OSHA 30-Hour Online Training For General Industry

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Introduction to OSHA

Lesson 1 Study Guide

LESSON PURPOSE:

The purpose of this lesson is to learn about how OSHA – the Occupational Safety and Health Administration – advocates to protect America's workers.

LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify the importance of OSHA to workers
- Describe employer responsibilities under OSHA
- List methods explaining how OSHA inspections are conducted
- Explain the worker safety and health resources available

OSHA® Occupational Safety and Health Administration

OSHA works to save lives, prevent injuries, and protect the health of America's workers.

About OSHA

OSHA is the Occupational Safety and Health Administration.

OSHA's mission is to protect the safety and health of America's workers.

OSHA accomplishes this by doing the following:

- Setting and enforcing standards
- Providing training, outreach, and education
- Establishing partnerships
- Encouraging continual process improvement in workplace safety and health

Hazard Prevention

Hazard prevention is OSHA's priority. Lives are saved when **workers know their rights** and **employers meet their responsibilities**.

Training

Training is an essential part of preventing hazards. One of the main responsibilities employers have under OSHA is to provide training on the **basics of occupational safety and health issues**. This training must **meet OSHA standards**.

Employers

OSHA holds employers responsible for **safety and health conditions in the workplace**.

Employees

The OSH Act points out that employees shall **comply with occupational safety and health standards** that are applicable to their actions and conduct.

The OSHA standards for Construction and General Industry are also known as Part 1926 and Part 1910.

Worker Rights Under OSHA

Workers should know their rights under OSHA.

OSHA requires employers to take certain actions to keep workers safe. Workers should also be aware of their rights under OSHA.

The United States Congress created OSHA under the Occupational Safety and Health Act of 1970, known as the OSH Act.

OSHA's creation provided workers with the right to a safe and healthful workplace.

Worker Rights

It's important to know your rights as a worker. Worker rights are spelled out under Section 11(c) of the OSH Act. They include the following:

- Right to seek safety and health on the job without fear of punishment
- Right to a safe and healthful workplace
- Right to know about hazardous chemicals through access to training, labeling, and an MSDS*
- Right to complain or request hazard correction from your employer
- Right to refuse work due to dangerous conditions
- Right to file a complaint with OSHA
- Right to be free from retaliation for exercising safety and health rights
- Right to participate in an OSHA inspection**
- Right to information about workplace injuries and illnesses***

** A Material Safety Data Sheet (MSDS) gives information about hazardous chemicals.*

*** During an OSHA inspection, you have the right to talk to the inspector privately.*

**** This includes the right to access and review the OSHA 300 Log and the OSHA 300A Summary.*

Employer Responsibilities Under OSHA

Employers must comply with OSHA standards and provide a workplace that is free from recognized hazards.

OSHA requires employers to do the following:

- Adopt practices and maintain conditions to protect workers on the job
- Be familiar with and comply with the standards that apply to their workplaces
- Ensure that workers are provided with (and use) PPE when needed

Worker Training

Employers must provide training to employees.

- Train workers in the specific safety and health aspects of their workplace
- Certain job assignments should be limited to specialized personnel

PPE

Employers must provide personal protective equipment (PPE) to employees.

- Train workers in the use of PPE
- Pay for most required PPE, including hard hats

Recordkeeping

Giving access to records is an important part of maintaining OSHA compliance.

Employers are required to provide workers with training, PPE, and worksite records.

- Keep records of injuries and illnesses on the worksite
- Keep and maintain an OSHA 300 Log, OSHA 301 Form, and OSHA Form 300A Summary
- Make these records available to employees for review

REMEMBER

Where no specific standard applies, employers must comply with the "General Duty Clause."

OSHA Inspections

OSHA enforces job safety and health standards through worksite inspections.

OSHA compliance safety and health officers (CSHOs) are authorized to conduct workplace inspections at reasonable times.

Employers are required to provide workers with training, PPE, and worksite records.

Priorities

OSHA has a system of inspection priorities.

PRIORITY	CATEGORY OF INSPECTION
1st	**Imminent Danger -** There is reasonable certainty that a danger exists. It is expected to cause death or serious physical harm immediately.
2nd	**Fatality/Catastophe -** The employer needed to report to OSHA any worker fatality or the hospitalization of three or more employees.
3rd	**Complaints/Referrals -** A worker or representative can file a complaint about a safety or health hazard in the workplace.
4th	**Programmed Inspections -** These are scheduled inspections covering industries and employers with high injury and illness rates, established hazards, or other exposures.

Stages

The four major stages of an OSHA inspection are:

1. Presenting Credentials
2. The Opening Conference
3. The Walkaround
4. The Closing Conference

REMEMBER

If an employer receives an OSHA citation, it must be posted for three days or until the violation is fixed.

Worker Resources

Part of knowing your rights means knowing where to go for help.

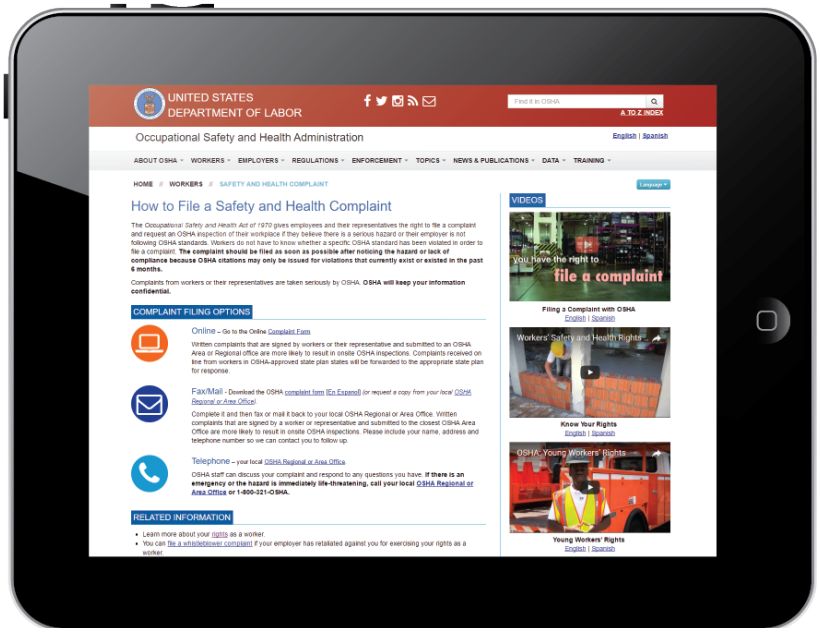
Workers and employers should work together to reduce hazards.

If possible, communicate and discuss safety and health problems with your employer.

However, if you feel that an **OSHA inspection is needed** to get hazards corrected at your workplace, **submit a written, signed complaint** with specific hazard information.

There are several ways to file a complaint:

- Download a complaint form from the OSHA website. Complete it and mail or fax it to OSHA
- Contact the local area office and file a complaint.
- File a complaint online



The OSHA website has safety and health information and links to resources that can help workers.

For more safety and health information, as well as links to resources for workers, visit the OSHA website at www.osha.gov.

REMEMBER

Be specific and accurate when completing an OSHA complaint form. The CSHO will use this information to research, plan, and begin the investigation.

NOTES:

Walking and Working Surfaces

Lesson 2 Study Guide

LESSON PURPOSE:

The purpose of this lesson is to recognize walking and working surface hazards can lead to serious injuries, and provide information to protector yourself from the risks.

LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify the common hazards associated with walking and working surfaces
- Describe the major types of walking and working surface hazards
- List methods that can be used to protect against walking and working surfaces hazards
- Explain employer requirements regarding walking and working surfaces

According to OSHA, slips, trips, and falls constitute most of general industry accidents.

Defining Walking and Working Surface Hazards

According to OSHA, slips, trips, and falls constitute most of general industry accidents.

A walking and working surface can be defined as any surface on which an employee walks or works to perform their job duties.

REMEMBER

Hazard prevention is OSHA's primary goal!

Below are some examples of ways to prevent walking and working surface-related injuries in the workplace:

- Keep surfaces clean and clear of obstructions
- Clean spills quickly and warn others of wet surfaces
- Report lights that have burned out or stopped working
- Remain alert for changes in elevation
- Use appropriate protective footwear and equipment

Human Factors

In addition to risks presented by the workplace itself, human factors also contribute to slips, trips, and falls.
Awareness of these human factors can prevent workplace injuries:

- Age and its effect on balance
- Fatigue
- Inattentiveness (e.g. daydreaming, using a cell phone)
- Poor/obstructed eyesight
- Inappropriate footwear

Slips, trips, and falls can lead to injuries, disabilities, and even death. Use caution and follow appropriate practices in the workplace.

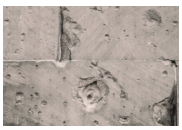
Types of Walking and Working Surface Hazards

Accidents and injuries caused by walking and working hazards are preventable if the proper precautions are taken.

The National Institute for Occupational Safety and Health (NIOSH) has defined the top 10 slip, trip, and fall hazards:

1 Contaminants on the walking surface
Common examples include water, grease, cleaning products, spilled items, sand, flour, and highly polished surfaces (e.g. marble, ceramic tile)

2 Indoor surface irregularities
Entrances, hallways, and drains are common indoor surfaces that are susceptible to damage, warping, buckling, and unevenness



3 Outdoor surface irregularities
Entrances, lawns, parking spaces, walkways, and drains are examples of outdoor surfaces that can become hazardous when they are poorly maintained, uneven, or contain protruding structures or holes

4 Snow and ice
Injuries occur in locations where snow and ice can accumulate – entrances, walkways, and stairs are common examples of these locations

5 Inadequate lighting
Vision impairment makes it difficult to see potential hazards
Often found in parking structures, storage rooms, hallways, stairwells, and walkways

6 Stairs and rails
Uneven stairs and handrails of improper height and position can cause injuries

7 Ladders and stepstools

8 Tripping hazards
Common examples include clutter and cords

9 Improper use of floor mats

10 Drains and pipes
Improper pipe alignment and clogged drains can lead to surface spills

Protecting Yourself from Surface Hazards

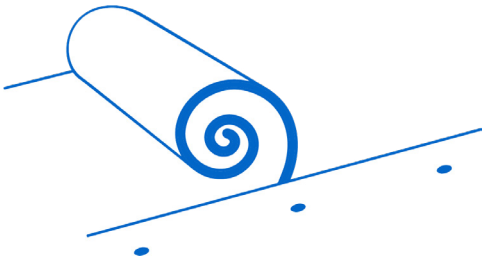
Protection is essential to the safety of everyone in the workplace.

Employees should always be prepared to protect themselves from the hazards associated with walking and working surfaces.

These are preparation techniques to decrease the risk of workplace injuries and accidents:

- Follow proper cleaning procedures for floors and always wear appropriate slip-resistant footwear when working with contaminants.
- For surface irregularities, remain as attentive as possible by surveying your surroundings and take extra precautions if vision is limited.
- Always be prepared in cold and wet conditions by wearing slip-resistant footwear, moving with caution, and using floor mats at entrances.
- Do not conduct work tasks if you cannot see clearly and inform your employer of poorly lit areas.
- When using stairs and rails, check for visual clues, surface contaminants, evenness, and available light.
- To protect yourself when using ladders and stepstools, always wear appropriate footwear and ensure they are on level ground. Always maintain three points of contact with the ladder while climbing. Never use the top of a regular stepladder as a step, and never use metal ladders near electrical equipment.
- To avoid tripping hazards, keep walkways clear by putting items away and keeping cords tangle-free and off the floor.
- Inform your employer and tend to the spill hazard if you notice any clogs or pipe spills.
- Protect yourself from floor and wall openings, and avoid weakened or damaged scaffolding.

Make sure you are trained in the proper usage of ladders to protect yourself.



Employer Responsibilities

Employers are responsible for maintaining the safety of walking and working surfaces.

Employers should inspect and perform preventative maintenance on walking and working surfaces on a regular basis to avoid serious injuries, lost work days, reduced productivity, and worker compensation claims.

Here are examples of standard employer requirements regarding walking and working surfaces:

- A written housekeeping program ensures that workers are prepared for contaminant spills and tripping hazards.
- For surface irregularities both indoors and out, faulty floor coverings, cracks, and holes should be repaired, and changes in elevation should be marked.
- Employers should have a snow and ice removal plan in place. When winter weather is imminent, employers should provide freezing weather monitors, extra slip-resistant mats, and information about icy and/or snowy conditions.
- Adequate lighting should be provided, especially in poorly lit areas. All bulbs should have an appropriate brightness.
- Employers should ensure that stairs have visual cues to provide a warning in change of elevation, have slip-resistant tread, are kept clean, and have adequate lighting.
- Handrails should be considered at locations with less than 4 steps. They should also be within consistent height range, and installed on both sides, as appropriate.

Make sure your workplace is compliant with OSHA standards.

- Employers should provide training in the proper use of ladders and stepstools. Training should cover the importance of appropriate footwear and equipment, using level surfaces, and keeping appropriate contact.
- Mats should be provided as needed to protect employees. Mats should be of adequate size and condition and should be secured to prevent movement.
- Employers should ensure that drains are regularly unclogged and that pipes are properly aligned to avoid spill hazards.
- Floor openings, wall openings, and scaffolding should be properly guarded.

NOTES:

Exit Routes, Emergency Action Plans, and Fire Prevention

Lesson 3 Study Guide

LESSON PURPOSE:

The purpose of this lesson is to provide you with information that enables you to recognize and eliminate potential hazards related to exit routes and fires.

LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify exit routes and fire hazards
- Describe the major types of exit routes and fire hazards
- List ways to protect yourself by utilizing an emergency action plan
- Explain how employers are responsible for implementing an emergency action plan

Exit Routes

Learn to recognize major exit routes on worksites.

Exit Routes Defined

OSHA defines exit routes as:

> "Continuous, unobstructed paths from a point in a building to a point of safety."

Exit route hazards occur when there are not enough exit routes for a person to safely evacuate the building or the area. There should be enough exit routes for everyone in the workspace to evacuate quickly and safely if there is an emergency.

Exit Route Parts

1. **Exit access** – The portion of the route that leads to the exit
2. **Exit** – The portion that provides a protected way of travel to the exit discharge
3. **Exit discharge** – The portion of the route that leads directly outside of the building

Examples of Exit Routes

- An exit route that is not clearly marked
- An exit door that is locked, barricaded, or blocked, or exit routes that lead through doors that could be locked
- A building that does not have enough exit routes to sufficiently accommodate the number of people in the building
- Exit doors that are not side hinged
- Exit routes that are not at least 7 ½ feet tall or 28 inches wide
- Exits that are not separated by fire-resistant materials
- Exit discharges that do not lead directly outside
- An exit route that is not a permanent part of the workplace

Fire Hazards

Learn how to identify fire hazards in the workplace.

Fire Hazards Defined

OSHA defines fire hazards as:

> "Items that could easily catch fire or start a fire."

Examples of Fire Hazards

- Candles
- Ovens
- Electrical wiring
- Chemicals

In the workplace, everyone is responsible for fire safety.

OSHA Standards for Exit Route and Fire Hazards

Poorly designed exit routes and evacuation plans have led to several tragic incidents. Because a blocked or locked exit route can lead to serious injury or death if an emergency happens, OSHA strictly enforces its standards for exit routes.

A fire extinguisher is a great example of a fire control device

The Triangle Shirtwaist Factory fire was one of the most prominent accidents in U.S. History. In 1911, 146 workers were killed.

Loss of life occurred because of several safety violations:

- Stairwell doors were locked
- Workers were trapped by long tables and bulky machines
- The building's fire escape was poorly built, resulting in its collapse as workers attempted to flee
- There were not enough available water buckets to douse the fire

Tragedies like this one have helped lead to many of the standards that now exist for all exit routes.

Types of Exit Route Hazards

When workers are trying to evacuate quickly, they need a clear path to safety.

Contributing factors to exit route hazards

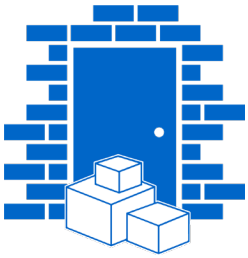
Obstructions

- According to OSHA:

> "Exit routes must be free and unobstructed. No materials or equipment may be placed, either permanently or temporarily, within the exit route."

Locked or blocked doors

- Exit doors must be unlocked and able to be opened from the inside at all times, without keys, tools, or special knowledge.

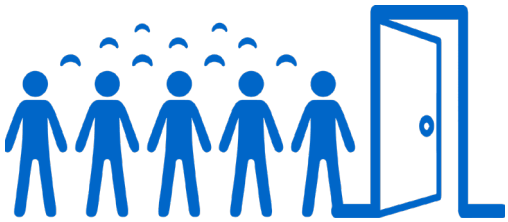


Poorly marked exit routes

- Exit routes must be easily identifiable, well lit, permanent, and contain an exit sign at each exit.
- Exit signs must be visible, illuminated from a reliable light source, and distinctive in color.

An insufficient number of exit routes

- A building must have enough exit routes to ensure that everyone in the workplace can evacuate safely.



Explosive or highly flammable materials

- An exit must be separated from the workplace by fire-resistant materials in the event of a fire or explosion preventing occupants from evacuating.

Types of Fire Hazards

The recognition of fire hazards is necessary for workplace safety.

Contributing factors to fire hazards

Flammable and combustible materials

- Because these materials can ignite at any time, a workplace must have adequate fire control devices (e.g. hoses or fire extinguishers).
- When flammable liquids are used, there must be a way to dispose of leakage or spills promptly and safely. Regular disposal of these liquids must be practiced.

High hazard areas and hazardous materials

- High hazard contents are materials that are likely to burn quickly or produce poisonous fumes or explosions in a fire.
- An exit route should not be designed to have people walking toward or into high hazard areas.
- If materials are not handled and stored carefully and properly, it could lead to a fire or another type of workplace disaster.

Ignition sources

- Employees MUST be aware of potential ignition sources in their workplace, and keep them away from flammable and combustible materials.
- Examples include:
  - Open flames
  - Lighters
  - Space heaters
  - Heat guns
  - Static electricity
  - Hot surfaces
  - Electric arcs and sparks
  - Welding equipment

Electricity hazards

- Most electrical hazards can be eliminated through safeguards and safe work practices:
  - Using ground fault circuit interrupters
  - Ensuring that exposed boxes are made of non-conductive material
  - Using plugs designed to prevent energization until insertion occurs
  - Making sure that circuit breaker and fuse boxes are appropriately labeled
  - Providing training on how to properly use equipment and follow instructions when using equipment

Emergency Action Plan

When there is an emergency in your workplace, you should know what to do.

An emergency action plan...

- Must be in writing, kept in the workplace, and be available to all employees for review.

REMEMBER

If the company has 10 or fewer employees, the plan can be communicated orally.

- Contains important information about emergency evacuation procedures, floor plans/maps showing emergency escape routes, and actions to be taken by employers and employees in an emergency.
- Covers all types of emergencies, such as fires, explosions, toxic chemical releases, hurricanes, tornadoes, blizzards, and floods.
- Describes additional responsibilities that are to be carried out by specified employees to ensure an emergency is handled as smoothly as possible.

EXAMPLE

The designated emergency response coordinator is responsible for directing emergency activities, ordering an evacuation, contacting emergency services, and answering questions about the company's emergency action plan.

Many emergencies in the workplace can be prevented by taking proper safety precautions.

Here are some examples:

- Ensure hazardous materials and flammable liquids are properly handled and kept away from ignition sources
- Unlock or unblock exit doors and remove obstructions from exit routes
- Wear appropriate personal protective equipment, as appropriate
- Fix or replace fire alarms and/or fire extinguishers
- Lock out, tag, and replace worn or frayed electrical cords

Fire Detection Systems must meet OSHA standards. They are required to be Installed correctly, tested regularly, maintained in working condition, kept on when not being serviced, cleaned regularly, equipped with supervised systems, and repaired or replaced when not working properly.

Fire Extinguishers help put out and/or control small fires. They must be mounted, located, and identified so that they are easily accessible to employees without subjecting them to possible injury. They must also be maintained, fully charged, operating properly, and kept in their designated locations when not being used.

Type	Description	Symbol
Class A	Designed to stop paper, cloth, wood, and many plastic fires	A
Class B	Used on fires in oil, gasoline, some paints, lacquers, grease, solvents, other flammable liquids	B
Class C	Used for fires in wiring, fuse boxes, energized electrical equipment, computers, and other electrical sources	C
Multipurpose	Can be used on fires normally requiring Class A/B/C extinguishers	N/A
Class D	Used on fires involving powders, flakes, or shaving of combustible metals	D
Class K	Used on kitchen fires	K

Employer Responsibilities

Employers are required by OSHA to provide a workplace free from serious recognized hazards.

Emergencies are never expected, but they can happen any time. Employers are responsible for establishing an effective emergency action plan and preparing their workers to handle any emergencies that might occur in the workplace.

It is the employer's responsibility to ensure their workplace complies with OSHA standards and requirements for exit routes, fire prevention, and emergency action procedures.

Requirements for Exit Routes

- Permanent
- Enough exits in the proper arrangement for speedy escape
- Separated by fire resistant materials
- Exit openings must be limited to those necessary to allow access to exit or exit discharge
- Must be protected by approved self-closing fire door
- Must be maintained during construction, repairs, or alterations
- Arrangement of exit routes should be so that an employee will not have to travel toward a high hazard area, unless it is effectively shielded
- Emergency safeguards (i.e. sprinkler and alarm systems) must be working

Requirements for Emergency Action Plans

Once an employer develops a comprehensive emergency action plan, they must properly communicate it to their employees to avoid panic, confusion, and misinformation. It should be regularly evaluated and updated as needed.

Employers should train their employees about workplace hazards and teach them what to do in an emergency. Every employee should be familiar with the evacuation plan, alarm system, reporting and shutdown procedures, and potential emergencies.

Housekeeping is a vital part of maintaining a safe workplace. Here are examples of OSHA standards for housekeeping:

- Keeping all workplaces, passageways, storerooms, and service rooms clean, orderly, and sanitary
- Keeping aisles and passageways clear and in good repair, with no materials or obstructions that might create a hazard
- Making sure that working surfaces are cleared of debris, especially solid and liquid wastes, at the end of each work shift or job

Alarm systems are designed to alert people inside a building when there's an emergency. OSHA states:

> "Employers must install and maintain an operable employee alarm system that has a distinctive signal to warn employees of fire or other emergencies."

Alarms must be recognized by all employees as a signal to evacuate the work area or perform actions identified in the emergency action plan.

Employer Responsibilities

It is important that the company's emergency action plans are properly communicated.

Requirements for Fire Prevention Plans

Fire prevention plans must include the following:

- List of all major fire hazards in the workplace
- Proper handling and storage procedures for all hazardous materials
- Potential ignition sources and how they're controlled
- Type of fire protection equipment necessary for each hazard
- Procedures for controlling flammable and combustible waste
- Procedures for maintenance of safeguards on heat-producing equipment
- Name/job title of employees responsible for maintaining equipment or controlling fuel source hazards

A poorly planned evacuation can result in confusion, injury, and property damage. To avoid these, employers should do the following:

- Designate evacuation wardens to check offices, restrooms, and other areas to make sure all workers have evacuated the area
- Give someone the task of accounting for all employees
- Encourage their employees to know where they should go in the event of a building evacuation order
- Train employees to shut off equipment in the event of a critical operation shut down
- Provide a medical and first aid program

Any time an employee is hospitalized, has a body part amputated, or loses an eye due to a work-related accident, the employer must notify OSHA in person or over the phone within 24 hours. If there is a workplace fatality, the employer must notify OSHA within 8 hours.

NOTES:

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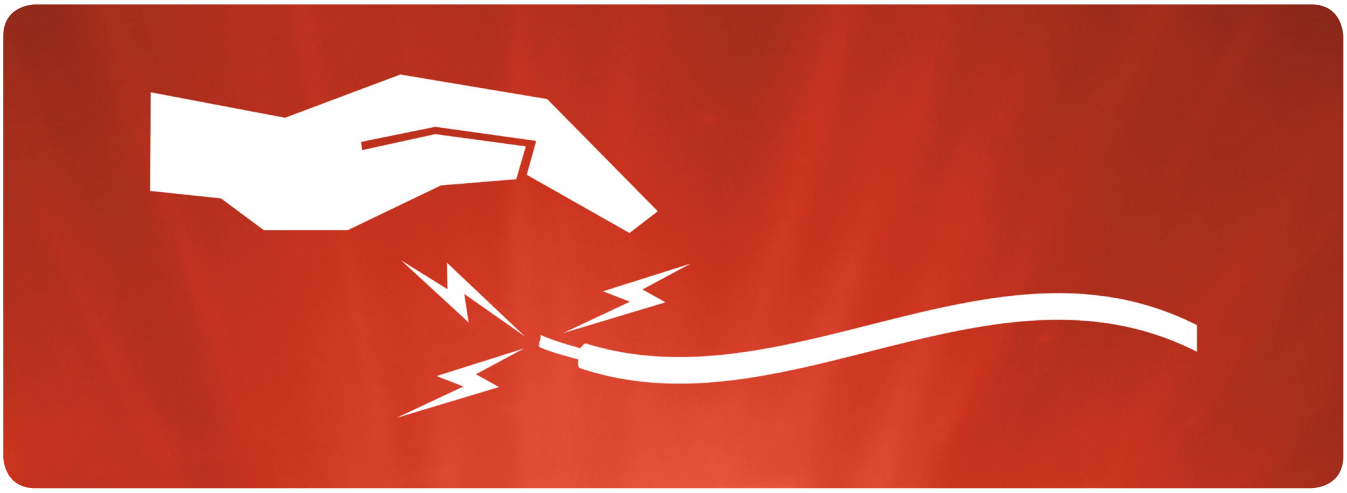


Electrical Hazards

Lesson 4 Study Guide

LESSON PURPOSE:

The purpose of this lesson is to provide you with information that enables you to recognize electrical hazards and how to eliminate them by adhering to OSHA standards.

LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify major electrical hazards
- Describe types of electrical hazards
- List safety measures to protect yourself from electrical hazards
- Explain employer requirements to protect workers from electrical hazards

Any time you work with electricity in the workplace, there is potential for hazards, and you must be prepared to protect yourself.

Electrical Hazards Defined

OSHA defines electrical hazards as:

> "Dangerous situations in which a worker can make, or does make, electrical contact with energized equipment or conductors. When contact is made, whether directly or indirectly, workers are at risk of serious injury."

Electrical hazards are serious workplace hazards that expose workers to the following:

- **B**URNS
- **E**LECTROCUTION
- **S**HOCK
- **A**RC FLASH/ARC BLAST
- **F**IRE
- **E**XPLOSIONS

Note the first letter of these hazards. Together, they spell "Be Safe." Workers can "Be Safe" in the workplace by recognizing, avoiding, and protecting against electrical hazards.

Always remember to B.E. S.A.F.E. in the workplace.

Burns. Burns are the **most common electricity-related injury**. There are three types of burns:

- **Electrical burns**
  - Caused by heat generated by the flow of electric current. Tissue damage is common.
- **Arc/flash burns**
  - Caused by high temperatures produced by electric arcs or explosions close to the body.
- **Thermal contact burns**
  - Occurs when skin and/or clothing comes in contact with electric equipment.

Electrocution. Electrocution is fatal. It results when a person is exposed to a **lethal amount of electrical energy**.

Shock. Electrical shock is defined as a "reflex response to the **passage of electric current through the body**." This means that shock occurs when a human body becomes part of an electrical circuit. When this happens, electrical current enters the body at one point and leaves at another.

Arc Flash/Blast. An arc flash is the sudden **release of electrical energy through the air** when a high-voltage gap exists and there is a breakdown between conductors. An arc flash gives off thermal radiation (heat) and bright, intense light that can cause burns.

Fire. Most **electrical fires** result from "fixed wiring" problems such as faulty electrical outlets and old wiring. Another source of electrical fires includes problems with cords (such as extension and appliance cords), plugs, receptacles, and switches.

Explosions. An explosion can occur when **electricity ignites an explosive mixture** of material in the air. In an atmosphere that contains explosive gases, vapors, or combustible dust, even low levels of electricity can lead to violent explosions on the worksite.

Accidents caused by Electrical Hazards

Workers should always be prepared to protect themselves from electrical hazards.

Working with or near electricity presents a variety of risks. Workers should always be prepared to protect themselves from electrical hazards. Although many assume that it will never happen to them, injuries and fatalities caused by electricity are common in the workplace.

Lockout/tagout procedures

The control of hazardous energy, by locking out or tagging out equipment, is one of the most frequently violated OSHA standards. Accidents related to improper lockout/tagout procedures are preventable.

REMEMBER

Remaining alert for hazards and adequately preparing yourself for each new task can help ensure that you do not contribute to electrical injury statistics in the workplace.

[insert caption about Lockout/tagout]

The following is a six-step process for lockout/tag out procedures:

1. **Plan and prepare for shutdown** by locating and identifying all energy sources and notifying all appropriate personnel
2. **Shut down** all equipment using proper procedure
3. **Isolate energy** by separating the equipment from external energy sources
4. **Apply locks and tags** on each device as required
5. **Control stored energy** by discharging any energy stored in the equipment
6. **Verify isolation of energy**

Types of Electrical Hazards

Learn how to protect yourself from many types of electrical hazards you'll face in the workplace.

Each year, approximately 4,000 workers suffer from electricity-related injuries, many which can be avoided if proper precautions are taken.

Common examples of electrical hazards, and ways to avoid these hazards, are explained below:

- Contact with power lines
  - Receive proper training
  - Wear proper protection
  - Work safely
  - Do not make contact, directly or indirectly, with live power line
- Contact with energy sources
  - All live parts of electrical equipment that operate at 50 volts or more must be guarded.
  - Electrical outlets, switches, and junction boxes must have covers.
  - Electrical panels must have a dead front, which separates live wires from a person and prevents them from getting shocked.
  - Four of the most common energized sources that can lead to injuries and accidents include **light fixtures, improper wiring, water, and failure to lock out and tag out**.
- Improper use of power cords
  - Normal wear and tear on extension and flexible cords can loosen or expose wires, causing potential danger.

Types of electrical injuries

Electrical hazards can lead to various injuries, ranging from minor discomfort to death.

CURRENT	REACTION
Below 1 milliampere	Generally not perceptible
1 milliampere	Faint tingle
5 milliamperes	Slight shock felt; not painful but disturbing. Average individual can let go. Strong involuntary reactions can lead to other injuries.
6-25 milliamperes (women)	Painful shock, loss of muscular control
9-30 milliamperes (men)	The freezing current of "let go" range. Individual cannot let go, but can be thrown away from the circuit if extensor muscles are stimulated.
50-150 milliamperes	Extreme pain, respiratory arrest, severe muscular contractions. Death is possible.
1,000-4,300 milliamperes	Rhythmic pumping action of the heart cease. Muscular contraction and nerve damage occur, death likely.
10,000 milliamperes	Cardiac arrest, severe burns; death probably

This chart details the body's reaction to varying levels of electric shock.

The severity of electrical shocks and burns can depend on a variety of factors:

- The pathway through the body
- The amount of current flowing through the body
- The length of time of exposure
- Whether or not the skin is wet or dry.

Important electrical current terminology:

- Amp/Amperage: The strength of an electrical current. 1 amp is equal to 1,000 milliamps.
- Ohm (Ω): A unit of measurement for electrical resistance.
- Resistance: The ability of a material to decrease or stop electrical current.

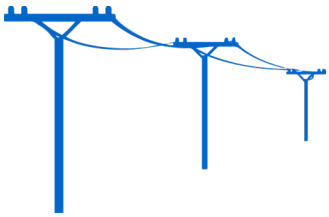
REMEMBER

Following the appropriate steps when working with electricity can protect you from these injuries.

Protecting Yourself from Electrical Hazards

Learn how to protect yourself from the risks posed by electrical hazards.

There are a variety of strategies to protect yourself from electrical hazards in the workplace.



When working with **power lines**, remember to…

- Always keep a safe distance away – at least 10 feet - from overhead power lines
- Ensure the lines have been de-energized and grounded
- Use only nonconductive tools and materials

The use of **ground-fault circuit interrupters (GFCIs)** can greatly improve the safety for those working with electricity in the workplace. A GFCI detects ground faults and interrupts the flow of the electric current to prevent or lessen the effect of an electric shock. GFCIs should be tested at least once a month and especially after a blackout or power failure.

The three types of GFCIs include:

- Receptacle: able to fit into a standard outlet box
- Portable: designed for easy transport by way of an extension cord
- Circuit breaker: controls an entire circuit and is installed as a replacement for a circuit breaker on the main circuit board.

Power cords must be inspected prior to use to ensure that they are in good operating conditions. When inspecting and using flexible extension cords, you should:

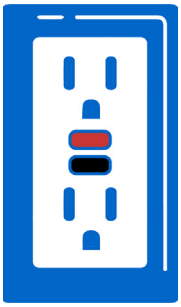
- Ensure that the cord rating matches the specified need for durability
- Check for cord damage, which can expose electrical conductors and the associated hazards.

When using **powered tools** and equipment in the workplace, it is important to use them only as they have been designed:

Always	Never
• Disconnect tools when not in use • Make sure your working area is well lit • Wear appropriate clothing/ equipment • Use double-insulated tools • Ensure cords do not cause a tripping hazard	• Carry a tool by the cord • Yank a cord to disconnect it • Hold tools in a way that could cause accidental starting • Use or store tools in wet/ damp environments • Place cords near heat, oil, or sharp edges

Protecting Yourself from Electrical Hazards

Learn how to protect yourself from the risks posed by electrical hazards.



