection.

Lung and Breathing Protection

Where harmful contaminants exist in the air and cannot be reduced to a safe level by ventilation, use breathing-protection devices. These are available in two types:

- Dust masks are effective against dust and fibers. They are light, porous membranes that fit over the nose and mouth. They are comfortable, inexpensive, and disposable. Dust masks are effective against dust and fibers from fiberglass and asbestos. This type mask should meet the National Institute of Occupational Safety and Health (NIOSH) Specification TC21C-132.



Dust Mask

- Chemical masks contain a chemical-cartridge element and a filtering element. Choose a chemical mask that is designed for the material to be filtered. For example, there is a chemical-mask element specifically designed for paint spray and solvents, one for ammonia, and another for mercury. The type of filtering element to be used is also specific for the job. The effective life of the filter is set by the manufacturer. Follow instructions on the labels of the chemical and filtering elements when replacing them. Make sure the mask you are using has the proper NIOSH/MESA approval number for effectiveness against the hazardous material you encounter. MESA is the acronym for the Mining Enforcement and Safety Administration.



Chemical Mask

There may be other types of safety equipment your work requires. If there is other safety equipment available and you are not certain you are thoroughly familiar with its use, check with your supervisor.



Maintaining a Safe Work Area

Companies make many efforts to provide safe work areas for employees. They provide general safety items such as fire extinguishers and first-aid kits. In addition, they provide physical-safety features such as guard rails to shield people from injury. As a part of your own safety plan, you should be aware of what these provisions are, where they are, and how to use them.

A list follows of those provisions that may be provided in your work area, along with some precautions about each. As you read through this list, make mental notes concerning which of these provisions do exist in your work area. When you have finished this part of the lesson, take this list and see which of these are in your area and if the precautions mentioned are being observed. If you have not yet been assigned to a job, save this list and use it when you do have an assigned work area.

Building Exits












Emergencies may make it necessary for you to leave the plant quickly. When entering a work area, locate all exits so you can leave quickly if necessary.

Law requires that exits be marked by signs. Nothing should impair the visibility of the sign. In darkened areas, the sign should be lighted. All exit doors should swing outward and should not be locked from the inside.

The area around exit doors must be free of obstructions. Keep in mind that a door that does not have an exit sign over it does not provide a way to get out of the building.

Emergency Fire Equipment

Portable fire extinguishers are important pieces of safety equipment for any plant. Know where they are in your work area. They should be in a conspicuous and accessible place. Portable fire extinguishers are designed to be used with different kinds of fires. There is only one type of extinguisher which is satisfactory for all the common types of plant fires. It is the multipurpose dry chemical tri-class A, B, C type. Fire extinguishers are rechargeable and should be checked periodically. There should be tags on them indicating the condition of charge and what date they were checked.

KIND OF FIRE		APPROVED TYPE OF EXTINGUISHER			
DETERMINE THE CLASS OF FIRE YOU ARE FIGHTING...	THEN CHECK THE COLUMNS TO THE RIGHT OF THAT CLASS	MATCH UP PROPER EXTINGUISHER WITH CLASS OF FIRE SHOWN AT LEFT Important: Using the wrong class of extinguisher for a fire may be dangerous.			
		CARBON DIOXIDE Carbon Dioxide Gas Under Pressure	PUMP TANK Plain Water	MULTI-PURPOSE DRY CHEMICAL	ORDINARY DRY CHEMICAL
 CLASS "A" FIRES Use These Extinguishers ORDINARY COMBUSTABLES Wood, Paper, Cloth, etc.					
 CLASS "B" FIRES Use These Extinguishers FLAMMABLE LIQUID, GREASE Gasoline, Paint, Oils, etc.					
 CLASS "C" FIRES Use These Extinguishers ELECTRICAL EQUIPMENT Motors, Switches, etc.					

Fire Extinguishers and Classes of Fires

Fire blankets are another piece of emergency equipment provided where there is the danger of clothing fire. You will usually find them stored in a marked metal cabinet or weatherproof storage bag. These blankets are very effective in smothering burning clothing.

The final precaution in the area of fire safety is to know the location of the fire alarms in the building.

