

Introduction to OSHA

The Occupational Safety and Health Act of 1970 was passed by Congress “to assure so far as possible every working man and woman in the nation safe and healthful working conditions and to preserve our human resources.”

The Occupational Safety and Health Administration (OSHA) is a division of the United States Department of Labor.

Since its creation in 1971, OSHA has had a big impact on worker health and safety.

Employer Responsibilities

The mission of OSHA is to save lives, prevent injuries and protect the health of America’s workers. Employers must:

- Meet their responsibility to provide a workplace free from recognized hazards
- Keep workers informed about OSHA and safety and health matters with which they are involved
- Comply, in a responsible manner, with standards, rules and regulations issued under the OSH Act
- Be familiar with mandatory OSHA standards
- Make copies of standards available to employees for review upon request
- Evaluate workplace conditions
- Minimize or eliminate potential hazards
- Provide safe, properly maintained tools and equipment and ensure that employees use them
- Warn employees of potential hazards
- Establish or update operating procedures and communicate them to employees
- Provide medical examinations when required
- Provide training required by OSHA standards
- Report a fatality, hospitalization, amputation or loss of an eye
- Keep OSHA-required records of work-related injuries and illnesses and post them appropriately
- Avoid discriminating against employees who properly exercise their rights under the OSH Act
- Provide access to employee medical records and exposure records to workers and others as required by law
- Determine if personal protective equipment (PPE) should be used to protect workers
- Pay for most required PPE

Employer Rights

- Seek free advice and on-site consultation from OSHA
- Be involved in job safety and health through industry associations
- Take an active role in developing safety and health programs
- Be assured of the confidentiality of any trade secrets
- Submit a written request to the National Institute for Occupational Safety and Health (NIOSH) for information on whether any substance in a workplace has potentially toxic effects in the concentrations being used
- Submit information or comments to OSHA on the issuance, modification or revocation of OSHA standards and request a public hearing

Employee Responsibilities

- Read the OSHA “It’s the law!” poster (OSHA 3165) at the jobsite
- Comply with all applicable OSHA standards
- Follow all employer safety and health rules and regulations, and wear or use prescribed protective equipment while engaged in work
- Report hazardous conditions to their supervisor
- Report any job-related injury or illness to their employer, and seek treatment promptly
- Cooperate with the OSHA compliance officer conducting an inspection
- Exercise their rights under the OSH Act in a responsible manner

Employee Rights

- Receive adequate training and information
- Request information from their employer on safety and health hazards, precautions and emergency procedures
- Review copies of appropriate OSHA standards, rules, regulations and requirements that the employer should have available at the workplace
- Request that OSHA investigate if employees believe hazardous conditions or violations of standards exist in their workplace
- Observe any monitoring or measuring of hazardous materials and see any related monitoring or medical records
- Object to the abatement period set in a citation issued to their employer
- Participate in hearings conducted by the Occupational Safety and Health Review Commission
- Submit information or comments to OSHA on the issuance, modification or revocation of OSHA standards and request a public hearing
- Seek safety and health on the job without fear of punishment
- Refuse to do a job if they believe in good faith that they are exposed to imminent danger

OSHA's Recordkeeping Requirements

As set out in the OSH Act, OSHA established an effective, centralized, nationwide system for monitoring occupational safety and health problems – a vital requirement for gauging problems and solving them.

Keeping records allows OSHA to compile survey material, helps identify high-hazard industries, and informs employees about their employers' workplace safety record. These records also help employers identify potential sources of injuries and illnesses at their worksites – and hopefully then correct or mitigate them.

Inspections

Inspections may be conducted by OSHA compliance safety and health officers. A typical on-site inspection includes the presentation of inspector credentials, an opening conference, an inspection walk-around and a closing conference. **Inspection priorities, in order, are:**

1. **Imminent Danger:** Inspecting a workplace where a danger exists that can be expected to cause death or serious physical harm is the highest priority.
2. **Fatalities/Catastrophes:** Fatalities as well as catastrophes that result in hospitalization, amputation or loss of an eye must be reported by the employer to OSHA.
3. **Complaints/Referrals:** A worker or worker representative can file a complaint about a safety or health hazard in the workplace.
4. **Programmed Inspections:** These inspections cover industries and employers with high injury and illness rates, specific hazards or other exposures.
5. **Follow-up Inspections:** OSHA also conducts follow-up and monitoring inspections. These inspections are made as needed and take priority over programmed inspections.

Citations and Penalties

Citations inform the employer and employees of the regulations and standards allegedly violated and of the proposed time for abatement. The employer must post a copy of each citation at or near the place where the violation occurred, for 3 days or until the violation is corrected, whichever is longer.

Under the OSH Act, OSHA may cite the following violations and propose the following penalties. Note that the threshold for penalties changes annually. You can find more information on the OSHA website.

- **Other-than-Serious:** A violation that has a direct relationship to job safety and health, but probably would not cause death or serious physical harm. OSHA may propose penalties for each other-than-serious violation
- **Serious:** A violation where there is substantial probability that death or serious physical harm could result and that the employer knew, or should have known, of the hazard. OSHA may propose a mandatory penalties for each serious violation

- **Willful:** A violation that the employer intentionally and knowingly commits, or a violation that the employer commits with plain indifference to the law. OSHA may propose large penalties for each willful violation, and there is a minimum penalty for each violation

Other penalties are **Repeated** and **Failure-to-Abate**. If an employer chooses to appeal a decision, it must be done formally in writing within 15 working days of receiving the citation.

General Duty Clause

What if there is no specific standard forbidding a particular activity, but that activity can easily be identified as being dangerous and potentially harmful to a worker? Can the employer be cited? The answer is YES!

The company or employer can be cited under the “General Duty Clause” found in the OSH Act.

Resources

There are many resources available to you if you want to find out more information about a safety or health issue in your workplace.

These include:

- Your employer, supervisor and co-workers
- Safety Data Sheets (SDSs)
- Labels and warning signs
- Employee orientation manuals and other training materials
- Written procedures
- OSHA’s hotline at **1-800-321-OSHA (6742)**
- The OSHA website: <http://www.osha.gov>
- Your local area or regional OSHA office
- Compliance Assistance Specialist training sessions/materials
- Health Hazard Evaluations (HHEs) conducted by the National Institute for Occupational Safety and Health (NIOSH)
- OSHA Training Institute Education Centers (OTIEC) and other university occupational and environmental health programs
- Doctors, nurses and other healthcare providers
- Public libraries

Safety Signs – Supervisor Supplement

Use this guide to support your workers after they complete the *Safety Signs* course.

Safety Sign Inspections

Periodically, walk through the work area and look at the safety signs. Make sure each sign is:

- Visible
- Legible
- Placed in the right area
- Accompanied by appropriate controls

Workplace Safety Sign Tour

When workers start a new job, either because they are new hires or their responsibilities are changing, take time to give them a brief safety sign tour of their work area.

During the tour:

- Point out safety signs
- Explain the controls associated with the signs
- Ask the workers if they have any questions about what the signs mean or what workers need to do

Follow-up Questions to Ask Workers

After workers take the *Safety Signs* course, stop by to ask them if they have any questions about specific signs in their work areas or if they have noticed any problems with those signs.

Remind workers to tell you if they see any problems, especially if signs are present without appropriate safety controls.

Worker Observation

After workers take the *Safety Signs* course, observe them to make sure they are noticing signs and acting accordingly. Remember to praise workers for doing a good job, not just point out when there is something wrong.

When you give feedback:

DO:

- Explain your purpose (safety)
- Assume people don't know the risks
- Lead with the positive
- Be timely and specific
- Express concern
- Be personable
- Restate what they say to you
- Thank the person

DON'T:

- Distract workers
- Assume you know what is wrong and how to fix it
- Make it personal
- Be vague/general
- Write while observing

Personal Protective Equipment (PPE) Overview for Construction: Protective Characteristics

Your employer will conduct a PPE hazard assessment to identify the hazards present at your worksite and determine the appropriate PPE. Your employer will also establish a PPE program and monitor its overall effectiveness.



You should recognize that PPE is the LAST line of defense between you and a hazard. Your responsibilities are to:

- Wear it
- Maintain it
- Avoid hazards

PPE Types

PPE requirements vary depending on which part of your body might be exposed to hazards.

PPE for the Head

Wear head protection if you risk knocking your head against something or having something hit your head at work. A safety helmet or hard hat:

- Has a hard shell and shock-absorbing liner, or suspension system
- Protects you from knocks and blows to the head
- Guards against electrical shock and burns

To ensure your hard hat protects you properly:

- Don't wear another hat under your hard hat or store anything inside of your hard hat while wearing it
- Don't store your hard hat in direct sunlight such as the rear window shelf of an automobile, since sunlight and extreme heat can weaken the helmet's protection

PPE for the Eyes and Face

Safety glasses:

- Serve as a minimum eye protection requirement
- Have sturdy frames, impact-resistant lenses and side shields
 - Products marked as impact protectors ("Z87+") must pass high-impact testing
- Some feature tinted lenses to reduce glare outdoors
- Keep bigger particles and objects from flying into or striking the eye
- Do not seal around the face – so liquids, fine dusts and other substances can get into eyes

Safety goggles:

- Provide greater protection against sprays, splashes and airborne particles
- Form a tight-fitting seal around the eyes
- Have impact-resistant lenses when marked with a plus sign (+)

Face shields:

- Curve or wrap around the face
- Protect the face from impact and penetration hazards as well as splashes or sprays of harmful liquids
 - In cases where high velocity particles are a possibility, face shields are considered secondary protectors to be used *in addition* to high-impact safety glasses or goggles

Welding helmets keep your face and eyes safe from:

- Flying sparks, metal splatter and slag chips
- Light radiation or intense light

PPE for the Ears

Wear PPE for your ears to conserve your hearing.