Guarding can help prevent employees from accidentally contacting energized equipment. Guarding involves moving or enclosing electric equipment with doors, fences, or other types of barriers to prevent accidental contact with live parts.

Grounding prevents the buildup of voltages that could cause an electrical hazard. When you ground a tool or electrical system, you are intentionally creating a low-resistance path that connects to the earth. Grounding does not guarantee that a worker won't be shocked by an electrical current, but it will substantially reduce the risk, especially when used along with other safety measures.

Insulators, like glass, mica, rubber, and plastic, help reduce or stop the flow of electrical current. Insulation is used to coat metals and other conductors to help prevent shock, fires, and short circuits. All **conductors** used for general wiring must be insulated unless otherwise permitted by OSHA electrical regulations. The conductor insulation must be of a type that is approved for the voltage, operating temperature, and location of use.

A **disconnecting means** is a switch that is used to disconnect the conductors of a circuit from the source of electric current. These switches are important because they allow the flow of electricity to be stopped, which can protect workers and equipment.

When dealing with disconnecting means, pay attention to the following:

1. Each disconnect switch and circuit must be legibly marked.
2. These markings shall be of sufficient durability to withstand weather, chemicals, heat, corrosion, or any other environment.
3. Each disconnect switch or overcurrent device required for a circuit must be clearly labeled to indicate the circuit's function.

Common Personal Protective Equipment (PPE) when working with or near electricity includes the following:

- Safety glasses
- Face shields
- Hard hats
- Safety shoes
- Insulating rubber gloves
- Insulating sleeves
- Flame-resistant clothing

REMEMBER

Correctly following **lockout/tagout procedures** when working with electrical equipment is another way that workers can protect themselves from electrical hazards. Compliance with lock out/tag out procedures prevents an estimated 120 fatalities and 50,000 injuries each year.

Employer Responsibilities

Employers must take certain steps to ensure the safety of workers.

It is the employer's responsibility to ensure their workplace complies with OSHA standards and requirements for electrical hazards.

Because injuries involving electricity can be serious, or sometimes fatal, workers must be properly trained before they can work with electricity.

Employers must protect their employees from electrical hazards in the following ways:

- Ensure that workers maintain a safe distance from lines and have the power company de-energize, ground, and properly insulate lines.
- Enforce the isolation of electrical parts by making sure all pull boxes, junction boxes and fittings are covered, and all metal covers are grounded.
- Ensure that every electric utilization system and all utilization equipment installed, majorly modified, or replaced after March 15, 1972, complies with the standards for electricity set by the National Fire Protection Association, which have been adopted by OSHA.
- Enforce the use of ground-fault circuit interrupters (GFCIs)

Employers and employees must cooperate in order to maintain a safe working environment.

- Establish an Assured Equipment Grounding Conductor Program (AEGCP), which covers all cord sets, receptacles that are not a part of the permanent wiring of a building or structure, and any equipment connected by a cord and plug made available for use by employees.
- Make sure that all moving electrical equipment on the job site is barricaded, all power tools being used are kept in safe working condition, and that all lockout/tagout practices on the job site are being enforced.
- Implement a first-aid system that is readily available for use
  - If a worker is shocked, it is imperative that victims are attended to as quickly as possible since brain damage, or even death, can occur if blood flow is not reestablished within four minutes.

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Personal Protective Equipment (PPE)

Lesson 5 Study Guide

LESSON PURPOSE:

The purpose of this lesson is to present you with current OSHA and industry information about worksite illnesses, injuries, and fatalities, and learn how to recognize the types of PPE available to protect workers from those hazards.

LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify types of PPE
- Describe major types of PPE
- List different ways to protect yourself using PPE
- Explain employer requirements for providing PPE

Use personal protective equipment (PPE) to minimize your exposure to hazards.

PPE Defined

OSHA defines personal protective equipment:

> "Personal Protective Equipment is equipment worn to minimize exposure to a variety of hazards."

When to Use PPE

Use personal protective equipment when engineering, work practice, and administrative controls are not possible or do not provide workers with sufficient protection.

Types of PPE

Examples of personal protective equipment generally fall into the following categories:

- Eye and Face Protection
- Head Protection
- Leg and Foot Protection
- Hand and Arm Protection
- Hearing Protection
- Body Protection
- Respirators

PPE must be appropriate to your **job site**, **tasks**, and **potential hazards**.

Types of PPE and How to Protect Yourself

Remember the basics about different types of PPE.

Eye and Face Protection

- Protect yourself from eye and face injuries.
- PPE should be fitted by a trained professional.

Head Protection

- Protect yourself from serious or fatal head injuries.
- You must use head protection if there is danger of falling objects.
- PPE must meet ANSI standards.

Leg and Foot Protection

- Protect yourself from foot and leg injuries.
- Check PPE for wear and tear before using it.
- PPE must meet ANSI standards.

Hand and Arm Protection

- Protect yourself from harmful substances coming into contact with your skin.
- PPE must be specific to the hazards present.
- Inspect PPE prior to each use.
- Make sure PPE fits properly.

Hearing Protection

- Protect yourself against hearing loss.
- Check the equipment's Noise Reduction Rating.
- Protection is mandatory if you already suffer from hearing loss.

Body Protection

- Protect yourself from bodily injury.
- Select appropriate body protection based on the hazard assessment.
- Make sure the type of material is appropriate for the job.
- Ensure a proper fit and coverage to protect yourself from the specific hazard.

Respirators

- Protect yourself from insufficient oxygen environments.
- Use and clean respirators properly.
- Do not wear a respirator in an atmosphere it was not designed for.
- If employees will use respirators, employers must have a written respiratory program.

Eye and Face Protection

Use PPE to protect your eyes and face from hazards such as chemical splashes and flying particles.

When working on a worksite, you'll be exposed to many different hazards that can damage your eyes and face.

Potential eye and face injury hazards include flying particles and chemical splashes.

A face shield and goggles help protect your eyes and face from hazards.

Use PPE to protect yourself from these and other hazards. Note that eye and face protection selected for employee use must clearly identify the manufacturer.

Examples of PPE that protects your eyes and face include the following:

Safety Spectacles – These are protective eyeglasses with impact-resistant lenses. They may also have side shields.

Goggles – These provide protection that completely covers the eyes. They provide protection from impact, dust, and splashes. Goggles should fit over your eyeglasses.

Face Shields – These are transparent sheets of plastic that cover you from chin to head. They protect against splashes or sprays from liquids.

REMEMBER

- Your goggles and safety spectacles should be fitted by someone skilled in the procedure.
- Fit adjustable features on an individual basis.
- If you wear corrective lenses such as eyeglasses, your PPE should fit over them, or otherwise incorporate your existing lenses as applicable.
- Wear eye protection over contact lenses if required.
- Replace scratched lenses and ineffective headbands when necessary.
- Clean and disinfect your eye and face protection regularly and thoroughly. Do not share protective eyewear.

Head Protection

Use PPE to protect yourself from head injuries that can cause impairment or may be fatal.

When working on a worksite, you'll be exposed to many different hazards that can result in serious or fatal head injuries.

Potential head injury hazards include impact, penetration, electrical shock, and burns.

Examples of PPE that provides head protection include **safety helmets** and **hard hats**.

You might need to wear head protection in addition to other types of PPE, such as safety goggles or ear plugs.

REMEMBER

- Hard hats must meet ANSI standards* and be appropriate for the job site.
- Wear head protection when there is danger of falling objects from above.
- Use the appropriate Class of hard hat for your job.**
- Clean and inspect your headgear.
- Replace hard hats that are compromised.
- Always replace a hard hat that has sustained an impact, even if you don't see any damage.

MEDICAL ALERT

Examples of head injuries include:

- Being struck on the head by falling objects.
- Bumping the head against fixed objects such as exposed pipes or beams.
- Suffering from contact with electrical hazards.

** OSHA requires hard hats to meet standards set by the American National Standards Institute (ANSI). Hard hats must be shown to provide protection that's equivalent to or better than the standard.*

*** Class A, Class B, and Class C hard hats are ANSI approved.* ***Bump hats are not ANSI approved****, and they only protect against head bumps and lacerations.*

Leg and Foot Protection

Use PPE to protect yourself against leg and foot injuries.

When working on a worksite, you'll be exposed to many different hazards that can injure your legs and feet.

Potential hazards include: falling or rolling objects; materials that can crush or penetrate the legs and feet; and exposure to hot substances and corrosive or poisonous materials.

*Safety footwear must meet ANSI minimum compression and impact performance standards.**

Examples of PPE that protects your legs and feet include the following:

Leggings – These protect the lower legs and feet from heat hazards such as molten metal or welding sparks.

Metatarsal Guards – These protect the instep area from impact and compression.

Toe Guards – These fit over the toes of regular shoes, protecting the toes from impact and compression hazards.

Combination Foot and Shin Guards – These protect the lower legs and feet.

Safety Shoes – These protect the feet from hot work surfaces. By design, they may be electrically conductive or non-conductive.

REMEMBER

- Protect your legs and feet from exposure to hot substances and corrosive or poisonous materials.
- Wear non-conductive footwear if your feet will be exposed to electrical hazards.
- Wear conductive footwear if you'll be exposed to static electricity.
- Safety footwear must meet ANSI minimum compression and impact performance standards.*
- Inspect footwear prior to each use.
- Make sure PPE fits properly.

** Protective footwear must be compliant with standards set by the American National Standards Institute (ANSI). PPE must be shown to provide protection that is equal to or better than the standard.*

Hand and Arm Protection

Use PPE to protect your hands and arms from injury.

When working on a worksite, you'll be exposed to many different hazards that can injure your hands and arms.

Potential hazards include absorption of harmful substances.

Examples of PPE that protects your hands and arms include **gloves**, **finger guards**, **arm coverings**, and **elbow-length gloves**.

Selecting PPE

Consider the following factors when selecting gloves for hand and arm protection:

- Type of chemicals handled
- Nature of contact (total immersion, splash, etc.)
- Duration of contact
- Area requiring protection (hand, forearm, and/or arm)

Note that neoprene gloves offer good pliability, and protect against harmful elements such as hydraulic fluids, gasoline, and alcohol.

Employers should work to eliminate hazards using engineering and work practice controls. Use PPE for extra protection against hazards that cannot be eliminated.

Select the right kind of gloves for the job.

REMEMBER

- Prior to each use, inspect PPE for rips, cracks, separation of materials, worn grip, or worn abrasion resistance.
- Make sure gloves and guards fit properly.
- Neoprene gloves offer good pliability, and protect against harmful elements such as hydraulic fluids, gasoline, and alcohol.

Hearing Protection

Use PPE to prevent hearing loss.

When working on a worksite, you'll be exposed to many different hazards that can damage your hearing.

Potential hazards include exposure to loud noises.

The protective value of earmuffs can be reduced by glasses, long hair, facial hair, and facial movements such as chewing.

Examples of PPE that protects your hearing include the following:

Single-Use Earplugs – These are self-forming and are made of waxed cotton, foam, silicone rubber, or fiberglass wool.

Pre-Formed or Molded Earplugs – These must be individually fitted by a professional. They may be disposable or reusable.

Earmuffs – These require a perfect seal around the ear.

REMEMBER

- **Ensure a proper fit and form** of earmuffs and earplugs, especially when PPE is being used over corrective lenses or with long hair or facial hair.
- **Inspect PPE prior to each use**.
- **Check the Noise Reduction Rating**, which is identified on the product package, and confirm that it provides adequate hearing protection for the nature and duration of the job.

Body Protection

Use PPE to protect yourself from bodily injury.

When working on a worksite, you'll be exposed to many different hazards. Body protection is required when workers are exposed to the following hazards:

- Cuts
- Radiation
- Extreme Temperatures
- Hot Splashes
- Impacts from Tools
- Machinery and Materials
- Hazardous Chemicals

Examples of PPE that provides body protection include the following:

- Laboratory coats
- Coveralls
- Vests
- Jackets
- Aprons
- Surgical gowns
- Full body suits

Protective Material

Select appropriate body protection based on the hazard assessment and tasks associated with the job. Protective clothing comes in a variety of materials, including the following:

- Paper-like fiber
- Treated wool and cotton
- Cotton duck
- Leather
- Rubber
- Rubberized fabric
- Neoprene
- Plastic

Respirators

Use PPE to protect yourself from hazardous environments.

When working on a worksite, you may be exposed to a variety of atmospheres and environments.

Potential hazards include exposure to insufficient oxygen environments and harmful dust, fog, smoke, mist, gas, vapors, and sprays.

Types of respirators include the following:

Particulate Respirators – These filter out airborne particles.

Air-Purifying Respirators with Cartridges or Canisters – These remove contaminants from the air.

Atmosphere Supplying Respirators – These supply clean air from another source to the user.

All respiratory equipment must be National Institute for Occupational Safety and Health (NIOSH) certified and approved.

MEDICAL ALERT

Health risks associated with respiratory hazards include:

- Cancer
- Lung Impairment
- Disease
- Death

REMEMBER

- Use and clean respirators properly.
- Choose a respirator that's certified for use to protect against the specific contaminant(s) to which you'll be exposed.
- Do not wear a respirator in an atmosphere that contains contaminants which the respirator was not designed for.

Employer Responsibilities

Employers and employees must cooperate in order to establish and maintain a safe and healthful working environment.

Employer Requirements for PPE

In general, employers are responsible for the following:

- Performing a hazard assessment of the workplace.
- Identifying and providing appropriate PPE for employees.
- Maintaining PPE, including replacing worn or damaged PPE.
- Periodically reviewing, updating, and evaluating the effectiveness of the PPE program.

Performing a hazard assessment is the first step towards developing a comprehensive safety and health program.

During the hazard assessment, the employer determines the potential physical or health-related hazards on the job site.

Physical hazards can include the following:

- Moving objects
- Changing temperatures
- High-intensity lighting
- Rolling or pinching objects
- Electrical hazards
- Sharp edges

Health hazards can include overexposure to the following:

- Harmful dusts
- Chemicals
- Radiation

Performing a hazard assessment is the first step towards developing a comprehensive safety and health program.

Training

Employers are required to provide effective training to employees who use PPE. The training must be comprehensive and understandable, and it must include the following information:

- When and how to use and wear PPE
- Which type of PPE to use
- Proper fit and maintenance of PPE
- PPE limitations

Employers must provide PPE to employees, and employers are responsible for all protective equipment. Employer-provided PPE must protect employees from injuries and hazards.

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Hazard Communication

Lesson 6 Study Guide

LESSON PURPOSE:

The purpose of this lesson is to identify how hazard communication provides a common approach to ensure that workers understand the types of chemicals in their workplace and how to properly handle them.

LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify the Hazard Communication Standard (HCS)
- Describe the classifications and categories of chemical hazards
- List ways that the Hazard Communication Standard (HCS) protects employees in the workplace
- Explain employer responsibilities for providing a Hazard Communication Program

Hazard communication is critical to preventing serious injuries on the job.

According to OSHA, approximately 32 million workers work with and are potentially exposed to hazardous chemicals in the workplace. These chemicals can cause health problems, ranging from minor skin irritations to serious injuries or diseases like cancer.

The Hazard Communication Standard (HCS) is an OSHA standard that provides information about hazards and identities of chemicals in the workplace.

Various protective measures should be taken to ensure safety for both employers and employees in the work environment. Examples include the following:

- Identifying and listing hazardous chemicals found in the workplace
- Obtaining safety data sheets (SDS) and labels for each hazardous chemical
- Developing a written Hazard Communication program

Hazardous Chemical Classifications

Health hazards caused by chemical exposure	*Physical hazards caused by chemical exposure*	*Other chemical classifications*
• Acute Toxicity • Skin Corrosion/ Irritation • Serious Eye Damage/Eye Irritation • Respiratory or Skin Sensitization • Germ Cell Mutagenicity • Carcinogenicity • Reproductive Toxicity • Specific Target Organ Toxicity • Aspiration Hazard These effects can range from acute (short-term) to chronic (long-term).	• Explosives • Flammable chemicals • Oxidizers • Gases Under Pressure • Self-Reactive Chemicals • Pyrophoric Chemicals • Self-Heating Chemicals • Chemicals which emit flammable gases while in contact with water • Organic Peroxides • Metal corrosives	Simple asphyxiants displace oxygen in the ambient atmosphere which can cause oxygen deprivation to anyone exposed. Combustible dusts are solids that become a fire hazard when suspended in air or another oxidizing medium. Pyrophoric gas is a gas that will spontaneously ignite in air at a temperature at or below 130 F. Hazards not otherwise classified (HNOC) describe negative physical or health effects based on evidence that does not meet OSHA's criteria for an existing physical or health hazard class.

Classifying and Categorizing Chemical Hazards

While working on the job, you'll be exposed to a variety of health, physical, and chemical hazards.

The Globally Harmonized System of Classification and Labeling of Chemicals (GHS) is an international approach to Hazard Communication that provides a universally agreed upon criteria for classification of chemical hazards and a standardized approach to label elements and SDSs.

The HCS was modified to adopt the GHS to improve worker safety and health through more effective communication about chemical hazards. The GHS allows workers in all countries where the system is used to effectively use hazard information on chemicals that they may encounter from different regions.

To ensure chemical safety in the workplace, information about the identities and hazards of the chemicals must be made available and understandable to workers.

Chemical manufacturers and importers required to:

- Evaluate hazards of chemicals to verify proper classification
- Prepare labels and SDSs

Hazard classification incorporates the following three steps:

1. The **identification** of relevant data regarding the hazards of a chemical
2. A **subsequent review** of that data to ascertain the hazards associated with the chemical
3. A **determination** of whether the chemical will be classified as hazardous, and the degree of that hazard

Health hazard classes	*Effect details*
Acute Toxicity	Causes adverse effects when the chemical is ingested, transferred through the skin, or inhaled
Skin Corrosion	Irreversible damage to the skin; Reactions include ulcers, bleeding, bloody scabs, discoloration, areas of alopecia (no body hair), and scars
Skin Irritation	Reversible damage to the skin, such as lesions or a rash
Serious Eye Damage	Damage to eye tissue/serious physical decay of vision
Eye Irritation	Reversible damage such as burning or temporary loss of sight
Respiratory Sensitization	Hypersensitivity of airways when inhaled
Skin Sensitization	Allergic response from skin contact
Germ Cell Mutagenicity	Cause a permanent change in the amount or structure of the genetic material in human cells (mutations)
Carcinogenicity	Cause or increase likelihood of developing cancer
Reproductive Toxicity	Cause adverse effects on sexual function and fertility in adults and development of offspring
Specific Target Organ Toxicity	Single exposure class: Cause specific, non-lethal damage to organ after single exposure; May be reversible or irreversible Repeated/Prolonged Exposure Class: Cause specific, non-lethal damage to organ after single exposure; May be reversible or irreversible
Aspiration Hazard	Cause severe effects when ingested through oral or nasal cavity; Effects include chemical pneumonia, pulmonary injury, or death

Classifying and Categorizing Chemical Hazards

While working on the job, you'll be exposed to a variety of health, physical, and chemical hazards.

Physical/Chemical hazard classes	*More information*
Explosives	Solid or liquid chemicals that are capable, by chemical reaction, of producing gas at such a temperature and pressure that they rapidly damage the surrounding environment.
Flammable Gases	They work with air that is 68°F (20°C), and have a standard pressure of 14.7 psi.
Flammable Aerosols	Stored non-refillable receptacles that contain a flammable gas compressed, liquefied, or dissolved under pressure; Fitted with release device allowing contents to be ejected
Oxidizing Gases	May cause or contribute to combustion of other material
Gas under Pressure	Contained in a receptacle at a pressure of 29 psi or more, or which are liquefied, or liquefied and refrigerated
Flammable Liquids	Liquids having a flash point of not more than 199.4°F (93°C). Flash point refers to the minimum temperature at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture with air near the surface of the liquid. There are four categories of flammable liquids, with Category 1 liquids having a lower flashpoint than Category 4 liquids.
Flammable Solids	Solids which are readily combustible, or which may cause or contribute to fire through friction
Self-Reactive Chemicals	Thermally unstable liquid or solid chemicals liable to undergo a strongly exothermic decomposition even without participation of oxygen (air)
Pyrophoric Liquids or Solids	Both liable to ignite within 5 minutes after coming into contact with air
Self-Heating Chemicals	Solid or liquid chemicals, other than pyrophoric ones, which, by reaction with the air and without energy supply, are likely to self-heat.
Chemicals with Water Contact Emit Flammable Gases	Assigned to solid or liquid chemicals that, by interaction with water, are likely to become spontaneously flammable or to give off flammable gases in dangerous quantities
Oxidizing Liquids/ Solids	May cause or contribute to combustion of other material when exposed to oxygen
Organic Peroxides	Liquid or solid chemicals that are considered a derivative of hydrogen peroxide, thermally unstable, may be liable to fire and explosion, and can react dangerously with other substances
Corrosive Metals	Chemicals which, by chemical action, will materially damage or destroy metals

How Hazard Communication Can Protect You

Learn how to protect yourself and others from health hazards.

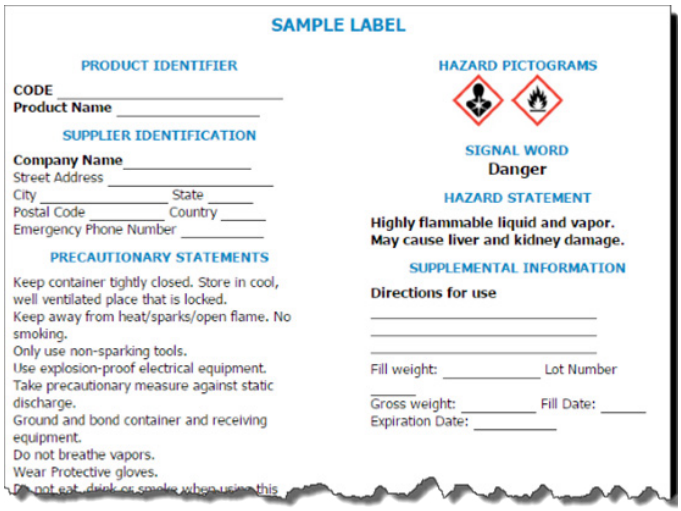
Hazard communication can protect you from becoming ill or injured by properly communicating, through labels and other forms of warning, the dangers associated with chemicals found in the workplace.

Labels

Per OSHA and GHS standards, a label is defined as

> "an appropriate group of written, printed or graphic information elements concerning a hazardous chemical that is affixed to, printed on, or attached to the immediate container of a hazardous chemical, or to the outside packaging."

The chemical manufacturer, importer, or distributor must ensure that the information provided for each hazard class and associated hazard category for the hazardous chemical is prominently displayed together on the label, tag, or marked in English.



SAMPLE LABEL

PRODUCT IDENTIFIER

CODE _____
Product Name _____

SUPPLIER IDENTIFICATION

Company Name_____
Street Address _____
City _____ State _____
Postal Code _____ Country _____
Emergency Phone Number _____

PRECAUTIONARY STATEMENTS

Keep container tightly closed. Store in cool, well ventilated place that is locked.
Keep away from heat/sparks/open flame. No smoking.
Only use non-sparking tools.
Use explosion-proof electrical equipment.
Take precautionary measure against static discharge.
Ground and bond container and receiving equipment.
Do not breathe vapors.
Wear Protective gloves.
Do not eat, drink or smoke when using this

HAZARD PICTOGRAMS

SIGNAL WORD

Danger

HAZARD STATEMENT

Highly flammable liquid and vapor.
May cause liver and kidney damage.

SUPPLEMENTAL INFORMATION

Directions for use

_____
_____
_____

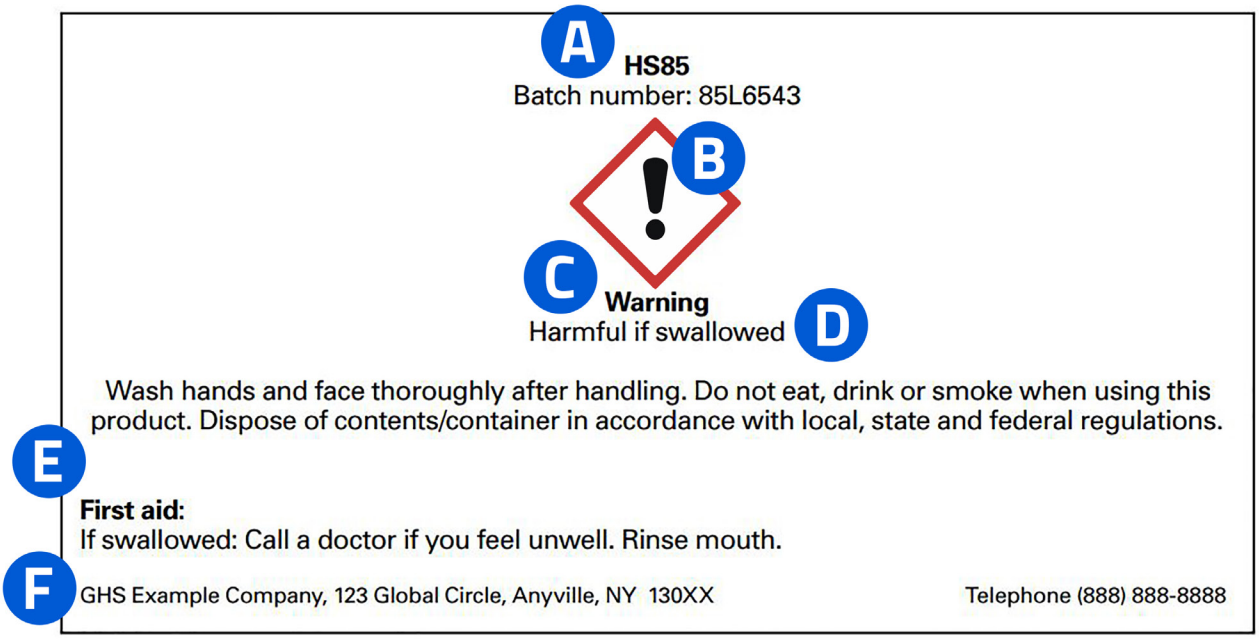
Fill weight: _____ Lot Number _____
Gross weight: _____ Fill Date: _____
Expiration Date: _____

Components of labels include the following:

- **Product identifier:** Name or number for a hazardous product
- **Supplier identifier:** Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party
- **Precautionary statement(s):** A phrase that describes recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure to a hazardous chemical or improper storage or handling
- **Pictogram(s):** A composition that may include a symbol in addition to other graphic elements, such as a border, background pattern, or color, that is intended to convey specific information about the hazards of a chemical.
- **Signal word:** Used to indicate the relative level of severity of hazard, and alert the reader to a potential hazard on the label.
- **Hazard statement(s):** A statement assigned to a hazard class and category that describes the nature of the hazard(s) of a chemical, including, where appropriate, the degree of hazard
- **Supplemental information:** Any additional information

Label Elements

Review this sample label to better understand its required elements.



A. Product Identifier

This is how the hazard is identified. Examples include the **chemical name**, **batch number**, or **code number**.

B. Signal Word

This indicates a hazard's severity. The only two words used as signal warnings are "**Danger**" and "**Warning**."

C. Hazard Statement(s)

These describe the **nature** and **degree** of the hazard.

D. Pictogram(s)

These graphic symbols communicate specific information about a chemical's hazard.

E. Precautionary Statement(s)

These describe the measures you should take to prevent or minimize hazardous effects.

F. Supplier Identifier

This is the chemical manufacturer, importer, or other responsible party's information.

Label Elements

Labels must include pictograms that alert workers to the chemical hazards they may be exposed to.

Pictograms And Their Associated Hazard Classes

Health Hazards

- Carcinogen
- Mutagenicity
- Reproductive Toxicity
- Respiratory Sensitizer
- Target Organ Toxicity
- Aspiration Toxicity

Exclamation Mark

- Irritant (Skin and Eye)
- Skin Sensitizer
- Acute Toxicity
- Narcotic Effects
- Respiratory Tract Irritant
- Hazardous to Ozone Layer (Non-Mandatory Warning)

Gas Cylinder

- Gas Under Pressure

Flame

- Flammables
- Pyrophoric
- Self-Heating
- Emits Flammable Gas
- Self-Reactive
- Organic Peroxides

Skull & Crossbones

- Acute Toxicity (Fatal or Toxic)

Corrosion

- Skin Corrosion or Burns
- Eye Damage
- Corrosive to Metals

Flame Over Circle

- Oxidizer

Environment

- Aquatic Toxicity

Exploding Bomb

- Explosive
- Self-Reactive
- Organic Peroxide

Safety Data Sheets

Safety data sheets (SDSs) communicate the hazards associated with chemicals.

Safety data sheets must be made **readily available** when designated representatives, the Assistant Secretary, and the Director request them.

Safety data sheets:

- May be kept in any form.
- May be designed to cover groups of hazardous chemicals in a work area.
- Must be readily accessible during each work shift to employees.
- Must contain 16 specific sections.*

For complex mixtures that have **similar hazards and contents**, the chemical manufacturer, importer, or employer may prepare **one safety data sheet** to apply to similar mixtures.

Responsibilities

Chemical Manufacturers or Importers – They must provide SDSs with the shipped containers. Or, they must send SDSs to the distributor or employer before or at the time of shipment.

Employers – They must make sure the required information is provided for each hazardous chemical.

**Inclusion of the 16 sections ensures consistency in how information is presented. For more information on the 16 sections of safety data sheets, visit the OSHA website.*

Safety data sheets must be readily available upon request.

If employers, chemical manufacturers, or importers have **significant new information** about a chemical's hazards (or ways to protect against hazards), they must add this information to the SDS within **three months**.

REMEMBER

"Safety data sheets" (SDSs) are formerly known as "material safety data sheets" (MSDSs). MSDSs may still be used during the transition period for compliance with updated Hazard Communication Standard (HCS) requirements.

Employer Responsibilities

Employers and employees must work together to reduce health hazards on the worksite.

Preventing Heat Hazards

Employers must prevent heat illness by doing the following:

- Provide cool, potable water.
- Provide frequent cool-down breaks.
- Schedule the heaviest work load during the coolest part of the day.
- Encourage workers to drink water and cool down.
- Look for signs and symptoms of heat stress.
- Provide training on heat stress including prevention, recognition, and first aid.
- Prohibit use of the common drinking cup.

Hazard Classification

- Train all employees in label elements.
- Train employees in the 16 sections of safety data sheets.
- Hazard classification under the GHS provides specific criteria to address health and physical hazards as well as classification of chemical mixtures.
- Chemical manufacturers and importers must provide a label that includes a signal word, pictogram, hazard statement, and precautionary statement for each hazard class and category.

Good recordkeeping is an important responsibility.

Employers must inform employees of the following:

- Employer requirements for chemical hazard training.
- Employer requirements for sharing of information with employees.
- Operations in employee work areas where hazardous chemicals are present.
- Locations and availability of the written hazard communication program.

REMEMBER

The written hazard communication program should include the required lists of hazardous chemicals and safety data sheets.

Employee Training

Employers are responsible for providing proper training to employees.

Employers must provide employees with effective information and training on hazardous chemicals in their work area.

- Provide training at the time of an employee's initial assignment.
- Provide additional training when a new chemical hazard is introduced.
- Training must include a statement of conditions.

Effective training programs are:

- Observable.
- Measurable.

Training of temporary workers is a joint responsibility of the employer and the temp agency.

REMEMBER

Training is meant to inform employees **prior** to exposure. Do not delay training until after the work has begun.

Training Requirements

Employer-provided training should cover the following:

- Measures employees can take to protect themselves from hazards.
- Work practices, emergency procedures, and other procedures that protect employees from exposure to hazardous chemicals.
- Details of the hazard communication program developed by the employer.
- Explanations of labels received on shipped containers.
- Explanations on the employer's workplace labeling system.
- Information of the safety data sheet, including the order of information.
- Information on how employees can obtain and use appropriate hazard information.

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Materials Handling

Lesson 7 Study Guide

LESSON PURPOSE:

The purpose of this lesson is to provide you with information that will enable you to recognize and eliminate materials handling hazards in your workplace.

LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify the most common hazards associated with materials handling, storage, use, and disposal
- Describe methods that can be used to prevent injuries when performing manual lifting
- List methods that can be used to eliminate hazards when using forklifts, cranes, or slings to handle materials
- Explain methods that can reduce the risk of hazards when storing, using, or disposing of materials

Handle and store all materials properly and efficiently.

Materials Handling

Efficient handling and storing of materials is essential in maintaining a safe and productive worksite. Proper materials handling practices allow a continuous flow of parts and assemblies. It also ensures that materials are available when they're needed.

REMEMBER

When handling materials, keep the following in mind:

- Handle and store all materials efficiently, as improper handling and storage can lead to costly injuries.
- Maintain awareness of handling operations and the continuous flow of parts and assemblies.

Protecting Yourself

Don't underestimate the hazards posed by materials handling on the worksite. Make sure you're taking steps to protect yourself and those around you.

- Follow general requirements for material storage.
- Maintain good housekeeping in storage areas.
- Store special materials properly.
- Take extra precautions when storing lumber.
- Follow proper procedures for waste disposal.
- Ensure proper use of rigging equipment.
- Properly use equipment such as forklifts.

First-line supervisors are accountable for employee training. Employers must provide safety and health programs in addition to training programs.

Identifying Materials Handling Hazards and Injuries

The efficient handling of materials is important in the workplace.