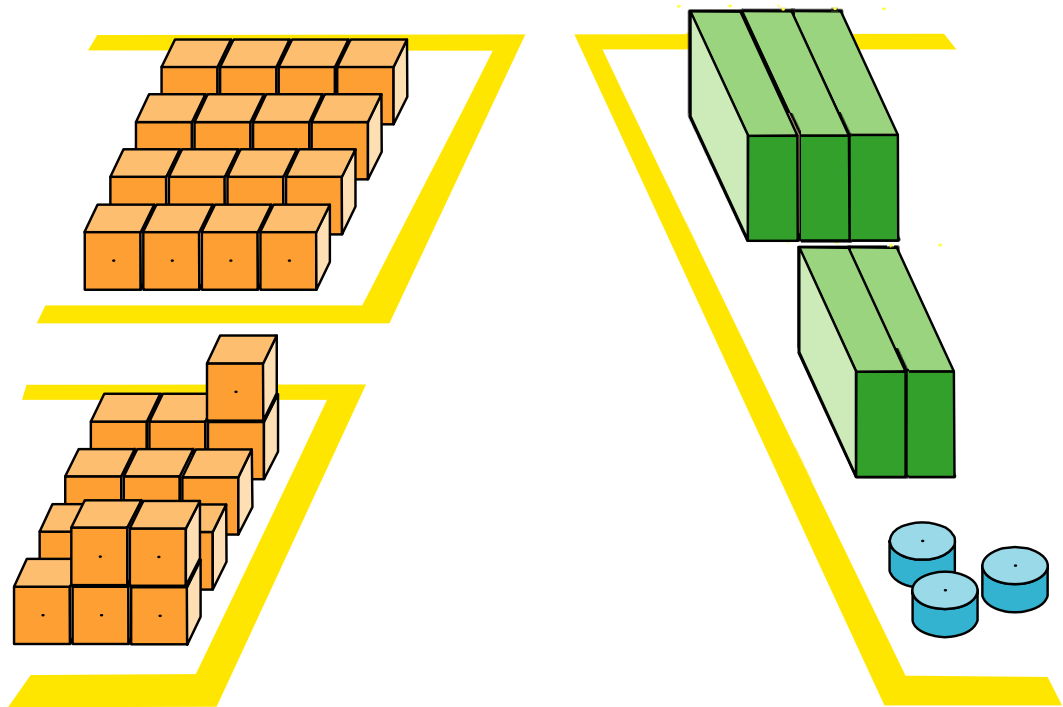
Emergency Aids

Portable first-aid kits are usually available in the plant to treat minor cuts, abrasions, and burns. They are usually located on a conspicuous place on the wall or kept in a wall cabinet designated by a green cross. Eyewash bottles are usually available at the first-aid station. In areas where caustic chemicals are used or other eye contaminants exist, eye fountains for washing out the eyes are provided.

Where telephones are provided in the plant area, emergency phone numbers should be listed. This listing of numbers may be a part of an overall emergency procedure specified for the plant or for that particular location in the plant.

Safety Zones and Lanes

Movement of people and materials through a plant is done with greater safety if it is kept clean and if safe traffic lanes and zones are marked and kept open.



Observe Traffic Lanes and Zones

Each piece of power equipment requires adequate floor area for safe operation. Traffic lanes must be kept free of congestion to allow the safe movement of people, supplies, and mobile equipment.

Do not leave items of equipment or supplies standing in traffic lanes. Do not stand in traffic lanes while you work. Be alert to the condition of the floor. Wipe spills immediately. Remove any substance from the floor that might cause someone to slip. Make sure floor gratings are in proper position and that they are secure.

You have now completed this part of the material. Progress Check #2 follows. This is an open-book exercise. Refer to the material in the unit as necessary.



Progress Check #2

1. Knowledge of how to do the job is likely to be at its lowest level, and therefore most critical to us at what two times?
 - a. _____
 - b. _____
2. Why should workers avoid wearing loose clothing around rotating or other movable-parts equipment?
3. Name three types of coverings that provide protection from objects striking the head.
 - a. _____
 - b. _____
 - c. _____
4. From what two means of eye protection do workers have to choose if they need prescription glasses to see correctly?
 - a. _____
 - b. _____
5. How do you determine if a pair of glasses are safety glasses?
6. Gloves should not be worn when operating _____.
7. The two types of ear protection are _____ and _____. Of the two types, _____ generally give more protection.

8. Dust masks are effective against which types of air contaminants?
9. What is the only type fire extinguisher that is satisfactory for use for all the common types of plant fires? _____
10. What should be periodically checked on fire extinguishers?



Recognizing and Avoiding Unsafe Practices

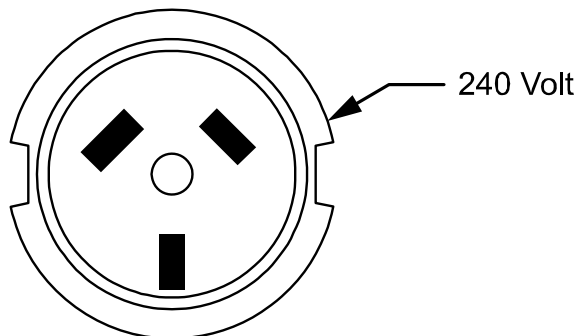
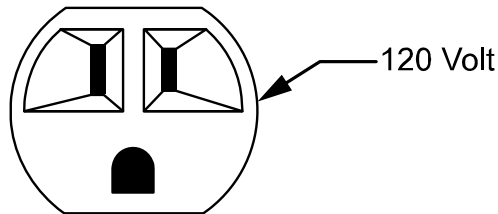
Each day, workers perform many kinds of routine and specialized tasks, all of which have the potential to cause injury. You can significantly reduce your risk of injury if you remember the precautions discussed in each of the categories that follow:

- Working with electricity
- Working with rotating and other movable-action machinery
- Working with chemicals and solvents
- Using pneumatic and hydraulic powered equipment
- Using ladders
- Lifting heavy objects
- Working in areas with harmful fumes
- Protecting yourself against bloodborne pathogens

Working with Electricity

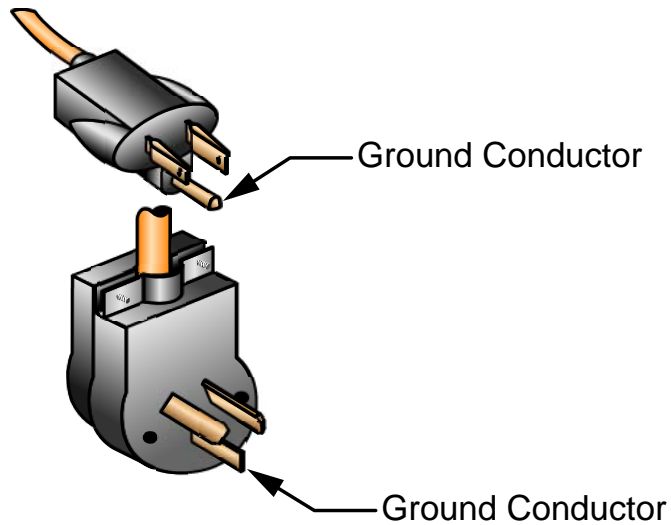
Electricity is one of the most useful power sources in an industrial plant. It can also be the most dangerous. It takes very little current passing through the body to cause death. Ordinary electrical-outlet voltage can supply more than enough current to cause death or serious, painful burns. Because of these risks, there are a number of precautions that you should observe when you are using equipment or tools powered by electricity:

Electricity may be supplied in two different voltages, 120 volts and 240 volts. It is important that you be able to identify the outlets for each voltage. Power tools or machines are designed to operate on specific voltages. Serious damage, fire, and/or injury can result if incorrect voltage is used.