- Your employer may require it based on the level or intensity of noise and exposure time
- If you ever notice signs of hearing damage or loss, be sure to wear hearing protection regardless of whether your employer requires it or not

PPE for the Hands

Selecting the best hand and arm protection can be a challenge. Consider the:

- Hazards (for example, sharp or abrasive objects, electricity, molten metals or dangerous chemicals)
- Type of protection needed (for example, heat-, cut-, grip- or slip-resistant gloves)
- Thickness of glove in relation to amount of protection and dexterity needed

When using gloves:

- Remove any rings, watches or bracelets that might cut or tear your gloves
- Avoid wearing gloves when operating rotating machinery that can snag gloves
 - Loose gloves can get caught in moving parts and pull your hand and arm into the machinery

PPE for the Body

Jeans and long-sleeve shirts are often adequate against minor hazards like dirt, nuisance dust, minor abrasions and sun exposure. Other types of body protection may include:

- Coveralls
- Jackets
- Vests
- Aprons

Choose body PPE made of material that is appropriate for each hazard.

- Treated wool and cotton for changing temperatures, dust and abrasions
- Insulated and tightly woven cotton protects for cuts, bruises, extreme temperatures
- Leather and welding aprons for hot work
- Paper-like synthetic fibers for liquid, puncture, tear and abrasion resistance
- Synthetic rubber and plastic materials for chemicals and other harmful substances

PPE for the Feet and Legs

Common foot PPE includes:

- Steel-toed boots
- Foundry shoes
- Conductive (CD-rated) shoes
- Static-dissipating (SD-rated) shoes
- Electrical hazard (EH-rated) shoes

Respiratory Protection

Wear respiratory protection anytime you may be exposed to hazards that may damage your respiratory system. These hazards include:

- Lead
- Asbestos
- Silica
- Spray coatings

Respiratory protection may include:

- Air-purifying respirators (APRs) that filter and purify the air
- Air- or atmosphere-supplying respirators that supply fresh air

Your employer should provide you with a fit-test and health check before you use a respirator.

Personal Protective Equipment Overview for Construction: Using and Maintaining PPE

PPE is intended to separate workers and worksite hazards, but the barrier between can be compromised.

You should recognize that PPE is the LAST line of defense between you and a hazard. Your responsibilities are to:

- Wear it
- Maintain it
- Avoid hazards



PPE Fit

PPE should not move around or fall off while you work, and should not be too tight or constricting. To get a good fit:

- Choose a size that fits snugly but not tight
- Adjust and secure any straps, fittings or headbands
- Check for a good seal when fitting respirators, goggles and hearing protection

Too-loose PPE could:

- Snag on something, tear and become ineffective
- Get caught in machinery – and draw you in as well
- Provide an inadequate seal to block out the hazards

Find a balance between having enough comfort and enough protection. Safety comes first.

Cleaning and Storing PPE

Keeping PPE clean, dry and damage-free helps it last longer and remain effective. Clean PPE:

- After checking the manufacturer's recommendations
- Before and after each use
- With soap and water (alcohol, thinners and strong cleaning agents can degrade materials)

Inspecting PPE

After cleaning PPE, inspect it for:

- Signs of excessive wear (i.e., holes, cracks, tears)
- Broken fittings
- Elastic straps that are slack, worn or twisted

After visually inspecting the PPE, you may also need to:

- Conduct an air or water test to check for leaks
- Send PPE out for testing, repair and recertification by a qualified professional

Never use ineffective PPE. Instead, replace or repair it. Be sure to label it as “out of service” so no one else will use it.

Struck By, Caught Between - Staying Out of the Line of Fire



Recognizing Hazards

Hazards cannot be avoided or controlled unless they can be recognized. Ways to recognize hazards include incidents and jobsite experience, observations, and training. Once you recognize hazards, assess risk and decide whether enough precautions are being taken.

When building a safety plan, incorporate a number of precautions to create layers of protection – high-visibility vests are a great idea, but they work even better if you also add work area lighting.

The Goal of Controls

The goal of implementing a control is to reduce or eliminate the risk of injury and death, while not making the work significantly more difficult to perform or creating any new hazards in the process.

When building a safety plan, create layers of protection:

- Adherence to work processes or wearing certain personal protective equipment (PPE)
- Building safety into the worksite, tools, materials and equipment
- Precautions that do *NOT* rely exclusively on flawless execution

Control at the Source

CONTROL AT THE SOURCE is the best solution:

- Reduce or eliminate the risk of injury and death
- Do not make the work significantly more difficult to perform
- Do not create any new hazards in the process

Control Along the Path of Motion

- Barriers and screens can be erected along the path of the hazard to keep people and moving (or potentially moving or hazardous) objects separated
- A barrier itself can become a hazard if struck with enough force

Control at the Worker Level

- A worker-level control is one that the worker can personally control (like wearing PPE)
- Last resort in protection when hazards can't be controlled at the source or along the path
- Includes personal protective equipment, special clothing or special work methods
- Be aware of surroundings and potential hazards

Planning for Worker-Level Control

- Make sure your employer provides safety training and communicates methods to safely operate equipment

- Your employer should also provide information about the hazards of activities in your work area and precautions you need to take as determined by pre-task planning
- Anticipate what might happen when operating equipment and when required to work near equipment being operated by others
- This requires knowledge of daily activities being performed by others, coordination and pre-planning. Coordinate with your supervisor for updates on activities in your work area

Coordinating with Heavy Equipment Operators

- Don't assume the other person sees you
- Watch out for yourself and others
- Don't get complacent

Line of Fire or Danger Zone

Stay out of the line of fire (danger zone)

- Be mindful of crane swing radius
- Don't walk under a load being lifted by a crane
- Go around the area that might be hit if the load were to suddenly shift or a portion of it were to drop from above

Other predictable danger zones include situations where:

- Welding and cutting slag is thrown downward and in the direction of cutting
- Broken towing and lifting lines recoil violently and predictably
- Uncoiled roll material recoils predictably
- Unstable materials shift predictably
- Chemical vapors and dusts migrate downwind in predictable fashion

Struck-By and Caught-In or Caught-Between Hazards

Work Zones

In routes where worker traffic enters and exits the work zone:

- Equipment operators should know where the entrances and exits for workers are located
- Be aware of traffic moving through those areas
- Workers should not rely on the drivers of these vehicles seeing you. It is each worker's responsibility to be aware of vehicles and avoid them

Heavy Equipment

Remember that heavy equipment can't stop fast or maneuver quickly. When it stops, it can throw a load.

When heavy equipment is in the zone:

- Spotters should be used when equipment is backing up
 - Spotters must maintain an appropriate distance from backing equipment and remain aware of obstructions and traffic
- Make yourself aware of the spotters and the various alarms that indicate a piece of equipment is backing up, because the driver may not see you

- Make sure you are not in the path of the hazard/equipment. If you are, ensure that either the spotter or the operator has seen you
- If you see a piece of equipment above you on an incline, move away from the path of the hazard if it were to roll
- When you hear an alarm, locate the source, evaluate where the material is being dumped, and ensure you are not in the danger zone
- Be aware of crush points on moving pieces of equipment and ensure that you are not between them and a solid object

Overhead/Scaffold Work

You are at risk of being struck by falling objects when you are beneath scaffolding or where other overhead work is being done.

Overhead work controls can help prevent injury.

- Stack materials to prevent sliding, falling or collapse
- Wear a hard hat and other PPE
- Make sure toeboards, nets and other controls are in place

Scaffolds must be designed by a qualified person and inspected as needed by your jobsite Competent Person. Report any concerns to the Competent Person.

When overhead utilities are present:

- Provide spotters when people and equipment will be working near the lines
- Make sure that you are out of reach of a power line that might be severed by a piece of equipment and fall to the ground
- Touching or being too close to a power line can result in arcing and electrocution

Know about area obstructions and respect overhead clearances.

- Equipment tip-overs and pinching/crushing injuries are possible if equipment contacts an overhead structure or other obstruction
- Survey work areas for clearance issues and obstructions and always look in the direction of travel to avoid contact

Public Traffic

Be aware of any public traffic through the work zone:

- Know where the traffic is and how close you will be to it
- Wear high-visibility, reflective work wear to increase your visibility to drivers and to co-workers (zip vests closed)
- Watch for oncoming traffic that may not be aware of you and be prepared to quickly move out of the path of the hazard at the first sign of danger
- Always face oncoming traffic

Constructing Masonry Walls

Implement these worker-level controls when working around masonry walls:

- Identify the boundaries of the work area and where the top of a wall may end up if the wall collapses

- Stay out of the work area unless you are essential to and actively engaged in the construction or lifting operations being conducted
- Be aware when heavy equipment is working near the wall, especially when it is on the other side of the wall from you
- Pay attention to wind speed and direction
 - Directional wind shift can change where the wall might fall
 - Suspend work activities during periods of high wind
- Involve qualified persons when making decisions regarding proper bracing against wind and lateral forces and removal of temporary bracing
- Important: A hard hat can mean the difference between life and death if struck by a falling brick

Projectile and Entanglement Hazards of Tools/Equipment

Projectiles may be created by interaction of materials, tools and equipment. To avoid injury:

- Maintain guards on tools that rotate (saws, grinders, etc.)
- Choose the appropriate tool for impact tasks and avoid impact tools with mushroomed striking surfaces
- Wear eye and face PPE when hammering, chipping, and using pneumatic or powder-actuated tools
- Observe clearances and heed warnings at blasting sites
- Do not use compressed air to blow down clothing, and care must be taken to avoid dead-ending compressed air in pocketed areas

Pay attention to machine hazards.