Any time you handle materials in the workplace, there is potential for hazards, and you must be prepared to protect yourself.

What are materials handling hazards?

A materials handling hazard can be defined as any potential hazard created by the improper handling of materials.

Manual material handling involves using your body to complete a task. Carrying a heavy tool, stacking boxes, or unpacking materials requires manual handling.

Mechanical material handling involves using a machine to complete a task. Moving something with a forklift, driving a tractor, or lifting something with a crane is considered mechanical handling.

These operations provide a continuous flow of parts and assemblies and ensure that materials are available when needed. When materials are improperly handled or stored, however, it can often result in costly injuries.

The most common materials handling hazards include:

- Lifting large, heavy items
- Unbalanced loads
- Overloaded machinery
- Falling objects
- Improperly stacked materials
- Faulty equipment
- Bending, twisting and turning

Musculoskeletal disorders (MSDs), which often affect the back, neck and arms, are the most common injuries caused by materials handling hazards.

Describing Materials Handling Hazards

Workers may be injured and materials can be damaged or destroyed if they are not handled properly.

To help minimize the potential for materials handling hazards, OSHA has set various rules and recommendations to follow when handling materials.

More information about the major types of materials handling hazards is provided below:

Heavy lifting is one of the leading causes of workplace injuries, which commonly affect the back and are caused by bending, twisting, and turning while lifting heavy items.

Pulling, pushing, and carrying often involve awkward postures, forceful exertions, and strain on the body, which can cause injuries. Materials may be safely moved by using a hand truck or utility cart.

The **storage** of materials, especially where and how they're stored, can lead to numerous hazards in the workplace. Improperly stacked or secured items may fall and injure workers. To ensure safety, clearances should be made for aisles, loading docks, through doorways, and wherever passage must be made.

Bad **housekeeping** can lead to a disorderly worksite, which, in addition to decreasing productivity, can increase the risk of workplace injuries. A worksite should be clean and organized. If **staging** isn't planned well, more opportunities for injury are presented.

When loading or unloading materials from **vehicles**, employees may have to reach over other items or climb into small, awkward spaces, which often presents multiple hazards.

Unguarded openings such as open pits, tanks, vats, and ditches can be major hazards when handling materials. OSHA mandates that guardrails or covers must be provided to protect workers from these potential hazards.

In many workplaces, **forklifts and other industrial trucks** are used to move and store materials. Industrial trucks like forklifts cause approximately 36,000 injuries and about 100 fatalities per year. An estimated 20 to 25 percent of those injuries are caused by inadequate training.

Rigging equipment, like alloy steel chains, wire and natural rope, and synthetic webbing, is often used to help lift or transport materials. If a load is too heavy, the equipment may snap, tear, or break. Fatigue, abrasive wear, and abuse can also cause rigging equipment to fail.

Protecting yourself from Materials Handling Hazards

Employees must be trained in the proper handing of materials.

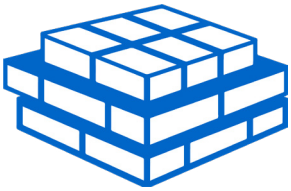
When handling or working with materials, it is important to take the proper precautions to prevent hazards and avoid dangerous situations.

Using ergonomics

Ergonomics is defined as the study of work and is based on the principle that the job should be adapted to fit the person rather than forcing the person to fit the job. In the workplace, ergonomics focuses on the work environment and ensures that work stations, controls, displays, safety devices, tools, and lighting fit the physical requirements of the employees to help ensure their health and well-being.

- You can improve **lifting techniques** by using the principles of ergonomics. Here's one technique for small, lightweight loads:
  1. If possible, avoid lifting from the ground
  2. Never bend at the waist
  3. Keep the load close to your body and lift by pushing with your legs
- Using "**team lifting**" is a temporary measure that can reduce your load by half
- **Store heavy items** and commonly used items in ways that will allow you to access them in a safe way
- Various **tools and equipment** can be used to make potentially hazardous tasks much safer and reduce risk

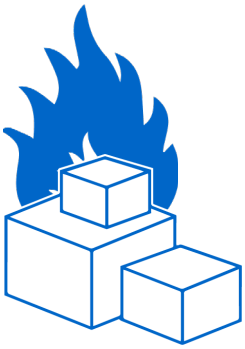
Storage



To prevent potential hazards when storing materials, employers and workers should:

- Keep storage areas free from any accumulated materials that may create tripping, fire or explosion hazards, or could attract pests
- Store materials at least 10 feet away from exterior walls
- Separate materials that are non-compatible
- Place bound material on racks and secure it, either by stacking, blocking or interlocking it
- Use lifelines and safety belts if working on stored grain in silos, hoppers or tanks

Fire safety



Workers should understand that flammable and combustible materials must be stored according to their fire characteristics. Flammable liquids, for example, must be separated from other materials by a fire wall. Other combustibles must be stored in an area where smoking, open flames, and spark-producing devices are prohibited.

Protecting yourself from Materials Handling Hazards

Employees must be trained in the proper handing of materials.

Stacking

When stacking **lumber**, workers must:

- Stack lumber no more than 16 feet high if it is handled manually
  - If lumber is stacked using a forklift, it shouldn't be stacked more than 20 feet high
- Remove all nails from used lumber before stacking
- Make sure the lumber is stacked and leveled on solidly supported bracing
- Make sure that stacks are stable and self-supporting

When stacking **drums, barrels and kegs**:

- Stack them symmetrically.
- Place planks, plywood, or pallets between each tier to make a firm, flat stacking surface
- Lock the bottom tiers to keep them from rolling if the drums, barrels, and/or kegs are stored on their sides
- When stacking two or more tiers high, chock the bottom tier to prevent shifting when stacking two or more tiers high

When stacking **loose bricks**:

- Stack them no more than 7 feet in height
  - When these stacks reach a height of 4 feet, taper them back 2 inches for every foot of height above the 4-foot level
- When masonry blocks are stacked higher than 6 feet, taper the stacks back one-half block for each tier above the 6-foot level

Proper stacking and good housekeeping are essential in minimizing hazards.

Other stacked materials on the worksite can also present hazards:

- Avoid storing pipes and bars in racks that face main aisles, so that removing supplies does not create a hazard to people walking by
- Stack and block poles, structural steel, bar stock, and other cylindrical materials to prevent spreading or tilting, unless they are in racks
- Stack bags, containers, and bundles so they are blocked, interlocked, and limited in height to remain stable and secure against sliding or collapse
- Stack bagged material by stepping back the layers and cross-keying the bags at least every 10 layers. To remove bags from the stack, start from the top row first
- Band boxed materials or secure them with cross-ties or shrink plastic fiber
- Store balled paper and rags inside a building no closer than 18 inches from the walls, partitions, or sprinkler heads

Employer Responsibilities

Employers and employees should work together to reduce materials handling hazards on worksites.

Using mechanical equipment

Mechanical equipment and rigging equipment should be proof-tested before use to ensure it can handle the loads for which it will be used. After the test, the equipment must be marked to indicate what the safe working load is.

Workers must learn to recognize the hazards associated with different types of actions and equipment and understand the safety precautions necessary to prevent those hazards.

Employees must be trained in the proper handling and storing of materials. This is an essential part of any safety and health training program.

Safety and Health Programs

- Managers must take an active role in developing safety and health programs.
- To ensure continued safety, plans should be ongoing.
- Follow the four main elements of safety and health programs.

Employers must provide training to employees.

Training

- Formal training reduces material handling hazards.
- Training should emphasize factors that contribute to reducing workplace hazards.

Ergonomics

- The job should fit the person, rather than the person fitting the job.
- Changing workplace conditions makes the job easier and reduces stressors.
- Practices include reducing the size or weight of objects being lifted.

Employers are responsible for developing training programs for employees.

Employer-Provided Training

Formal training is an essential part of reducing material handling hazards.

Training Programs

OSHA recommends using a formal training program to reduce material handling hazards on construction sites. Instructors should be well-versed in a variety of topics that relate to safety engineering and materials handling and storing.

Training programs should emphasize ways to reduce workplace hazards.

Employer-provided training should achieve the following:

- Alert employees to the dangers of lifting materials without proper training.
- Show employees how to avoid unnecessary physical stress and strain.
- Teach workers to recognize potential hazards.
- Teach workers how to prevent and correct hazards.

Safety and Health Programs

Managers must take an active role in developing safety and health programs. This ensures effective materials handling and storing on the worksite, while reducing the potential for hazards and injuries.

The four main elements of an effective occupational safety and health program include the following:

1. Commitment from management and employee involvement.
2. Worksite analysis.
3. Hazard prevention and control.
4. Safety and health training.

First-line supervisors must understand the importance of controlling potential hazards. Use ongoing safety and health programs to motivate employees to use protective gear and observe proper job procedures on an ongoing basis.

First-line supervisors must be held accountable for employee training.

Supervisors should establish and **communicate safety goals, conduct worksite examinations, design job sites effectively,** and **provide training** that addresses safety and health responsibilities of both management and employees.

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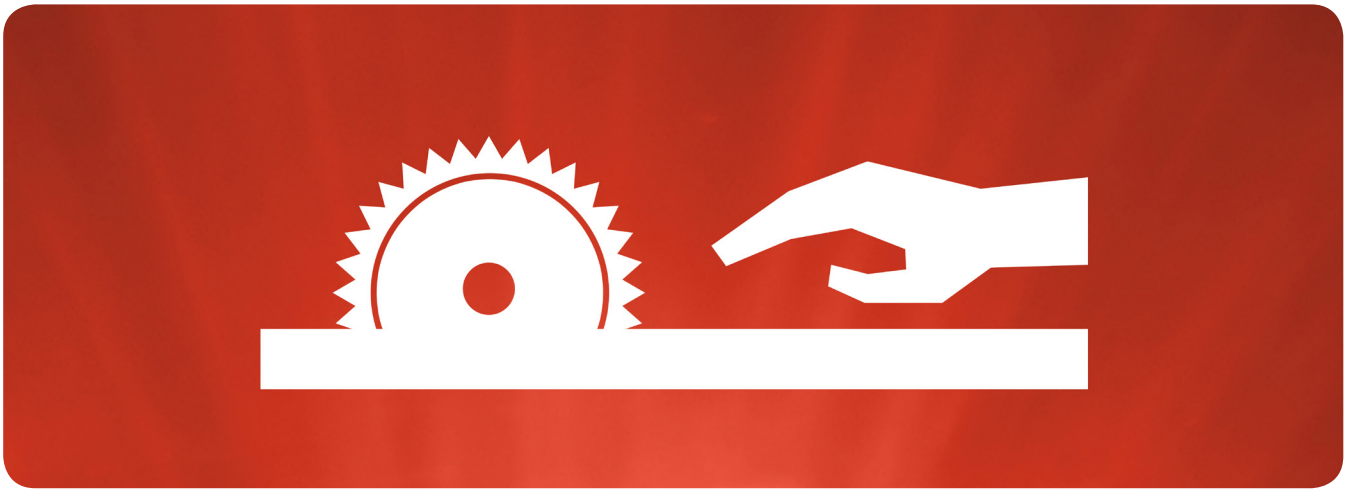


Machine Guarding

Lesson 8 Study Guide

LESSON PURPOSE:

The purpose of this lesson is to provide you with information that enables you to recognize and eliminate major machine guarding hazards in your workplace.

LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify machine guarding
- Describe major types of machine hazards and methods of machine guarding
- List ways to protect yourself from machine guarding hazards
- Explain employer requirements for machine guarding in the workplace

Learn how to recognize machine guards on worksites.

Machine Guard Defined

A machine guard is a device used to protect or shield machine operators and others in the surrounding area of a machine from possible mechanical hazards, such as crushed limbs, flying sparks, or excessive noise levels.

Machine guards come in many different forms. Some examples include shields, fences, covers, casings, troughs, spillways, and railings.

REMEMBER

Machine guards should always be used when and as required.

A machine guarding hazard is any potential hazard created by a lack of safeguards or an improper utilization of safeguards on a machine. General examples are listed below:

- A worker's clothing may get caught in a nip point, pulling them into the machine
- A worker's finger can get caught in an unguarded grinding wheel
- A worker may be struck and blinded by flying chips and sparks created by a machine
- A worker could be injured if an attempt is made to service a machine that was not properly turned off, locked out, and tagged

REMEMBER

Any moving part on a machine can be a potential machine hazard.

Types of Machine Hazards and Safeguarding

Be aware of the hazards posed by machinery with unguarded moving parts.

Before you can protect yourself, you must understand the different types of machine hazards, as well as know the safeguarding methods available for your protection.

There are three basic areas of moving parts that require safeguarding:

1. **The point of operation**
   - The area on a machine where the work is performed. If a machine's point of operation exposes an employee to injury, it must be guarded.
2. **Power transmission apparatus**
   - All parts of the mechanical system which conduct energy to the part of the machine performing the work. Examples of such apparatuses include pulleys, coupling, belts, connecting rods, spindles, chains, cranks, and gears.
3. **Other moving parts**
   - All components of the machine which move while the machine is working, such as rotating parts, parts that transverse, feed devices, or other supporting parts of the machine.

Machine Hazards and Safeguarding

Mechanical Motion Hazards

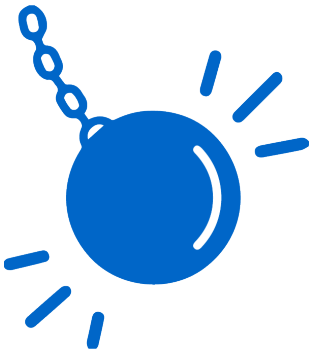
Be aware of the potential for mechanical hazards – both motion and action - on the worksite.

In-Running Nip Point - The in-running nip point is the point where moving parts contact or come close to other parts.

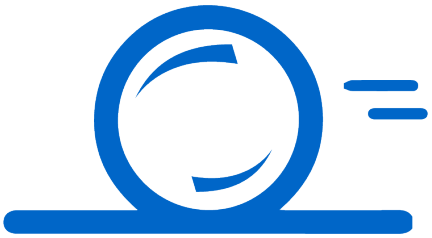
The 3 main types of in-running nip points include

1. Contact between parts that rotate in opposite directions while their axes are parallel to each other
2. Point of contact between parts that rotate and parts that move longitudinally
3. Point between a rotating part and a fixed part which results in a cutting, crushing, or scraping action

Rotating Motion - On a machine, rotating motion can be very dangerous, particularly when an object in rotating motion contacts another object. Even if there is only minor contact and the rotation is slow, hair or clothing could get caught and cause severe injuries.



Reciprocating Motion - Reciprocating motion is a repetitive up-and-down or back-and-forth linear motion used by many different types of machines. Workers must be careful when working near machines that have reciprocating motion to avoid getting struck by a machine part or getting caught between a moving part and a stationary object, such as between a part of a reciprocating table top and a wall.



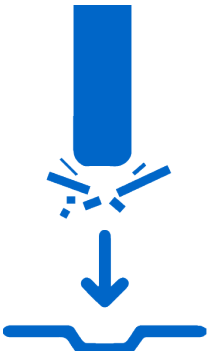
Transversing Motion - Transverse motion is movement in a straight, constant line. This type of motion can result in hazards from pinch or shear points created by the moving parts which can catch or hit workers.

Mechanical Motion Hazards

Be aware of the potential for mechanical hazards – both motion and action - on the worksite.

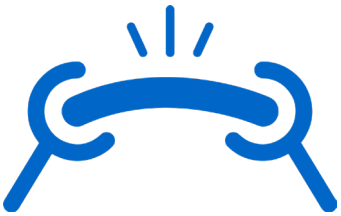
Mechanical action hazards

Cutting action is used by many different machines, such as circular saws, drilling machines, and lathes. This action can happen in a rotating, reciprocating, or transverse motion. Injuries can occur if a body part contacts the cutting action at the point of operation.



Punching action in machines, such as power presses or iron workers, involves blanking, drawing, or stamping metal or other materials by applying power to a slide or ram.

A **shearing action**, used by machines such as a pneumatically powered shear, is trimming or shaving metal or other materials by applying power to a slide or knife.



Bending action involves drawing or stamping metal or other materials by applying power to a slide. Power presses, press brakes, and tubing benders all use bending action.

EXAMPLE

Examples of non-mechanical hazards include flying objects, noise, and power sources.

Methods of Machine Safeguarding

Protect yourself and others from machine guarding hazards.

1. **Guards** are barriers which stop access to hazardous points on machines
   a. Fixed guards are permanently attached to the machine and are not dependent on moving parts to function.
   b. Interlocked guards automatically shut off a machine when opened or removed.
   c. Adjustable guards are flexible and can be changed to fit different stock sizes.
   d. Self-adjusting guards place a barrier between the danger area and the machine operator.

REMEMBER

Fixed guards are generally preferred because they are simple and durable.

2. **Safety devices** can function in different ways, including:
   - Stopping the machine
   - Restraining/removing the operator's hands from the danger area
   - Requiring the worker to use both hands on the machine controls
   - Controlling a barrier synchronized with the machine's work cycle

Below is a list of specific types of safety devices and their functions:

a. Presence-sensing devices
   - Photoelectric/optical devices depend on a light field
   - Radiofrequency or capacitance devices depend on a radio beam
   - Electromechanical devices depend on a probe/contact bar which descend a specific distance when the machine is started

b. Pullback devices use cables attached to hands, wrists, and/or arms which allow access to the point of operation

c. Restraint or holdback devices use cables or straps attached to the hands at a fixed point that allows movement within a specific safe area.

d. Safety trip controls quickly deactivate a machine in an emergency.

e. Two-hand controls/Two-hand trips require simultaneous pressure by the operator to the controls, set away from the danger area, to activate the machine. While two-hand controls require constant pressure to keep the machine active, two-hand trips only require initial simultaneous pressure which can be released after activation.

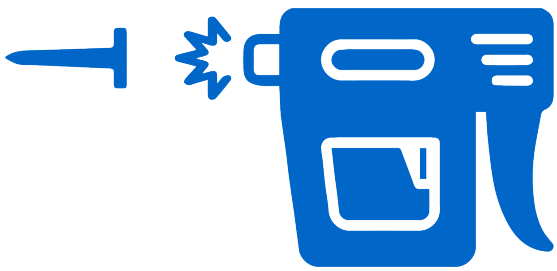
f. Gates are barriers that can be moved to protect the operator at the point of operation before the machine can be started.

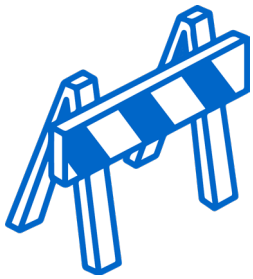
Methods of Machine Safeguarding

Protect yourself and others from machine guarding hazards.

3. **Location/Distance**
   - A detailed worksite hazard assessment should be conducted before proper location or distance safeguarding can be correctly determined and implemented.

4. **Feeding and Ejection Methods**
   a. An automatic feed method uses a machine mechanism to feed stock which does not require the operator to enter the danger area when work is being performed.
   b. A semiautomatic feed method uses chutes, movable dies, sliding bolsters, or other non-mechanical methods to feed the material.
   c. An automatic ejection method expels work pieces by air or mechanical means.
   d. A semiautomatic ejection method expels work pieces by mechanical means initiated by the operator.
   e. Robots can be programmed to perform work normally done by humans.





5. **Miscellaneous Aides**
   - An awareness barrier is to remind a person that he or she is approaching a dangerous area. However, the barrier does not prevent a person from entering the danger area.
   - A special hand tool – like a push stick or block - may be used to place or remove material, particularly from or into the point of operation of a machine.

Above is an example of a special hand tool.

Protecting Yourself Using Machine Guarding

Workers must take the proper precautions when working with machinery.

Protection from and awareness of machine guarding hazards in the workplace are essential in maintaining the safety and health of every worker. Potential machine hazards must be removed or guarded before work begins.

Remember the following requirements when safeguarding machinery in the workplace:

- **Prevent contact:** The safeguard must stop any part of the worker's body from contacting hazardous moving parts.
- **Secure:** For a safeguard to be effective workers should not be able to easily remove or tamper with the guard, it should be made with durable material that withstands normal use and it must be firmly secured to the machine.
- **Falling objects:** A good safeguard should ensure that no objects can fall into moving parts. Small tools dropped into a machine can easily become projectiles.
- **New hazards:** A guard cannot create a hazard itself, such as a shear point, a jagged edge, or an unfinished surface that might cause cuts.
- **Interference:** A safeguard cannot hamper a worker from performing a job quickly and comfortably. If it does, a worker might remove or override the guard.
- **Lubrication:** Ideally, workers should be able to lubricate a machine without removing the safeguards.

Specific and detailed training is a very important part of any effort to guard against machine-related hazards.

Protecting Yourself Using Machine Guarding

Workers must take the proper precautions when working with machinery.

Specific and detailed training is a very important part of any effort to guard against machine-related hazards.

Training should involve the following:

- Describing and identifying any potential hazards associated with specific machines
- Describing safeguards and how they protect workers
- How, when, and who can remove specific safeguards

Other methods of protecting yourself

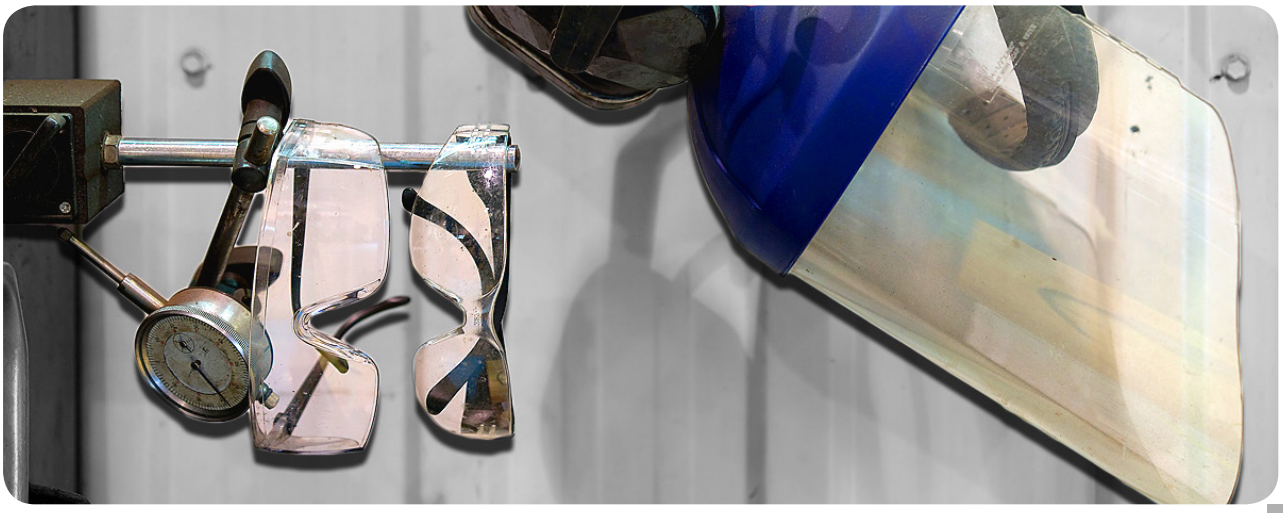
OSHA's **lockout/tagout practices** and procedures are designed to protect workers from the release of hazardous energy.

When working with machinery, it is particularly important to make sure your eyes and face are properly protected with the use of **personal protective equipment (PPE)**.

Proper maintenance of machinery helps keep workplaces safe. Machines should be maintained and serviced by personnel who have been trained to work on those machines. When the servicing or maintenance is finished, there are specific steps that must be followed to return the machine or piece of equipment to service:

1. Inspection of the machine to confirm that all guards and other safety devices are in place and working,
2. Checking the area to ensure that turning the power source back on and starting up the machine will not threaten employees,
3. Removal of the lockout devices,
4. Turning all power source back on for the machine, and
5. Informing all affected employees that the machine will be returned to service.

Don't forget that workplace safety requires the following from ALL employees: cooperation, communication, knowledge, and alertness.



Employer Responsibilities

Employers and employees must cooperate in order to reduce hazards on the worksite.

To ensure the safety and health of workers regarding machine guarding, employers must:

- Provide appropriate machine guards and devices
- Provide maintenance and routine inspections for all guards and devices
- Make sure employees are properly trained before they use a machine
- Make sure employees are trained in hazard recognition
- Train employees in lockout/tagout procedures
- Provide PPE

It is the employer's duty to assess the workplace, determine any potential hazards and ensure that employees working on or around machinery are safe from injury. Workers should not be allowed to use any machinery that has not been tested by the employer and proven to be properly guarded against potential hazards.

It is essential that all employers at sites with mechanical hazards have a detailed medical and first aid program. All employees must be trained on correct workplace medical and first aid program procedures to know what steps to take in the event of an accident.

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Bloodborne Pathogens

Lesson 9 Study Guide

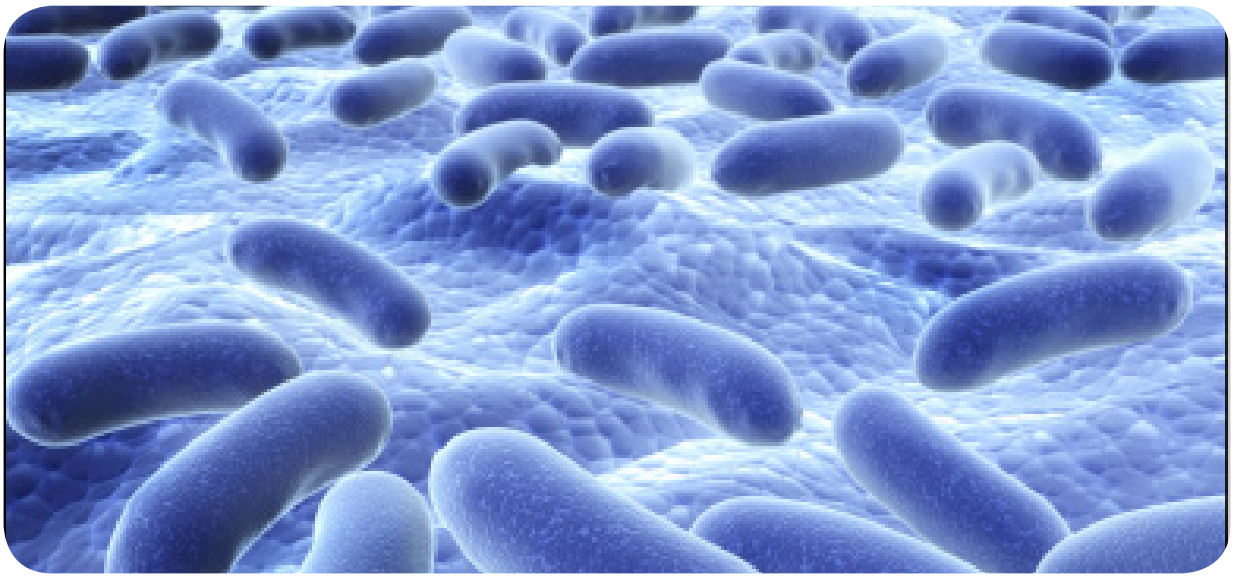
LESSON PURPOSE:

The purpose of this lesson is to learn to recognize and avoid bloodborne pathogen hazards in the workplace, and learn the importance of an Exposure Control Plan.

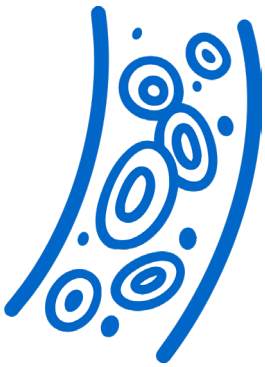
LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify bloodborne pathogens
- Describe major types of bloodborne pathogens
- List ways to protect yourself from bloodborne pathogens
- Explain employer requirements to protect workers from bloodborne pathogens

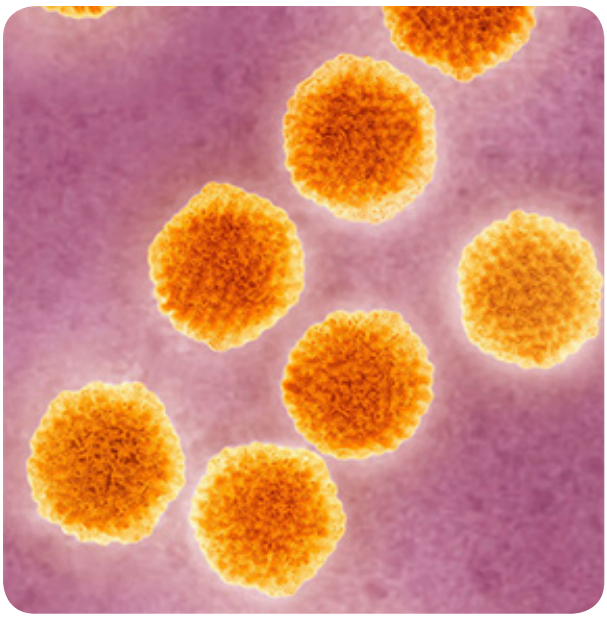


OSHA protects employees against bloodborne pathogens.



Bloodborne pathogens are infectious, disease-causing microorganisms present in human blood. Diseases caused by bloodborne pathogens are spread through contact with blood or other potentially infectious material (OPIM).

Some of the most common bloodborne pathogens and the illnesses they cause include Hepatitis B, Hepatitis C, and the Human Immunodeficiency Virus (HIV).



Pathogenic microorganisms that are present in human blood can cause disease.

Describing Bloodborne Pathogens

An estimated 5.6 million workers in the health care industry and related occupations are at risk of exposure to bloodborne pathogens.

Workers in many occupations, including healthcare and housekeeping, may encounter the risk of bloodborne pathogen transmission during the course of their work.

Occupational exposure to bloodborne pathogens is defined by OSHA as a "reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials (OPIM) that may result from an employee's duties."

Below is more detailed information regarding the most common bloodborne pathogens and the illnesses they cause:

Hepatitis B

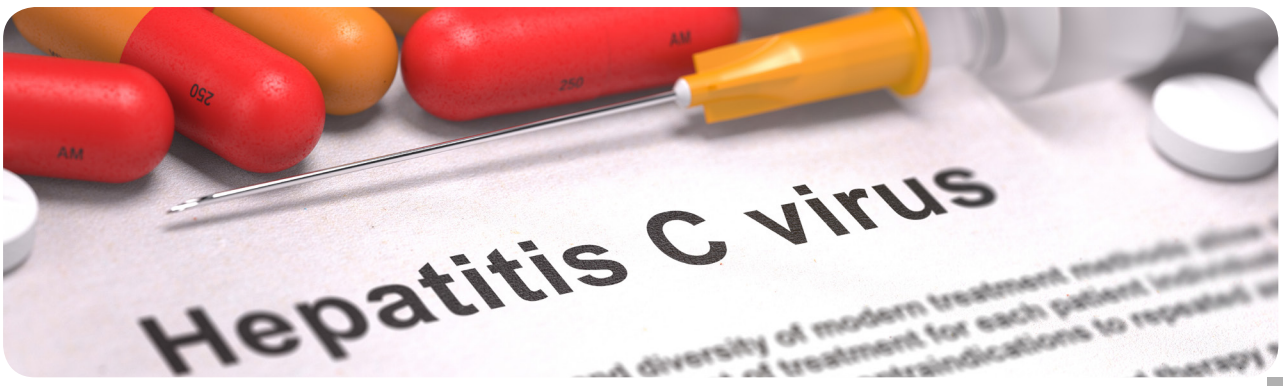
- Caused by the Hepatitis B virus (HBV)
- Attacks liver
- Can cause lifelong infection, scarring of liver, liver cancer, or death
- Transferred via blood or other bodily fluids
- Can be acute or long-term chronic infection
- Vaccination is best way to prevent transmission

Hepatitis C

- An infection of the liver caused by Hepatitis C virus (HCV)
- Becomes long-term, chronic illness for 70-85% of infected
- Can result in long-term health problems and even death
- No vaccine
- Transmitted though exposure to infected blood, including via needlesticks

HIV/AIDS

- Attacks the immune system
- Can eventually lead to Acquired Immune Deficiency Syndrome (AIDS)
- No vaccine or cure
- Transmitted when blood or another bodily fluid comes into contact with a mucous membrane or damaged tissue, or is introduced into the bloodstream (from a needle or syringe)



Protecting Yourself

Following proper precautions can greatly reduce the risk of exposure to bloodborne pathogens.

Universal precautions are methods of infection control where all human blood and potentially infectious materials are handled as if they are known to be infectious. The use of personal protective equipment (PPE) must be standard when exposure to blood or bodily fluids is likely.

Engineering controls are designed to isolate or eliminate employee exposure to bloodborne pathogens. Examples of engineering controls are:

- Disposable containers for sharps
- Self re-sheathing needles
- Safer medical devices, including:
  - Needleless systems - devices which do not use needles for the collection or withdrawal of body fluids or for the administration of medication or fluids, and
  - Sharps with engineered injury protection - examples of these are non-needle sharps, or needles with build in safety features or mechanisms that effectively reduce the risk of exposure incidents.

Work practice controls identify and alter the way a task is performed to minimize exposure to bloodborne pathogens. Examples of work practice controls include:

- Employees must be provided with hand washing facilities or another way to clean hands and any other skin with soap and water, or flush mucous membranes with water immediately or as soon as feasible, following contact of such body areas with blood or other potentially infectious materials (OPIM).
- Employees must wash their hands immediately or as soon as feasible after the removal of gloves or other PPE, and immediately after contact with potentially infectious materials, and
- All used instruments must be disposed of in puncture-resistant, leak-proof, closeable, biohazard-labeled containers immediately after use.