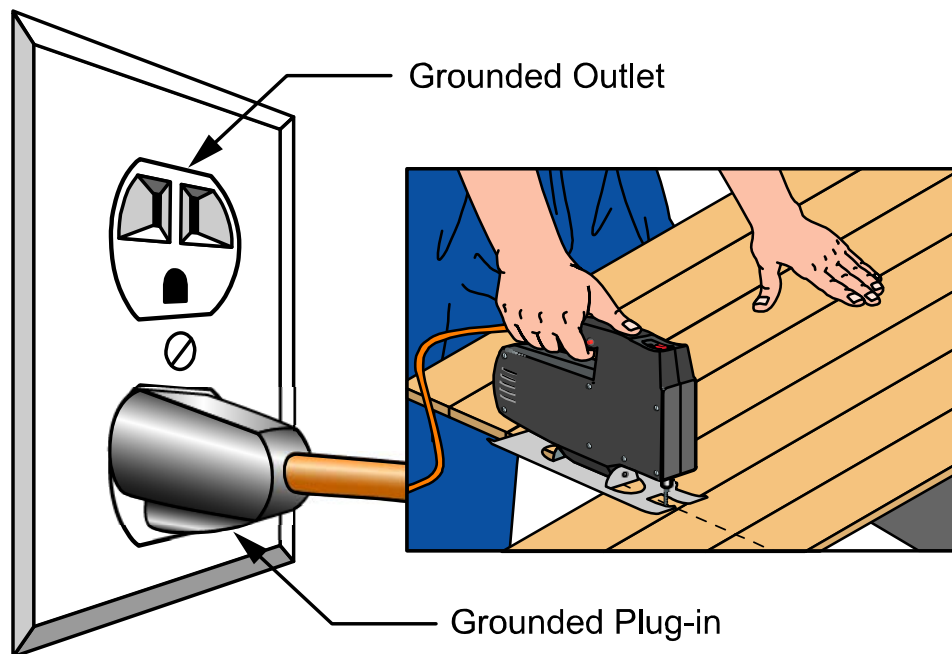
Learn to Recognize Proper Power Outlets

Electrical tools and equipment have a safety feature included in their wiring. It is called a ground conductor and is one of the wires connected to electrical tools and equipment through their plug.



Ground Conductors

When the three-pronged plug is inserted into the receptacle with the grounded outlet, protection against accidental grounding is provided.



Proper Grounding Helps Prevent Electric Shock

NEVER REMOVE the grounding prong to match a two-conductor outlet. Also, do not use a tool or piece of equipment which has the grounding prong removed. Some tools are of the double-insulated design and do not require a grounding conductor. Tools of this kind have only two prongs in their plug.

Before using an electrical hand tool, inspect its connecting cord for worn or damaged insulation. If the insulation has worn through, been cut, or is damaged, do not use it until the cord has been replaced. When extension cords are needed, be sure they are of the proper wire size to carry the current needed by the tool. Also, be sure the extension cord has the third-prong ground connection at both ends if the tool has a three-pronged plug.

Never stand on wet ground or a wet floor when using an electrical tool. The wet ground or floor increases your chances of injury from a shorted circuit.

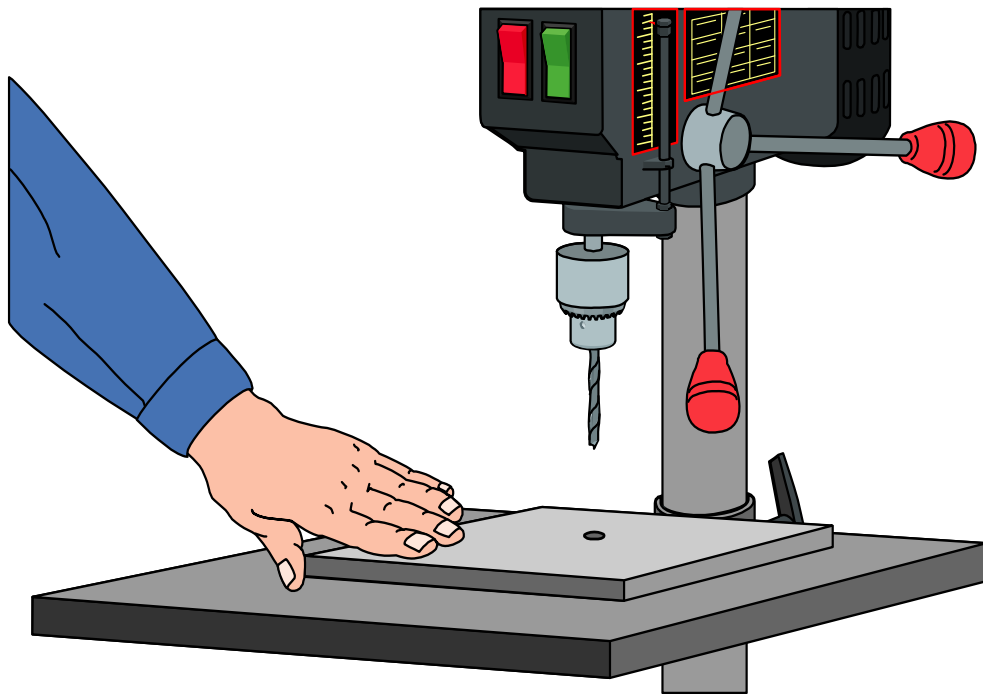
When working around electrical systems of any kind, do not wear jewelry such as rings, watches, bracelets, and/or necklaces. All of these are good conductors of electric current.