- Moving parts such as motors, power transmission shafts, pulleys, gears, chains and belts can be hazardous
- Machine guards are placed around moving parts to lessen the chances of inadvertent worker contact with mechanical hazards
- Decals and markings are commonly placed near machine danger zones
- Do not wear loose, untucked clothes, and pull back and restrain long hair
- Take note of hazards mentioned in equipment operating manuals, look at decals and markings on equipment, follow stated precautions, and ensure machine guards are maintained where required

Excavation/Trenching Work

Worker controls that you can implement mostly occur before you enter the trench. These controls include:

- Proper design including trench boxes and other shoring, sloping or benching, as needed
- Daily inspections by your crew's Competent Person to check for indicators of possible cave-in (cracking of side walls and materials sloughing off of the side walls)
- Making sure spoil piles/equipment are back from the edge by at least 2 feet (0.6 meters)
- Noting the position of equipment that could slide into the trench and catch you between the equipment and the ground
- Making sure you have a means of quick egress from the trench, such as a ladder or ramp

Work Zone Safety

Traffic control standards are in place to help ensure the safety of the public and workers. The most common standard is the Manual on Uniform Traffic Control Devices (MUTCD), Part VI. It sets national standards for the TEMPORARY control of traffic in a work zone.

Traffic Control Plans

- Must be in writing
- Are reviewed with local authorities
- Should follow or exceed guidelines of the MUTCD
- May be simple or complex

You must make provisions for safe movement of all types of traffic. Types of traffic may include:

- Private cars
- Pedestrians
- Bikers
- Trucks
- Emergency vehicles
- Railroads or public transit

Work Zone Inspection

You should inspect your work zone every day, including Saturdays, Sundays and holidays. Weather will influence the quality of your traffic control, such as winds blowing over devices. Be sure to document your inspections and corrective actions. When you inspect your work zone, look for:

- Skid marks
- Damaged barricades
- Damaged, dirty or misplaced traffic control devices

Visibility

An important way to maintain traffic control safety is to make sure the public can see you. Always wear your traffic vest over jackets. Vests should be in good condition, zipped closed, and orange, yellow or green in color.

Traffic Control Devices

Another component of a traffic control plan is traffic control devices (TCDs). TCDs include signs, drums, cones, message boards, chevrons, barricades, concrete barriers and traffic lights.

Traffic Cones

The most commonly used device is the traffic cone. Cones must be:

- Orange
- Reflective (for night use)
- A minimum of 28" tall for high-speed roadway (most states require larger)
- Weighted or doubled to keep upright, as needed

Drums

Drums must not be recycled 55-gallon drums. They should:

- Be lightweight and flexible
- Be at least 36" by 18"
- Have closed tops
- Be orange with white stripes
- Have drain holes for water buildup
- Be weighted, as needed

Work Zone

Each work zone is made up of five sections advance warning area, transition area, buffer space, work area and termination area.

- The **advance warning area** is located prior to work areas, warns motorists of work ahead and has warnings that become more specific as you approach
- The **transition area** is where traffic moves from its normal path before it reaches your work area; this may be a detour or lane changes and tapers
- The **buffer area** provides a “buffer” or safety cushion between your work and the transition area. If motorists drive through the TCDs, it gives them room to correct their course before they hit you or others in the work zone
- The **work area** is where the actual work takes place; therefore, it must be large enough to contain workers, tools, equipment, material, vehicles and debris.
- The termination area is where traffic has passed beyond the work area; its goal is to put motorists back where we found them using shifting, merging and termination tapers

Safety Guidelines

- Face oncoming traffic
- Be aware of construction vehicles and equipment
- Stay within the work zone and out of the buffer space
- Do not cross open lanes of traffic
- Know emergency procedures and warnings
- Avoid complacency
- If an accident occurs, be careful when assisting motorists and passengers

Flaggers

One of the most important jobs on the work crew is flagging. In spite of the name, use stop/slow PADDLES rather than flags. The flagger must be:

- Trained in flagging safety
- Knowledgeable about work procedures
- Certified in compliance (only in some states)
- Professional
- Assertive
- Clearly visible at all times

Working at Night

Traffic control performed during hours of darkness requires that you pay special attention due to the potential for higher speeds, reduced visibility, impaired drivers, driver fatigue and driver inattention. To increase the visibility of operations, you should:

- Make sure jackets go under vests
- Use light plants, but aim them away from motorists
- Provide light wands, chemical light sticks for backup
- Lay flares on the ground

Excavation and Trenching Safety

Excavation and trenching work is performed thousands of times daily, in all types of conditions. Increasing your awareness of the hazards associated with excavation work and understanding the laws, regulations, and company safety policies and procedures associated with your work will help keep you safe.

Soil Dynamics

- Soil is extremely heavy. It can weigh more than 100 pounds (45 kilograms) per cubic foot, and a cubic yard may weigh more than 2,700 pounds (1,600 kilograms per cubic meter)
 - That is more than 1 ton, the equivalent weight of a pickup truck, in less space than an average office desk!
- A collapse doesn't have to completely cover a worker to be fatal
- The typical point of failure in most excavations is within the **bottom third** of the excavation. Under pressure from the soil above, this part of the wall will break off from the side wall. This creates an undercut area at the base of the excavation. Gravity then brings down overhead soil

Soil Conditions

- **Moisture** plays a major role in the cohesiveness of the soil. Hazardous soil conditions can be created by having either too much or too little moisture. Weather conditions change soil stability. Do not go into trenches or excavations if water has accumulated or is freely seeping in
- **Vibration** caused by construction operations or nearby traffic can also change soil stability
- **Weight** from equipment, excavated soil or other materials can contribute to collapse if placed near the unsupported face of an open excavation or trench
 - Soil, tools and materials must be kept at least 2 feet (.6 meter) from the excavation or trench edge
- **Loose material** that is subject to falling should be removed from the side walls
- Remove or support large items near the excavation (e.g., sidewalks, buildings)
- Soil is classified as stable rock, Type A soil, Type B soil and Type C soil, or combinations of these four classifications. The A, B and C classifications relate to the cohesiveness of soil
 - **Type A** (the most cohesive) is mostly stable, usually consisting of clay, silty clay and hardpan
 - **Type B** soils can consist of previously disturbed soils, except those that would be classified as Type C, or soil that meets strength requirements of Type A but is fissured or subject to vibration. Type B soil has medium stability and can consist of silt, sandy loam, medium clay and unstable dry rock
 - **Type C** soil is the least stable and can contain sand, gravel and soft clay. It can consist of submerged rock or soil or soil freely seeping water

Protective Systems

- **Sloping** and **benching** are protective measures that cut the walls of an excavation back at an angle to its floor. The angle is determined by the soil classification. Generally, the flatter the angle, the wider the excavation at the top and the greater the protection provided for workers
 - Sloping ratios:
 - Type A – $\frac{3}{4}$ to 1
 - Type B – 1 to 1
 - Type C – $1\frac{1}{2}$ to 1
 - Benching describes a method where soil is stepped back to meet sloping ratios. Benching is not used for Type C because of the instability of the soil
- **Shoring** is a mechanical support system used when appropriate sloping is not possible
- **Shielding** involves cave-in protective structures. Shields used in trenches are often referred to as **"trench boxes"**

- Trench boxes should extend at least 18" (.5 meter) above the surrounding area to prevent soil, tools or other material from falling on workers
- The area between the trench box and the face of the trench should be as small as possible to prevent unexpected movement
- When trench boxes are being installed or moved vertically, no one should be allowed in the trench

Access

- A ladder, stairway or ramp must be located in excavations that are 4 feet (1.2 meters) or more deep
- Workers should not have to walk more than 25 feet (7.5 meters) to use a ladder
- Ladders must be secured and extend 3 feet (1 meter) beyond grade
- When ladders are used with trench boxes, they need to be placed within the box
- If a ramp is used, it must allow workers to walk upright out of the excavation
- Fall protection is needed when an excavation presents fall hazards of 6 feet (1.8 meters) or greater
- Walkways with guardrails must be provided if workers are required or permitted to cross over excavations that are 6 feet (1.8 meters) or greater

Underground Interferences

- Utility companies or owners must be contacted at least 48-72 hours prior to digging so the location of underground line locations can be marked
 - All states have a one-call hotline for this purpose
- Marked locations are approximations of utility locations. Care must be used and the exact location determined by hand-digging or other safe means
- Exposed underground pipe needs to be protected and supported to prevent damage
- Site supervision must be notified if utilities are disturbed
- If you make contact with any underground casing or pipe, have your supervisor contact the utility owner immediately

Competent Person

- Every jobsite that has an excavation should have a "Competent Person." The Competent Person must be capable of identifying existing and predictable hazards and have the authorization to take prompt corrective measures to eliminate problems
- The Competent Person must perform inspections of excavations, adjacent areas and protective systems prior to work start daily and as needed

Hazardous Atmospheres

- Excavations can potentially contain hazardous atmospheres that are oxygen-deficient (less than 19.5% oxygen) or that have accumulation of toxic gases. Unsafe air is usually due to work activities and/or contaminated soil
 - Activities include welding, cutting, application of coatings or adhesives, use of cleaning solvents, abrasive blasting or use of internal combustion engines
 - Contaminated soil may be due to location near past or present oil or gas fields, chemical plants, gasoline stations, landfills, wastewater treatment facilities or other locations where chemical contamination of the soil may have occurred

Emergency Procedures

- Collapse happens quickly. Initial collapses may lead to secondary collapses, making rescue difficult or unsafe
- Call 911 and secure the area. Rescues should be undertaken by specially trained medical or emergency rescue personnel ONLY

Concrete and Masonry Awareness

NOTE: You need qualified professionals to coordinate technical safety matters beyond the scope of this course.