Some examples of **PPE** that are specialized to protect workers from exposure to blood and OPIM include:

- Gloves
- Gowns
- Laboratory coats
- Eye protection
- Face masks or shields

Protecting Yourself

Following proper precautions can greatly reduce the risk of exposure to bloodborne pathogens.

What do to if an exposure incident occurs

An exposure incident is any kind of contact with potentially infectious materials to the eyes, mouth, any mucous membrane, non-intact skin, or parenteral contact with blood that is a result of the employee's duties.

If an exposure incident occurs…

- Wash the area with soap and water
- Irrigate eyes with water and saline
- Flush splashes to the nose, mouth, or any other part of the skin that the infectious materials touched with water
- Report the incident immediately to the person named on the Exposure Control Plan
- Get to a healthcare professional as soon as possible for treatment

Employer Responsibilities

An Exposure Control Plan explains exactly what the employer will do to minimize exposure to bloodborne pathogens.

- Providing Hepatitis B vaccinations to employees
  - Usually given in three doses over six-month period
  - Must be made available, at no cost, to all workers who have received their training and within 10 working days of initial assignment
  - Employees who decline the Hepatitis B vaccination must sign a declination form.
  - Medical records of each employee must be kept, in accordance with OSHA requirements.
- Creating and maintaining a training program
- Using engineering and work practice controls to minimize risk
  - Must ensure that safe medical devices are always used and that they are appropriate, effective, and commercially available.
- Creating and maintaining an Exposure Control Plan
  - Must contain the following elements:
    - Identification of jobs and tasks where potential exposure to blood and other infectious materials is evident
    - Outline of the current protective measures being used, and
    - The procedure for the evaluation of circumstances surrounding exposure incidents as required by OSHA regulations
  - Must be reviewed and updated annually, as well as whenever necessary to reflect new/modified tasks and procedures
- Following proper housekeeping practices
  - Employers must ensure that the worksite is maintained in a clean and sanitary condition
  - General housekeeping includes:
    - Disinfecting contaminated areas
    - Correctly labeling and disposing of contaminated waste
    - Proper handling of other contaminated materials, such as laundry
- Ensuring proper labeling in the workplace
- Following proper post-exposure practices
  - The employee must immediately be sent to a healthcare professional for an evaluation following an exposure incident.
- Ensuring the availability of appropriate PPE
  - Must be made readily accessible at the worksite or issued to employees at no cost to them
  - Remember: It is the employer's responsibility to ensure proper use of PPE, unless it is determined that the use of PPE would have posed an increased hazard to the safety of the worker or coworker.

REMEMBER

Remember, following precautions can greatly reduce the risk of exposure to bloodborne pathogens!

NOTES:

NOTES:

Managing Safety and Health

Lesson 10 Study Guide

LESSON PURPOSE:

In this lesson, you will explore OSHA's recommended guidelines for effective safety and health programs.

LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify the importance of safety and health programs
- Describe the key elements of safety and health programs
- List the ways you can protect yourself using safety and health programs
- Explain the employer's responsibilities regarding safety and health programs

Safety and health programs help prevent workplace injuries, illnesses, and death.

Identifying Safety and Health Programs

Workplace safety and health programs are organized efforts and procedures for identifying workplace hazards and reducing accidents and exposure to harmful situations and substances.

The main elements of a safety and health program are management commitment and employee involvement, worksite analysis, hazard prevention and control, and training.

Having safety and health programs in place is good for any company in the general industry.

Management Commitment and Employee Involvement

With management providing leadership and resources, employees can benefit from working in a safe environment.

Employers and employees must work together by communicating and making safety a priority in the workplace. By providing leadership and resources, management can help steer the workplace toward a safer future. Employees can play a role in their own safety by becoming involved in the identification of hazards and control measures needed to prevent accidents and injuries.

When implementing a safety and health program, OSHA recommends that the following actions be taken:

- Set goals and objectives for the program that can be understood and measured by employees at all levels
- Ensure that top management involvement with the program is visible; this sends the message that management is committed to worker safety
- Encourage employee involvement in the creation and implementation of the program, allowing them to commit their insight and energy to the safety of all
- Clearly assign and communicate program authority, responsibilities, and resources so that each team member knows what is expected of them
- Hold management and employees accountable for their responsibilities to ensure essential tasks are performed
- Review the program annually to evaluate its successes and failures, and revise as needed

Worksite analysis

Being unaware of a hazard due to improper worksite analysis practices is a sign of an ineffective safety and health program.

- OSHA recommends the following measures to identify all hazards:
- Complete comprehensive worksite surveys for safety and health hazards; also complete periodic update surveys
- Fully analyze new and planned facilities, processes, materials, and equipment before use
- Routinely perform analysis of hazards associated with job duties and tasks
- Regularly conduct site safety and health inspections to identify new hazards
- Provide a reliable system that encourages employees to inform management about safety or health issues without fear of reprisal
- Investigate all accidents and “near misses” to identify the cause and means of prevention of each
- Analyze injury and illness trends to identify patterns and prevent recurrences

Management Commitment and Employee Involvement

With management providing leadership and resources, employees can benefit from working in a safe environment.

How to identify workplace hazards

Describing a hazard in a consistent manner helps to ensure that the efforts are made to eliminate the hazard target. Good hazard scenarios describe:

- The environment
- The exposure
- The trigger
- The consequences
- Any other contributing factors

EXAMPLE

In the metal shop (**environment**), while clearing a snag (**trigger**), a worker's hand (**exposure**) encounters a rotating pulley. It pulls her hand into the machine and severs her fingers (**consequences**).

To perform a job hazard analysis, you would ask the following questions:

- What can go wrong?
- What are the consequences?
- How could it happen?
- What are other contributing factors?
- How likely is it that the hazard will occur?

Let's answer these questions about the example scenario:

- ***What can go wrong?*** The worker's hand could encounter a rotating object that "catches" it and pulls it into the machine.
- ***What are the consequences?*** The worker could receive a severe injury (e.g. lose their fingers or lose their hand).
- ***How could it happen?*** The accident could happen because of the worker trying to clear a snag during operations or as part of a maintenance activity while the pulley is operating.
- ***What are other contributing factors?*** This hazard occurs very quickly. It does not give the worker much opportunity to prevent it or recover once her hand encounters the pulley.
- ***How likely is it that the hazard will occur?*** If there have been accidents or "near misses," the likelihood of a recurrence would be considered high. If the pulley is exposed and easily accessible, the likelihood that the hazard will occur is high because there is no guard preventing contact.

By following the steps in this example scenario, you can organize your hazard analysis activities. A Job Hazard Analysis Form helps you organize your findings:

Example Job Hazard Analysis Form

Job Location: Metal Shop	***Analyst:*** Joe Safety	***Date:***
Task Description: Worker reaches into metal box to the right of the machine, grasps a 15-pound casting and carries it to grinding wheel. Worker grinds 20 to 30 castings per hour.		
Hazard Description: Picking up a casting, the employee could drop it onto his foot. The casting's weight and height could seriously injure the worker's foot or toes.		
Hazard Controls: 1. Remove castings from the box and place them on a table next to the grinder. 2. Wear steel-toe shoes with arch protection. 3. Change protective gloves that allow a better grip. 4. Use a device to pick up castings.		

Management Commitment and Employee Involvement

With management providing leadership and resources, employees can benefit from working in a safe environment.

Controlling and preventing hazards helps to avoid workplace injuries and accidents.

Hazard prevention and control

When hazards are discovered, they must be prevented or controlled to avoid accidents and injuries. Effective worksite design should prevent most hazards, while those that cannot be eliminated should be appropriately controlled.

OSHA recommends the use of these measures:

- Implement reliable and effective engineering controls, and provide PPE when engineering controls are insufficient
- Establish safe practices and procedures to be followed by all parties and enforced as necessary
- Implement administrative controls (i.e. adjusting a work schedule)
- Maintain facilities and equipment to prevent breakdowns and accidents
- Prepare and plan for emergencies by training and conducting drills
- Establish a medical assistance program that places first aid equipment on-site and identifies local physicians and emergency care to reduce the severity of accidents and injuries

Training helps both management and employees ensure on-the-job safety.

Safety and health training

Training is an important component of any effective safety and health program. While each workplace will have different methods and procedures for training based on the needs and functions of the job, every workplace should ensure that management and employees are prepared to protect themselves and others. Training will also help management and employees identify their own safety and health responsibilities.

Types of Safety and Health Programs

There are a variety of safety and health programs in place at job sites.

While safety in the workplace has improved over the years, the facts and figures show that there is a lot of work to be done.

Safety & Health Program Statistics

- Nearly 50 American workers are injured every minute of the 40-hour work week and almost 17 die each day
- Nearly one-third of all serious occupational injuries and illnesses stem from overexertion or repetitive motion
- Only about 30 percent of businesses have established safety and health programs
- This means that about half of the 95 million workers covered by OSHA are not protected by safety and health programs
  - Since OSHA's creation almost 30 years ago, workplace fatalities have been cut in half
- Establishing a safety and health program to prevent occupational injuries and illnesses has shown a $4 to $6 return for every dollar invested
- With only one OSHA inspector for every 2,400 worksites, we can't rely on inspections alone to keep workers safe; safety and health programs can help!

Based on the job tasks and worksite set up, your employer might have any combination of safety and health programs in place including:

- A **Hazard Communication Program**, which ensures hazardous materials are labeled correctly and details exposure plans
- An **Emergency Action Plan**, which explains emergency and evacuation procedures
- An **Energy Control Program**, to ensure the proper control of hazardous energy
- A **Fall Protection Checklist**, to be used before any task that may require fall protection equipment and ensure proper procedures are followed
- A **Forklift Operator Checklist**, used to enforce proper forklift operations and decrease the chance of hazards
- A **Fire Prevention Plan**, which helps prevent fires and fire hazards in the workplace
- A **PPE Assessment Checklist**, which helps employees determine whether they need personal protective equipment to perform a given task

Evaluation of Program Effectiveness

Periodic comprehensive audits evaluate the means, methods, and processes of programs.

It is important to evaluate the effectiveness of any program. Audits help determine if program objectives are being met. By evaluating the performance and the objectives themselves, a comprehensive review of the program is completed, allowing for informed decisions regarding changes and revisions.

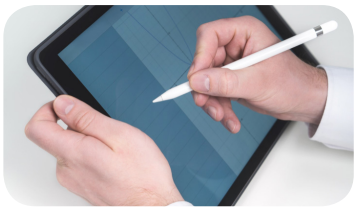
How To Evaluate A Program:

Step 1: Assemble a team

Workplace safety affects all employees, and they are the best source of valuable on-site hazard information.

Step 2: Collect the relevant data

The method and frequency of data collection will vary between organizations and vary based on the goals of the program. Common ways to collect data include records, surveys, interviews, focus groups, personal observations, and environmental measures.



Step 3: Analyze the data

Depending on the types of questions asked and the results of the data collection effort, completing this step may be simple or complex. Team members should be allowed to individually interpret the results before the team comes together to compare findings, arrive at conclusions, and summarize these findings for everyone.

Step 4: Share the results

A discussion should be started by these findings. Feedback concerning measures to act on the results and implement changes should also be addressed.

REMEMBER

Management must create effective rules and procedures, and they must be followed. If plans aren't followed, they can't be effective.

Recording and Reporting Occupational Injuries and Illnesses

Also known as Part 1904, this rule discusses the OSHA regulations for recording and reporting work-related injuries and illnesses.

The recording or reporting of a work-related injury, illness, or fatality does not mean that the employer or employee was at fault, that an OSHA rule has been violated, or that the employee is eligible for workers' compensation or other benefits.

Records are also used by employers and employees to manage safety and health programs at individual workplaces. Analysis of the data is proven to be an effective method for discovering workplace safety and health problems, and for tracking progress in solving said problems. OSHA also uses this data to help direct programs and measure performance.

Partial Exemptions

All employers covered by the **Occupational Safety and Health Act of 1970 (the OSH Act)** must report any workplace incident that results in a fatality or the hospitalization of three or more employees.

Partial exemption (of reporting) is granted to companies meeting qualifying size requirements, or is classified as a qualifying industry under 1904.2.

Employers with 10 or fewer employees do not need to keep OSHA injury and illness records unless specifically requested. Employers with more than 10 employees must keep OSHA injury and illness records unless the establishment is classified as a partially exempt industry.

Determining work-relatedness

An injury or illness that occurs while the employee is engaged in a work-related activity is considered work-related. However, when an employee checks into a hotel or motel, he or she is establishing a "home away from home." When employees are in the "home away from home" status, injury or illness that occurs is not considered work-related.

When an employee is working at home and is working for pay or compensation as a result, a case of injury or illness is considered work-related. However, cases are not work-related if illness or injury is a result of something in the general home environment.

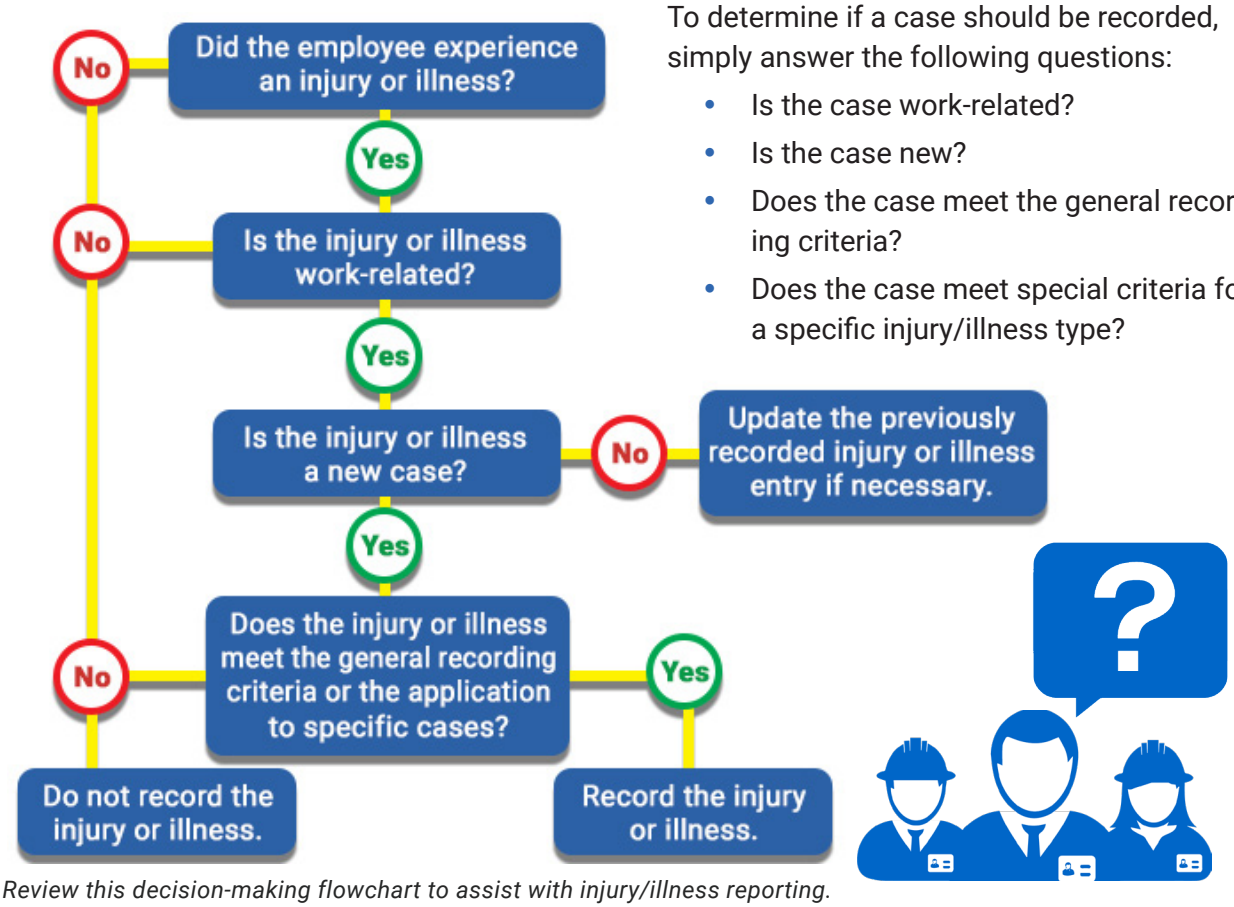
Recording and Reporting Occupational Injuries and Illnesses

Also known as Part 1904, this rule discusses the OSHA regulations for recording and reporting work-related injuries and illnesses.

Procedures for recording events

To determine if a case should be recorded, simply answer the following questions:

- Is the case work-related?
- Is the case new?
- Does the case meet the general recording criteria?
- Does the case meet special criteria for a specific injury/illness type?



Review this decision-making flowchart to assist with injury/illness reporting.

The following instances are not considered work-related and would not require recording:

- An employee is present as a member of the public
- Employee symptoms arise in a work environment, but is solely due to a nonwork-related event
- An employee is injured while voluntarily participating in a wellness, medical, fitness, or recreational activity
- An employee is injured because of eating, drinking, or preparing food or drink for their own personal consumption
- An employee is performing personal tasks outside of their assigned work hours
- An employee is injured as the result of personal grooming, self-medication for a condition that is not work-related, or is intentionally self-inflicted
- The employee is injured in a motor vehicle accident on a company parking lot or company access road while the employee is commuting to or from work
- An employee is suffering from a common cold or flu

General Recording Criteria

There are a variety of circumstances that categorize workplace injuries and illnesses as recordable.

An injury or illness is recordable – or deemed as "significantly aggravated" - if it results in one or more of the following:

Death

- Employers must report the death of any employee to OSHA within 8 hours
- Injuries resulting in amputation or in-patient hospitalization must be reported to OSHA within 24 hours

Days Away From Work

- Cases are determined by counting the number of calendar days that the employee is not able to work (including weekends and holidays)
- The day count should be capped at 180 days away

Restricted Work Or Job Transfer

- Evaluated by time and job functions

Medical treatment

- Beyond first aid

EXAMPLE

If the employee was scheduled to work an 8-hour day, but is only about to work 4 hours

Loss Of Consciousness

Diagnosis

- By a physician, of a significant injury/illness

EXAMPLE

Examples include cancer, chronic diseases, fractured bones, and punctured eardrums.

Recordkeeping Forms

OSHA recordkeeping forms must be ulitized in the evet of workplace injuries and illnesses.

OSHA 300 Log

The OSHA 300 form is called the Log of Work-Related Injuries and Illnesses. You must enter information about your business at the top of the OSHA 300 Log, enter a one or two-line description for each recordable injury or illness, and summarize this information on the OSHA 300-A at the end of the year.

On the 300 Log, the employer checks only one outcome column for each case: the column representing the most serious outcome of the case. If the status of the case changes, then the entry must be changed. For example, if the injured employee is experiencing days away from work, then dies, the employer must remove (or line out) the days away entry and the day count, and then check the box for a fatality.

OSHA 300-A Summary

The OSHA 300-A is known as the Summary of Work-Related Injuries and Illnesses. This form details work-related injuries and illnesses, is signed by company executives and posted by employers from February 1 through April 30. By showing general information, this form makes it easier to protect the privacy of injured or ill workers. The form asks for additional data on the average number of employees and hours worked to make it easier to calculate rates. Incidence rates are the best way to compare an establishment or an individual company's data to the national statistics and to their prior performance.

OSHA 301 Form

The OSHA 301 form is called the Injury and Illness Incident Report. Employers must complete an OSHA 301 Incident Report form, or an equivalent form, for each recordable injury or illness entered on the OSHA 300 Log. The 301 form captures data on each injury and illness (the length of service, what time the injury occurred, what time the employee started work, etc.).

On the OSHA 301 Form, the questions about how the person was injured or became ill are identical to the BLS survey questions, which makes it easier for employers to complete the survey forms when they receive them. Many employers use a Worker's Compensation Report, a First Report of Injury or a Company Accident Report as an equivalent form. This is approved by OSHA. However, these forms must include all of the same data that is found on the 301 form or can be supplemented so that that data is attached to it.

Employers must enter recordable cases on the relevant forms within 7 calendar days of receiving information that a recordable case has occurred.

OSHA Inspections

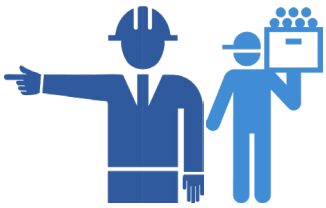
Every workplace is required by OSHA to communicate the availability of standards and inspections as part of an employee's rights.

The OSH Act authorizes the Department of Labor to conduct inspections as well as issue citations and proposed penalties for alleged violations.

The purpose of this is to establish rules and policies for the enforcement of inspections, citations, and proposed penalties.

Posting of Notice:

- Employers are required to have OSHA notifications clearly posted to inform employees of their protections and obligations
- Any employer failing to comply with the provisions of this section will be subject to citation and penalty



Authority and Objection:

- Every workplace can be inspected by the Compliance Safety and Health officers of the Department of Labor
  - These designated officials are authorized to enter any work environment – without delay and at reasonable times – to inspect and investigate
- If the employer objects to the inspection, the Safety and Health officer will terminate the inspection or continue the inspection in areas where no objection is raised
  - The employer must provide a reason for the objection

Compulsory Process:

- The institution of any appropriate action, including ex parte application for an inspection warrant or its equivalent
  - An ex parte decision is one decided by a judge without the need for all involved parties to be present
- Sought in advance of an attempted inspection or investigation if it is necessary or desirable
  - **Entry Not a Waiver:**
    - Defined as "any permission to enter, inspect, review records, or question any person, may not imply or be conditioned upon a waiver of any cause of action, citation, or penalty under the Act."

OSHA Inspections

Every workplace is required by OSHA to communicate the availability of standards and inspections as part of an employee's rights.

Notice of Inspections:

Notice of inspections may not be given in advance, except in the following situations:

- In cases of immediate danger, to enable the employer to minimize the danger as quickly as possible
- In circumstances where the inspection can most effectively be conducted either after regular business hours, or where special preparations are necessary for an inspection
- Where necessary to assure the presence of representatives – employer, employees, or the appropriate personnel needed to aid in the inspection.

Conduct of Inspections:

At the beginning of an inspection, the Compliance Safety and Health officer must:

- Present their credentials to the agent in charge at the establishment
- Explain the purpose of the inspection
- Indicate generally the scope of the inspection and the records they wish to review

During an inspection, the Compliance Safety and Health officer have authority to:

- Take environmental samples and take or obtain photographs related to the purpose of the inspection
- Employ other reasonable investigative techniques
- Question any owner, employer, employee, or agent of an establishment

Some representatives will be given an opportunity to accompany the Compliance Safety and Health officer during the physical inspection of the workplace to aid the inspection. Different representatives may be need during different phases of an inspection. However, the officer is authorized to deny the right of accompaniment to any person who interferes with a fair and orderly inspection.

After an inspection, the Compliance Safety and Health officer must:

- Confer with the employer and informally advise them of any apparent safety or health violations discovered by the inspection
- Keep all information regarding trade secrets obtained through the inspection confidential, as applicable

REMEMBER

The conduct of inspections requires that there is no unreasonable disruption to operations at the employer's establishment.

OSHA Inspections

Every workplace is required by OSHA to communicate the availability of standards and inspections as part of an employee's rights.

Citations:

If a violation of OSHA requirements exists, the employer will be issued either a citation or a notice of violations, which have no direct or immediate relationship to safety or health.

De minimis violations are trivial or minor offenses that can be easily remedied.

- An appropriate citation or notice of de minimis violations will be issued after being investigated by the Compliance Safety and Health officer, even if the employer immediately takes steps to eliminate the violation
- If a citation or notice of de minimis violations is issued for a violation alleged in an employee request for inspection, a copy of the citation or notice of de minimis violations must also be sent to the employee who made such request or notification

The following regulations apply to the issuing of citations:

- Citations must describe the alleged violation, including a reference to the following:
  - Provision(s) of the Occupational Safety and Health (OSH) Act
  - Standard
  - Rule
  - Regulation
  - Order alleged to have been violated
- Citations must designate a reasonable time or times for abatement of the alleged violation

After the issuance of a citation, the Area Director will notify the employer of the proposed penalty, or if no penalty is being proposed.

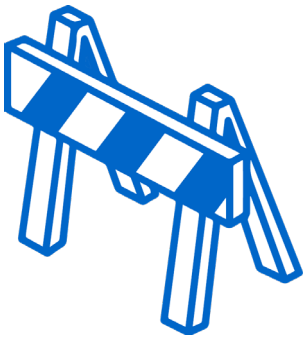
- One exception to this is that the employer can contest the proposed penalty before a Review Commission, within 15 working days of receiving it
  - Every notice of intention to contest must specify whether it is directed to the citation, the proposed penalty, or both

OSHA Inspections

Every workplace is required by OSHA to communicate the availability of standards and inspections as part of an employee's rights.

The Area Director will determine the amount of any proposed penalty.

- Upon receiving any citation under the OSH Act, the employer must immediately post the citation – throughout their establishment – at or near each place an alleged violation occurred.
  - Each citation or copy should be posted until the violation is fixed or for 3 working days, whichever is later.
- If an inspection reveals that an employer has failed to correct a cited violation within the given time, the Area Director will notify the employer of the failure and the additional penalty proposed due to the failure.
- Any employer receiving this type of citation may notify the Area Director, in writing, that they intend to contest the notification/proposed additional penalty before a review commission.

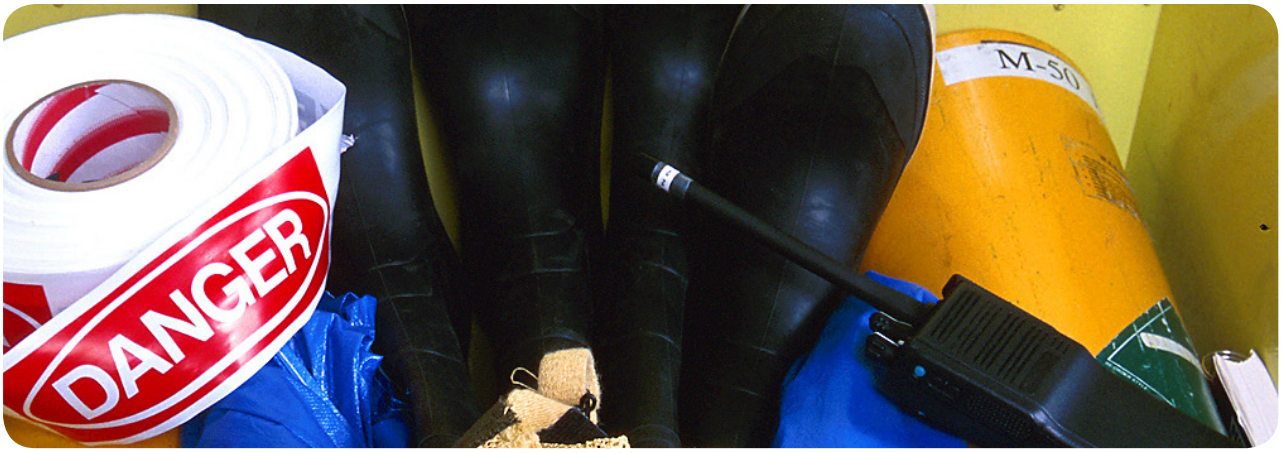


OSHA inspections are intended to result in the abatement date – the date established by any formal settlement agreement – of any violations of the OSH Act, which refers to the following:

- The date in the citation for the abatement of the violation
- The date established in the citation to reach the correction
- Within 10 calendar days after the abatement date, the employer must notify OSHA that each cited violation has been corrected.
  - The employer's certification that abatement is complete must include, for each cited violation:
    - The date and method of abatement
    - A statement that affected employees and their representatives have been informed of the abatement
- The employer is not required to provided notification of completed abatement if the OSHA Compliance officer who was present during the initial inspection observes the violation has been corrected within 24 hours

Protecting Yourself Using Safety and Health Programs

Safety and health programs are essential to keeping employees safe in the workplace.



The main goal of safety and health programs is to keep workers safe. Every employee should know which safety and health programs exist, how to find the program information on demand, and should be prepared to follow the policies and procedures contained within each program.

Training should not be viewed as punishment. All training exercises and requirements should be treated as opportunities to protect yourself. Even if you've already been trained in something similar, each work site is different. Pay attention, absorb the information being provided, and take the experience seriously.

Always use ***PPE*** when directed and be sure to use it only as directed. PPE is required in certain situations for a reason. Failure to use PPE when directed can lead to accidents, injuries, or even death.

Protecting Yourself Using Safety and Health Programs

Safety and health programs are essential to keeping employees safe in the workplace.

You should immediately ***report*** any accidents, injuries, or suspected hazards to management or the designated safety officer. By informing management of safety and health issues in the workplace, you are protecting yourself and those with whom you work. If employees fail to report their injuries and illnesses, it will certainly lead to inaccurate and misleading information. Because of this, OSHA requires that each employee to know the process of reporting an injury or illness case.

OSHA has promoted a better injury and illness information circumstance by increasing the employees' knowledge of their employer's **recordkeeping** program. Removing the walls that may exist in reporting of work-related injuries and illnesses will also promote the increase of safety information to better help workers.

OSHA requires the employer to save the OSHA 300 Log, the Annual Summary, and the OSHA 301 Incident Report forms for five years following the end of the calendar year that is covered by each record. The five-year retention requirement exists because this length of time enables employers, employees, and researchers to obtain sufficient data to discover patterns and trends of illnesses and injuries.

Employer Responsibilities

The ultimate responsibility of the employer is to provide employees with a safe and healthful workplace.

Employers should utilize safety and health programs when it is both in the best interest of their employees and when it is required. Safety and health programs will play a huge role in the employer's contribution to safe, healthy workplaces.

Employers have a responsibility to identify hazards when considering safety and health programs. Hazard identification in the workplace should:

- Identify existing and potential hazards before work begins and/or continues
- Assess the severity of each hazard identified and prioritize them
- Conduct these processes as often as necessary to maintain safety
- Notify employees of any hazardous situations/conditions

Employers must be sure to provide their employees with the resources needed to protect themselves. This includes providing access to the information and training that workers need to succeed.

Managers, supervisors, and specified employees should be granted the authority to implement safety and health programs as appropriate to worker responsibilities. The employer must also identify at least one manager, supervisor, or employee to receive and respond to safety and health conditions and, when appropriate, to initiate corrective action.

Communicating about safety is key to a safe and healthful workplace. Employers must take the time to discuss safety issues with employees of all levels to get a thorough, unbiased gauge of the conditions. Employee participation, evaluation, and feedback should always be encouraged.

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Hazardous Materials

Lesson 11 Study Guide

LESSON PURPOSE:

The purpose of this lesson is to provide you with information necessary to reduce the possibility of injury or sickness related to hazardous material in the workplace.

LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify hazardous materials
- Describe types and examples of workplace hazardous materials
- List ways to protect yourself from hazardous materials
- Explain employer responsibilities for protecting against hazardous materials

Hazardous materials are common in many workplaces - ranging from meat packing factories to beauty salons.

Hazardous Materials Defined

"Hazardous materials are substances that can cause a wide range of health and physical problems with exposure."

Major Types of Hazardous Materials

- Flammable liquids
- Flammable gases
- Poisonous gases
- Radioactive materials

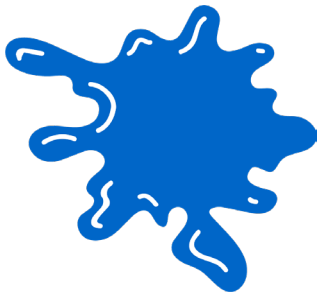
Flammable, explosive, and blasting materials are all very dangerous in the presence of sources of ignition such as open flames, hot surfaces, electrical and mechanical sparks, and static electricity.

Poisonous gases and radioactive materials are both potentially hazardous substances that occur naturally in our environment, such as carbon monoxide and the sun's rays.

It is important to know if a substance is or can be a hazard in certain forms or quantities. Exposure to such substances can have long term and serious health effects, such as lung damage or cancer.

Exposure to Hazardous Material

When working with or around hazardous materials it is very important to be vigilant about possible accidents or poor conditions.



Toxicity

Toxicity is determined by the amount of a substance that is required to cause injury. A substance is considered highly toxic when it only takes a small amount to cause great harm.

OSHA guidelines have set out almost 500 enforceable **Permissible Exposure Limit** (PEL) requirements to defend workers against the dangerous health effects of hazardous materials.

Most of the permissible exposure limits are based on an 8-hour **Time-Weighted Average** (TWA), meaning the employee can be exposed to the substance for up to 8 hours without negative health effects. In addition, many hazardous materials include a skin exposure limit to discourage or prevent skin contact.

Work environment dangers associated with hazardous materials that all employees should be aware of include:

- Compressed gas cylinders
- Ignition sources
- Explosive and blasting agents
- Storing hazards

Workplace exposure to hazardous materials could include the following scenarios:

1. Chemicals such as cleaning agents can cause burns if used without proper Personal Protective Equipment (PPE)
2. Confined spaces without proper ventilation can cause illness due to chemical exposure
3. Workers can be exposed to radiation from taking improper safety precautions when using x-ray machines
4. Incorrectly stored flammable substances can cause fires or explosions

Some of the ways that you can protect yourself include:

- Understanding and implementing safe work practices
- Using the appropriate PPE for your work environment
- Inspecting materials to make sure they are stored and maintained correctly
- Being aware of required moving procedures for hazardous materials
- Maintaining proper ventilation when working with or around hazardous substances
- Training in fire prevention plans and spill procedures

Types of Hazardous Materials

Hazardous materials can pose significant health risks when they are not handled or maintained properly.