When drilling holes in plant structures such as walls or ceilings or into electrically driven equipment, check thoroughly to avoid drilling into a live wire.

Working with Rotating and Other Movable-Action Machinery

There are a number of causes of injury that result from working with rotating and other movable-action machinery. Among these causes are the following:

1. Mistakenly placing hands, arms, feet, or other parts of the body in the path of movement of parts of the machine. Study carefully the movement pattern of any machine you use or work around to insure that you are not placing any part of your body in the path of movement. Where possible, guard rails are used on machines to protect operators. **DO NOT** remove these guard rails while the machinery is running. Also, when guiding into machinery materials such as wood or metals to be sawed, drilled, stamped, or acted on in any manner, keep fingers and hands away from the cutting, drilling, and stamping areas of the equipment.



Keep Your Hands Clear of Presses and Vises

2. Parts of the body being pulled into the machinery because of clothing or jewelry being caught by it. Never wear loose clothing such as ties or scarves while working with moving equipment. Also, be careful that cuffs are always buttoned and that shirt or blouse tails stay tucked in. Loosely fitted clothing should also be avoided. Do not wear any type of jewelry such as necklaces, rings, or bracelets that could be snagged by the machine.
3. Machinery, taken out of service for maintenance or servicing should not be restarted before those who are working on it are finished. Not only can this cause significant damage to the equipment, but also it can cause serious injury or death to those working on it. The Occupational Safety and Health Administration (OSHA) requires that companies have procedures covering the removal and restoration of the source of power and/or flow of materials for machines. These are called LOCKOUT PROCEDURES. These procedures apply to all servicing activities that require entrance into, or close contact with, the machinery's or equipment's hazardous parts.



Lockout Procedure

Before any maintenance, inspection, cleaning, adjusting, or servicing of equipment (electrical, mechanical, or other) that requires entrance into or close contact with the machinery's or equipment's hazardous parts, the main power-disconnect switch or valve or both that controls its source of power or flow of material, shall be locked out or blocked off with padlock, blank flange, or similar device. The following is an example of a lockout/tagout procedure from a manufacturing company.

Each person performing these duties shall place their lock and identification tag (i.e., two persons working, two (2) locks and tags; three persons working, three (3) locks and tags, etc.).

Step 1

Shut off the source of power at the switch where source of power is supplied.

Step 2

Place your individual lock and tag on the switch or valve. (If valve cannot be locked out or properly isolated by closing valves and locking them out, blank flanges shall be installed in the line-if parts could fall out they must be properly blocked.)

Step 3

Test the unit control to make sure you have the right switch or valve before working on the equipment.

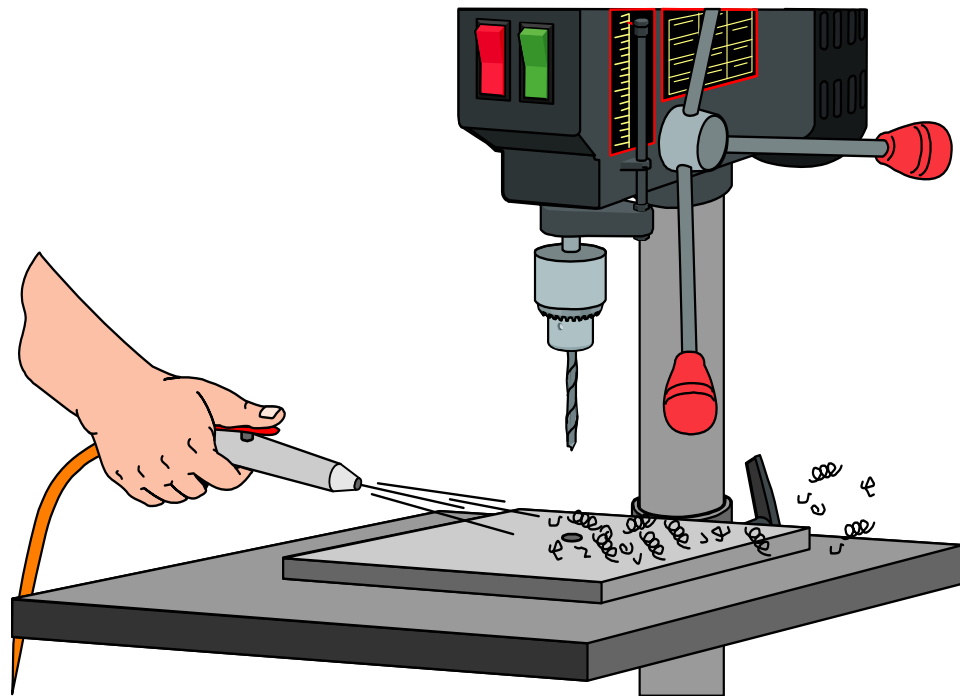
Step 4

When the job is completed and **ONLY** then, remove your lock and tag personally. No other person can remove your lock or tag. More specific lockout instructions will be given by your supervisor. Failure to follow these instructions will result in disciplinary action which could include discharge.

Using Pneumatic and Hydraulic Powered Equipment

Compressed air is the power source of pneumatic equipment. It requires hoses and connections. Connections between supply hoses and the equipment it drives often have quick-attach couplings. These permit easy and fast changes between types of equipment. Use care when disconnecting these couplings. They can slip from your hands and produce a whipping motion that can cause injury.

Compressed air is also used for cleaning and drying. When using it in this way, attach a safety-blow nozzle. These nozzles reduce the discharge pressure of the air, providing greater safety.