General Safety Requirements

Topic	General Safety Requirements
Construction loads	<ul style="list-style-type: none"> – Do not place construction loads on new concrete surfaces until a qualified person certifies them to carry the weight – Qualified persons are typically engineers with civil or structural engineering credentials
Reinforcing steel	<ul style="list-style-type: none"> – All protruding reinforcing steel must be guarded to prevent impalement – Prevent unrolled wire mesh from recoiling (secure each end of the roll or turn the roll over)
Post-tensioning operations	<ul style="list-style-type: none"> – The sudden release of energy from failed tendon cables, anchorages and tensioning equipment presents severe risk to personnel (recoiled cables, projectiles, etc.) – Place signs and barriers to keep non-essential personnel away – Areas behind tensioning jacks and dead-end anchorages are the most severe danger areas – No one should ever be in-line with cables being tensioned
Working under loads	<ul style="list-style-type: none"> – Do not work under objects moved or supported by cranes (includes concrete buckets and pre-cast concrete panels)
Personal protective equipment (PPE)	<ul style="list-style-type: none"> – Wet concrete is a skin/eye irritant – Remove wet or saturated clothing – Immediately rinse your skin and eyes – Seek immediate medical attention for eye contact – Be prepared for splashes when working with concrete slurries – Wear protective boots, gloves and eye protection (coveralls when practical)
Power concrete trowels	<ul style="list-style-type: none"> – Verify that power concrete trowels and other manually guided powered and rotating equipment have control switches to automatically shut down power when the operator's hands are removed from the handles
Concrete buggies	<ul style="list-style-type: none"> – Handles must not extend beyond the wheels on either side
Tremies/Hoppers	<ul style="list-style-type: none"> – Secure with wire rope in addition to regular connections
Bull floats	<ul style="list-style-type: none"> – Non-conductive or insulated handles reduce risk of electrical shock
Masonry saws	<ul style="list-style-type: none"> – The guard with a semicircular enclosure over the blade is designed to retain blade and material fragments – Dust suppression systems limit exposure to silica dust
Lockout/Tagout	<ul style="list-style-type: none"> – Do NOT service equipment unless it is properly locked out and tagged – Tags must read "DO NOT OPERATE" or similar

Cast-in-Place and Pre-Cast Concrete

- Formwork must be able to support all vertical and lateral loads
- Placement and rate of pour must be consistent with design (excessive rate of pour can overload forms)
- A qualified person will develop/update plans and drawings, which will be accessible at the jobsite

Shoring and Re-shoring Systems

Shoring and re-shoring systems must be:

- Designed by a qualified person
- Set in firm contact with surfaces supported
- Inspected prior to, during and after concrete placement
- Immediately reinforced if damaged or weakened

Vertical Slip Forms

Vertical slip forms are forms that we move upwards during continuous pours to create tall structures such as bridges, towers, buildings and dams.

Reinforcing Steel

Reinforcing steel for vertical structures must be adequately supported to prevent overturning and collapse.

Scaffolds and Work Platforms

- Fully planked walkway systems along the upper level of formwork include guardrails to prevent falls
- Use a fall arrest system for any work outside the guardrail systems
- Protect lower level walkways from falling materials
- Workers must leave walkways before slip forms are moved

Formwork Removal

- Employers determine if the concrete is strong enough to support their weight/load
 - Plans and specifications give conditions
 - The concrete has been properly tested
- NEVER remove re-shoring until the concrete has strength to support weight/loads

Lifting Operations

IMPORTANT: Dropping or losing control of lifted panels and other pre-cast members can result in severe injuries or death. Workers who aren't needed to lift, move and secure panels must keep away from the lifting area.

Workers involved in lifts must take precautions to avoid pinch/crush hazards:

- Avoid being under a panel while it is being tilted
- Avoid being on the blind side of the panel while the crane is traveling with it
- Avoid being between the crane and the panel
- Avoid reaching between the panel being lifted and an adjacent panel
- Avoid reaching under panels to adjust shims and bearing pads
- Avoid the release of lifting lines prior to bracing completion
- Use taglines to guide pre-cast panels and help the ground crew avoid pinch/crush areas
- Make sure qualified crane operators/riggers verify lifting equipment condition and capacity
- Suspend lifting operations in strong wind, heavy rain and other adverse weather conditions

A Qualified Person will:

- Determine if embedded or attached lifting inserts and hardware are of sufficient capacity
- Verify when onsite castings have achieved sufficient strength

- Decide if slab foundation/footing has capacity for pre-cast loads and weight of cranes operating on the pad
- Verify that temporary base restraints are in place to prevent kick-out
- Ensure that panels remain braced/supported until permanent structural connections are complete

Masonry Construction

Limited access or exclusion zones:

- Are established by employers prior to the start of masonry construction
- Restrict access to only workers actively engaged in constructing the wall
- Stay in place until walls higher than 2.4 meters (8 feet) are adequately supported

The limited access or exclusion zone must:

- Be equal to the height of the wall to be constructed plus 1.2 meters (4 feet)
- Run the entire length of the wall
- Be on the side of the wall that will not be scaffolded
- Be marked by barricades and signs that say: "Keep Out – Limited Access Zone"

High Winds

Masonry walls are particularly vulnerable to wind loading while under construction. In high winds (48-64 kilometers or 30-40 miles per hour), immediately evacuate scaffolding and the danger area, including the limited access zone.

Slips, Trips and Falls for Construction

Most slips, trips, and falls can be prevented by simply practicing good safety habits.

Definitions

Term	Definition
Slip	A loss of balance caused by too little friction between a person's foot/feet and his/her walking surface
Trip	A loss of balance caused by the interruption of the movement of a person's foot by an obstacle
Same-level fall	A slip and fall, trip and fall, or step and fall. Occur more often than elevated, but are associated with fewer and less serious injuries.
Elevated fall	A fall from any distance, such as from a ladder, down stairs, off equipment, or from docks, trees, roofs or other height. Occur less often than same-level, but are associated with more serious injuries.

Fall Hazards

Causes of Slips and Trips

The following are just some examples of items in the workplace that can cause **slips**:

- Water
- Mud
- Grease/Oil
- Leaves and pine needles
- Food
- Dust
- Plastic wrapping
- Highly polished floors
- Loose floorboards or tiles
- Metal surfaces
- Mounting/dismounting vehicles/equipment
- Transitioning from one surface to another

Examples of **trip** hazards include:

- Clutter
- Tools
- Cords, cables, hoses in walkways
- Obstacles in aisles and walkways
- Changes in elevation or levels
- Irregularities in walking surfaces
- Missing or uneven floor tiles or bricks
- Non-uniform or irregular steps

Housekeeping and Equipment

Housekeeping and improper equipment use can cause slips and trips:

- Poor housekeeping
 - Items on the ground or on steps
 - Spilled liquids or water
- Inadequate/bad lighting
 - Too dark
 - Glare
- Improper or careless use of equipment
 - Ladders, scaffolds, vehicles, etc.
 - Wearing the wrong shoes

Bad Habits

Bad habits can cause slips and trips:

- Carrying objects that obstruct view
- Not using handrails
- Moving too fast to avoid hazards
- Taking shortcuts
- Being distracted

Protect Yourself

What can you do to avoid the causes of slips, trips and falls?

- Keep work areas neat
 - Eliminate clutter from aisles
 - Keep floors clean and dry
 - Maintain drainage, using gratings or raised platforms
 - Use caution signs on wet floors
 - Use boot brush stations
 - Eliminate protruding nails, splinters or loose boards
 - Take care when using cords
 - Block off or mark hazardous areas
- Keep work areas well-lit
 - Avoid lighting that's too dark or too bright
 - Keep work areas, stairs and aisles well-lit
 - Avoid wearing sunglasses indoors
- Use equipment correctly
 - Know the:
 - Weight of the equipment and materials you will be using
 - Location of skylights and floor hole covers
 - Load capacities of structures
 - When working at heights, watch out for electrical lines, moving equipment and unguarded mechanical parts
- Develop good habits

Ladders

To avoid slips and trips related to ladders:

- Use the right ladder for the job
- Do not use makeshift ladders such as barrels, boxes or sawhorses
- Follow these guidelines when climbing or descending:
 - Only one person should be on a ladder at a time
 - Always face toward the ladder when climbing up or down
 - Keep your belt buckle area between the side rails to avoid over-leaning
 - Use both hands when climbing or descending
 - Never carry anything in your hands
 - Use three points of contact (two hands, two feet equals four points)
- If a ladder is required as part of your job, you must have ladder safety training
- Ladders should be placed with a secure footing and should be lashed or held in position

- Ladders used to gain access to a roof or other area should extend at least 3 feet (0.9 meters) above the point of support
- Place the base of extension or straight ladders 1/4 of the working length of the ladder away from the base of the structure
- Ladders should never be used in the horizontal position as scaffolds or work platforms
- Never use metal ladders near electrical equipment

Stepadders should be equipped with a metal spreader or locking device of sufficient size and strength to securely hold the front and back sections in the open position

- All ladders should be maintained in good condition
- They should be inspected frequently and before each use
- If you find a defect:
 - Tag it out of use
 - Secure or lock it up so others can't use it
 - Report it to maintenance or your supervisor

Scaffolding

There are different types of scaffolds, each with their own regulations and requirements. Some of the general requirements that apply to all scaffolds are:

- The footing or anchorage for scaffolds must be sound, rigid and capable of carrying the maximum intended load without settling or displacement
 - Unstable objects, such as barrels, boxes, loose brick or concrete blocks, must not be used to support scaffolds or planks
- Scaffolds and their components must be capable of supporting at least 4 times the maximum intended load
- Scaffolds must be maintained in a safe condition and must not be altered or moved horizontally while they are in use or occupied
- Damaged or weakened scaffolds must be immediately repaired and cannot be used until repairs have been completed
- A safe means must be provided to gain access to the working platform level through a ladder, stairs or a ramp.
- Overhead protection must be provided for personnel on a scaffold exposed to overhead hazards
 - Guardrails, midrails and toeboards must be installed on all open sides and ends of platforms more than 10 feet (3 meters) above the ground or floor
 - Wire mesh must be installed between the toeboard and the guardrail along the entire opening, where persons are required to work or pass under the scaffolds
- Employees must not work on scaffolds during storms or high winds or when scaffolds are covered with ice or snow

Stairs

Because you use stairs so regularly, you may take them for granted, but in fact, a large number of slips, trips and falls occur on stairs.