Hazardous materials can be in a gas, liquid, or solid state and have many different characteristics and dangers associated with them.

Some examples of hazardous materials in the workplace include:

TYPE OF HAZARDOUS MATERIALS	DEFINITION	EXAMPLES
Carcinogens 	Substances that can cause cancer in living tissue.	Formaldehyde Wood Dust Asbestos Benzene
Toxins 	Poisonous substances created by organic matter, such as bacteria or plants.	Ricin comes from the waste produced when processing castor beans. Cadmium is a white metal used in products like batteries or pigments.
Irritants 	Non-corrosive chemicals that can cause inflammation by chemical reaction on living tissue on the site of contact. The effects are reversible.	Ammonia Sodium Hydroxide Hydrogen chloride
Corrosives 	Chemicals that cause a chemical reaction that permanently damages living tissue and certain metals. Certain metals include aluminum and steel.	Lye Sulfuric Acid Nitric Acid
Flammable Liquids 	Liquids that have a flashpoint below 100 °F (38 °C).	Gasoline Acetone Turpentine Pentane
Flammable Gases 	Gases that burns in air at a concentration of less than 13% or has a lower flammable limit of 13% or higher with a flammable range greater than 12%.	Hydrogen Oxygen Methane Butane

Examples of Hazardous Materials

Hazardous materials present a variety of risks.

In addition to OSHA, many federal agencies are involved with the regulation, monitoring, and reporting of hazardous materials and waste including the Environmental Protection Agency (EPA), Centers for Disease Control and Prevention (CDC), and the Department of Transportation (DOT).

Hazardous material accidents often result in explosions or fires. Although many workplace chemicals are suspected of being dangerous, only a few of those substances are regulated. Research has shown that exposure to hazardous substances can result in cancer or other diseases that can affect major organs like skin, nerves, lungs, and stomach.

Statistics show that approximately 190,000 workers suffer from illness and 50,000 workers die on an annual basis from chemical exposure.

Here are some specific examples of accidents caused by hazardous materials in the workplace:

- Farm workers experiencing respiratory problems from unprotected exposure to crop pesticides
- Water treatment employee losing consciousness from exposure to carbon monoxide from a gasoline powered pump
- Worker in a poultry processing facility experiencing eye irritation, sore throat, and headaches from high chlorine concentration in the water that is used to clean meat
- Firefighter is injured while refilling a compress gas cylinder with air and container explodes
- Nail technician developing asthma from exposure to hazardous manicure chemicals

Hazardous waste – resulting from the disposal of chemicals that are flammable, corrosive, or toxic – is a serious health and safety risk for workplace employees and the general surrounding population and environment.

Understanding Hazardous Materials

Hazardous materials present a variety of risks.

Work environment dangers associated with hazardous materials that all employees should be aware of include compressed gas cylinders, ignition sources, explosive and blasting agents, and storing hazards. Flammable, explosive, and blasting materials are all very dangerous in the presence of sources of ignition such as open flames, hot surfaces, electrical and mechanical sparks, and static electricity.

Classifying flammable liquids is determined by the flashpoint.

A **flashpoint** is the minimum or lowest temperature at which a liquid gives off enough vapor to form an ignitable mixture.

The flashpoint of a liquid is identified by slowly heating the liquid in a test container and introducing a small flame to the vapor area above the surface of the liquid. The lowest temperature at which a flash occurs from the flame is the flashpoint of the liquid.

REMEMBER

The lower the mixture's flashpoint, the greater the hazard.

OSHA's Flammable Liquid Standard 29 CF 1910.106

In 2012, OSHA modified its existing Hazard Communication Standard to follow the regulations of the United Nations' Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

A flammable liquid is a liquid that has a flashpoint at or below 199.4 °F (93 °C).

Ignitable liquids are no longer divided into flammable and combustible liquids. Instead, flammable liquids are classified into 4 categories:

Category 1

- flammable liquids have
  - A flashpoint below 73.4 °F (23 °C)
  - A boiling point equal to or below 95 °F (35 °C)

Category 2

- flammable liquids have
  - A flashpoint below 73.4 °F (23 °C)
  - A boiling point greater than 95 °F (35 °C)

Category 3

- flammable liquids have a flashpoint
  - Equal to or greater than 73.4 °F (23 °C)
  - Equal to or less than 140 °F (60 °C)

Category 4

- flammable liquids have
  - A flashpoint greater than 140 °F (60 °C)
  - Equal to or less than 199.4 °F (93 °C)

Category 3 and 4 flammable liquids have additional regulation and categorization information based on the substance's flashpoint and heating:

If a **Category 3** liquid is heated to within 30 °F (-1.1 °C) of its flashpoint and has a flashpoint equal to or above 100 °F (37.8 °C), it must be handled following the requirements of a Category 3 liquid with a flashpoint below 100 °F (37.8 °C).

If a **Category 4** liquid is heated to within 30 °F (-1.1 °C) of its flashpoint, it must be handled following the requirements of a Category 3 liquid with a flashpoint at or above 100 degrees Fahrenheit.

Poisonous Gases

Many naturally occurring gases can be safe in low concentrations or exposure, but become lethal at high levels.

Hazardous materials in a gas state can present serious risks for workers if inhaled or touched, including irritation, injury, or even death. If hazardous substances are known to be present in a workplace, then air sampling and other testing is required to monitor levels and prevent exposure risks.

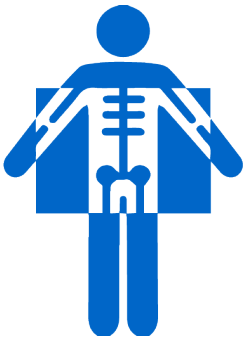
Hydrogen sulfide is a common example of a poisonous gas. It's often described as having an egg smell. Typically, hydrogen sulfide is created in a natural environment, but industrial activities can also produce the gas.

This potentially dangerous gas can be absorbed quickly through the lungs and can result in adverse health effects. Short exposure to low levels of the gas can cause effects such as eye irritation and coughing, while concentrated exposure to high levels can cause convulsions, breathing difficulty, and can ultimately lead to death.

Primary sources of protection against poisonous gases or airborne pathogens include the use of gas masks, protective clothing, and appropriate workplace ventilation.

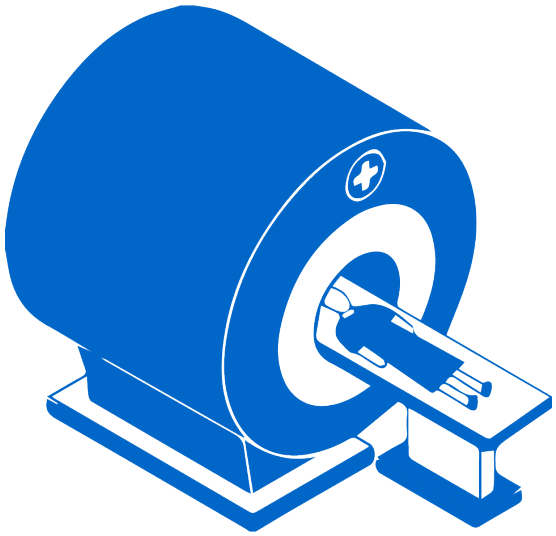
Radioactive Materials

Radiation is used in a wide range of occupations and can pose as a potentially hazardous to the health of workers.



Radiation harms workers by depositing energy into body tissue. Such energy deposits can result in cell damage. Depending on the amount and period of exposure, radiation can be deadly.

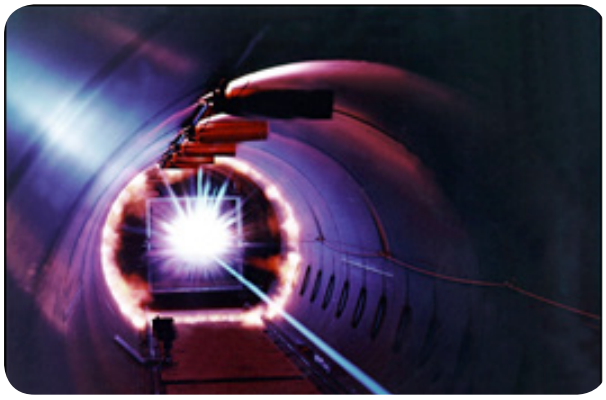
In some exposure incidents, the cells might survive but become briefly or permanently damaged over an extended period. These abnormal cells can become malignant and cause related health risks. The type and degree of cell damage is determined by the amount and period of absorption, dose, and the exposed body parts.



Radiation can be found in manmade sources like CT scans.

The two types of radiation are:

Ionizing radiation – has a significant amount of energy and can push electrons from atoms in a process called ionization. Examples include x-rays and radioactive elements. Ionizing radiation can harm the atoms of humans and therefore pose some health risks such as destroyed tissue or damaged DNA.



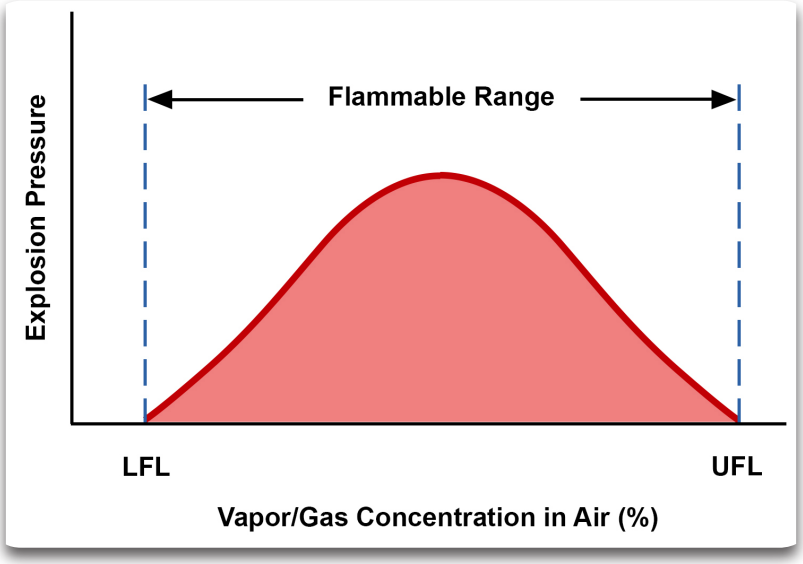
Non-ionizing radiation – has less energy than ionizing radiation but can move atoms in a molecule around or cause them to vibrate but cannot remove electrons. Examples include visible light, microwaves, and lasers.

Ignition and Explosion

Flammable substances are not necessarily dangerous by themselves. It takes an ignition source to make them catch fire or explode.

Flammable Range

Flammable range, also known as explosive range, is the range of a concentration of a vapor or gas from a flammable liquid that will burn or explode if an ignition source is present.



- Upper Flammable Limit (UFL) or Upper Explosive Limit (UEL) is the maximum percentage of vapor in air above which spread of flame does not occur in the presence of a source of ignition.
- Lower Flammable Limit (LFL) or Lower Explosive Limit (UEL) is the minimum percentage of vapor in air below which spread of flame does not occur in the presence of a source of ignition.

These boundary line limits are usually expressed in terms of proportion by volume of vapor in air. The terms “flammable” and “explosive” are used interchangeably in the description of this range.

- A vapor or air mixture below the lower flammable limit is too thin to ignite.
- A mixture above the upper flammable limit is too dense to ignite.

Some sources of ignition are:

- Open flames
- Static electricity
- Cutting and welding
- Hot surfaces
- Electrical and mechanical sparks
- Lightning

Employers and employees must take all adequate precautions to prevent the ignition of flammable vapors.

Ignition and Explosion

Flammable substances are not necessarily dangerous by themselves. It takes an ignition source to make them catch fire or explode.

Explosives and Blasting Agents

Explosive or blasting agents are materials, mixtures, or devices used to blast or explode structures or substances. The difference between an explosive agent and a blasting agent is that a blasting agent requires a primer to explode. The U.S. Department of Transportation classifies explosive agents into the following 3 types:

- **Class A Explosives** have detonating powers and are the most dangerous

- **Class B Explosives** are flammable hazards

- **Class C Explosives** have a mixture of Class A and/or Class B explosives but in restricted amounts

Explosive and blasting agents are highly volatile substances that must be stored securely in specific structures called magazines. Magazines must be protected from possible ignition sources, ventilated, and maintained.

EXAMPLE

Examples of explosive materials include black powder, dynamite, electric blasting caps, and igniter cords.

Storage Hazards

The storage and handling of hazardous materials is a very important part of any worksite safety plan.

Flammable liquids can only be stored in approved and appropriately closed containers and portable tanks.

Portable tanks have a liquid capacity of more than 60 U.S. gallons. They can be both movable and closed containers.

Closed containers must have emergency venting systems to prevent explosions in the event of increases in pressure due to environment, such as a fire, or material stability changes.

Flammable liquids in Category 1 and 2 – and those in 3 with a flashpoint below 100 degrees Fahrenheit – must be kept in covered containers when not in use.

Isolate and separate the incompatible materials by storing them in separate areas or rooms. The degree of isolation depends on quantities, chemical properties, and packaging. If you are separating storage materials in the same area or room, make sure they are apart from each other.

When removing or transferring a flammable liquid from a container within a building, only the following methods are acceptable:

- Closed piping system
- Safety can
- Device used to draw liquid through the top
- By gravity through a self-closing valve

Storage Hazards

The storage and handling of hazardous materials is a very important part of any worksite safety plan.

Safety cans are often an approved method of containing or transferring flammable liquids within a worksite building or structure. It cannot be more than 5 gallons and has a spring-closing lid and spout cover.

Spills

When handling spills or leaks, take the following steps to control the hazard:

1. Eliminate all sources of ignition
2. Stop the leak, if possible
3. Contain the material
4. Isolate the area
5. Avoid direct contact with the material
6. Use appropriate fire control procedures

Ventilation & Fire Control

Constant air flow will help prevent a fire from getting out of hand.

Ventilation

MEDICAL ALERT

Workers should not depend on their senses for the detection of dangerous airborne substances. Often these vapors cannot be seen or smelled.

Proper ventilation is vital in the prevention of fires, explosions, and the inhalation of hazardous airborne substances. Areas where uncontained hazardous materials are present should have constant air flow to prevent the pooling or accumulation of flammable or dangerous vapors.

Industrial plants using Class I liquids must have ventilation at a rate of no less than 1 cubic foot per minute per square foot of solid floor area. This must be accomplished by natural or mechanical ventilation with discharge or exhaust to a safe location outside of the building.

The ventilation process must go through 6 air changes per hour, which means that clean air is cycled throughout the room so that hazardous fumes or materials do not have the chance to accumulate into dangerous levels.

All storage rooms must be provided with either a gravity or mechanical exhaust ventilation system designed to ensure a complete change of air within the room no less than 6 times per hour.

Ventilation & Fire Control

Constant air flow will help prevent a fire from getting out of hand.

Fire Control

Incorrect labeling, handling, or storage of hazardous materials can pose serious risks for fire or explosion. All workplaces should have a Fire Prevention Plan (FPP).

This written document should clearly list all possible fire hazards, such as:

- Ignition Sources and Hazardous Materials
- Proper Maintenance and Use Guides
- Protective Equipment Used in The Event of a Fire

OSHA also has specific requirements for installation, maintenance, and testing of employee fire alarm systems to warn workers. Employees must know their workplace's specific FPP and react appropriately if an alarm is activated.

Where to Place the Fire Extinguisher

If flammable materials are used at a site, then a portable fire extinguisher must be within 10 feet of the entryway of a storage room. If a Category 1, 2, or 3 liquid is in a storage area – separate from the main storage room in a building – then a fire extinguisher must be within 25 feet, but not closer than 10 feet.

The distance between the fire extinguisher and hazardous material is determined by how quickly a fire can develop depending on the flammable liquid. Having the fire extinguisher available away from the fire allows personnel to grab the extinguisher at a safe distance before putting out the fire. If the extinguisher were too close and the fire grew too fast, then the extinguisher would not be reached in time.

Protecting Yourself Against Hazardous Materials

Workers must know the procedures for inspecting, storing, moving, and controlling hazardous materials to maintain a safe workplace.

When working with or around hazardous materials, it is very important to be:

- Knowledgeable about the substances
- Aware of workplace safety and health procedures
- Vigilant about possible accidents or poor conditions

To protect against workplace incidents, employees must be continuously vigilant, frequently reviewing their work environment, and following safe practices.

By establishing safe work practices, worker exposure to hazards can be minimized. Some of the ways that you can protect yourself include:

- Understanding and implementing safe work practices
- Receiving training on the proper use and maintenance of personal protective equipment (PPE)
- Inspecting materials to make sure they are stored and maintained correctly
- Gaining awareness of required moving procedures for hazardous materials
- Maintaining proper ventilation when working with or around hazardous substances
- Training and knowledge of fire prevention plans and spill procedures

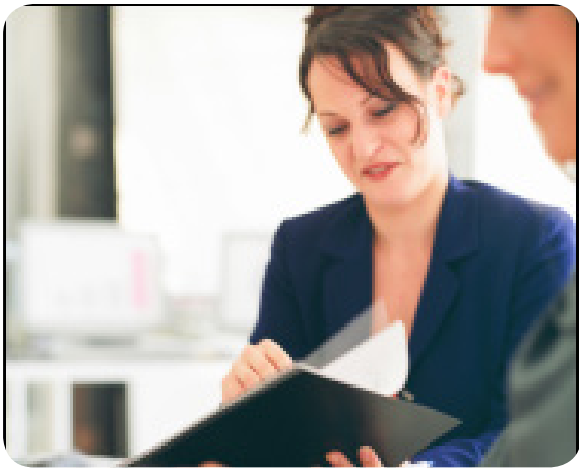
The nature of the industry or specific workplace will determine if certain OSHA requirements or standards should be applied. Some specific areas include:

- Permit-required confined space rules
- Requirements for electrical protective equipment, such as rubber insulating gloves for worksites with exposure to electrical currents
- Hearing conservation programs for workplaces with high noise exposure (i.e. airports).
- Chemical hygiene plans for laboratories using hazardous chemicals

If both engineering and administrative controls cannot remove all the dangers associated with a hazardous material in a workplace, then PPE must be used.

Employer Responsibilities for Hazardous Materials

Employers must standardize the internal structure and required practices to ensure a safe workplace.



Responsibilities of employers for protecting their employees against hazardous materials include:

- Creating and implementing a Safety and Health Program
- Site specific engineering regulations and workplace practices
- Following OSHA's hazard communication standards
- Providing clear and easy entry and access to sites and buildings
- Conducting a process hazard analysis
- Creating a written operating procedure document for all worksite processes
- Training and assisting employees and contractors to increase risk awareness and prevention
- Making periodic site evaluations to develop necessary protection methods
- Ensuring employees have access to medical examination, at no cost to employees

It is important for workers to:

- Be aware of the types of hazardous substances that might be present in their workplace
- Know how to inspect, store, move, and control those substances
- Know how to handle emergency situations that might result from exposure or the release of hazardous materials

Whenever possible, engineering and administrative controls should be put in place by the employer to prevent exposure to hazardous materials.

When exposure cannot be avoided, then the appropriate Personal Protective Equipment and procedures must be used to prevent workplace accidents.

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Permit-Required Confined Spaces

Lesson 12 Study Guide

LESSON PURPOSE:

The purpose of this lesson is to cover permit-required confined spaces and the precautions necessary for entry.

LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify confined spaces and why they pose such a hazard to workers
- Describe requirements for confined space entry
- List the responsibilities of employers, supervisors, authorized entrants and attendants when performing permit-required confined space entry
- Explain appropriate documentation for confined space entry

It is possible to encounter a confined spaces in just about every occupation.

Duties in confined spaces create hazards for workers that may not otherwise be present.

Permit-required confined spaces have one or more of these characteristics:

1. Contain or have the potential to contain a hazardous atmosphere
2. Contain materials with the potential to engulf someone who enters the space
3. Have an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section
4. Contain any other serious heath and/or safety hazards

Confined Spaces Defined

By definition, a **confined space**:

> 1. Is large enough for an employee to fully enter and perform assigned work
> 2. Has a restricted means of entry or exit
> 3. Is not designed for continuous occupancy

Examples of Confined Spaces

Common examples of confined spaces include:

- Underground vaults
- Tanks
- Storage bins
- Pits
- Diked areas
- Vessels
- Silos

Defining Permit-Required Confined Spaces

It is possible to encounter a confined space in just about every occupation.

To fully understand permit-required confined spaces, you should also become familiar with the following terminology:

Hazardous Atmosphere

A **hazardous atmosphere** can expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, injury, and acute illness. The following can cause a hazardous atmosphere:

1. Flammable gas, vapor, or mist more than 10% of its lower flammable limit (LFL)
2. Airborne combustible dust at a concentration that meets or exceeds its LFL
3. Atmospheric oxygen concentration below 19.5% or above 23.5%
4. Any other atmospheric condition that is immediately dangerous to life or health

Attendant

An **attendant** is an individual stationed outside one or more permit spaces who monitors the authorized entrants. An attendant also performs all duties assigned in the employer's permit space program.

Isolation

Isolation is the process by which a permit space is removed from service and completely protected against the release of energy and material into the space. To achieve isolation, one or more of the following actions must be completed:

- Blanking or blinding
- Misaligning or removing sections of lines, pipes, or ducts
- A double block and bleed system
- Lockout or tagout of all sources of energy
- Blocking or disconnecting all mechanical linkages

Defining Permit-Required Confined Spaces

It is possible to encounter a confined space in just about every occupation.

To fully understand permit-required confined spaces, you should also become familiar with the following terminology:

Ventilation

Ventilation is the act of providing a room, mine, etc. with fresh air in place of air that has been used or contaminated.

Authorized Entrant

An employee who is authorized by their employer to enter a permit space is known as an **authorized entrant**.

Retrieval System

A **retrieval system** is comprised of the equipment – including a retrieval line, chest or full-body harness, wristlets, and a lifting device or anchor – used for non-entry rescue of persons from permit spaces.

Confined Space Hazards

It is possible to encounter confined spaces in just about every occupation.

Among the dangerous situations associated with confined space entry, one of the most crucial is the failure to recognize that a danger exists.

Recognizing confined spaces is the first step toward improving safety. Conditions that may be typical under regular circumstances can become hazardous when present in a confined space.

Let's explore some common hazards of working in a permit-required confined space:

- Oxygen-deficient atmosphere
- Toxic atmosphere
- Materials in the space that can engulf or immerse a worker
- Inward converging walls that can slope downward and trap or asphyxiate a worker

OSHA rules for permit-required confined spaces:

- The employer must evaluate the workplace to determine if any spaces are permit-required confined spaces
- If an employer decides its employees will not enter permit spaces, the employer must prevent employees from entering permit spaces
- If the employer decides that its employees will enter permit spaces, the employer must develop and implement a written permit space program, available for inspection by employees, or his or her authorized representative

Before an employee enters the space, the internal atmosphere must be tested with a calibrated direct-reading instrument for:

1. Oxygen content
2. Flammable gases and vapors
3. Potential toxic air contaminants

Hazardous Atmosphere – Detected!

Forced air ventilation, testing, and written certification can help protect from hazardous atmosphere.

To eliminate the dangers of a hazardous atmosphere, continuous and forced air ventilation must be used as follows:

- An employee may not enter the space until the forced air ventilation has eliminated any hazardous atmosphere
- The forced air ventilation must be so directed at the immediate areas where an employee is or will be present and must continue until all employees have left the space
- The air supply for the forced air ventilation must be from a clean source and may not increase the hazards in the space
- The atmosphere within the space must be periodically tested to ensure that the continuous forced air ventilation is preventing the accumulation of a hazardous atmosphere
- Any employee – or their authorized representative – who enters the space, must be provided with an opportunity to observe the periodic testing

If a hazardous atmosphere is detected during entry:

- Each employee must leave the space immediately
- The space must be evaluated to determine how the hazardous atmosphere developed
- Measures must be implemented to protect employees from the hazardous atmosphere before any subsequent entry takes place
- The employer must provide written verification that all pre-entry measures are met

The employer must verify that the space is safe for entry and that the required pre-entry measures have been taken, through a written certification.

Written certification must contain:

- Date
- Location of the permit-required space
- Signature of the person providing the certification

The certification must be made before entry and must be made available to each employee, or their authorized representative, entering the space.

When there are changes in the use or configuration of a non-permit confined space that might increase the hazards to entrants, the employer must reevaluate that space and, if necessary, reclassify it as a permit-required confined space.

Alternative to a Full Permit Entry

Under certain conditions, the employer may use alternate procedures for worker entry into a permit space.

If an employer can demonstrate with monitoring and inspection data that a hazard – the only hazard whether actual or potential – can be made safe for entry using continuous forced air ventilation, then the employer may be exempted from some requirements – such as permits and attendants.

However, even in these circumstances, the employer must test the internal atmosphere of the space for:

1. Oxygen content

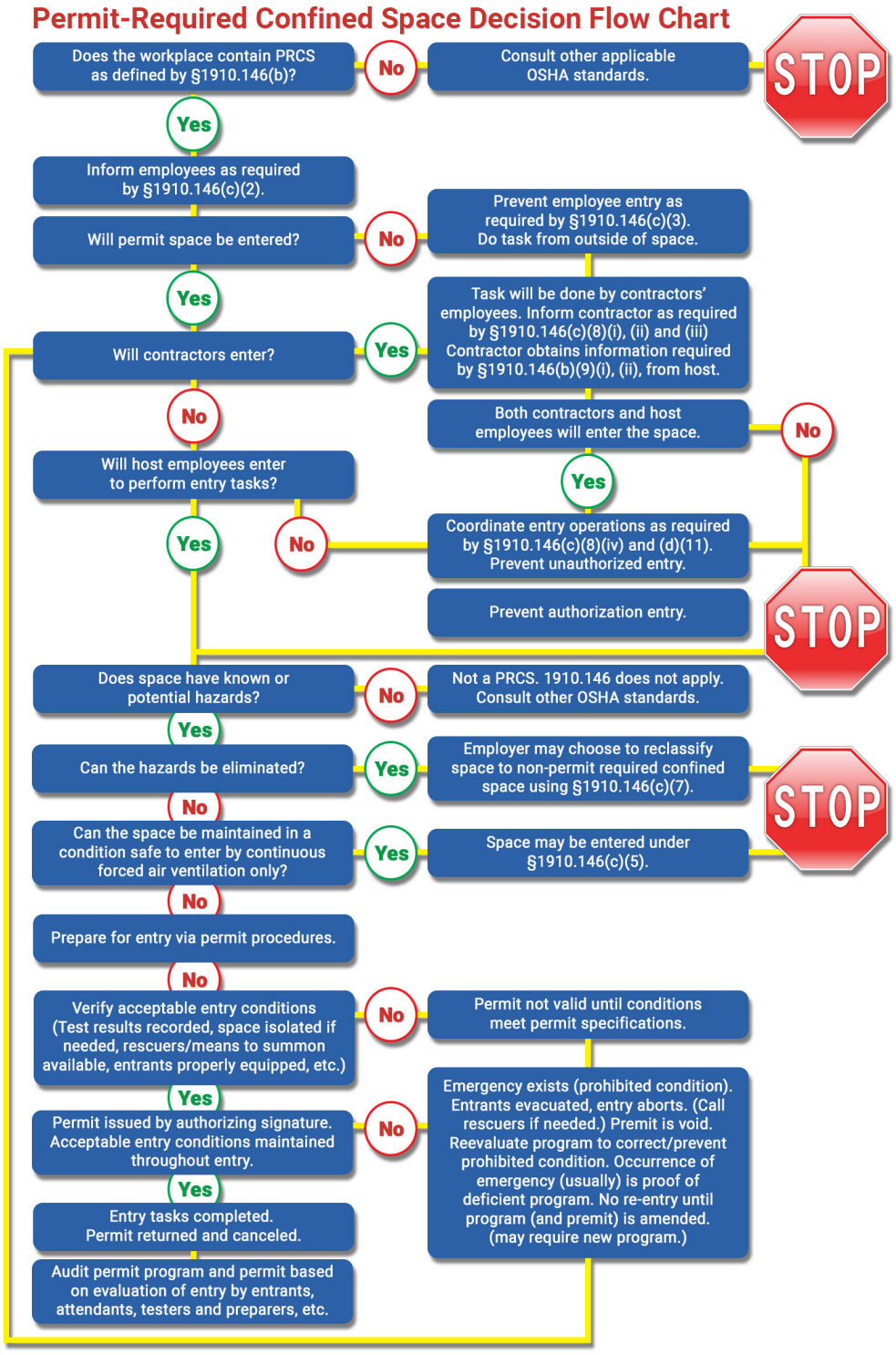
2. Flammable gases and vapors

3. The potential for toxic air contaminants before any employee enters it

The employer must also provide continuous forced ventilation and verify that the required measurements are performed before entry.

Permit Required Confined Space Decision Flow Chart

This flow chart illustrates the process of deciding what procedures to use for worker entry into a permit space.



Employer Documentation

Your employer must fulfill written programs and labeling policies before allowing operations to take place in a permit-required confined space.

Any employer who allows employee entry into a permit space must develop and implement a written program for the space.

Among other things, the OSHA standard requires the employer's written program to:

- Implement necessary measures to prevent unauthorized entry
- Identify and evaluate permit space hazards before allowing employee entry
- Test atmospheric conditions in the permit space before entry operations and monitor the space during entry
- Identify employee job duties
- Provide and maintain, at no cost to the employee, personal protective equipment (PPE) for safe entry
- Ensure that at least one attendant is stationed outside the permit space for the duration of entry operations
- Coordinate entry operations when employees of more than one employer are working in the space
- Implement appropriate procedures for summoning rescue and emergency services and preventing unauthorized personnel from attempting rescue
- Establish and implement a system (in writing) for the preparation, issue, use, and cancellation of entry permits
- Review established entry operations annually and revise the permit space entry program as necessary
- Mandate any attendant who is required to monitor multiple spaces to follow appropriate procedures during emergency situations

REMEMBER

Your employer's written program for permit-required confined spaces must perform atmospheric hazard testing in the following sequence:

1. Oxygen
2. Combustible gases or vapors
3. Toxic gases or vapors

If it is necessary to enter the permit space to eliminate hazards, such entry must be performed in accordance with OSHA. If testing and inspection during that entry demonstrate that the hazards within the permit space have been eliminated, the permit space may be *reclassified* as a non-permit confined space for as long as the hazards remain eliminated.

Employer Documentation, cont.

Your employer must fulfill written programs and labeling policies before allowing operations to take place in a permit-required confined space.

The employer's written program should establish the means, procedures, and practices to eliminate or control hazards necessary for safe permit space entry operations. These may include:

- Specifying acceptable entry conditions
- Isolating the permit space
- Providing barriers
- Verifying acceptable entry conditions
- Purging, making inert, flushing, or ventilating the permit space

Before entry is authorized, the employer must document the completion of measures required by preparing an entry permit. Before any entry begins, the entry supervisor identified on the permit must sign the entry permit to authorize entry.

Entry permits **must** include the following information:

- Name of permit space to be entered, authorized entrant(s), eligible attendants, and individuals authorized to be entry supervisors
- Test results
- Tester's initials or signature
- Name and signature of supervisor who authorizes entry.

The completed permit must be made available at the time of entry to all authorized entrants or their authorized representatives by posting it at the entry portal. This gives the entrants assurance that pre-entry preparations have been completed.

REMEMBER

If hazardous conditions are detected during entry, employees must immediately leave the space.

When entry to permit-required confined spaces is prohibited, the employer must take effective measures to prevent **unauthorized entry**.

- The entry supervisor must terminate entry and cancel the entry permit when the entry operations covered by the entry permit have been completed,

If an injured entrant is exposed to a substance for which a **Safety Data Sheet (SDS)** or other similar written information is required to be kept at the worksite, that SDS or other written information *must* be made available to the medical facility personnel treating the exposed entrant.

The Responsibility of a Host Employer & Contractors

Both host employers and contractors are responsible for ensuring safety procedures are followed in permit spaces.

An employer may need to arrange for additional help to perform work. The additional help may come in the form of contractors.

Host Employer

When a host employer arranges to have contractors – or employees from another employer – to perform work that involves permit space entry, the host employer must:

- Inform the contractor of workplace permit spaces and entry requirements
- Apprise the contractor of:
  - The elements
  - Any precautions or procedures that the host employer has implemented for the protection of employees in or near permit spaces
- Coordinate entry operations with the contractor, when both host personnel and contractor personnel will be working in or near permit spaces
- Debrief the contractor after the entry operations regarding
  - The permit space program followed
  - Any hazards confronted or created in permit spaces during entry operations

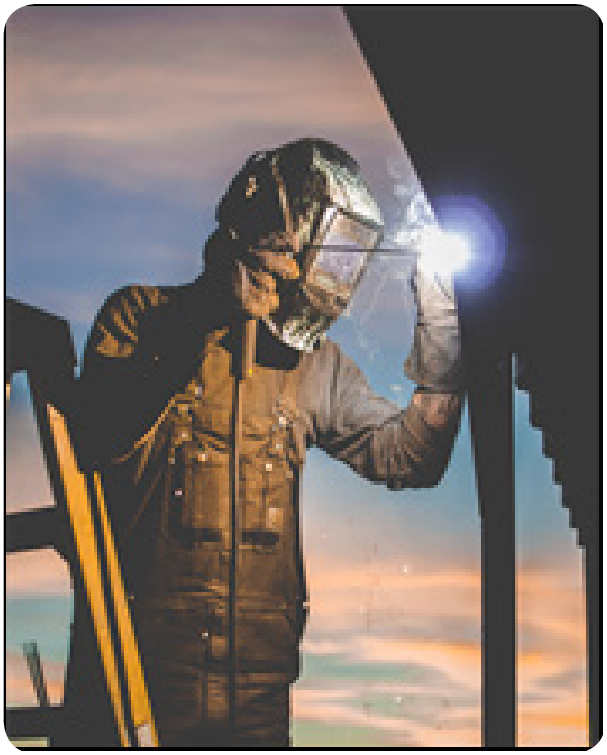
Contractor

Each contractor who is retained to perform permit space entry operations must:

- Obtain any available information regarding permit space hazards and entry operations
- Coordinate entry operations with the host employer
- Inform the host employer of the permit space program that the contractor will follow

Testing Equipment & Conditions

The employers are responsible for providing the appropriate testing equipment, maintaining that equipment properly, and ensuring that employees use that equipment properly.