Safety-Blow Nozzle with Compressed Air

Fluid under pressure is the power source of hydraulic equipment and machinery. Often some portions of the lines carrying the pressurized fluid are flexible lines. These lines can develop pinhole leaks that allow an invisible mist of fluid to escape. Because of the pressure, the fluid can penetrate the skin or damage the eye. When you suspect such leaks may be present and you are searching for them, protect your eyes with safety glasses and your skin with long sleeves and gloves.

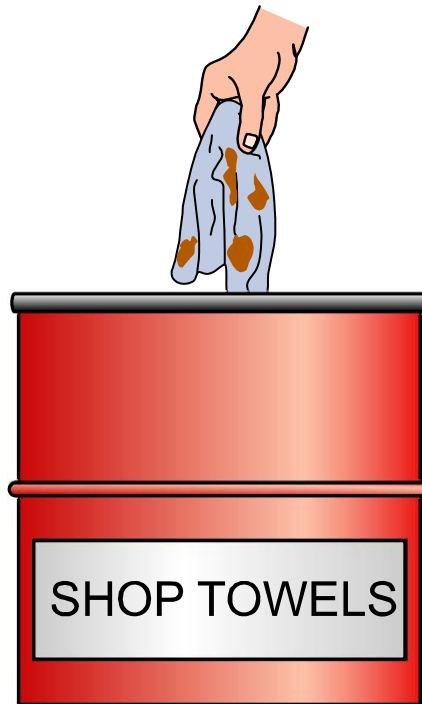


Working with Chemicals and Solvents

In an industrial plant you will be working around or using chemicals and solvents. Chemicals are used in manufacturing processes. Both chemicals and solvents may be used for cleaning, painting, and gluing. These substances present hazards: they can damage the skin, and some can poison the body when they are absorbed through the skin. Many chemicals and solvents have fumes which are harmful when inhaled. Many of them, including almost all solvents, are flammable. You can work safely around these substances by observing these precautions:

1. Wear rubber or plastic-coated gloves when using solvents to clean parts or surfaces and when handling chemicals. It is also a good practice to use a face shield over chemical-splash goggles when working with caustic chemicals or acids. In work areas where exposure to chemicals is extensive, rainsuits may be required. Such rainsuits are made of a durable fabric that repels chemicals.
2. Where instructions for the use of these substances indicate they should not be inhaled, use a respirator with an appropriate chemical cartridge and filter.
3. Most solvents are extremely flammable. For this reason they should not be used around any type of flame or arcing such as that produced by welding. Be careful when you use solvents around electrical equipment like large motors or switch contacts that produce heavy arcing.
4. Never store flammable substances close to open flames or in the vicinity of high-heat sources. Store them only in appropriately marked containers and in well-ventilated areas.

5. Use appropriate containers to dispose of all materials such as shop towels, sawdust, or sweeping compounds which have absorbed inflammable substances. These materials are easily ignited by matches or sparks and can also ignite due to spontaneous combustion.



Safety Container for Shop Towels

Even when all safety precautions are followed, workers can still come into contact with harmful chemicals. If this should happen, wash off the chemical immediately, using enough water to insure complete cleansing. You might need to use showers or eyewash stations to provide adequate water.

To help employers and employees become informed about these work hazards and how to protect themselves, the federal government through the Occupational Safety and Health Administration (OSHA) has implemented a program called The Hazard Communication Standard, also known as "Employee's Right to Know."



OSHA Standards establish uniform requirements to make sure that the hazards of all chemicals imported into, produced or used in the U.S. workplace are evaluated. It ensures that there is a downstream flow of information starting from the chemical manufacturer to distributor, then to the employer and last to the employee.

OSHA requires that all chemical manufacturers, importers, and distributors must label all chemical drums, barrels, and containers with specific information to safeguard all individuals either storing, transporting or using the chemical.

Signal Word

ACETONE
(Dimethyl Ketone, CAD 67-64-1)

DANGER! EXTREMELY FLAMMABLE

Acute: **CAUSES IRRITATION OF EYES, SKIN AND MUCOUS MEMBRANES.**
Chronic: **EXPOSURE TO LIQUID MAY CAUSE DERMATITIS.**

Keep away from heat, sparks and flame. Avoid contact with eyes, skin, and clothing.
Keep container closed. Use with adequate ventilation. Wash thoroughly after handling.

FIRST AID:
IMMEDIATELY CALL POISON CONTROL CENTER OR HOSPITAL EMERGENCY ROOM.

IF CONTACTED: Immediately flush eyes with plenty of water for at least 15 minutes. Wash skin with soap and plenty of water. GET MEDICAL ATTENTION for eyes. Wash clothing before reuse.
IF INHALED: Remove to fresh air. If not breathing, give artificial resuscitation.
IF SWALLOWED: Give water to dilute. CONSULT POISON CONTROL CENTER OR HOSPITAL EMERGENCY ROOM. Never give anything by mouth to an unconscious or convulsive person.

Consult MSDS for further hazardous information and instructions, or contact
ABC CHEMICAL CO. 100 POLLUTION BLVD. SULFUR GAS, LA 81001

Name of Product

Hazard Statement

First Aid Information

Exposure Information

Name and Address of Company

Safety Labels

Labels are used as the first of communication and most commonly relied upon by the user for basic safety and health information:

- Name of product
- Hazard statement
- Explosive information
- First aid information
- Name and address of company

Remember, never remove a label from any container; or switch or replace contents of one container with contents or chemical from another.

MSDS (Material Safety Data Sheet)

The primary source of information for the employer and employee is the Material Safety Data Sheet, known as the "MSDS." According to OSHA regulations MSDS must be supplied by the chemical manufacturer, importer, or distributor to the buyer or end user.