- Look where you are going
- Make sure you can see around what you're carrying
- Take one step at a time – never skip steps
- Hold handrails
- Keep steps clean and dry

If You Fall

- Try to keep your wrists, elbows and knees bent
- Do not try to break the fall with your hands or elbows
- It is better to land on your arm than on your head
- It is better to land on your buttocks than on your back

Fall Protection

A good precautionary measure is to use fall protection anytime you are working on an unprotected or elevated work surface from which you could fall. Good practices recommend using it whenever you are at least 4 to 6 feet above the ground.

Ask your manager or supervisor for guidance about using fall protection on your worksite.



Common Fall Hazards

Common fall hazards include:

- Floor holes
- Open-sided floors
- Roof edges
- Skylights
- Ladders
- Aerial lifts

Mistakes that may cause a fall include:

- Not respecting fall hazards
- Not paying attention
- Equipment/tool failure
- Slips
- Overreaching
- Complacency

Methods of Fall Protection

Consider using fall protection when:

- Guardrails are removed
- Guardrails/covers are not able to be installed
- You are working hands-free

Primary fall protection includes footing, balance, handholds, stable work surfaces, and positioning equipment.

Secondary fall protection is classified as active or passive:

- **Passive** systems include guardrails, covers and safety nets
- **Active** systems include:
 - **Work positioning:** Allows you to work hands-free
 - **Fall restraint:** Prevents you from falling off an edge or into an opening
 - **Fall arrest:** Catches your body after you have fallen

When planning to use personal fall protection, consider free fall, clearance and swing fall:

- **Free fall** is the distance traveled from the point where you start falling to the point where your fall protection system begins to slow you down
- **Clearance** is the distance required for your personal fall arrest equipment to activate, decelerate and then completely stop your fall
- **Swing fall** can occur when you walk away from under your anchor point. When you fall, you will swing back under your anchor point like a pendulum

Fall Protection Equipment

Personal fall protection includes the following components:

- **Body support** includes a full body harness
- **Connectors** may be lanyards, snap hooks or carabiners
- **Anchor points** are the points at which you attach your anchorage connector
 - Use anchor points that are as high as possible and located at least at D-ring level
 - Anchor to a structure that can handle 5,000-pound load or that a qualified person has identified for you
 - Make sure you have enough clearance so your fall protection system stops you before your body strikes an object below
- **Self-Retracting Lifelines (SRLs)** require much less clearance than a lanyard and allow more freedom of movement
- **Vertical** and **horizontal lifelines** are also used on some worksites

Inspecting and Maintaining Equipment

You should inspect fall protection equipment before every use

- Inspect body support more frequently when welding or working with chemicals or sharp edges
- Inspect connectors periodically throughout the day

A qualified person should also inspect equipment annually.

If equipment is ever involved in a fall, even if it does not show signs of damage, remove it from use and return it to your supervisor.

To keep your fall protection equipment working, you should:

- Store equipment properly
- Never throw it into a storage box
- Keep it dry and clean
- Keep it out of direct sunlight

Mobile Elevated Work Platforms (MEWPs)

Types of Equipment

Aerial lifts raise personnel to an elevated work position on a platform supported by masts or booms. They include extensible or articulating boom platforms, aerial ladders and vertical towers (mast lifts).

Scissor lifts can lift larger loads and provide more workspace than aerial lifts. They are not for lifting extremely heavy materials. They generally provide the most space for multiple workers. They mostly lift straight up/down but may also shift horizontally.

Vertical mast lifts can lift personnel in tight quarters. They lift straight up/down, have multi-stage masts, and have platform extensions that extend beyond the base of the vehicle.

Preparation

Prepare the People

Everyone who uses mobile elevated work platforms needs training about their equipment and site **BEFORE** they work. Only **trained** and **authorized** persons should operate mobile elevated work platforms.

Prepare the Equipment

Select the appropriate lift for the task/capacity/surface. **WARNING: Operating an indoor, solid-tire, slab lift on outdoor, rough terrain is a common contributor to serious tip-over incidents.**

Follow manufacturer's instructions to perform the **pre-use inspection** of the equipment, including the vehicle and lift components.

If you discover an unsafe condition, tag the lift "Out of Service" and report the issue to the appropriate person immediately.

Prepare the Site

Survey the work area (risk assessment) for:

- Overhead hazards
- Electrical lines
- Moving equipment/people
- Material and debris
- Ground/floor conditions
- Slopes/grades
- Lighting

Take precautions such as:

- Placing barricades
- Posting signs
- Insulating tools/equipment
- De-energizing powered equipment/utilities
- Performing lockout/tagout

Safe Operation

- Extended outriggers or stabilizers can help prevent tip-overs
- Follow manufacturer's directions about operating or not during windy conditions
- Use fall protection and appropriate tie-off points on mobile elevated work platforms
 - You CAN be injured even if the fall arrest system functions flawlessly
- Move with the lift lowered when traveling, and survey the area before lifting again
- Look in the direction in which you are traveling
- Travel with the counterweight up
- Follow manufacturer's guidance about turning on grades
- Do NOT travel with people in the platform or bucket unless the equipment is specifically designed for this type of operation

Working Safely

- Clean slippery substances off shoes and ladder rungs
- Maintain three points of contact when climbing on access ladders
- Close and secure the chain or gate after boarding
- Put a barricade under overhead activity
- Communicate plans to use mobile elevated work platforms
- Use horns and other signaling devices to make your presence known
- Place tools, equipment and materials on the platform before climbing, or hoist tools, equipment and materials up after boarding
- Avoid clutter on working surfaces, clean up as you go, and only take what you need
- Avoid stepping up on anything when on the platform or in the bucket
- Reorient the lift, rather than leaning out
- Avoid exiting the platform or bucket until it is lowered
 - If you MUST exit at heights, follow manufacturer instructions and company policies, which likely include personal fall protection
- You can fall if you exit the lift onto a place without a proper floor and railings
- Employers must have rescue plans that describe what to do if someone falls
- Remove the keys from the mobile elevated work platform to prevent unauthorized use

Ladder Safety for Construction: Selection and Inspection

All workers need to know how to select and inspect ladders to prevent injury or death.



Portable Ladders

- Can be moved
- Types include:
 - Step
 - Straight (fixed length)
 - Extension (variable length)
 - Job-made (only when properly built)

Choosing the Right Ladder

- Choose the right ladder for the job
 - Scaffolds or scissor lifts may be better suited for pushing and pulling work
- Use fiberglass ladders around electricity
- Check safety label for information about:
 - Type and size
 - Grade
 - Duty rating (weight capacity)
 - Model or ID number
 - Highest standing level

Inspecting a Ladder

- Inspect the ladder – every time you use it – for:
 - Modifications (paint, reinforcements, alterations)
 - Missing company/mmanufacturer identification on side or guard rail
 - Defective rungs, steps, surfaces, rails, feet, supports, shelves, spreaders, wheels/casters, locks, ropes, etc.
 - Missing non-slip pads (without these, ladders can move and slide out from underneath workers)
- If a ladder is defective, remove it from service. Tag it, secure it and report defects to your supervisor/foreman

Ladder Safety for Construction: Setup and Use

Setting Up a Ladder

- Retract/lock ladder parts before carrying
- Carry ladders horizontally (get help, if needed)
- Before setting up a ladder, **check for overhead electrical wires and moving objects**
- **Clear the area** around the base of the ladder of debris
- If you must use a ladder in high-traffic areas, **set up barricades**. In a doorway, post signs and lock or block the door
- Rest **both side rails on the top support** and secure the ladder to prevent slipping
- The top of the ladder should be **three rungs higher** than the edge of the structure
- Rung dog openings on extension ladders should face the supporting structure
- Place the ladder on a **firm, level footing**
 - NEVER put a ladder on boxes, bins, vehicles, machines, or slippery or unstable surfaces
 - You may need to shovel out underneath to ensure an even surface (do NOT level with rocks or planks)
- Place the feet of an extension or straight ladder $\frac{1}{4}$ of the ladder's working length away from the base of the structure
 - Distance from base to structure is correct when you can place one foot against each side rail, extend your arms straight out in front of you, and touch a rung without lowering or raising your arms
- If your ladder has flexible feet:
 - Set the feet horizontally on hard surfaces
 - Turn the feet at right angles to the side rails and "plant" the feet vertically on soft surfaces
- **Lock** all ladder sections/parts. Make sure stepladder spreaders are fully open and locked
- **Secure** the ladder
 - If outdoors, tie the bottom of the ladder to a stake driven into the ground
 - Secure the top of the ladder to something structurally sound
 - At a minimum, if you're on even ground, have someone hold the bottom of the ladder as you climb



Consider Weather

ALL work at heights is dangerous during lightning, high winds, rain, sleet or snow. Check with your company's safety officer to determine when work should be suspended.

Climbing a Ladder

Remember: Only one person can be on a ladder at a time (unless it's intended for two!)

- **Face the ladder** when going up or down and when working from it
- **Maintain three points of contact** by keeping two hands and one foot, or two feet and one hand, on the ladder at all times
- **Do NOT carry objects** in your hands while climbing

Staying on a Ladder

- Keep your belt buckle area between the side rails to avoid over-leaning
- Don't climb higher than is safe
 - Avoid going above the fourth rung from the top of a straight or extension ladder
 - Avoid going above the second rung from the top of a stepladder
 - **Never stand on the top rung of a ladder!**
- Use **fall protection** such as fall arrest and fall prevention systems

Scaffold Safety Awareness

Scaffolds are:

- Temporary elevated structures that are used as platforms for supporting workers and equipment
- Usually erected on-site

When adequately maintained and set up correctly, scaffolds are a valuable tool to ensure your safety and allow you to be more efficient when accomplishing your work.