Type of equipment necessary for confined space entry:

- Testing and monitoring equipment appropriate to conditions
- Ventilating equipment for acceptable entry conditions
- Communications equipment for attendant/monitor
- Personal protective equipment
- Lighting equipment
- Barriers and shields
- Equipment for safe ingress and egress – such as ladders
- Rescue and emergency equipment
- Any other equipment necessary for safe entry into and rescue from permit spaces

When entry operations are conducted in permit spaces, the employer must evaluate conditions. Evaluation methods include:

- Test conditions in the permit space for atmospheric hazards
  - Oxygen
  - Combustible gases and vapors
  - Toxic gases and vapors
- Pre-entry testing must be performed to the extent feasible before entry is authorized
- If entry is authorized, entry conditions must be continuously monitored
- Provide each authorized entrant with results of testing

Monitoring is a crucial aspect of permit-required confined space entry. At least one attendant must be outside the permit space for the length of time the operations is taking place.

If multiple spaces are to be monitored by a single attendant, the employer should include the means and procedure for the attendant to respond to emergency situations.

Permit System

Before entry is authorized, the employer must prepare an entry permit.

Key requirements of the entry permit:

- The entry supervisor must be identified on the permit and sign to authorize entry
- The name of the permit space that will be entered
- The date and authorized duration of entry
- The purpose of entry and know hazards
- The acceptable entry conditions
- The test results and the tester's initials or signature
- The names of all authorized entrants
- The required Personal Protective Equipment (PPE) and alarm systems
- The communication procedures and equipment
- The name and telephone number of rescue or emergency services
- The completed permit must be available at the point of entry during operations
  - The entrants can confirm that pre-entry preparations have been completed

The entry supervisor must terminate entry and cancel the entry permit when:

- Operations detailed on the entry permit are completed
- New conditions exist outside of those detailed on the entry permit

OSHA standards require the employer to keep all canceled permits for at least one year. New conditions must be noted on the canceled permit and used in revising the permit space program.

Training Requirements

Employers must ensure that employees have acquired the understanding, knowledge, and skills necessary to safely perform their duties.

In addition to this training, rescue team members also require training in CPR and first aid.

The employer must provide proper training for all workers before working and throughout employment in permit spaces. Additional training requirements may occur when:

- The job duties change
- A change occurs in the permit space program
- The permit space operation presents any new hazard
- An employee's job performance shows deficiencies

After completion of training, the employer must keep a record of employee training and make it available for inspection by employees and their authorized representatives. The record must include the employee's name, the trainer's signature, or initials and dates of the training.

Attendants & Entry Supervisors

Attendants and Entry Supervisors ensure safety requirements are met at the permit-required confined space.

The attendant is required to:

- Remain outside the permit space during entry operations
  - Unless relieved by another authorized attendant
- Perform non-entry rescues
  - When specified by the employer's rescue procedure
- Know existing and potential hazards
  - Including information on:
    - The mode of exposure
    - Signs or symptoms
    - Consequences
    - Physiological effects
- Maintain communication with workers entering the permit space
  - Keep an accurate record or workers

The attendant must order evacuation of the permit space when:

- A prohibited condition exists
- A worker shows signs hazard exposure
- An emergency outside the confined space exists
- The attendant cannot effectively and safely perform required duties

The attendant must also:

- Summon rescue and emergency services
- Ensure that unauthorized people stay away from permit spaces
  - Or exit immediately if they have entered the permit space
- Inform authorized entrants and the entry supervisor if any unauthorized person enters the permit space
- Perform no other duties that interfere with the attendant's primary duties

Entry supervisors are required to:

- Know space hazards
  - Including information on the mode of exposure, signs or symptoms and consequences
- Verify emergency plans and specified entry conditions such as:
  - Permits, tests, procedures and equipment before allowing entry
- Terminate entry and cancel permits when entry operations are completed
  - Or if a new condition exists
- Verify that rescue services are available
  - Ensure the means for summoning them are operable
- Take appropriate measures to remove unauthorized entrants
- Ensure that acceptable entry conditions and operations are maintained

Emergency Situations: Rescue Service Personnel

Employers must ensure that rescue and emergency services are capable of responding to an emergency in a timely manner.

Rescue service personnel must:

- Receive PPE and rescue equipment and training on how to use it
- Receive the same training as authorized entrants training in addition to rescue duties
- Have certification in first aid and CPR
- Perform practice rescue exercises on an annual basis
- Be informed of the hazards in the permit space

Harnesses and Retrieval Lines

All authorized entrants must be equipped with harnesses and retrieval lines as applicable for the worksite.

- Entrants who enter a space must wear a chest or full body harness
  - From the center of their back near their shoulders
- Wristlets may be used
  - If the use of a chest or full body harness is not possible or creates a greater hazard
- The retrieval line must be attached to a mechanical device or a fixed point outside the permit space
  - It must be present more than five feet away from a vertical position

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Introduction to Lockout/Tagout

Lesson 13 Study Guide

LESSON PURPOSE:

In this lesson, we will study the OSHA requirements for lockout/tagout procedures. These procedures help keep workers safe from the accidental release of hazardous energy.

LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify the requirements and procedures for locking and tagging out machines and equipment
- Describe major hazards that can occur when the accidental release of hazardous energy is not controlled
- List ways to prevent injuries by controlling the release of hazardous energy
- Explain employer training responsibilities and requirements for authorized employees

What is the lockout/tagout standard, and where does it apply?

Lockout/Tagout Standard

The **lockout/tagout standard** outlines the requirements for the service and maintenance of machines and equipment to prevent potential hazards from occurring on the jobsite. This standard establishes minimum performance requirements for the control of such hazardous energy.

The lockout/tagout standard has requirements in place to help prevent hazards from affecting workers.

Employers are required to demonstrate how to utilize a tagout system to provide full employee protection, establish a regular training program, and conduct periodic inspections, as set forth by OSHA regulations.

Lockout/Tagout Features

Features of a lockout/tagout system include:

- If an energy isolating device is capable of being locked out, the employer's energy control program must utilize a lockout system
- If an energy isolating device is not capable of being locked out, the employer's energy control program must utilize a tagout system
- A lockout/tagout device must be placed on the energy isolating device associated with that equipment whenever there is:
  - New equipment
  - Replacement of equipment
  - Repair or maintenance
  - Renovation/modification
- The machine or equipment must be isolated from the energy source and rendered inoperative

Defining the Lockout/Tagout Standard

What is the lockout/tagout standard, and where does it apply?

Workers may find themselves exposed to hazards when performing service or maintenance on machinery and equipment. Here's a list of workplace hazards and prevention techniques that can be implemented by using the lockout/tagout standard:

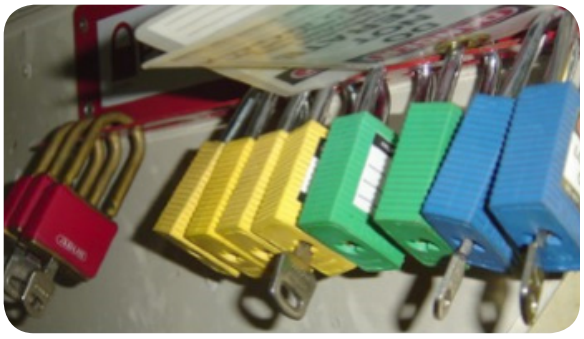
- **Live or stored energy** – Not properly shutting down and locking out an energy source can result in the electrocution of employees
- **Moving machine parts on mechanical equipment** – Not properly locking out mechanical equipment can lead to trapped or crushed employees
- **Stored heat that can be released (e.g. steam or hot liquids)** – Not properly locking out energy sources to pipes can cause injuries to workers if they are unexpectedly sprayed or splashed.

The lockout/tagout standard does **not** cover the following:

- Construction, agriculture, and maritime employment
- Installations under the exclusive control of electric utilities for power generation, transmission, and distribution, including equipment for communication or metering
- Exposure to electrical hazards with conductors in electric use (this is covered by electrical regulations)
- The drilling and servicing of oil and gas wells
- Work on cords and plugs connected to electrical equipment that is exposed to unexpected hazards
- The startup of equipment that is controlled by unplugging the equipment from a source

Defining the Lockout/Tagout Standard

Lockout and tagout devices must be consistent within the workplace.



Lockout and tagout devices must be singularly identified, used exclusively for controlling energy (in comparison to other devices), and must not be used for any other purposes.

Lockout and tagout devices are required to do the following:

- Withstand the environment to which they are exposed, for as long they are exposed
- Be constructed and printed so that weather conditions, wet locations, and corrosive environments will not cause the tag to become illegible
- Specify the identity of the employee applying the device(s)

A lock is an example of a **lockout device**. To prevent a machine from activating, a lock is designed to set the energy-isolating device of said machine in the off or safe position. The placement of a lockout device is important for its functionality.

Tagout devices (i.e. tags) function similarly, but may evoke a false sense of security because they do not provide the physical restraint that is provided by a lock. Because of this, both lockout and tagout devices need to be understood as part of the overall energy control program.

Locks and tags can only be placed or removed from machinery or equipment by an authorized employee. This individual is the only one allowed to lock out/tag out equipment and are trained to do so.

Defining the Lockout/Tagout Standard

Lockout and tagout devices must be consistent within the workplace.

OSHA has created a procedures checklist to use when applying lockout/tagout devices. It determines the completeness of the lockout/tagout procedure. The checklist includes the following questions:

- Is all machinery or equipment capable of movement required to be locked out during cleaning, servicing, adjusting, or setting up operations?
- If the power disconnect for equipment does not result in the disconnect of the electrical control circuit, can the control circuit be disconnected and locked out, or is it prohibited?
- Are all equipment control valve handles provided with a means for locking out?
- Does the lockout procedure require that stored energy (mechanical, hydraulic, air, etc.) be released or blocked before equipment is locked out for repairs?
- Are appropriate employees provided with individually-keyed personal safety locks, and are they required to keep personal control of their key(s) while they have safety locks in use?
- Is it required that employees check the safety of the lockout by attempting a startup?
- Is it required that only the employee exposed to the hazard can place or remove the safety lock?
- Are employees instructed to always push the control circuit stop button prior to re-energizing the main power switch?
- Is there a means provided to identify any or all employees who are working on lockout equipment by their locks or accompanying tags?
- Are enough accident prevention signs, locks, and/or tags provided for any potential repair emergency?
- If part of a machine is accidentally activated after an operator leaves the control station, is that part required to be separately locked out or blocked?
- If equipment cannot be shut down, locked out, and tagged, can an established procedure be followed to maintain job safety?

REMEMBER

The lockout/tagout procedures checklist is not all-inclusive for every workplace or equipment.

Using the Lockout/Tagout Standard to Protect Yourself

Working with active energy is dangerous, but understanding the lockout/tagout standard will keep you safe at work.

It is important to learn how to protect yourself using lockout/tagout procedures. The authorized employee must follow these preparations when shutting down machines or equipment, and they must be done in the following sequence to prevent hazards:

1. Preparation for shutdown – Before an authorized employee turns off a machine, they must have knowledge of the following:
   - The type and magnitude of the energy being used
   - The hazards of the energy being controlled
   - A method to control the energy
2. Machine or equipment shutdown – The machine or equipment must be turned off or shut down using the procedures established for the equipment. An orderly shutdown must be used to avoid any additional hazards as the equipment stops moving
3. Machine or equipment isolation – All energy-isolating devices that are needed to control the energy must be physically located to detach the machine or equipment from the energy sources

When tagout devices are used with energy-isolating devices instead of being locked out, the tag attachment must be secured at the same point of the lock that would have been attached. When a tag cannot be affixed directly to the energy-isolating device, the tag must be in a position that can easily be seen to anyone attempting to operate the device.

Following the lockout or tagout of an energy-isolating device, all potentially hazardous energy must be rendered safe. Even if there is a possibility of said energy rising to a hazardous level, the energy-isolating device must be watched until the possibility of danger is non-existent.

Using the Lockout/Tagout Standard to Protect Yourself

Working with active energy is dangerous, but understanding the lockout/tagout standard will keep you safe at work.

When removing lockout and tagout devices, protect yourself and other employees by verifying these conditions and following these rules:

- The machine and equipment must be fully operational and intact
- All nonessential items must be removed from the work area
- All employees must be safely positioned or absent from the area

In situations where the lockout or tagout devices must be temporarily removed, and the machine or equipment is energized to test, certain steps must be taken to prevent any electrical hazards or injuries:

1. Clear the machine or equipment of tools and materials
2. Remove unauthorized employees from the machine or equipment area
3. Following testing, deenergize all systems and reapply all locks

Each lockout/tagout device should be removed by the authorized employee who originally applied the device, but if it must be removed by another employee, the specific procedure for doing so must include at least the following elements:

- Contacting the authorized employee to inform that their lockout or tagout device has been removed
- Checking the work area to ensure that all employees have been safely positioned or removed
- Informing all affected employees that the lockout or tagout devices have been removed before a machine/equipment is started

Be mindful of the following when working with lockout/tagout devices:

- Lockout devices are more effective and secure than tagout devices for protecting employees from hazards
- When a tagout device is used instead of a lockout device, the tagout device must be attached at the same location that the lockout device would have been attached
- When using only a tagout device, the tag must demonstrate that the safety achieved is equivalent to the level of safety a lockout device would accomplish

Employer Requirements

The employer is responsible for providing the appropriate training and retraining for all employees who qualify.

Employer-led training should ensure that the purpose of the energy control program is understood by employees and that the skills required for the safe application, usage, and removal of the energy controls are learned by employees.

Each authorized employee must receive training in the following areas:

- Recognizing hazardous energy sources
- The type of energy available in the workplace
- The necessary methods for energy isolation and control

Employees should be retrained when there is a change in the following areas:

- Job assignments
- Machinery
- Processes that present new hazards
- Energy control procedures

Additional training must also be conducted whenever an employer as reason to believe that there are inadequacies in the employee's knowledge of the use of the lockout/tagout procedure.

Where appropriate, the employer must provide locks, tags, and chains for isolating, securing, or blocking machines or equipment from energy sources.

When employees are engaged in maintenance or servicing of machinery, their employers required to develop, document, and use procedures that control potentially hazardous energy. The energy control procedure must specify the following:

- How to use the procedure
- Steps for shutting down, isolating, blocking, and securing equipment to control hazardous energy
- Procedural steps for the placement, removal, and transfer of lockout/tagout devices and who is responsible for them
- Requirements for testing machines/equipment to determine the effectiveness of the lockout/tagout devices and other energy control measures

It is important that employers conduct a periodic **inspection** of the energy control procedure at least once a year to ensure that it is being followed. The inspection must be performed by an authorized employee other than the one utilizing the energy control procedure being inspected, and all inadequacies revealed by the inspection must be corrected.

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Welding, Cutting, and Brazing

Lesson 14 Study Guide

LESSON PURPOSE:

You will learn to recognize welding, cutting, and brazing hazards and to adhere to OSHA standards regarding workplace safety, accidents, and injuries.

LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify common health risks and potential hazards associated with welding, cutting, and brazing
- Describe safe operating procedures for oxygen cylinder storage, arc welding and cutting, and other specialized operating procedures
- List safety measures to protect yourself from welding, cutting, and brazing hazards
- Explain employer responsibilities to protect their workers from welding, cutting, and brazing hazards

Learn how to protect yourself from welding and cutting hazards in construction

Workers in the general industries need to be aware of the hazards posed by:

- Welding
- Cutting
- Brazing

These activities pose a unique combination of hazards. Learn to recognize and reduce the most common hazards associated with these activities.

MEDICAL ALERT

Health hazards associated with welding can often be attributed to the **chemical and physical agents**.

Definitions

To minimize hazards on the worksite, start by understanding the following terms:

- **Welding** - An act that unites metallic parts by heating and allowing the metals to flow together. Metals can also be hammered or compressed together with/without previous heating.
- **Cutting** - An act that divides into parts.
- **Brazing** - An act that solders metals.
- **Soldering** - An act that joins metals together.
- **Fuel Gas** - This produces the heat needed to melt metal in gas welding and cutting.
- **Fume** - A smoke or gas produced by welding or cutting.
- **Manifold** - This describes combined cylinders used in welding.
- **Check Valve** - A valve that permits flow in only one direction.
- **Flashback Arrester** - Protects cylinders from flashbacks and backfires.

The following pertain to welding, cutting, and brazing:

- Gas Welding & Cutting
- Arc Welding & Cutting
- Fire Prevention
- Ventilation & Protection
- Preservative Coatings
- Common Welding Health Hazards

To prevent injury or death, follow OSHA regulations for tools, practices, and procedures of these tasks.

Welding, Cutting, and Brazing Hazards

There are a variety of accidents that can occur because of welding, cutting, and brazing on jobsites.

Some examples of welding, cutting, and brazing health hazards include:

- Exposure to dangerous metal fumes or gases resulting in lung disease or irritation to the respiratory tract
- Ultraviolet (UV) and infrared radiation resulting in damage to the eyes and skin
  - Excessive UV radiation can inflame the cornea and cause arc-eye.
    - Arc-eye is a condition that is characterized by a sensation of sand in the eye
  - Infrared radiation can become intense enough to burn the surface of skin and soft tissue
- Burns from flame, arc, molten metal, and other heated surfaces
- Electrical shocks
- Cuts
- Crushed toes or fingers
- Hearing damage or loss due to prolonged exposure to loud noises.

Additional hazards found in welding and cutting operations include:

- Improperly storing gas cylinders
- Moving gas cylinders in an unsafe manner
- Failing to maintain welding and cutting equipment

Welding Equipment

Follow OSHA regulations for the safe use of welding equipment.

All workers involved in welding, cutting, and brazing operations must know how to properly use the following:

- Hoses
- Torches
- Regulators

Proper practices when using these types of welding equipment include the following:

- Hoses must be inspected at the beginning of every work shift and removed from service if found to be defective.
- Fuel gas and oxygen hoses must be readily distinguishable from each other, and not interchangeable.
- Clogged torch tip openings must be cleaned with suitable devices and inspected at the beginning of every work shift.
- Only light a torch with a friction lighter or other approved device, and not by matches or other unapproved hot surfaces.
- Oxygen and fuel gas regulators should all be in proper working order while in use.

Gas Welding and Cutting

When using fuel gas during welding and cutting operations, follow OSHA regulations that are specific to these operations. Follow regulations for:

Welding equipment can create a fire hazard, so make sure to use it safely.

- Safe use
- Safe transportation
- Safe storage

Construction workers must understand the similarities and differences between **fuel gas** and **oxygen manifolds**.

REMEMBER

- **Fuel gas** produces the heat needed to melt metal.
- A **manifold** describes combined cylinders used in welding.

Fuel Gas and Oxygen Manifolds

Follow OSHA requirements for fuel gas and oxygen manifolds.

Fuel Gas

When welding and cutting, follow OSHA regulations for the active use of fuel gas.

- An appropriate regulator must be used to reduce pressure when using cylinders for devices with shutoff valves.
- "Cracking" (opening a valve slightly and closing immediately) must be done on the valve to clear any dust or dirt that might enter the regulator.
- For quickly closing, the valves of a fuel gas cylinder should not be open for more than 1 1/2 turns.
- If there is a leak around the valve stem when the valve on a fuel gas cylinder is opened, the valve must be closed, and the gland nut tightened.

Welding equipment can create a fire hazard, so make sure to use it safely.

Oxygen Manifolds

Equipment for fuel gas and oxygen manifolds are similar in appearance and use. OSHA requirements for their handling and maintenance are also similar.

However, their parts are not interchangeable. They should be marked and differentiated to avoid confusion.

OSHA Requirements

These requirements apply to fuel gas and oxygen manifolds:

- Manifolds must be labelled with the name of the substance contained. The name's lettering must be at least one inch high.
- Manifolds must be placed in safe, well ventilated, and accessible locations.
- Manifolds cannot be located within enclosed spaces.
- Manifold and header hose connections must be capped when not in use.
- Manifolds must not have items placed upon them when in use.
- Fuel gas and oxygen manifold hoses must be easily distinguishable via color or touch.
- Fuel gas and oxygen manifold hose connections must be kept free of grease and oil.

Transportation and Storage

Follow OSHA regulations for transporting and storage of gas cylinders.

Transporting Gas Cylinders

Take proper care when transporting and storing compressed gas cylinders. This includes transportation to and from gas welding operations.

OSHA requires the following procedures:

- Valve protection caps must be in place and secured prior to transportation.
- Valve protection must always be in place during transportation.
- When hoisted, cylinders must be secured on cradles, slingboards, or pallets.
- Cylinders should be secured in an upright and vertical position when transported by powered vehicles.
- Cylinders cannot be hoisted or transported by magnets or choker slings.
- Cylinders must be moved by hand by tilting and rolling them on their bottom edges.
- Cylinders cannot be intentionally dropped, struck, or permitted to strike each other violently.
- Unless secured on a special transport carrier, all regulators must be removed.

Storing Gas Cylinders

OSHA requirements for storing compressed gas cylinders include the following:

- Gas cylinders must be kept separate from incompatible oxygen cylinders.
- Gas cylinders kept in buildings should be stored in a well-protected, well-ventilated, dry locations, and away from combustible materials.
- During actual operations, gas cylinders should be kept out of reach of sparks, hot slag, and flames.
- Store gas cylinders where they cannot become part of an electrical circuit.
- Never use either full or empty gas cylinders as rollers or supports.

Always position cylinders vertically.

REMEMBER

Cylinders must never be stored, kept, or otherwise positioned in any manner other than vertically.

Arc Welding and Cutting

Follow OSHA regulations for arc welding and cutting.

OSHA regulations include safe practices for:

- Manual electrode holders.
- Welding cables and connectors.
- Ground returns.
- Machine grounding.

Manual Electrode Holders

Only use manual electrode holders that:

- Are specifically designed for arc welding.
- Have a capacity that can safely handle the maximum rated current required by the electrodes.

The current-carrying parts passing through the outer surfaces of a manual electrode holder's jaws must:

- Be fully insulated against the maximum voltage encountered to ground.
- Be specifically designed for arc welding and cutting.
- Safely handle the maximum rated current required by the electrodes.
- Protect employees from electrical hazards.

Part 1926.351, Arc Welding and Cutting discusses OSHA standards for safe arc welding and cutting.

Welding Cables and Connectors

Only use cable that is free from repair needs or splices for a minimum distance of 10 feet from the cable end that the electrode is connected to.

- Cables and connectors must be completely insulated and flexible.
- All cables and connectors should be capable of handling the maximum current requirements.
- Any cables in need of repair should not be used.
- Worn cables with exposed bare conductors should be protected by rubber and friction tape.

Specialized Welding, Cutting, and Brazing Procedures

Understanding these specialized procedures will increase your safety and decrease your risk of injury on the job.

Welding

There are two classifications of welding – fusion and pressure.

There are three types of fusion welding:

1. **Electric arc welding** is the most commonly used in general industry. An electric arc is used to melt the base and filler metals. Types of arc welding have varying levels of fume production, with Flux Core Arc Welding (FCAW) at the highest, and Tungsten Inert Gas (GATW or TIG) at the lowest.

   To know that safety was appropriately considered in the design of arc welding equipment, the machine selected must comply with one of the following:

   - The Requirements for Electric Arc-Welding Apparatus, NEMA EW-1-1962, National Electrical Manufacturers Association
   - The Safety Standard for Transformer-Type Arc-Welding Machines, ANSI C33.2-1956, Underwriters' Laboratories

2. **Gas or oxy-fuel welding** uses a flame from burning gas to melt metal at a joint. This type of welding is commonly used for welding iron, steel, cast iron, and copper. Examples of fuel gas include:
   - Acetylene
   - Methylacetylene-propadiene (MPS)
   - Propylene
   - Gasoline
   - Hydrogen

3. **Thermit welding** uses chemical reactions to create intense heat to melt metals.

Specialized Welding, Cutting, and Brazing Procedures

Understanding these specialized procedures will increase your safety and decrease your risk of injury on the job.

All welding and cutting operations can be dangerous, but oxygen and fuel gas welding can be particularly hazardous.

Because oxygen and fuel gas welding can be so risky, OSHA has developed specific standards for the use and construction of any equipment used during welding or cutting operations:

- All devices and attachments that allow for the mixing of oxygen with flammable gases are banned, except at the burner or in a standard torch. Such attachments are only allowed if they have been approved specifically for that purpose
- Acetylene must never be generated, piped, or used at a pressure over 15 pounds per square inch gauge (psig) or 30 pounds per square inch absolute (psia); This upper limit is in place to prevent dangerous uses of acetylene in pressurized chambers
  - This requirement does not apply to the storage of acetylene dissolved in an appropriate solvent in cylinders that are manufactured and maintained in accordance with the U.S. Department of Transportation
- Liquid acetylene is banned from use
- Approved apparatuses for gas welding include:
  - Torches
  - Regulators
  - Pressure-releasing valves
  - Acetylene generators and manifolds
- Workers who are charged with handling oxygen or fuel-gas supply equipment are required to be instructed and deemed fit by employers for this sk
- All information that details the operation and maintenance of oxygen or fuel-gas equipment must be readily available

Ground Returns and Machine Grounding

Follow OSHA guidelines that apply to manual ground return cables and machine grounding under the context of welding and cutting operations.

Ground Return Cables

Ground return cables must have safe current-carrying capacities equal to or exceeding the specified maximum output capacity of the arc welding or cutting unit it services.

When a single ground return cable services more than one unit, its safe current-carrying capacity must exceed the total specified maximum output capacities of all the units it services.

OSHA Regulations

These OSHA guidelines apply:

- The safe current-carrying capacity of a single ground return cable servicing multiple units must exceed the total maximum output capacities of all the units it services.
- All ground connections must be inspected to ensure that they are mechanically strong and electrically adequate for the required current.
- Machine frames must be grounded through a third wire in the cable or through a separate wire grounded at the current's source.

Part 1926.351 discusses safe practices for ground returns, machine grounding, and more.

Pipelines

Pipelines containing gases or flammable liquids, or conduits containing electrical circuits, must not be used as a ground return.

- When a structure or pipeline is employed as a ground return circuit, the required electrical contact must exist at all joints.
- The generation of an arc, sparks, or heat at any point must cause rejection of the structures as a ground circuit.

REMEMBER

Ground return cables must have safe current-carrying capacities that are equal to or exceed the specified maximum output capacity of the arc welding or cutting unit it services.

Fire Prevention

When performing welding and cutting operations, follow OSHA requirements for fire prevention.

OSHA Regulations

Fire hazards are a serious issue to consider when performing any welding or cutting operation. OSHA regulations for fire prevention include the following:

- When welding or cutting is being performed, it must be done in a safe location.
- If the object cannot be moved, all potential fire hazards within the area must be removed or otherwise protected.
- Fire extinguishing equipment must be provided and readily available within the area.
- No welding, cutting, or heating can be done where there are flammable compounds or other heavy dust concentrations that can create a hazard.

Employer Responsibilities:

- Employers are required to implement a fire safety program within the workplace.
- When **fire prevention** precautions are insufficient for welding, cutting, or heating operations, assign fire watchers to guard against fire hazards.

Perform all welding operations away from flammable compounds that can create hazards.

Fire Watchers

Fire watchers are additional personnel assigned to a work area when normal fire prevention precautions are not sufficient.

Fire watchers have the following responsibilities:

- Guard the operation area throughout the work period.
- Guard the operation area for a period after the operation is completed.

Fire watchers must also be properly trained in the following areas:

- Recognize and anticipate fire hazards.
- Know how to use the provided firefighting equipment.

Ventilation and Protection

Use ventilation strategies to remove air contaminants in welding, cutting, and heating operations.

Air contaminants and fumes can be a serious hazard on the construction worksite.

Workers may need to use several different ventilation strategies to remove hazards.

Ventilation strategies depend on the:

- Location
- Circumstances
- Tools
- Types of welding in place

Mechanical Ventilation

This is a strategy used to remove air contaminants during a welding or cutting operation. The following OSHA requirements apply:

- Mechanical ventilation must consist of either general mechanical ventilation systems or local exhaust systems.
- Contaminated air exhausted from a working space must be discharged clear of the source of intake air.
- Mechanical ventilation is adequate if it removes fumes and smoke at the source, and all air that replaces the withdrawn air is clean and breathable.

Use different ventilation strategies depending on the type of welding in place.

Confined Spaces

Welding, cutting, or heating operations performed in a confined space must have adequate mechanical ventilation. The following specific requirements also apply:

- An employee on the outside of the confined space must be assigned to communicate with workers and to provide aid in the event of an emergency.
- When welders must enter a confined space, means must be provided for quickly removing them in the event of an emergency.
- When ventilation in a confined space is unattainable, employees must be protected by airline respirators.

Metals of Toxic Significance

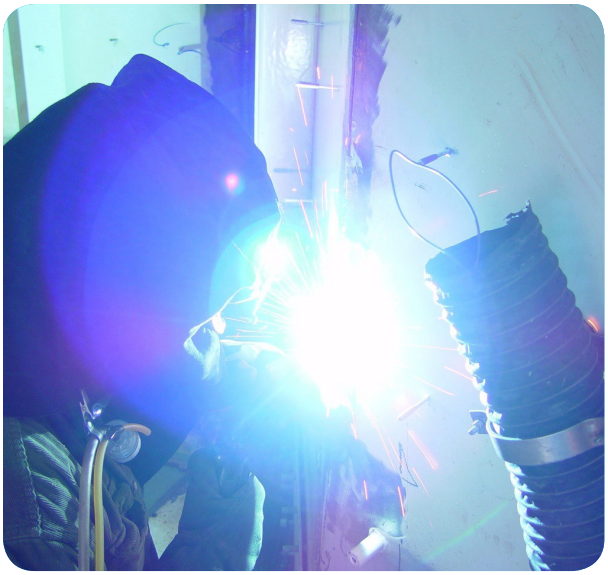
Ensure adequate ventilation when welding, cutting, or heating metals of toxic significance.

Adequate **mechanical ventilation** must be provided when an operation involves any of the following metals:

- Zinc-bearing base, filler metals, or metals coated with zinc-bearing materials.
- Lead base metals.
- Cadmium-bearing filler materials.
- Chromium-bearing metals or metals coated with chromium-bearing materials.

In some cases, either adequate **local exhaust ventilation** must be provided or **air line respirators** must be equipped on all operators. This applies when working on any of the following metals in an enclosed space:

- Metals containing lead (other than as an impurity) or metals coated with lead-bearing materials.
- Cadmium-bearing or cadmium-coated base metals.
- Metal coated with mercury-bearing metals.
- Beryllium-containing base or filler metals.



Take special precautions when working with certain metals.

MEDICAL ALERT

Beryllium is highly toxic. Work involving beryllium must be done with both local exhaust ventilation **and** air line respirators.

REMEMBER

Other employees exposed to the same atmosphere as the welders or burners must be protected in the same manner as the welder or burner.

Preservative Coatings

Follow OSHA regulations for welding, cutting, and heating of objects with preservative coatings.

Preservative coatings help prevent corrosion and water damage.

However, new hazards may arise when welding, cutting, or heating a coated surface.

Take the necessary precautions as discussed in Part 1926.354, welding, cutting, and heating in way of preservative coatings.

Flammability

Prior to any operation, a competent person must test the surface and determine its flammability.

- Coatings are considered to be highly flammable when scrapings burn with extreme rapidity.
- When coatings are determined to be highly flammable, strip them of the area to be heated.

If fire prevention precautions are insufficient for welding, cutting, or heating operations, then additional workers known as fire watchers must be assigned to the operation to guard against fire hazards.

Welders must understand OSHA requirements for welding objects with preservative coatings.

Toxic Coatings

Protect yourself and others against toxic preservative coatings.

- In open air, employees must be protected by a respirator.
- In enclosed spaces, all surfaces covered with toxic preservatives must be stripped of all toxic coatings for a distance of at least four inches from the area of heat application.
- Alternately, employees must be protected by air line respirators.

Common Welding Hazards

To protect yourself and others, be aware of the common hazards associated with welding.