Some of the information contained in these sections is of a scientific or technical nature, and maybe difficult for the average worker to understand. OSHA addresses this problem by stating that the company must provide all employees with a formal safety training program to include, how to read the MSDS.

The company must have a current MSDS for all chemicals in the workplace, and keep them in an accessible location in the plant. OSHA also states that the employees have the right to read and inspect the MSDS, whenever the need arises concerning safety issues or obtaining safety information.



The MSDS is a comprehensive document thoroughly detailing all aspects of the chemical. The basic areas covered are as follows:

- Basic Reference Information
- Hazardous Ingredients
- Physical/Chemical Characteristics
- Fire and Explosion Hazard Data
- Reactivity Data
- Health Hazard Data
- Precautions for Safe Handling and Use
- Control Measures

Basic Reference Information

The product information section gives the material's common name, chemical name, manufacturer's name and address, and emergency contact numbers.

Hazardous Ingredients

The hazardous ingredients section identifies the hazardous ingredients in the material.

Physical/Chemical Characteristics

Physical data gives the material characteristics, such as what it looks and smells like.

Fire and Explosion Hazard Data

Fire and explosion data give information on how to extinguish the material should it become ignited.

Reactivity Data

Reactivity data identifies the stability of the material and warns of what and how substances will react to it.

Health Hazard Data

Health hazard information explains routes of entry into the body, types of health effects, and emergency and first aid procedures.

Precautions for Safe Handling and Use

Safe handling precautions identifies proper methods for handling, cleaning, storage, as well as other protective measures.

Control Measures

The control and protective measures section lists the personal protective equipment to use when working with the material.

The OSHA Right-To-Know Act is a broad and far reaching program. It has had an immense impact on improving safety in the workplace. To maintain the effectiveness of the program compliance to the regulations and guidelines must be continuous. All the parties involved, the manufacturer, importer, distributor, employer, and employee will benefit tremendously in the long-run with the reduction of injuries, downtime, and equipment damage.

INFORM that the MSDS is important to everyone who works with hazardous chemicals. Being familiar with the each MSDS becomes critical in case of an emergency. It is important to take time to review all MSDSs involved in the work area.

EMPHASIZE that Material Safety Data Sheets contain all of the hazard information about each material. **The time to review the MSDS is before handling a new material.** MSDSs are placed in each work area.

Working in Areas with Harmful Fumes

In the operation of welding and cutting, toxic materials are given off in the form of smoke and other gases. Work areas in which this type of work is done must be well ventilated to prevent inhalation of toxic fumes and to prevent the possibility of oxygen deficiency. Certain metals, fluxes, and cleaning compounds are inhalation hazards. These include fluorine, lead, zinc, iron oxide, beryllium, cadmium, and mercury. If you doubt that ventilation is adequate, discontinue welding or cutting which involves these materials.

Using Ladders

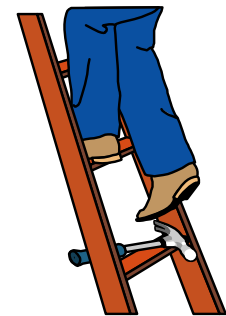
Ladders are common pieces of equipment in industrial plants. They are frequently needed to reach overhead machinery parts for installation or adjustment. And, while they are simple to use, they are involved in a substantial number of work accidents. Most of these involve falling from or with the ladder.



Slipping from slick oily shoes



Reaching too far



Tools on ladder



Standing on top rung



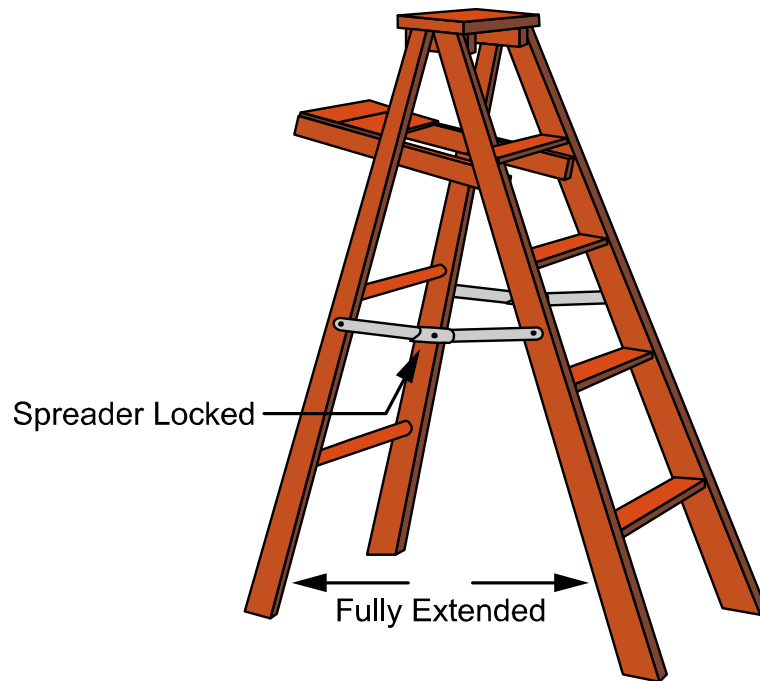
Facing away from ladder

Misuse of Ladders Can Be Hazardous

Some of the common causes of falling from ladders include the following:

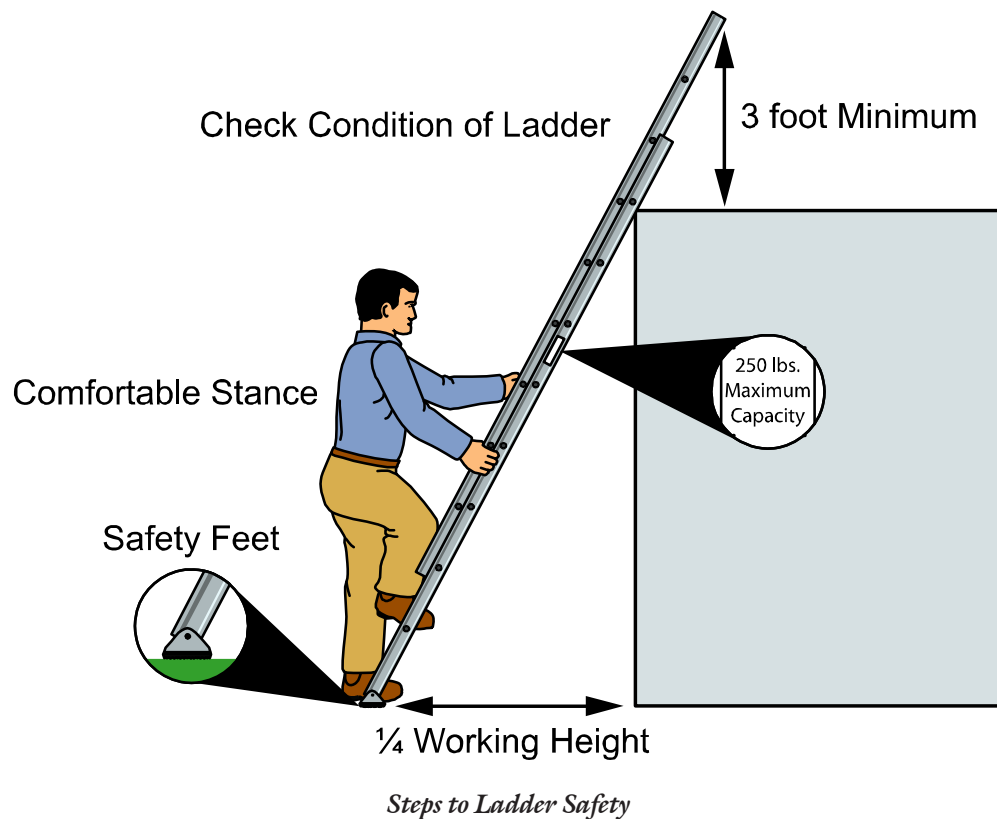
- Reaching too far to one side or too high.
- Walking down the ladder facing away from instead of facing it.
- Standing on the top rungs of step ladders.
- Slipping from rungs or steps because of wet or oily shoe soles or wrong types of shoes.
- Failing to remove tools from the ladder.

Ladders are made in two general types, step ladders and straight or extension ladders. To use a step ladder, spread the base to its full width and lock the spreader.



Correct Setup for Step Ladder

Avoid using the top shelf as a step. To aid balance, climb to a position where the waist portion of your body rests against the top step. If it is not possible to reach where you want from this position, you need a larger step ladder. To use a straight or extension ladder safely involves preparation.



1. Check the condition of the ladder. Check the steps or rungs for looseness or cracks. Tighten the tie rods if the rungs are loose. (A ladder should not be painted because the paint may cover defects.)
2. Make sure the ladder is equipped with safety feet to prevent the heel from slipping on a hard surface.
3. Check the load limit, which should be posted on the ladder. Make sure it is not exceeded.
4. Place the ladder so that it rests on a firm, level surface and is leaning against a solid object. Lean the ladder against the surface on which its top rests so that its base is about one foot from the surface for every four feet that the top extends up the surface.

5. Do not stand on the top two or three rungs of the ladder.
6. Avoid using metal ladders near electrical wiring. Contact with an energized bare wire can cause severe electrical shock.

Lifting Heavy Objects

As you work in the plant, remember the old saying "use your head and save your back." One out of five industrial injuries involves the back, with a substantial number of these injuries leading to lifelong pain or limited mobility or both. The best way to avoid back injuries from lifting is to avoid manually lifting heavy objects. When possible, use hoists, jacks, carts, or wheel trucks to move heavy objects. When these are not available, slide the object by pushing or pulling on it, if possible. When manual lifting has to be done, following certain rules can help prevent injuries.



Lifting Safely



Follow this procedure to lift safely:

1. Estimate the load to be lifted. If it is heavier than one person should attempt, get help.
2. Place feet properly. Spread your feet slightly (comfortably), with one foot slightly ahead of the other and alongside the object.
3. Bend knees, kneel, or squat. Get close enough to the load to reach under it without bending the back.
4. Use blocking under objects to get a handhold and to prevent mashed fingers.
5. Get a good grip. Be sure you can maintain your grip on the object. Use gloves when handling sharp or rough objects.
6. Let the legs do the lifting. To rise, straighten your legs, letting the powerful leg, arm, and shoulder muscles do the lifting.
7. Do not turn the body at the waist while carrying a load.
8. Lower the load to the floor from the carrying position by bending the knees while keeping the back straight. This keeps the load on the leg and arm muscles. Keep fingers and toes clear as the load is set.

Protecting Yourself Against Bloodborne Pathogens

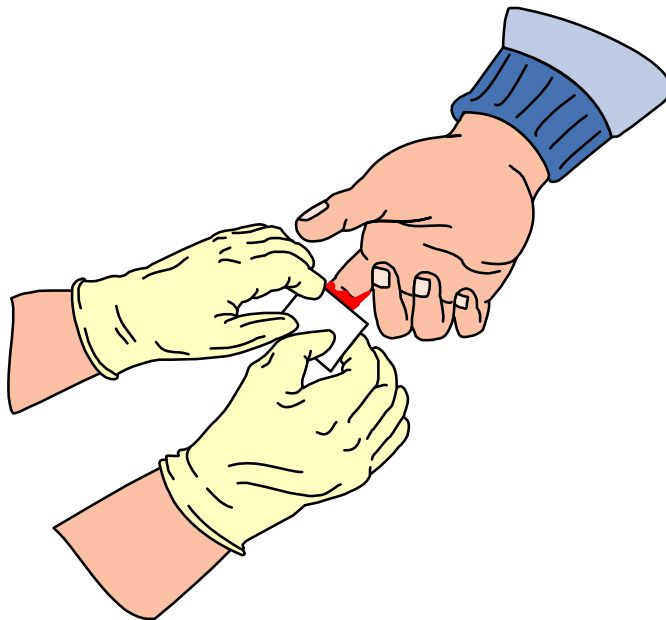
A bloodborne pathogen is a specific cause of disease, such as a virus or bacteria. “Bloodborne” means carried by or in blood and certain other body fluids. AIDS, hepatitis B and C, malaria, and syphilis are examples of diseases that are caused by bloodborne pathogens.