Classifications

There are three basic scaffold classifications:

- **SUPPORTED SCAFFOLDS** are platforms supported by legs, outrigger beams, brackets, poles, frames or similar rigid support
- **SUSPENDED SCAFFOLDS** contain one or more platforms suspended by ropes or other non-rigid means from an overhead structure
- **ROLLING SCAFFOLDS** are similar to supported scaffolds but are mounted on wheels

Hazards

Common scaffold hazards include:

- Falls from elevation, due to the lack of fall protection
- Collapse of the scaffold, caused by unstable footing, improper construction and overloading of materials and equipment
- Being struck by falling tools, work materials or debris
- Electrocution, due to overhead power lines
- Clutter, spills, wet or freezing conditions that cause slips, trips or falls

Safety Principles

A competent person should:

- Identify existing and predictable hazards
- Take prompt corrective measures to eliminate hazards

Design and Construction

Scaffolds should be:

- Erected under the supervision of a competent person
- Constructed and loaded in accordance with their design

Pre-planning includes:

- Determining the type of scaffold necessary for the job
- Determining the maximum load of the scaffold
- Ensuring a good foundation
- Avoiding electrical hazards

User Responsibilities

- Employees/users should inspect all scaffolds, scaffold components and personal fall protection equipment before each use
 - Defective components must be removed from service and replaced
 - Do not use a scaffold that has defective or missing parts
- Shield scaffold suspension ropes and harness system droplines (lifelines) from hot or corrosive processes, and protect them from sharp edges or abrasion
- Wear fall protection in accordance with your organization's policies and regulatory guidelines; **WARNING:** The use of body belts for fall arrest is prohibited

Guidelines

Guard Railing

- The top rail should be at least 2x4 (50x100 mm) lumber or the equivalent and must be:
 - At least 42 inches (1 m) high
 - Able to withstand a force of 200 pounds (90 kg) of pressure (down and out)
- Intermediate rails (mid-rails) should be made from 1x6 (25x150 mm) lumber or its equivalent and installed approximately halfway between the top rail and the platform surface
- The toeboard helps keep tools and material from falling off the scaffold and should be at least 3½ inches (8.9 cm) high
- To make sure the scaffold is rigid, space support posts for guard railing no more than 8 feet (2.4 m) apart

Overhead Protection

- If workers are exposed to falling objects, employers must provide overhead protection
- Power lines near scaffolds are dangerous! Make sure the power company has shut off the electricity before a scaffold is erected where a worker might approach the lines

Other Guidelines

- When hoisting materials onto a scaffold, attach a tag line to safely control the load and keep it from swinging and striking someone or damaging the scaffold
- Keep the work platform clear of tools, materials and debris that could cause tripping or overload scaffolds
- Do NOT work on scaffolds that are covered with ice and snow – except to remove the ice and snow

Proper scaffold maintenance is important:

- Check metal on scaffolds for rust (can weaken the structure)
- Do not use damaged parts
- If a scaffold is damaged in any way, don't use it until it's repaired or replaced

Types of Scaffolds

The most common types of scaffolds are:

- Supported
- Rolling
- Suspended

Supported Scaffolds

- Made of wood or metal supports and are built up higher as the work progresses
- Vertical members must be straight up and down and the horizontal members completely level
- Cross bracing or diagonal bracing or both will keep the scaffold erect, level and rigid
- Never climb on the cross bracing of a scaffold
- Make sure the footing and anchorage for built-up scaffolds are sound, rigid and strong enough to support four times the maximum intended load
- Never use unstable objects such as barrels, boxes, loose bricks or concrete blocks as support for scaffolds or planks
- Supported scaffolds should be secured to the building or structure
- The maximum work height should not be more than four times the smallest dimension of its base
- A ladder must be provided for safe access to the scaffold platform

Rolling Scaffolds

- Similar to supported scaffolds but are mounted on wheels
- To prevent tipping, the maximum work height of a rolling scaffold should not be more than four times the smallest dimension of its base
- Rolling scaffold wheels have a lock to prevent unexpected movement
- Wheels should be designed for use on smooth and level surfaces
- Never move the scaffold while people are working on it

Suspended Scaffolds

There are light duty, medium duty and heavy duty scaffolds, each designed for a specific requirement and use.

The general guidelines for two-point suspended scaffolds, or swinging stages, are that:

- Each employee working from a two-point suspended scaffold should be tied off to an independent safety line
- Wire ropes used to suspend such scaffolds should be able to withstand a load that is six times the load it is intended to support

Operating Procedures

- Only approved scaffolds should be used
- Do not use barrels, boxes, rebar or other makeshift substitutes for scaffolds
- Scaffold planks should be cleated or tied together with tie wire if the plank sticks over the support less than 6 inches (15 cm) or more than 12 inches (30 cm)
- Visually inspect all scaffold planks before each use
- Damaged scaffold planks should be destroyed immediately
- All scaffold planks should be at least 9 to 12 inches (23-30 cm) wide
- Adequate mud sills or other rigid footing, capable of withstanding the maximum intended load, should be provided

- Use diagonal bracing on all support components
- Do not overload scaffolds
- Use a screen or netting when scaffolds are erected over walkways
- Ladders must be used as a means of entry onto and exit off of the scaffold
- Gates should be incorporated in the scaffold design where possible

Rope Shielding

- Each scaffold and scaffold component should be capable of supporting its own weight plus at least four times the maximum intended load without failure
- Each suspension wire rope should be capable of supporting at least six times the maximum intended load
- Wire ropes should be made from material that is not adversely affected by heat or by acids or other corrosives
- Suspension wire ropes and droplines for fall protection systems should be shielded from heat-producing processes, acids or other corrosive substances, sharp edges or abrasions, and electrical component or system contact

Inspections

A competent person must:

- Inspect all scaffolds and scaffold components for visible defects before each use
- Supervise when scaffolds must be erected, moved, dismantled or altered

Each worker is responsible for inspecting each of the following before use:

- Scaffolds and components
- All components of personal fall protection equipment

REMEMBER: Any visibly damaged or worn equipment must be removed from service immediately.

When making inspections, consider the weight the scaffold is to carry.

- A scaffold should be capable of supporting four times the maximum intended load
- The load includes the weight of the people on the scaffold and any supplies and equipment being used

Materials Handling Practices for Construction

To reduce incidents associated with workplace equipment, employees need to be trained in the proper use and limitations of the equipment they operate.

Cranes

- Only trained and qualified or certified people may operate cranes
- Operators should know what they are lifting, what it weighs and the intended path of travel
 - For example, rated capacity of mobile cranes varies with the length of the boom and the boom radius
 - When a crane has a telescoping boom: A load may be safe to lift at a short boom length and/or a short boom radius, but may overload the crane when the boom is extended and the radius increases

Everyone working on a site that has a crane should keep the following guidelines in mind:

- Do NOT pass under loads or place any of your body parts where they may be crushed or pinched
- Make sure you are qualified to signal crane operators
- Use a tag line to guide loads
- Keep people away from fall hazards when loads are received at elevations
- Help watch for dangers such as winds, storms and power lines

Slings

- When working with slings, riggers or other knowledgeable employees must ensure that they are visually inspected before use and during operation, especially if used under heavy stress
- Riggers or other knowledgeable employees should conduct or assist in the inspection because they are aware of how the sling is used and what makes it unserviceable
- A damaged or defective sling should be removed from service
- Slings must not be shortened with knots or bolts or other makeshift devices
- Kinked sling legs are prohibited
- Slings should not be loaded beyond their rated capacity
- Suspended loads must be kept clear of all obstructions
- Crane operators should avoid sudden starts and stops when moving suspended loads
- Employees must remain clear of loads about to be lifted and suspended

Rugged Terrain Lifts, Telehandlers and Powered Industrial Trucks

Workers who must handle and store materials often use:

- Fork trucks
- Platform lift trucks
- Concrete buggies
- Other specialized industrial trucks powered by electrical motors or internal combustion engines

Affected workers should be knowledgeable about the equipment they are operating and be aware of its: safety requirements, design, maintenance and use.

Safety and Health

Ergonomics

Ergonomic principles for materials handling and storage may require controls such as:

- Reducing the size or weight of the objects lifted
- Using forklift rather than manually moving materials
- Moving concrete using a pumper truck or concrete buggy
- Ergonomics not only improves jobsite safety but also makes performing certain tasks easier

Lifting

Back injuries and lifting injuries CAN BE PREVENTED by:

- Training employees in appropriate lifting techniques
- Using proper materials-handling equipment on the jobsite

Before lifting:

- Size up the load and where you need to carry it
- Get help if you need to
- Consider using a dolly, cart, wheelbarrow or other assistance in moving heavy materials long distances

When you DO lift a load:

- Bend your knees to avoid stooping over
- Do not "jerk" or pull at the load
- Keep the load close to your body
- Move your feet when you pick something up or set it down
- Do not twist your body

Stacking and Storage Practices for Construction

When you are moving and storing materials at a construction site, there are a number of things that can go wrong, resulting in injuries like splinters, cuts, scrapes, or crushed fingers, hands and feet – and even death.

Potential Hazards

Workers can be injured by:

- Falling objects
- Improperly stacked materials
- Equipment and materials that may be sharp, abrasive or heavy

When manually moving materials, be aware of potential injuries such as:

- Strains and sprains
- Fractures and bruises
- Cuts and bruises

Moving, Handling and Storing Material

You should seek help moving a load when you cannot: properly grasp, lift or control it; see around or over it; or safely handle it.