There are several common hazards associated with welding, including the following:

- Physical agents
- Chemical agents
- Additional hazards

Physical Agents

Common hazard-causing physical agents associated with welding include:

- Ultraviolet radiation (UV)
- Infrared radiation (IR)
- Intense visible light

Chemical Agents

Exposure to chemicals is a common hazard associated with welding. Common hazard-causing chemical agents associated with welding include:

- Zinc
- Cadmium
- Beryllium
- Iron oxide
- Mercury
- Lead
- Fluorides
- Chlorinated hydrocarbon solvents
- Phosgene
- Carbon monoxide
- Ozone
- Nitrogen oxides

Additional Hazards

In addition to chemical and physical agents,

Follow safety standards to prevent common hazards and maintain a safe jobsite.

hazards commonly found in welding and cutting operations include:

- Improperly storing gas cylinders.
- Moving gas cylinders in an unsafe manner.
- Failing to maintain welding and cutting equipment.
- Improperly training employees.
- Poorly training supervisors.
- Failure to properly implement safety programs.

MEDICAL ALERT

Side effects of chemical exposure range in severity, and can include:

- Mild irritation
- Sort throat
- Pulmonary edema (fluid in the lungs)
- Death

Physical Hazards

Physical agents associated with welding are a common source of health hazards.

Welding produces **light** and **heat**, which can create physical hazards that damage the **eyes** and **skin**. Common physical hazards include:

- Ultraviolet radiation (UV)
- Infrared radiation (IR)
- Intense visible light

Ultraviolet Radiation (UV)

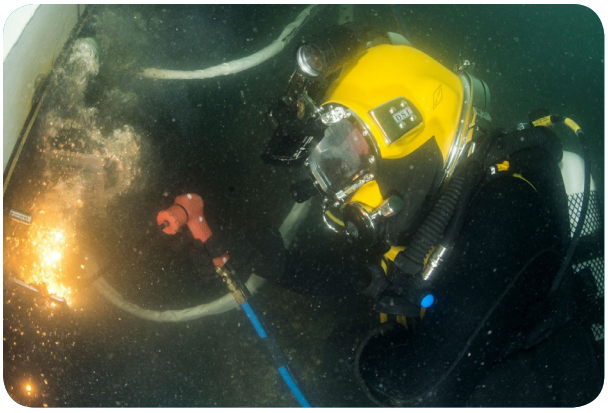
This is generated by the electric arc in the welding process. Exposure can result in severe burns to the skin, and damage to the eyes.

MEDICAL ALERT

Many arc welders are aware of a condition known as "arc-eye," which gives a sensation of sand in the eye. This is caused by excessive eye exposure to UV.

Infrared Radiation (IR)

This is produced by the electric arc and other flame cutting equipment. It can heat the skin's surface, as well as tissues immediately below the surface. This can lead to thermal burns.



Welding operations produce light and heat, which can be hazardous.

REMEMBER

Protect yourself from IR (and UV) with personal protective equipment (PPE) including a welder's helmet and protective clothing.

Intense Visible Light

Eye exposure to intense visible light can produce adaptation, pupillary reflex, and shading of the eyes. These are protective mechanisms that prevent excessive light from being focused on the retina. For the most part, use of a welder's helmet prevents eye exposure to intense visible light.

MEDICAL ALERT

Some welders have sustained retinal damage due to careless "viewing" of the arc. Never observe the arc without eye protection.

Chemical Hazards

Be aware of potential chemical hazards during construction work.

Zinc

Zinc is used in large quantities in the manufacture of brass, galvanized metals, and other alloys.

MEDICAL ALERT

Inhalation of zinc oxide fumes is known to cause metal fume fever. Symptoms are similar to those of the flu, and usually last less than a day.

Cadmium

Cadmium is used frequently as a rust-preventative coating on steel.

MEDICAL ALERT

Cadmium is a potential carcinogen. Depending on the duration and concentration, exposure can result in emphysema, kidney damage, severe lung irritation, pulmonary edema, and death.

Lead

Lead oxide fumes are generated when welding and cutting lead-bearing alloys or metals whose surfaces are painted with lead-based paint.

MEDICAL ALERT

Lead adversely affects the brain, central nervous system, circulatory system, reproductive system, kidneys, and muscles. Symptoms of lead poisoning include metallic taste in the mouth, loss of appetite, nausea, abdominal cramps, and insomnia.

Mercury

Mercury compounds are used to coat metals to prevent rust or inhibit foliage growth (marine paints). Mercury vapors are produced under the intense heat of the arc or gas flame.

MEDICAL ALERT

Exposure to mercury vapors may produce stomach pain, diarrhea, kidney damage, or respiratory failure. Long-term exposure may produce tremors, emotional instability, and hearing damage.

Chemical Hazards

Be aware of potential chemical hazards during construction work.

Beryllium

Beryllium is sometimes used as an alloying element with copper and other base metals.

MEDICAL ALERT

Acute exposure to high concentrations of beryllium can result in chemical pneumonia. Long-term exposure can lead to shortness of breath, chronic cough, significant weight loss, and general fatigue and weakness.

Fluorides

Fluoride compounds are found in the coatings of several types of fluxes used in welding.

MEDICAL ALERT

Exposure to these fluxes may irritate the eyes, nose, and throat. Repeated and long-term exposure to high concentrations of fluorides in the air may cause pulmonary edema and bone damage.

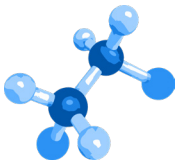
Iron Oxide

Iron is the principal alloying element in steel manufacture. When welding, fumes arise from the base metal and the electrode.

MEDICAL ALERT

Acute exposure can irritate the nasal passages, throat, and lungs.

Chlorinated Hydrocarbon Solvents



Various chlorinated hydrocarbons are used in degreasing or other cleaning operations. Keep chlorinated solvents at least 200 feet away from any welding or cutting operation.

MEDICAL ALERT

Heat and ultraviolet radiation from the arc will decompose the vapors and form highly toxic and irritating phosgene gas.

Chemical Hazards

Be aware of potential chemical hazards during construction work.

Phosgene

Phosgene is formed by decomposition of chlorinated hydrocarbon solvents by ultraviolet radiation.

MEDICAL ALERT

Phosgene reacts with moisture in the lungs to produce hydrogen chloride, which destroys lung tissue.

Carbon Monoxide

This gas usually forms by the incomplete combustion of various fuels. Welding and cutting may produce significant amounts of carbon monoxide.

MEDICAL ALERT

Carbon monoxide is colorless, odorless, and tasteless. Common symptoms of overexposure include pounding of the heart, a dull headache, flashes before the eyes, dizziness, ringing in the ears, and nausea.

Ozone

Ozone (O3) is produced by ultraviolet light from the welding arc. It's a highly active form of oxygen.

MEDICAL ALERT

Ozone can cause great irritation to all mucus membranes. Symptoms of exposure include headache, chest pain, and dryness of the upper respiratory tract. Excessive exposure can cause fluid in the lungs.

Nitrogen Oxides

The arc's UV light can produce nitrogen oxides from the nitrogen and oxygen in the air.

MEDICAL ALERT

The gas is irritating to the eyes, nose, and throat. High concentrations can cause shortness of breath, chest pain, and pulmonary edema.

Environmental Conditions

Anything that can adversely affect the equipment, its load capacity, or the employee performing the operation needs to be prepared before the work begins.

Environmental controls are necessary for several reasons. Air contaminants, extreme temperatures, and excessive vibration are just a few of the environmental factors that can inhibit performance and create a hazardous atmosphere.

- OSHA requires standard machines for electric arc welding service to be designed and constructed to carry their rated load:
- With rated temperature rises, where the temperature of cooling air does not exceed 140 °F (40 °C)
- Where altitude does not exceed 3,300 feet
- So that they must be suitable for operation in atmospheres containing gases, dust, and light rays produced by the welding arc

The main unusual service conditions include exposure to:

- Unusually corrosive fumes
- Steam or excessive humidity
- Excessive oil vapor
- Flammable gases
- Abnormal vibration or shock
- Excessive dust
- Weather
- Seacoast or shipboard conditions

Unusual service conditions may exist, and in such circumstances, machines must be especially designed to safely meet the requirements of this service.

The following limits must not be exceeded:

- Alternating-current machines:
  - Manual arc welding and cutting – 80 volts
  - Automatic (machine or mechanized) arc welding and cutting – 100 volts
- Direct-current machines:
  - Manual arc welding and cutting – 100 volts
  - Automatic (machine or mechanized) arc welding and cutting – 100 volts

If special welding and cutting operations require open circuit voltages higher than the voltages mentioned here, then insulation or other forms of protection must be supplied to prevent the operator from making accidental contact with the high voltage. If an operator is alternating-current (AC) welding in hot or wet conditions where sweating might occur, it is recommended to use reliable automatic controls to reduce the no-load voltage to decrease the possibility of shock hazards.

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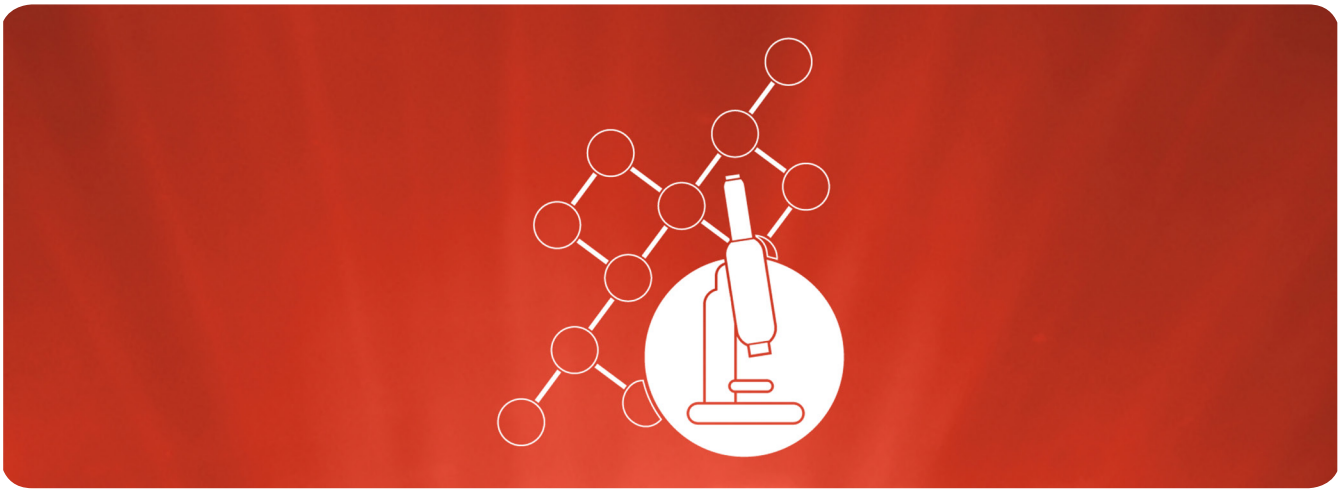


Industrial Hygiene

Lesson 15 Study Guide

LESSON PURPOSE:

The purpose of this lesson is to provide you with information that will help you understand industrial hygiene and work site injury prevention.

LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify industrial hygiene monitoring and analytical methods
- Describe the methods by which workers are protected through hazard recognition and controls
- List the types of hazards that industrial hygienists look for and methods to prevent them
- Explain employer requirements regarding industrial hygiene

Before you can understand what industrial hygiene is, you must be familiar with specific terms.

Industrial Hygiene Defined

OSHA defines industrial hygiene as:

> "The science of anticipating, recognizing, evaluating, and ultimately controlling conditions in the workplace that may cause injury or illness."

Hygiene Defined

Hygiene is defined as conditions and practices that serve to promote or preserve health.

Sanitary Defined

Sanitary is defined as favorable to health; free from dirt, bacteria.protection.

The Role of an Industrial Hygienist

An industrial hygienist is responsible for:

- Environmental monitoring and analytical methods to detect worker exposure
- Employ the appropriate protection referring to:
  - Engineering
  - Administrative
  - Work practice controls
  - Personal Protective Equipment (PPE)

OSHA & Industrial Hygiene

OSHA has developed and set mandatory occupational safety and health requirements applicable to more than 6 million workplaces in the United States.

Industrial hygienists are relied on to evaluate jobs and workplaces for potential health hazards:

- Over 40% of OSHA compliance officers are industrial hygienists
- Industrial hygienists help develop and issue OSHA standards
- Hazards include toxic chemicals, biological hazards. and harmful physical agents

The development of these standards involves determining the extent of employee exposure to hazards as well as deciding what is needed to control these hazards to protect workers.

Industrial hygienists perform a wide variety of functions:

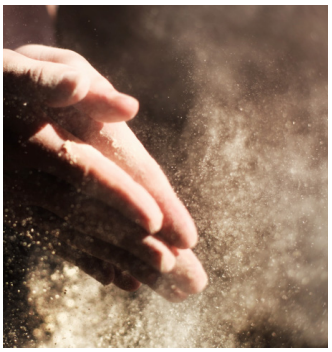
- Set up field enforcement procedures
- Issue technical interpretations
- Analyze, identify, and measure workplace hazards
- Determine the extent of employee exposure to hazards
- Decide what is needed to control job site hazards
- Provide OSHA with technical assistance and support

Hazard Characteristics

To be effective in recognizing and evaluating on-the-job hazards and recommending controls, industrial hygienists must be familiar with the hazards' characteristics.

Air contaminants are typically classified as either particulate or gas and vapor:

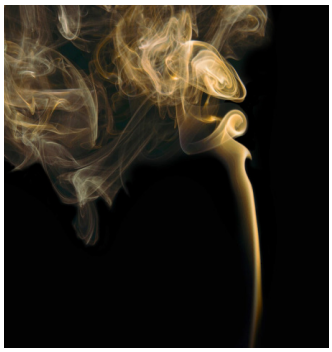
Types of Particle Hazards



Dusts

Solid particles that are created by handling, grinding, crushing, colliding, exploding, or heating materials:

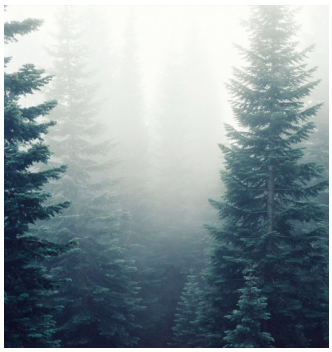
- Metal
- Rock
- Ore
- Coal
- Wood
- Grain



Fumes

Formed when a solid material evaporates in cool air

- In most cases the resultant particles react with the air to form an oxide



Mists

Liquid suspended in the atmosphere that is generated when liquids condense from a vapor turn back into a liquid

- Or when a liquid is dispersed by splashing or atomizing

Aerosols

A form of mist that is characterized by tiny liquid particles

- These liquid particles that are easily breathed in

Fibers

Solid particles, such as asbestos

- The length of which is several times greater than their diameter

Hazard Characteristics

To be effective in recognizing and evaluating on-the-job hazards and recommending controls, industrial hygienists must be familiar with the hazards' characteristics.

Gases

Formless fluids that expand to occupy the space or enclosure they contain

- Can be atomic, diatomic, or molecular in nature

Vapors

Created when liquids are evaporated and mix with the atmosphere

- Defined as the volatile form of material that is usually in a solid or liquid state at room temperature or pressure
- Sometimes considered a gas it is because atomic or molecular in nature

Chemicals

Chemical can affect workers by inhalation, absorption through the skin, or ingestion:

- Some hazards are toxic through inhalation, while some of them irritate the skin on contact
- Others can be toxic by absorption through the skin or through ingestion
- Some are corrosive to living tissue

Biological Hazards

Biological hazards are viruses, bacteria, fungi, and other living organisms that can cause infection by entering the body directly or via breaks in the skin:

- Occupations that deal with food processing, plants or animals, and plant or animal products are at risk
- Laboratory and medical workers can also be exposed to biological hazards, as can those who are working in any occupation that results in contact with bodily fluids

Hazard Characteristics

To be effective in recognizing and evaluating on-the-job hazards and recommending controls, industrial hygienists must be familiar with the hazards' characteristics.

Physical Hazards

Physical hazards are excessive levels of:

- Noise
- Vibrations
- Illumination
- Temperature
- Ionizing and non-ionizing electromagnetic radiation

MEDICAL ALERT

Sorting, assembling, and data entry can cause carpal tunnel syndrome.

Ergonomic Hazards

Ergonomic hazards involve a full range of tasks including excessive vibration and noise, eye strain, repetitive motion, and heavy lifting problems.

- These injuries may occur because of technological changes (i.e. increased assembly line speeds, addition of specialized tasks, etc.)

Biological, Physical, & Ergonomic Prevention

You might feel fine today, but repetitive motions and exposure to hazards can wear your body down and cause lasting health problems or disabilities over a long period of time.

Industrial hygienists point out the positive effects of hazard prevention. Not only does it increase efficiency, cause fewer accidents, and lower operating costs – it also ensures that workers are comfortable and able to perform their duties.

Biological Hazard Prevention

Laboratory and medical workers in contact with bodily fluids can be exposed. Biological hazards are an expectation in work environments related to medical and animal care. Here are some of the requirements for hazard prevention include:

- Prevent and control diseases in animal population
- Properly care for and handle infected animals
- Practice effective personal hygiene
- Hospitals should provide proper:
- Ventilation
- PPE, such as gloves and respirators
- Infectious waste disposal systems
- Controls, including isolation in instances of highly contagious diseases like tuberculosis

Physical Hazard Prevention – Ionizing Radiation

In occupations where there is exposure to ionizing radiation, the following are important tools in ensuring worker safety:

- **Time** – Danger from radiation increases with the amount of time exposed
- **Distance** – Radiation levels can be estimated by comparing the squares of the distances between worker and source
- **Shielding** – The greater the protective mass between a radioactive source and a worker, the lower the radiation exposure
  - Shielding can also be an effective control method in certain cases

Biological, Physical, & Ergonomic Prevention

You might feel fine today, but repetitive motions and exposure to hazards can wear your body down and cause lasting health problems or disabilities over a long period of time.

Noise Hazards Prevention

OSHA requires that workers in noisy surroundings get periodic hearing tests to prevent hearing loss. Occupational noise exposure –loud noises for a long period of time – can cause permanent damage or hearing loss disabilities.

It is possible to reduce exposure to noise by:

- Creating sound barriers at workstations around deafening operations
- Increasing the distance between the source and the receiver
- Isolating workers in acoustical booths
- Limiting workers' exposure time to noise
- Providing hearing protection

Ergonomic Hazards Prevention

Ensuring that employees are comfortable and putting as little strain on their bodies as possible is an important part of maintaining health and safety standards. Employers should provide the following to their employees:

- The use of appropriate engineering controls
- Teaching correct work practices
- Employing proper administrative controls
- Shifting workers among different tasks
- Reducing production demand
- Increasing breaks
- Providing and mandating PPE

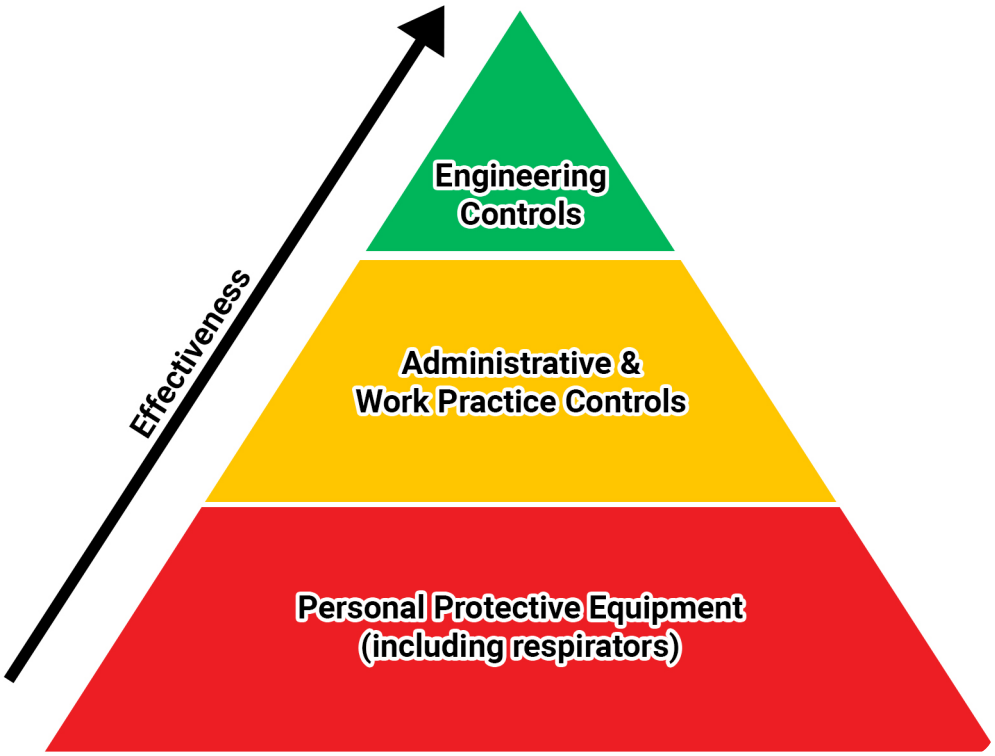
The industrial hygienist performs a work site analysis to determine the sources of potential hazards in the workplace and makes recommendations for different types of controls to prevent injury.

During the job site analysis, the industrial hygienist takes the appropriate measures to identify exposures, problem tasks, and risks. The basic job site analysis performed by an industrial hygienist includes the following:

- Inspection of all jobs, operations, and work activities
- Research/analyze how specific chemicals or physical hazards at that job site affect worker health
- If a situation hazardous to health is discovered, recommend the appropriate corrective actions

Hierarchy of Controls

OSHA's hierarchy of control methods help reduce risk and exposure to hazards.



OSHA's hierarchy of control methods

Industrial hygienists recognize that engineering, work practice, and administrative controls are the primary means of reducing employee exposure to occupational hazards.

Where other controls focus on the employee, **engineering controls** involve designing the work environment and the job itself to eliminate or reduce exposure to hazards.

Engineering controls include:

- Eliminating toxic chemicals
- Replacing harmful toxic materials with less hazardous ones
- Enclosing work processes
- Confining work operations
- Installing general and local ventilation systems

Engineering controls are the first and best strategy for controlling a hazard at its source.

Hierarchy of Controls

OSHA's hierarchy of control methods help reduce risk and exposure to hazards.

Work Practice Controls

Work practice controls include the company's general workplace rules and other operation-specific rules.

These controls can alter the way a task is performed.

Some work practice controls include:

- Following proper procedures that minimize exposures while operating production and control equipment
- Inspecting and maintaining process and control equipment on a regular basis
- Implementing good housekeeping procedures
- Providing good supervision
- Mandating that eating, drinking, smoking, chewing tobacco or gum and applying cosmetics in regulated areas be prohibited

OSHA uses the term administrative controls to define other measures that reduce employee exposure to hazards.

These measures can include:

- Additional relief workers
- Exercise breaks
- Worker rotation

Administrative controls also include controlling employees' exposure by scheduling production and workers' tasks, or both, in ways that minimize exposure levels.

EXAMPLE

The employer might schedule operations with the highest hazard exposure potential during periods when the fewest employees are present.

Hierarchy of Controls

OSHA's hierarchy of control methods help reduce risk and exposure to hazards.

If the previous three measures do not provide enough protection for the safety of the worker, then personal protective equipment (PPE) may also be required.

Examples of PPE include:

Gloves

Safety Goggles

Helmets

Safety shoes

Protective clothing

To be effective, PPE must be:

- Individually selected, properly fitted, and periodically refitted
- Conscientiously and properly worn
- Regularly maintained
- Replaced as necessary

Employer Requirements for Industrial Hygiene

Under the OSHA General Duty Clause, employers are required to furnish each of its employees a workplace free from recognized hazards that could cause death or serious physical harm.

An essential part of any safety and health system is the prevention, preparation, and correction of potentially hazardous work conditions using the hierarchy of controls. Despite the overall controls used to prevent hazards, correctional programs may still be necessary.

Preventive Maintenance Systems

- Good preventive maintenance plays a major role in ensuring that hazard controls continue to function effectively
  - Helps ensure hazard controls continue to function effectively
  - Keeps new hazards from arising due to equipment malfunction

Documentation

- Provide a record of the hazard
- Document the discovery of hazards
- Describe the hazard and its correction

Emergency Preparation

- Provide a record of the hazard
- Document the discovery of hazards
- Describe the hazard and its correction
- Employers must be prepared for emergencies on the job site
- Emergencies are hazards that are not normally found in the workplace:
  - Natural causes
  - Events caused by humans, but were beyond their control
  - Unforeseen circumstances
- Some of the steps in emergency planning include:
  - Conduct surveys for possible emergencies
  - Plan actions to reduce impact on the workplace
  - Provide employee information and training
  - Organize emergency drills as needed

Employer Requirements for Industrial Hygiene

Under the OSHA General Duty Clause, employers are required to furnish each of its employees a workplace free from recognized hazards that could cause death or serious physical harm.

Safety & Health Training

- OSHA considers training vital to every workplace
  - Trainees should understand the purpose of the training
- It is most effective when integrated into performance requirements and job responsibilities
  - People learn best when they can immediately practice and apply newly acquired knowledge and skills
- The training program should reflect needs and characteristics of workforce
  - Training should be targeted to new hires, contract workers, employees who wear PPE and workers in high-risk areas
  - Supervisors should receive training in company policies and procedures, as well as hazard detection and control
  - OSHA recommends long-term workers whose job changes because of new processes or materials be retrained
  - Entire workforce needs periodic refresher training in responding to emergencies
- Important training design includes the identification of needs
  - Information should be organized to maximize effectiveness
- Everyone should be included in the process to develop effective training
  - People learn in different ways, so an effective program will incorporate a variety of training methods
  - As trainees practice, they should receive feedback

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Ergonomics

Lesson 16 Study Guide

LESSON PURPOSE:

The purpose of this lesson is to provide information ergonomic hazards in the workplace and prevention methods.

LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify the purpose of ergonomics in the workplace
- Describe the types of ergonomic hazards that can be present in the workplace
- List the ways in which employees can protect themselves using proper ergonomic processes
- Explain employer requirements for providing safe, ergonomically sound work environments

Ergonomically sound environments can reduce stress and eliminate injuries.

Definition

Ergonomics is defined as the study of work, and it's based on an important principle:

> "The job should be adapted to the person, rather than forcing the person to fit the job."

Ergonomics is a study of stress and strain on the human body during work-related tasks.

The goal is to:

- Reduce the risk of long-term injury
- Determine what tasks or motions can lead to injury
- Find ways in which that task can be better fit to each individual worker

Evaluating a workplace from an ergonomics standpoint involves looking at both the physical and mental demands of the job.

Ergonomics focuses on the work environment. It covers a variety of items, including the following:

- The design and function of workstations.
- Controls.
- Displays.
- Safety devices.
- Tools and lighting to fit employees' physical requirements.
- Ensuring workers' health and well-being.

What is Ergonomics?

Ergonomically sound environments can reduce stress and eliminate injuries.

Ergonomic hazards can occur in various jobs and in various types of workplaces. Some examples of ergonomic hazards include:

- Repetitive motion injuries such as carpal tunnel syndrome

- Acute injuries such as strains and sprains from improper heavy lifting

- Tingling and numbness in hands or fingers from exposure to hand-arm vibration

MEDICAL ALERT

Ergonomics includes restructuring or changing workplace conditions to make the job easier. It also involves reducing stressors that cause cumulative trauma disorders and repetitive motion injuries.

REMEMBER

In material handling and storing, ergonomic principles may require controls such as **reducing the size or weight** of the objects lifted, installing a **mechanical lifting aid**, or **changing the height** of a pallet or shelf.

Musculoskeletal Disorders

Work-related musculoskeletal disorders are some of the most regularly reported causes of restricted work time.

Musculoskeletal disorders (MSDs) are a common type of workplace injury. This term refers to a group of injuries and illnesses that affect the form, support, stability, and movement of the body.

The musculoskeletal system includes the skeleton, muscles, cartilage, tendons, ligaments, joints, and other connective tissue.

MSDs are injuries to soft tissue in the body. These injuries are caused by exposure, either sudden or sustained, to repetitive motion, force, vibration, or awkward body positioning.

EXAMPLE

Examples of musculoskeletal disorders include:

- Carpal tunnel syndrome
- Epicondylitis (commonly known as tennis elbow)
- Rotator cuff syndrome
- Sciatic pain

MSDs may develop over time or may result from sudden events such as a single heavy lift.

MEDICAL ALERT

According to the Bureau of Labor Statistics (BLS) in 2013, MSD cases accounted for 33% of all worker injury and illness cases.

You may have a work-related MSD if you experience any of the following conditions while on the job:

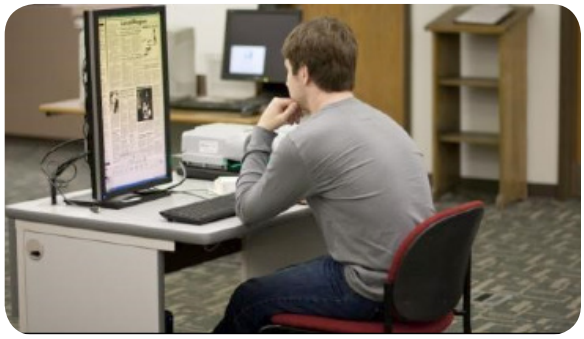
- Numbness in your fingers
- Numbness in your thighs
- Difficulty moving your finger
- Stiff joints
- Back pain

These conditions should be classified on recordkeeping forms as either injuries or illnesses. It is important that recordkeeping data is completed and that it is kept accurately.

Medical Awareness & Training

There are measures that can help reduce your risk of developing an MSD on the job.

Office Workers



Employees who work in an office might not realize that they are prone to workplace injuries. Repetitive motion, improper posture, or sitting still for long stretches of time can lead to injury over time.

Potential injuries from computer work may include:

- Neck strain
- Low back pain
- Hand and wrist tendinitis
- Carpal tunnel syndrome

Office workers should be aware of repetitive motion and overuse injuries, and take steps to avoid these injuries wherever possible.

Healthcare Workers

Workers in the healthcare profession are at great risk of injury on the job, particularly for patient handling tasks.

Patient handling tasks that pose the greatest ergonomic risk are:

- Repetitive tasks
  - Cranking manual adjustments for beds
- Tasks performed in awkward postures
  - Reaching across beds to lift patients or residents
- Tasks performed using a great deal of force
  - Pushing chairs or gurneys across elevation changes or up ramps
- Task that require heavy lifting
  - Moving equipment, hospital beds, or patients in wheelchairs
  - Helping patients or residence out of bed

Medical Awareness & Training

There are measures that can help reduce your risk of developing an MSD on the job.

There are ergonomic assistive devices to help healthcare workers:

- Moving patients or residence:
  - Slip sheets
  - Slide board
  - Rollers
  - Slings
  - Belts or hoists (both mechanical or electronic)

- Adjusting positions:
  - Adjustable beds
  - Raised toilet seats
  - Shower chairs or grab bars

MEDICAL ALERT

Per the Bureau of Labor Statistics (BLS), employees in nursing and personal care facilities suffer over 200,000 work-related injuries and illnesses a year.

Heavy Lifting

Repetitive heavy lifting can be a great risk toward developing injury or illness.

Lifting heavy items is one of the leading causes of injury in the workplace. According to the Bureau of Labor Statistics (BLS) in 2001, over 36% of reported injuries involving missed workdays were the result of shoulder and back injuries. Overexertion and cumulative trauma were the biggest factors in these injuries.

Industries in which workers may be exposed to ergonomic stressors that involve heavy lifting include:

- Manufacturing
- Farming
- Food and beverage delivery

These injuries to the soft tissue of the body are commonly associated with heavy lifting:

- Herniated discs
- Rotator cuff tears
- Hip or low back strain

REMEMBER

Many serious injuries require time away from work. Workers' compensation costs employers in this industry nearly $1 billion a year.

It is important to remember that the **weight of objects** can affect the type and severity of ergonomic stress on the body. Even though heavier objects can be more hazardous, it is important to know that lighter objects can also do damage.

Some loads, such as large spools of wire, bundles of conduit, or heavy tools and machinery place great stress on muscles, discs, and vertebrae.

When workers use smart lifting practices, they are less likely to suffer from back sprains, muscle pulls, wrist injuries, elbow injuries, spinal injuries, and other injuries caused by lifting heavy objects.

Heavy Lifting

Repetitive heavy lifting can be a great risk toward developing injury or illness.

Solutions for Heavy Lifting

There are some simple changes that can be made that can greatly reduce the risk of injury from heavy or repetitive lifting.

Use the following techniques to protect yourself against injury:

- Keep objects close to your body when lifting, holding, or carrying
- If objects must be held overhead, use supports and equipment
- Use platforms to raise objects to different work heights
- Do not carry objects in your hands while on a ladder
- Do not lift or position heavy objects while standing on a ladder
- When raising or lowering heavy objects, use mechanical equipment
- When working at heights or raising and lowering materials, use appropriate fall protection

If you must perform overhead work, be aware that holding unsupported objects above the shoulders can cause shoulder and neck fatigue, and serious injury.

When working with objects that must be held overhead:

- Use equipment and support materials to keep objects overhead, rather than holding them manually
- Never support heavy objects on your head
- Take short breaks to allow muscle and joint recovery time from the strain of working overhead

Using Ergonomics to Protect Yourself

While your employer is required to provide a safe and healthful workplace, it is also important for workers to understand how to keep themselves safe during the tasks that make up their day-to-day workflow.

Training Program

Providing education and training about ergonomic hazards and controls to workers, managers, and supervisors can make your workplace safer.

Participation in workplace safety training is important because it can demonstrate where hazards exist in the workplace and how they can be avoided.