Bloodborne pathogens are transmitted through blood, saliva and other types of bodily fluids.

Job situations which may result in exposure include:

- Job duties that bring you into contact with needles or other sharp objects such as glass that might be contaminated with infected blood.
- Providing emergency first-aid assistance to coworkers.

It is important that you use universal precautions to prevent becoming infected by contaminated blood. Universal precautions means that all blood and body fluids are considered a potentially infectious.



Universal Precautions

Basic Personal Protective Equipment to prevent infection of a bloodborne pathogen:

- Gloves
- Eye Protection
- Face shields or masks
- Aprons, gowns, or lab coats



Personal Protective Equipment

Minimize your exposure by following the necessary rules and regulations.

Progress Check #3

1. When using electrical tools and machinery, what precaution should be observed in connection with the electrical plug if the tool or equipment is not double-insulated?

2. What should not be worn when working around electrical systems?

3. When restarting machinery which has been taken out of service for maintenance or servicing, procedures called _____ must be strictly followed.

4. What precautions should be observed when storing flammable materials?

5. Describe the correct manner of using a step ladder.

6. Describe the correct way to manually lift a heavy object.



Summary

To work safely, two basic factors are involved: knowledge and attitude.

Statistics show that human factors cause workplace accidents. Additional statistics show that arms, hands, and fingers are frequently injured in workplace accidents.

Preparation for doing a job safely includes assessing both the human factors and the job factors. Human factors include knowledge, skill, physical condition, and positive attitude. Job factors include what hazards are present, what safety apparel is available, what emergency equipment is available, and what job planning has been done.

Suitable clothing must be worn in the industrial plant environment. Inappropriate clothing contributes to accidental injury.

Safety equipment exists to protect all parts of the body that are susceptible to injury from workplace hazards. There are head coverings of different types to protect the head. Eye protection is provided by safety glasses, goggles, face shields, and filter lenses. Arm and hand protection is provided by different types of gloves appropriate to the type of hazard. Ear protection is provided by ear plugs or ear muffs. Lungs are protected by dust or chemical masks, depending on the hazard.

The work area itself can pose hazards if not maintained properly. Exits must be clearly marked, unblocked, and unlocked from the inside. Fire extinguishers should be available, conspicuous, and well-maintained. First-aid equipment should be available and its location clearly indicated. Floors should be clear of hazards, and gratings should be in place. Safety zones and lanes should be clearly marked and kept open.

Unsafe practices must be recognized and avoided. Included among these are wearing improper clothing around rotating and movable-parts machinery.

Electrical power warrants caution. Knowing the appropriate voltage for equipment, insuring correct grounding, and being alert to worn or frayed insulation are all important. Jewelry should not be worn when working with electrical systems.

Machinery taken out of service for maintenance or servicing should be restarted only by those who originally took it out of service.

Working with chemicals and solvents requires protection for eyes, skin, and, often, the lungs. Most solvents are very flammable; therefore, avoid exposure to any type of flame or intense heat.

Pneumatic and hydraulic-powered equipment uses gases or liquids under pressure. Injury can result from the release of this pressure by improper or accidental means.

Ladders can be dangerous if not used properly. Observe the precautions associated with use of step or straight ladders.

Lifting heavy objects manually should be avoided when at all possible. When it is necessary, the lifting should be done in a manner that the legs, and not the back, do the lifting.

In the operation of welding or cutting, toxic materials are given off in the form of smoke and gases. Areas where this work takes place must be well ventilated.

By combining the right attitude with the knowledge of the hazards and the safety equipment available to deal with those hazards, you can work safely. You can prevent injury to yourself and others.



Glossary

Bloodborne Pathogens	A specific cause of disease, such as a virus or bacteria that is transmitted through blood, saliva and other types of bodily fluids.
Caustic	Capable of burning, corroding, dissolving, or otherwise eating away by chemical action.
Contaminant	A substance that mixes with another substance and causes that substance to be impure, as when fumes from a solvent mix with fresh air.
Food and Drug Administration (FDA)	An agency of the Federal Government responsible for insuring the safety of drugs and health-related items such as safety glasses.
Material Safety Data Sheet (MSDS)	A comprehensive document thoroughly detailing all aspects of chemicals.
Mining Enforcement and Safety Administration (MESA)	An agency that provides testing services to manufacturers of equipment used in mining, such as masks and respirators.
National Institute of Occupational Safety and Health (NIOSH)	An agency of the Department of Health, Education, and Welfare that conducts research on various safety and health problems.
National Safety Council	An industry-supported organization that gathers information about accidents and provides training programs and information on accident prevention.
Occupational Safety and Health Administration (OSHA)	An agency of the Federal Government that sets and enforces safety standards. It has the authority to make inspections, issue citations, and levy fines for violations of its standards.

Solvent	A liquid capable of dissolving another substance.
Spontaneous Combustion	When a material or substance bursts into flame because of confinement of air within the material or substance.
Statistics	Collections of numerical data which are organized for interpretation and analysis.