Best Practices

- Ensure that NO part of the body is under a raised load
- Blocking materials should be large and strong to support the load
- Use handles or holders and tag lines to reduce finger pinching or smashing
- Use personal protective equipment (PPE):
 - For loads with sharp/rough edges, wear gloves/hand and forearm protection and eye and face protection
 - When loads are heavy or bulky, wear steel-toed safety shoes or boots
- Do not stack or store ANY materials closer than 18 inches (45 centimeters) from sprinkler heads

When moving materials with mechanical equipment:

- Avoid overloading equipment
- Note the equipment-rated capacity on each piece of equipment
- Pay attention to ground conditions
- Consider other employees near the path of travel

When using rough-terrain lifts, telehandlers and powered industrial trucks, the load must be:

- Centered on the forks
- As close to the mast as possible
- At or below capacity; never overload a lift truck
- At the lowest position for traveling
- Correctly piled, if stacked

Stacking Materials

Material	Best Practices
Lumber	<ul style="list-style-type: none"> Remove nails before stacking Stack and level on solidly supported bracing Should be stable and self-supporting
Bricks	<ul style="list-style-type: none"> Stacks should be no more than 7 feet (2 meters) high Taper back 2 inches (5 centimeters) for every foot (30 centimeters) of height above 4 feet (1.2 meters) Taper masonry blocks back 1/2 block for each tier above the 6-foot (1.8-meter) level
Bags and bundles	<ul style="list-style-type: none"> Stack in interlocking rows to remain secure Stack bags by stepping back the layers and cross-keying the bags at least every 10 layers
Boxed materials	<ul style="list-style-type: none"> Band or hold in place using cross-ties or shrink wrap
Drums and barrels	<ul style="list-style-type: none"> Stack symmetrically If stored on sides, block bottom tiers When stacked on end, put planks, sheets of plywood or pallets between each tier to make a firm, flat stacking surface When stacking materials two or more tiers high, chock the bottom tier on each side to prevent shifting in either direction
Hazardous materials	<ul style="list-style-type: none"> Some cannot be stored together; check with your supervisor or general contractor if you are unsure
Combustible materials	<ul style="list-style-type: none"> Store away from areas in which workers are welding or doing hot work
“Unstackable” materials	<ul style="list-style-type: none"> Unstackable materials (due to size, shape or fragility) may be safely stored in cargo containers or bins
Cylindrical materials	<ul style="list-style-type: none"> Example: structural steel, bar stock, poles Stack and block
Pipes and bars	<ul style="list-style-type: none"> Do not store in racks which face walkways

Electrical Safety for Construction: Cord and Plug Connected Equipment

Using electricity around construction sites is so common that it's easy to forget it can cause everything from minor electric shocks to electrocutions and explosions. You need to be able to identify electrical hazards and protect yourself from them.

Electrical Hazards

Electrical hazards are conditions that expose workers to a number of dangers. You can remember the types of dangers associated with electricity by remembering the phrase "BE SAFE":

[B] A **BURN** is the most common shock-related injury and is caused by heat from electricity flow, an electric arc or explosion, or overheated electrical equipment.

[E] **ELECTROCUTION** results when a human is exposed to a lethal amount of electrical energy.

[S] **SHOCK** results when the body becomes part of the electrical circuit; current enters the body at one point and leaves at another.

[A] An **ARC FLASH** is the sudden release of electrical energy through the air. It gives off intense heat and bright light that can cause burns and can also produce strong pressure waves.

[F] Most electrical distribution **FIRES** result from wiring problems and problems with cords, plugs, receptacles and switches.

[E] An **EXPLOSION** can occur when electricity ignites an explosive mixture of material in the air.

Contact with Energized Sources

Contact with energized sources is likely to result in electrical shock and burns. Electrical burns can be:

- Arc burns
- Thermal contact burns
- Combination of burns

The severity and effects of an electrical shock depend on the:

- Pathway through the body
- Amount of current
- Length of exposure time
- Moisture on the skin at the time

REMEMBER: It takes very little current to do significant damage to your body or even kill you.

Improper Use of Extension and Flexible Cords

Flexible extension cords are often necessary on construction sites but may increase the risk of contact with electrical current if they are not 3-wire type, are not designed for hard-usage or have been modified.

To reduce electrical hazards:

- Properly use and maintain: cords, cord connectors, receptacles, and cord- and plug-connected equipment
- Connect cords to devices and fittings in ways that prevent tension at joints and terminal screws
- Be aware that cords may be damaged by door or window edges, staples and fastenings, abrasion from adjacent materials, or simply by aging
 - Properly route, secure and guard cords to prevent this damage and inspect for it prior to use
- Make sure electrical conductors are not exposed
- Keep cord connectors dry

Keep cords and equipment traffic separated! Reroute cords or cover cords with protectors. Heavy weight on cords can cause internal damages you cannot see!

General Safety Precautions

To protect yourself from electrical hazards, you can:

- Use ground-fault circuit interrupters (GFCIs)
- Inspect portable tools and extension cords
- Use power tools and equipment as designed

Use Ground-Fault Circuit Interrupters (GFCIs)

A ground-fault circuit interrupter (GFCI) is designed to protect people from severe electrical shocks by limiting the duration of an electrical shock. It detects ground faults and interrupts the flow of electric current. There are three types of GFCIs:

- Receptacle
- Temporary/Portable
- Circuit Breaker

Tool Safety Tips

- Inspect extension cords and tools prior to using them
- Flexible cords used with temporary and portable lights must be designed for hard use and should be marked with a usage-type designation size and number of conductors
- Never carry a tool by the cord
- Never yank a cord to disconnect a tool
- Keep cords away from heat, oil and sharp edges
- Disconnect tools when not in use and when changing accessories
- Do not hold fingers on the switch button while carrying a plugged-in tool
- Wear gloves and appropriate footwear
- Store tools in a dry place
- Do not use tools in wet/damp environments
- Keep working areas well-lit
- Ensure that cords do not cause a tripping hazard
- Remove damaged tools from use
- Use double-insulated tools

Even when a power system is properly grounded, electrical equipment can be hazardous because of extreme conditions, rough treatment and misuse.

Employer Requirements

To protect workers from electrical hazards, employers:

- Isolate electrical parts
- Supply ground-fault circuit interrupters (GFCIs)
- Establish and implement an assured equipment grounding conductor program (AEGCP)
- Ensure power tools are maintained in a safe condition
- Ensure proper guarding
- Provide training
- Ensure proper use of flexible cords

Many companies implement both GFCI and AEGCP protections even when regulations would have allowed just one these approaches. Learn what's required where you work.

Many companies use a written assured equipment grounding conductor program (AEGCP) to make sure cords and equipment are checked and the grounding conductor is kept in good condition.

One best practice is to apply a specific color of tape to a cord after confirming it is grounded. This way, workers can visually confirm when the cord was inspected. Remember that pre-use inspections are still a good idea, even if the tape indicates a recent inspection.

The AEGCP will:

- Include specific grounding procedures
- Explain how to complete required equipment inspections and tests

Electrical Safety for Construction: Power Lines and Lockout/Tagout

Using electricity around construction sites is so common that it's easy to forget it can cause everything from minor electric shocks to electrocutions and explosions. To stay safe, you need to be able to identify electrical hazards and protect yourself from them.

Electrical Hazards

Electrical hazards are conditions that expose workers to a number of dangers. You can remember the types of dangers associated with electricity by remembering the phrase "BE SAFE."

- [B]** A **BURN** is the most common shock-related injury and is caused by heat from electricity flow, an electric arc or explosion, or overheated electrical equipment.
- [E]** **ELECTROCUTION** results when a human is exposed to a lethal amount of electrical energy.
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- [F]** Most electrical distribution **FIRES** result from wiring problems and problems with cords, plugs, receptacles and switches.
- [E]** An **EXPLOSION** can occur when electricity ignites an explosive mixture of material in the air.

Electrical hazards discussed in this course include contact with overhead power lines and contact with energized sources.

Contact with Power Lines

Overhead and buried power lines carry extremely high voltage. Risks associated with them include electrocution (death), burns and falls from elevations.

- Use caution anytime you are working with cranes, ladders or other equipment under or near power lines
- Survey for the possibility of embedded electrical cables before cutting or drilling into walls
- Survey for the possibility of buried cables before digging
- Any covering on overhead power lines is for weather protection and will not protect from shocks and arcing. Death is likely if you contact them

Hazard Precautions

Contact with Energized Sources

Contact with energized sources is likely to result in electrical shock and burns. Electrical burns can be:

- Arc burns
- Thermal contact burns
- Combination of burns

The severity and effects of an electrical shock depend on the:

- Pathway through the body
- Amount of current
- Length of exposure time
- Moisture on the skin at the time

REMEMBER: It takes very little current to do significant damage to your body or even kill you.

Hazard Precautions

To protect yourself from electrical hazards, you can maintain a safe distance from overhead power lines and follow lockout/tagout procedures.

Before working near overhead power lines, make sure:

- Equipment/activities are located a safe distance from power lines
- The utility company has de-energized and visibly grounded the power lines or installed insulated sleeves on power lines
- Flagged warnings are in place to mark horizontal and vertical power line clearance distances
- Tools and materials are non-conductive

Equipment Around Power Lines

Cranes and Other High-Reaching Equipment

Be sure the utility company has confirmed the voltage and safe working distance from the power lines. Also, if crane work activities come within 20 feet of lines, you will need:

- An observer
- Barricades
- Pre-task plans
- An insulated link
- A boom cage guard
- A proximity device

Learn about specific precautions to follow where you work.

Ladders

Use non-conductive ladders and be sure to retract them before moving.

Material Storage

- Ensure that no materials are stored under power lines
- Use caution tape and signs to block the area under power lines

Excavations

- Locate and identify the markings from the local underground line locator service
- Hand dig within three feet of cable locations
- Be aware that more than one underground cable may be buried in the area of locator markings
- Once a locating device has been used to determine cable positions and routes, excavation may take place, with trial holes dug using suitable hand tools as necessary to confirm this
- Excavate alongside the service rather than directly above it. Final exposure of the service by horizontal digging is recommended, as the force applied to hand tools can be controlled more effectively
- Insulated tools should be used when hand digging near electric cables

Lockout/Tagout

Lockout/tagout is an essential safety procedure that protects workers from electrical injury. It prevents contact with operating equipment parts and prevents the unexpected release of hazardous materials near workers.