Ergonomic training should be:

- Updated and presented to employees as changes occur in the workplace
- Necessary to ensure that all employees can recognize any potential ergonomic hazards
- Integrated into general training on job practices

Breaks and Alternating Tasks

Avoid high repetition tasks or jobs that require long periods in the same posture. This may require several, short rest breaks. During these breaks, you should stand, stretch, and move around. These actions provide rest to your hands and eyes, and allows the muscles enough time to recover.

Alternate tasks whenever possible, mixing tasks into the workday that do not involve a computer. This encourages body movement and the use of different muscle groups.

Using Ergonomics to Protect Yourself

While your employer is required to provide a safe and healthful workplace, it is also important for workers to understand how to keep themselves safe during the tasks that make up their day-to-day workflow.

Avoid Awkward Posture

There are several possible solutions to avoid needless injury due to awkward postures:

- Placing materials that need to be manually lifted at power zone height
- Minimizing bending and reaching by placing heavy objects on shelves, tables or racks

Movements to Avoid

When moving heavy objects, remember these movements to avoid:

- Twisting, especially when bending forward while lifting
  - Turn by moving the feet rather than twisting the torso
- Lifting objects from between mid-thigh and shoulder height
  - Lift from below your waist height puts stress on legs, knees, and back
  - While lifting above your shoulders puts stress on the upper back, shoulders and arms
- Keeping objects close to the body
  - When lifting large, bulky loads, it is better to bend at the waist instead of at the knees to keep the load closer to your body
- Use ladders or aerial lifts to elevate workers
  - Move the ladders and aerial lifts closer so reaching is minimized
- Break down loads into smaller units
  - Carry one in each hand to equalize loads
- Use roll-out decks installed in truck beds to bring loads closer
  - Eliminate the need to crawl into the back of a truck

Working in an Office

Simple, everyday tasks like sitting for long periods of time can pose problems over time if proper ergonomic processes are not observed.

Millions of people work with computers every day and there is no sitting posture that will fit everyone who works at a computer; however, the recommended positions include:

Upright Sitting

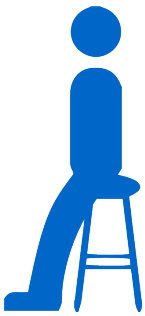
- Sitting so that the torso and neck are vertical and in line with the back of the chair, the thighs are horizontal to the seat cushion, and the lower legs are vertical

Standing

- Standing straight, with the legs, torso, neck, and head approximately in one line
  - Elevating one foot on a rest is an ergonomically acceptable variation of this posture

Declined Sitting

- Sitting with the thighs inclined so that the buttocks are higher than the knees, and the angle between the thighs and torso is greater than 90 degrees
  - In this position, the torso is either vertical or slightly reclined, and the legs are vertical

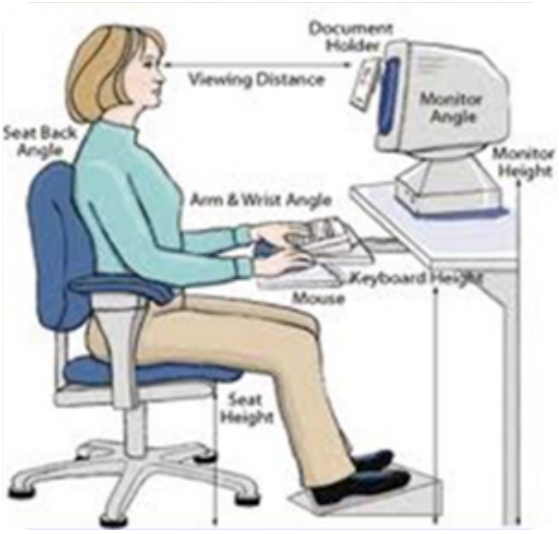


Reclined Sitting

- Sitting so that the torso and neck are straight while being reclined between 105 and 120 degrees from the thighs

Working in an Office

Simple, everyday tasks like sitting for long periods of time can pose problems over time if proper ergonomic processes are not observed.



While working at a desk, it is important not to stay in any position for long periods of time. If you work in a job where you are stationary for an extended period, use the following solutions to help reduce your risk of musculoskeletal disorders (MSDs):

- Provide different tasks and workstations
  - This will provide recovery time for overused muscles from the last activity
- Use an adjustable workstation so you can easily change your working postures
  - The use of adjustable furniture will allow you to sit or stand in different positions while working
- Use alternate both hands to use a mouse
  - This allows the tendons and muscles of the free hand to rest
- Substitute keystrokes for short cuts – like **Ctrl+S** to save or **Ctrl+P** to print
  - Especially if your job requires using a mouse and a keyboard
- Place the monitor in a comfortable position – not too close but not too far
  - This reduces awkward postures, fatigue, eye strain, and neck and back pain
- Document holders can reduce or eliminate head and neck pain
  - Printed materials that are level with the computer monitor can also reduce fatigue, headaches, and eye strain
- Use speaker phone or headset instead for long conversations
- Avoid awkward postures
- Keep the phone close enough to avoid repeated reaching

Working in a Warehouse

Ergonomic safety practices in work environments that require a lot of physical activity can help prevent serious injury.

Working in a warehouse environment requires a lot of physically demanding tasks. Employers and workers should work together to prevent injury by implementing ergonomic safety practices.

Repetitive Motion

Repetitive motion injuries are another common type of injury caused by ergonomic hazards.

Use the following precautions when performing repeated tasks, to lessen your risk of injury:

- When moving objects repeatedly, raise objects so that they are about knee high

EXAMPLE

For example, when stacking objects for storage

- Do not twist the body when lifting or placing objects

Proper Handholds

Properly placed handholds on shipments, crates, and buckets make lifting easier and reduce the risk of injury. Proper handholds should be made large enough to fit larger hands and should never dig into your fingers and palms.

Pulling vs Pushing

When working with heavy loads, pushing is generally preferable to pulling. Pushing heavy objects allows you to use large muscle groups and apply more force to the load, while pulling carries a greater risk of strain and injury.

Working in a Warehouse

Ergonomic safety practices in work environments that require a lot of physical activity can help prevent serious injury.

Tools to Minimize Manual Handling

Often, there are tools available in the workplace that can minimize the amount of manual handling that must be done when moving heavy objects.

These tools should be used whenever possible to minimize the risk of injury:

- Use mechanical means such as forklifts or duct lifts to lift heavy spools, transformers, switch gear, service sections, conduit and machinery
- Use pallet jacks and hand trucks to transport heavy items
- Use suction devices to lift junction boxes and other materials with smooth, flat surfaces. These tools place a temporary handle that makes lifting easier
- Use ramps or lift gates to load machinery into trucks rather than lifting it

Power Zone

When lifting heavy objects, place materials that are to be manually lifted at "power zone" height – about mid-thigh to mid-chest. You should maintain your neutral body posture with a straight spine alignment whenever possible. Usually, bending at the knees and not the waist, helps maintain proper spine alignment.

Pick up supplies in smaller quantities and break down loads off-site. When possible, request that vendors and suppliers break down loads prior to delivery.

Mechanical Lifts

When using a mechanical lift:

- Group items in a central area where the mechanical lifts can be used
- Establish a weight limit for single person lift
- Consider mechanical assists or multiple persons for lifting loads heavier than your established limit

Work-Related Injuries

If you do sustain an injury in the workplace, it is your right as a worker to report the injury to your employer.

The determination of whether any injury is a work-related injury may require the use of different workplace conditions and exposures.

Establishing the work-relatedness of a specific case may include:

- A careful history of the patient and the illness
- Conducting a medical examination
- Characterizing factors on and off the job that may have caused or contributed to the injury

Encourage Early Reporting of Symptoms

Early treatment can prevent or reduce the progression of symptoms, the development of serious injuries and subsequent claims.

Complete injury reporting is important to the success of the ergonomic safety process. The goal is to properly assess, diagnose and treat problems. To better help workers and employers, early reporting, diagnosis, and intervention can limit injury severity, improve the effectiveness of treatment, minimize the likelihood of disability or permanent damage, and reduce worker's compensation claims.

Early reporting is critical to prevent loss of time and serious injury. When employees fear reporting and fear participating in the ergonomic safety programs, injuries become worse. There are as many as 50% of workers who do not report their Musculoskeletal Disorders (MSDs) and other illnesses or seek workers' compensation for their injuries.

Accident and Record Analysis

Your employer should keep records of injuries and illnesses, and analyze them to identify any ergonomic patterns of injury so that the hazard can be prevented in the future.

This will include reviewing OSHA logs and Workers' Compensation reports. For this reason, it is important that you report any workplace illnesses or injuries to your employer, so that a solution can be implemented.

Implementing Protections

It is the employer's responsibility to provide a safe and healthful workplace for their workers.

According to OSHA, an employer has an obligation under the General Duty Clause to keep the workplace free from recognized serious hazards, including ergonomic hazards. OSHA can cite a company for ergonomic hazards under this clause.

The number and severity of MSDs resulting from physical overexertion – and the cost that comes with it – can be substantially reduced by applying ergonomic principles.

A proper ergonomic process should minimize risk factors that may lead to the development of MSDs:

- Exerting excessive force
- Performing the same or similar tasks repeatedly
- Working in awkward postures or being in the same posture for long periods of time
- Localized pressure into a body part
- Cold temperatures
- Vibration
- Combined exposure to several risk factors

Many industries have successfully used ergonomic solutions in their facilities to address their workers' MSD risks. These have included:

- Modifying existing equipment
- Making changes in work practices
- Purchasing new tools or other devices to assist in the production process

Making these changes in the work place can:

- Reduce physical demands
- Eliminate unnecessary movements
- Lower injury rates and associated workers' compensation costs
- Reduce employee turnover

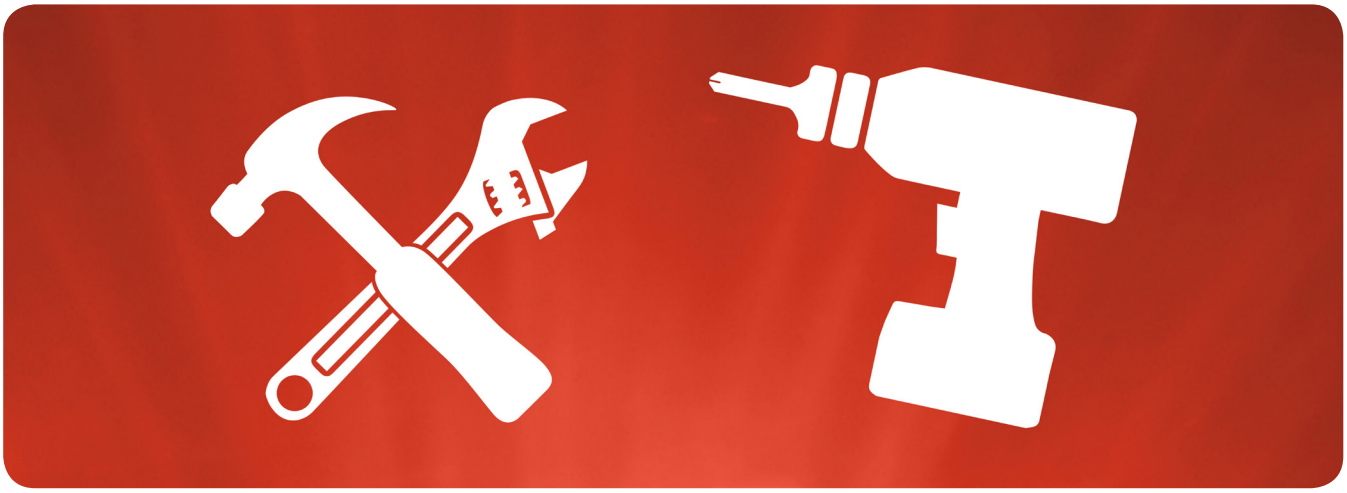
Support from management is crucial to the success of an ergonomic process.

Employers should:

- Define clear goals and objectives for the process
- Discuss those goals with workers and provide training
- Assign responsibilities to appropriate staff members
- Communicate process clearly to their workforce
- Ask employees to voice their concerns and suggestions
- Conduct regular walk-throughs to identify hazards

NOTES:

NOTES:



Introduction to Portable Power Tools and Other Hand-Held Equipment

Lesson 17 Study Guide

LESSON PURPOSE:

In this lesson, we will cover general requirements and basic tool safety, guarding portable tools, and specific tool hazards.

LESSON OBJECTIVES:

By the end of this lesson, you will be able to:

- Identify the basic rules of tool safety
- Describe the proper way to guard portable tools
- List the function and potential hazards of different tools
- Explain employer responsibilities and regulations of hand and portable power tools

Defining Hand and Portable Power Tool Hazards

Following general safety procedures can help prevent injuries caused by hand and power tools.

Using hand or portable power tools comes with several possible hazards that can lead to accidental injury or death. Examples of hazards include the following:

- Damaged or defective tools
- Exposed electrical components
- Dangerous fumes from fuel
- Improperly guarded tools
- Accidental starting

To better understand what a hand and portable power tool hazard is, you must familiarize yourself with the different types of tools.

Hand Tools

Hand tools are powered manually by hand and do not use other sources of power, such as electricity. Examples include chisels and hammers. Hazards posed by hand tools are most often the result of improper maintenance or operator misuse.

Hazards associated with hand tools include the following:

- The tips of certain hand tools can break off and hit other workers
- When not properly handled, sharp implements can cut and otherwise harm the user
- Metal tools produce sparks that can ignite flammable substances

Power Tools

Power tools are powered by a source other than manual effort. Because of their power source, power tools can be very hazardous when improperly used.

There are several types of power tools, categorized by the power source they use:

- Electric – Among the chief hazards of these tools are burns and shocks, which can lead to injuries
- Pneumatic – powered by compressed air; the user is in danger of getting hit by one of the tool's attachments, or by a fastener associated with the tool's use
- Liquid fuel – Fuel vapors can burn, explode, and give off dangerous exhaust fumes
- Hydraulic – These tools can expose both the tool operator and surrounding bystanders to high-pressure fluid release that could lead to injury or death; they must be powered by a fire-resistant fluid
- Powder-actuated – These tools drive nails with a powder load; because these tools can be especially dangerous, only specially trained employees can operate them

Defining Hand and Portable Power Tool Hazards

Following general safety procedures can help prevent injuries caused by hand and power tools.

To fully understand hand and portable power tool hazards, you should also become familiar with the following terminology:

Jack

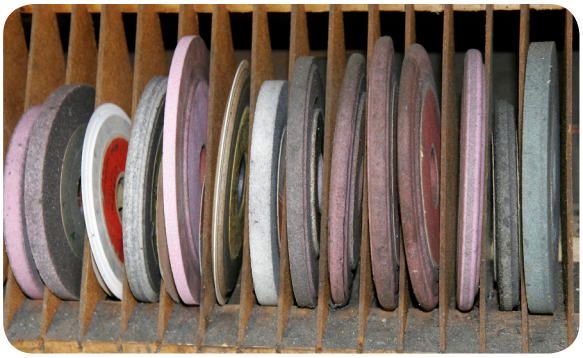
A **jack** is a mechanical device used for lifting, lowering, or moving a heavy load horizontally through the application of a pushing force. Lever/ratchet and screw/hydraulic are common types of jacks.

This is a silhouette of a ratchet jack

This is a hydraulic floor jack

Abrasive Wheel

An **abrasive wheel** is a cutting tool used to sand, polish, and/or buff material into a finalized product with the use of friction. Examples include diamond wheels and reinforced wheels.



Abrasive wheels use grains to create friction between the wheel and the material to be sanded, polished, and/or buffed

Protective Shield/Guard

According to OSHA, a **protective shield/guard** is "a device or guard attached to the muzzle end of the tool, which is designed to confine flying particles."

Stud, Pin, Fastener

A **stud, pin, or fastener** is a fastening device that is created and designed specifically for use within explosive-actuated fastening tools.

Types of Specialized Tools

Almost every industry has jobs or activities that require the use of tools to aid in the completion of tasks.

Portable Power Saws

- All power-driven circular saws having a blade diameter greater than 2 inches must be equipped with guards above and below the base plate or shoe
- The upper guard must cover the saw to the depth of the teeth, except for the minimum arc required to permit the base to be tilted for bevel cuts
- The lower guard must cover the saw to the depth of the teeth, except for the minimum arc required to allow proper retraction and contact with the work
- When the tool is withdrawn from the work, the lower guard must automatically and instantly return to the covering position
  - This does not apply to circular saws used in the meat industry
- All other hand-held powered circular saws having a blade diameter greater than 2 inches without positive accessory holding means must be equipped with a constant pressure switch or control that will shut off the power when the pressure is released
- All hand-held gasoline powered chainsaws need to be equipped with a constant-pressure throttle control that shuts off power to the saw's chain when the pressure is released

Types of Specialized Tools

Almost every industry has jobs or activities that require the use of tools to aid in the completion of tasks.

- All other hand-held powered tools with discs 2 inches or less in diameter may be equipped with either a positive "on-off" control, or with other controls as previously mentioned

EXAMPLE

Examples include platen sanders, grinders, disc sanders, routers, planers, laminate trimmers, nibblers, and shears

- Safety guards used on machines known as right angle head or vertical portable grinders must have a maximum exposure angle of 180 degrees
- Saber, scroll, and jig saws with nonstandard blade holders may use blades with shanks that are not uniform in width, so long as the narrowest part of the blade shank is an integral part in the mounting blade
- Blade shank width must be measured at the narrowest portion of the blade shank when saber, scroll, and jig saws have nonstandard blade holders
- The following types of machinery are not required to be equipped with a constant pressure throttle control:
  - Concrete vibrators and breakers
  - Powered tampers
  - Jackhammers
  - Rock drills
  - Garden appliances
  - Household and kitchen appliances
  - Personal care appliances
  - Medical or dental equipment
  - Fixed machinery
- Belt sanding machines must be provided with guards at each nip point where the sanding belt runs into a pulley
- All cracked saws must be removed from service

Types of Specialized Tools

Almost every industry has jobs or activities that require the use of tools to aid in the completion of tasks.

Powered abrasive wheel tools

- Abrasive wheel tools need to be equipped with guards covering their spindle, nut, and flange projections; these guards must have proper alignment with the wheel and should not exceed the strength of the fastenings:
  - Safety guards on working operations that leave enough protection to the user can leave the spindle end, nut, and outer flange exposed
  - In cases where the work entirely covers the side of the wheel, the side covers of the guard can be omitted
  - Machines that are designed as portable saws may leave the spindle end, nut, and outer flange exposed
  - These requirements must not apply to the following classes of wheels and conditions:
    - Wheels used for internal work while within the work being ground
    - Mounted wheels used in portable operations 2 inches or less in diameter
    - Types 16, 17, 18, 18R, and 19 cones, plugs, and threaded whole pot balls where the work offers protection
    - Natural sandstone wheels and metal, wooden, cloth, or paper discs

Types of Specialized Tools

Almost every industry has jobs or activities that require the use of tools to aid in the completion of tasks.

- Before an abrasive wheel is mounted, it should be inspected closely and tested to be sure that it is free from cracks or defects
  - To test, tap the wheels gently with a light, non-metallic instrument:
    - If the wheels sound cracked or dead, they could fly apart in operation, and they must not be used
    - An undamaged wheel will give a clear, metallic tone or "ring"
  - The spindle speed of the machine must be checked before mounting the wheel to make sure it does not exceed the maximum operating speed marked on the wheel
  - Grinding wheels must fit freely on the spindle and remain free under all grinding conditions
  - A controlled clearance between the wheel hole and the machine spindle is essential
  - The machine spindle must be made to nominal size (± 0.05 inches) plus 0 minus 0.002 inches, and the wheel hole must be made suitably oversized to ensure safety clearance under the conditions of operating heat and pressure
  - All contact surfaces of wheels, blotters, and flanges must be flat and free of foreign matter
  - When a bushing is used in the wheel hole, it must not exceed the width of the wheel and must not contact the flanges
- Do the following when using a powered grinder:
  - Always use eye protection
  - Turn off the power when not in use
  - Never clamp a hand-held grinder in a vise

Types of Specialized Tools

Almost every industry has jobs or activities that require the use of tools to aid in the completion of tasks.

Explosive-actuated fastening tools

- These tools, which are actuated by explosives to propel a stud, pin, or fastener, must meet the design requirements according to the American National Standard Safety Requirements for Explosive-Actuated Fastening Tools (ANSI A10.3-1970)
  - These requirements do not apply to devices designed for attaching objects to soft construction materials (e.g. wood, plaster, tar, drywall) or stud welding equipment
- Operators and assistants must use eye, head, and face protection when using these tools

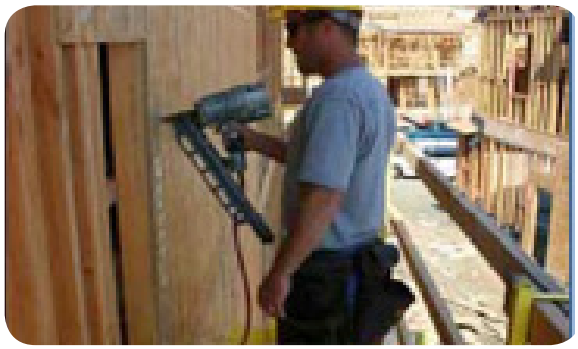
High-velocity tools

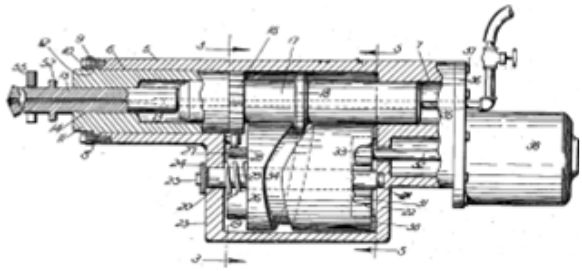
- The muzzle end of the tool must meet the following requirements:
  - It must have a protective shield or guard at least 3 ½ inches in diameter
  - It must be mounted perpendicular to and concentric with the barrel
  - It must be designed to confine any flying fragments or particles that might otherwise create a hazard at the time of firing
- The tool will not operate when equipped with the standard guard indexed to the center position if any bearing surface of the guard is tilted more than 8 degrees from contact with the work surface

Types of Specialized Tools

Almost every industry has jobs or activities that require the use of tools to aid in the completion of tasks.

Low-velocity tools





- Suitable protective shields, guards, jigs, or fixtures must be designed to be mounted perpendicular to the barrel on the muzzle end of the tool
- A standard spall shield must be supplied with each tool
- No load must be used IF it will accurately chamber in any approved, commercially-available piston tool – or any hammer operated piston tool – AND cause a fastener to have mean velocity more than 300 feet per second when measured 6.5 feet from the muzzle end of the barrel
  - In addition, employers must make sure that no individual test firing of a series exceeds 300 feet per second by more than 8%
- High-velocity and low-velocity tools share the following characteristics:
- The tools must be designed so that they cannot be fired unless they are equipped with a standard protective shield or guard, or a special shield, guard, fixture, or jig
- The firing mechanism must be designed so that the tools cannot fire during loading, preparation to fire, or if the tools are dropped after loading
- Firing of the tools must be dependent upon at least two separate and distinct operations of the operator – with the final firing movement being separate from the operation of bringing the tools into the firing position
  - In the case of a misfire, you should do the following:
    1. Hold the tool in the operating position for at least 30 seconds
    2. Try to operate the tool a second time
    3. Wait another 30 seconds while holding the tool in the operating position
    4. Proceed to remove the explosive load in strict accordance with the manufacturer's instructions

Types of Specialized Tools

Almost every industry has jobs or activities that require the use of tools to aid in the completion of tasks.

- The tools must meet the following requirements during operation:
  - They will not operate unless the operator is holding the tools against the work surface with a force at least 5 pounds greater than the total weight of the tool
  - Positive means of varying the power must be available to the operator as part of the tools or as an auxiliary
  - This is so that a power level can be selected to accommodate for the work to be done without the use of excessive force
- All breeching parts will be visible to allow a check for any foreign matter that may be present

EXAMPLE

Examples include those of the walk-behind, self-propelled, riding-rotary, and reel power variety

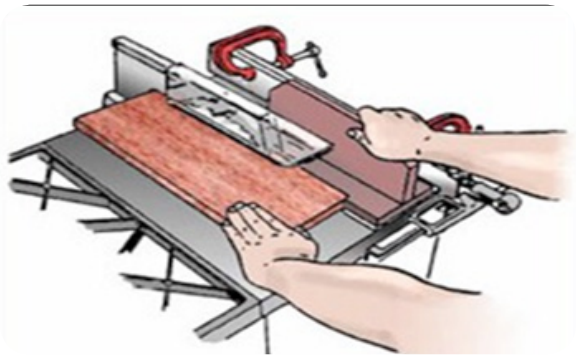
Power lawnmowers

- All power-driven chains, belts, and gears must be so positioned or otherwise guarded to prevent the operator's accidental contact during normal starting, mounting, and operation of the machine
- A shutoff device must be provided to stop operation of the motor or engine
  - This device must require manual and intentional reactivation to restart the motor or engine
- All positions of the operating controls must be clearly identified
- The following wording must be clearly visible at an engine starting control point on self-propelled motors:
  - "Caution. Be sure the operating control is in neutral before starting the engine."

Protecting Yourself from Portable Powered Tools

You should understand the potential hazards of using power tools, as well as the safety precautions that prevent power tool hazards from occurring..

Employees should be trained in the use of all tools – not just power tools. Specific OSHA requirements vary, but there are general requirements that can be applied to most tools in the workplace to help promote safety.



OSHA states that belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or moving parts of equipment need to be appropriately guarded.

Guards should be provided as needed to protect the operator and any others from the following hazards:

- Point of operation
  - This is the area on a machine where work is performed
  - Any special hand tools for placing and removing material in this area must permit easy handling of material without the operator placing a hand in the danger zone
- In-running nip points
- Rotating parts
- Flying chips and sparks

REMEMBER

Safety guards are never to be removed when a tool is being used.

Protecting Yourself from Portable Powered Tools

You should understand the potential hazards of using power tools, as well as the safety precautions that prevent power tool hazards from occurring..

Safety switches

The following hand-held power tools must be equipped with a momentary contact "on-off" control switch:

- Drills
- Tappers
- Fastener drivers
- Grinders (horizontal and vertical angled, with wheels larger than 2 inches in diameter)
- Disc and belt sanders
- Reciprocating saws
- Saber saws

The following hand-held power tools may be equipped with only a positive "on-off" control switch:

- Plate sanders
- Disc sanders with discs 2 inches or less in diameter
- Grinders with wheels 2 inches or less in diameter
- Routers
- Planers
- Laminate trimmers
- Nibblers
- Shears
- Scroll saws and jig saws with blade shanks ¼-inch wide or less

Power tool precautions

The following general precautions should be observed by all power tool users:

- A tool should never be carried by its cord or hose
- When disconnecting from a receptacle or outlet – never yank the cord
- Keep cords and hoses away from heat, oil, and sharp edges
- Disconnect any tools when servicing, changing accessories, or when not in use
- Keep all observers at a safe distance from the work site
- Secure work with a clamp or vise to use both hands to operate a tool
- Avoid accidental starting – the workers should not hold his or her fingers on the switch button while carrying a tool that is connected to a power source
- Maintain balance and good footing when using a power tool

Protecting Yourself from Portable Powered Tools

You should understand the potential hazards of using power tools, as well as the safety precautions that prevent power tool hazards from occurring.

Portable electrical tool precautions

To protect the user from electric shock and burns, all portable electrical tools are required to have the following:

- Double insulation
  - Available on some tools
  - Provides protection to the user without the need for third-wire grounding
- A three-wire cord plugged into a grounded receptacle
  - All three-wire cords contain two current-carrying conductors and a grounding conductor
  - One end of that grounding conductor is connected to the tool's metal casing, and the other end is grounded through a prong on the plug
  - Whenever an adapter is used to allow a two-hole receptacle, its adapter wire must be attached to a known ground
    - The third prong must never be removed from the plug
- Supply of power from low-voltage isolation transformer

Any operator of an electric tool should follow the practices below to prevent possible harm:

- Operate within design limits
- Use gloves and safety shoes
- Store in a dry place
- Do not use in wet locations unless the tool is approved
- Keep work areas well lit
- Ensure cords do not present a tripping hazard

Protecting Yourself from Portable Powered Tools

You should understand the potential hazards of using power tools, as well as the safety precautions that prevent power tool hazards from occurring.

Pneumatic tool precautions

When operating a pneumatic tool, remember the following:

- Eye protection is required
- Face protection is recommended
- Screens must be arranged to protect workers from flying fragments
- Heavy rubber grips can be worn to reduce the strain of using jackhammers
- Face shields, safety glasses, and safety shoes should be worn to protect against injuries if a jackhammer slips or falls

Powder-actuated tool precautions

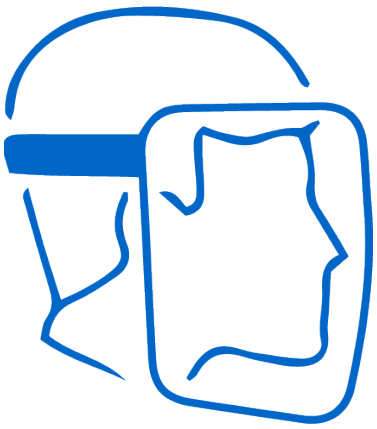
Remember the following when using powder-actuated tools:

- Do not use them in an explosive or flammable atmosphere
- Before using these tools, the worker should inspect them to determine that they are clean, all moving parts should operate freely, and the barrel is free from obstructions
- These tools should never be pointed at anybody
- They should not be loaded unless it is to be used immediately
- Suitable eye and face protection are essential

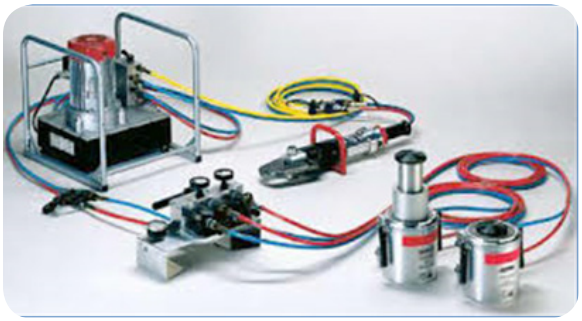
Protecting Yourself from Portable Powered Tools

You should understand the potential hazards of using power tools, as well as the safety precautions that prevent power tool hazards from occurring.

- If you are using a powder-actuated tool to apply fasteners, further precautions are required:
  - Fasteners must not be fired into materials that would let them pass through to the other side
  - The fastener must not be driven into materials such as brick or concrete any closer than 3 inches to an edge or corner
  - When driven into steel, the fastener must not come any closer than one-half inch from a corner or edge
  - Fasteners must not be driven into very hard or brittle materials that might chip, splatter, or cause the fastener ricochet
  - Use an alignment guide when shooting a fastener into an existing hole
  - A fastener must not be driven into a spalled area caused by an unsatisfactory fastening



Hydraulic tool precautions



There are specific requirements that workers need to be aware of before operating a hydraulic tool:

- The fluid used in any hydraulic power tool must be an approved, fire-resistant fluid that keeps its working characteristics at the highest temperatures to which the fluid will be exposed
  - An exception involves fluids used for the insulated parts of derrick trucks and aerial lifts, and for hydraulic tools to be used on or around energized lines
    - These tools must use an insulating type of fluid
  - Operators must not go above the manufacturer-recommended safe operating pressure for hoses, valves, pipes, filters, and other fittings

Protecting Yourself from Portable Powered Tools

You should understand the potential hazards of using power tools, as well as the safety precautions that prevent power tool hazards from occurring.

Jack precautions

- A jack must never be used to support a lifted load; once a load has been lifted, it needs to be immediately blocked up
- Place a block beneath the base of a jack if necessary to make the jack level and secure
  - If the lift surface is metal, place a 1-inch-thick hardwood block (or equivalent) between it and the metal jack head to reduce the danger of slippage
- Stop indicators must be included on all jacks and must never be exceeded
  - Additionally, the manufacturer's load limit for the jack must never be exceeded and must be clearly and permanently marked on the jack
- To set up a jack, make certain of the following conditions:
  - The base of the jack must be resting on a firm and level surface
  - The jack is centered correctly
  - The jack head is held against a level surface
  - The lift force of the jack is evenly applied
- All jacks must be regularly inspected and lubricated
  - Jacks that are used continuously on a site should be inspected at least once every six months

Employer Responsibilities

Each employer is responsible for the safe condition of tools and equipment used by employees.

To help reduce hazards, employers are required to comply with the following regulations:

- Employers must not issue or permit use of unsafe hand tools
- Compressed air must be reduced to less than 30 psi before it is used for cleaning
- Wrenches must not be used when jaws are sprung to the point that slippage occurs
- Impact tools such as drift pins, wedges, and chisels must be kept free of mushroomed heads
- The wooden handles of tools must be kept free of splinters and/or cracks; they must also be kept tight in the tool
- Cheater bars should never be used
- Employers must caution employees that tools should be directed away from aisle areas and other employees in the area
- Knives and scissors must be sharp
- Because sparks produced by iron and steel hand tools can be dangerous ignition sources around flammable substances, employers should provide spark-resistant tools made from brass, plastic, aluminum, or wood
- PPE must be provided to protect employees who are exposed to the hazards of falling, flying, abrasive objects, splashing objects, and harmful dusts, fumes, mists, vapors, or gases

REMEMBER

Employers and employees have a responsibility to work together to establish safe working procedures. If a hazardous situation is encountered, it should be immediately brought to the attention of the proper individual