The general steps of lockout/tagout are as follows:

1. Check for procedures and identify all sources of energy for the equipment or circuits in question.
2. Disable backup energy sources such as generators and batteries.
3. Identify all shut-offs for each energy source.
4. Notify all personnel that equipment and circuitry must be shut off, locked out, and tagged out.
5. Shut off energy sources and lock switch gear in the OFF position.
6. Deplete stored energy by bleeding, blocking, grounding, etc.
7. Test equipment and circuitry to ensure they are de-energized. A **qualified person** must do this.
8. Apply a lock or tag to alert other workers that an energy source or piece of equipment has been locked or tagged out.
9. Make sure all workers are safe and accounted for before equipment and circuits are unlocked and turned back on.
10. Make sure a qualified person determines when it is safe to re-energize circuits.

Employer Requirements

To protect workers from electrical hazards, employers are required to:

- Ensure overhead power line safety
- Isolate electrical parts
- Enforce lockout/tagout safety-related work practices
- Provide employees with tools, equipment and training to do the job safely

Hand Tool Safety for Construction

Hand tools are not powered by electricity or other sources. Remember that your company may have its own specific policies regarding hand and power tool safety. Review and follow those policies in addition to the information presented in this course.

Hazards

Common hazards associated with hand tools:

- Cuts, scrapes and punctures
- Injuries from falling objects
- Trips
- Electric shock

Preventing Fall Objects

Guardrail toeboards and screens prevent kicking or dropping tools off elevated work surfaces, such as scaffolding. Secure tools in a tool belt or container or lash them to something to prevent falling.

Working with Sharp Tools

Use sheaths and holsters for carrying sharp tools. When you are using cutting tools, cut in a direction that is away from your body.

Rejecting Defective Tools

Do not use any tools with loose heads or damaged handles that may have splinters, burrs, cracks or splits. Tag any worn, damaged or defective tool and store it in a safe place, marking “out of service” on the tag or container.

Using the Right Tools

Finally, and most important, use the right tool for the job. Don't use a knife as a screwdriver, and don't use a screwdriver as a chisel. Don't use a cheater bar or other device to apply pressure to a tool.

Taking Care of Yourself

Rest fatigued joints and muscles by taking short breaks and stretching. A good rule of thumb is to take a 2-minute break every 30 to 45 minutes.

IMPORTANT: If you are unsure of the correct precautions in a certain situation, it is your responsibility to get the information you need. Check with your supervisor or consult a safety regulation handbook for additional guidance.

Striking Tools

- Don't strike an object with the side of a hammer
- Don't use a hammer as a wedge or pry bar
- Keep your hands and tool handles free of oil, grease and moisture
- Wear eye and ear protection

Tightening and Loosening Tools

- Fit the screwdriver to the job
- Keep your fingers away from the tip
- Don't use pliers or a hammer on a screwdriver
- Don't use wrenches that are bent, cracked or chipped
- Don't use a cheater bar or pipe to extend a wrench or vise handle
- Don't use a shim to make a wrench fit
- Don't use vises with broken jaw inserts, cracks or fractures
- Don't use a C-clamp to hoist materials
- Don't use a clamp for permanent fastening
- Pay attention to the hand you are NOT using

Cutting Tools

- Avoid "mushroomed" heads
- Control saws by releasing downward pressure
- Keep blades sharp
- When using an axe, make sure that others are out of work range
- Stay out of the line-of-fire
- Never carry a tool by the blade
- Never point the blade toward yourself or a co-worker
- Pay attention to motion and body position
- Wear cut-resistant gloves

Scissor-type Tools

- Don't use pliers as a wrench or hammer
- Don't force pliers by using a hammer or cheater bar on them
- Never use pliers that are cracked, broken or sprung
- Select the appropriate cutter for the job
- Never use cutters around electrical wires unless the wires are de-energized
- Wear safety glasses or goggles for protection from flying bits of snipped materials

Prying Tools

Use a crowbar that contains a grip and a heel. Never use makeshift crowbars.

Digging Tools

- Don't twist your spine
- Put the most pressure on your legs
- Make sure the shovel and your shoes are not overly muddy, greasy or slippery
- Call the power company to determine electrical hazards

Smoothing Tools

Grasp the handle with one hand and the toe with the other hand. Never use a file as a pry bar, chisel, hammer or screwdriver.

Power Tool Safety for Construction

Power tools can be dangerous. When you misuse them, they can cause injuries ranging from cuts and scrapes to amputations or even death. The good news is that you can follow some basic safety guidelines to avoid these injuries.

Power Tool Hazards

Hand tools and power tools are alike in many ways:

- Present tripping hazards when on walking/working surfaces
- Can fall onto people below when you're working at heights
- Can penetrate underground and embedded cables and pipes
- May cause harm when you misuse or misapply them
- Are safe when you follow precautions

The energy and speed of power tool operation means that these tools are often less forgiving than hand tools when you use them improperly.

Hazards associated with power tools include:

- Cuts, scrapes and punctures
- Moving parts in which loose clothing, hair or fingers can get caught
- Inhalation and projectile hazards. Power saws and grinders can generate large amounts of dust and high-velocity particles can injure eyes and soft tissue. Wearing goggles and a respirator is often recommended

There are unique hazards associated with the type of **power source** used:

- Electric power tools: Even a short exposure to electric shock can cause severe injury, heart failure or even death
- Pneumatic power tools: If the air hose is punctured or cut, it could result in uncontrolled whipping of the hose
- Gasoline power tools: The fuel can cause a fire or explosion

Precautions

All Power Tools

- Never yank the cord or the hose when disconnecting a tool
- Carry the tool by the handle, not the cord or other part
- Keep cords and hoses away from heat, oil or sharp edges
- Disconnect cords when servicing a tool and when you are changing accessories
- Secure your work with clamps and vises
- Keep your fingers away from the switch or button when you are carrying a tool
- Keep tools sharp, clean and well-maintained
- Keep all safety guards in good working order; never detach or disable a guard

Electrical Tools

- Ensure cords are insulated and intact. Do NOT use a tool with a damaged cord
- If a tool is damaged or broken, tag it "out of service" and put it in a safe location
- Use devices that automatically shut off stray circuits, such as ground fault circuit interrupters (GFCIs), and double-insulated tools in wet areas
- Store tools in a dry area
- Wear gloves and protective footwear

Powered Abrasive Wheel Tools

- Perform sound and ring testing before mounting a grinding wheel
 - If the wheel is good, it will have a clear, metallic ring
 - If it sounds cracked or dead, consider it to be dangerous because it could fly apart during operation
 - Run the equipment for 30 seconds or more to ensure it is mounted properly
- Make sure the wheel or disc is appropriate for the tool size and speed ratings
- Wear eye and face protection

Pneumatic Tools

- Wear hearing, eye and face protection
- Adjust the power to prevent projectiles from over-penetration
- Be in firm contact with the work surface before discharging the tool
- Never point a pneumatic tool toward yourself or others

Cartridge (Powder or Explosive) Tools

- Do NOT use on thin materials such as plywood or drywall
- Never point the tool at yourself or anyone else
- Don't load the tool until you're ready to use it
- Don't leave a loaded tool unattended
- Wear eye and face protection
- Choose the cartridge needed for the tool and application
- Be in firm contact with the work surface before discharging the tool

NOTE: Because of the danger associated with cartridge tools, some locations may require workers to have a special certification before operating them.

Hydraulic Power Tools

- Never use your hands to search for leaks. Instead, use a piece of cardboard or wood
- Before disconnecting lines, be sure to relieve pressure
- Before applying pressure, be sure connections are tight and fittings and hoses are not damaged
- Always use the manufacturer's recommended safe operating pressures for the hoses, valves, pipes, filters and other fittings

Hand, Wrist and Finger Safety

To prevent hand injuries, you need to be able to recognize hazards and know a few simple precautions.



Common Injuries and Causes

- **Wrist fractures:** Are most often caused by trying to break a fall with an outstretched hand. Fractures can also occur when the wrist is caught between objects
- **Hand and finger fractures:** Are generally caused by trapping or twisting the fingers suddenly. Accidentally hitting the finger with a heavy object like a hammer or pipe also can cause a finger fracture
- **Hand sprains:** Occur when the ligaments in the hand or wrist are stretched too far and tear. These injuries can be caused by handling heavy equipment without assistance
- **Fingertip injuries:** Fingertips are subject to many different types of injuries: the bones can be fractured, the fleshy part of the finger may be torn, or the fingernail may be damaged. Working with sharp-edged equipment increases the potential for these types of injuries
- **Lacerations:** Lacerations or cuts can cause severe bleeding and may also sever nerves, muscles or tendons. Lacerations can occur if you are not careful while handling sharp cutting tools, such as knives or saws
- **Nerve compression:** Results from a swelling of tissues that surround a nerve, causing a loss of feeling or sometimes a tingling sensation. Repetitive movements can cause the swelling of tissues

Identifying Potential Hazards

- **Mechanical hazards** shear, rotate, crush, puncture, etc.
- **Environmental hazards** include heat, sparks, cold, rough-edged materials, electricity, heavy objects, etc.
- **Contact hazards** can be chemicals, alkalis, acids, solvents, etc.
- **Poor housekeeping** increases your risk of injury and includes tools left out, substances not stored, a messy work area, etc.

Increase your awareness of the equipment, energy sources and simultaneous activities going on around you. Follow your organization's procedures and job safety analyses (JSAs) without deviation.

More Potential Hazards

- **Jagged edges** require cut-resistant gloves to protect your hands from bruises, nicks and lacerations
- **Sharp and heavy tools/materials** can mean lacerations and severe cuts. Cut-resistant gloves work well here
- **Pinch points** are found where two metal objects come together, like when handling compressed gas cylinders or working around mesh gears, rollers and presses
- **Corrosive substances** can cause rashes, burns, chafed and chapped skin and chemical sensitivity. Rubber, vinyl or neoprene gloves provide protection
- **Bacteria** (especially during medical treatment): Disposable plastic gloves are effective
- **Tools and machines** can be especially dangerous because of moving parts
 - Make sure **machine guards** are in place where applicable
 - Make sure equipment is operating properly. Know your equipment!
 - Do not wear watches, jewelry, rings or loose clothing
 - Use good judgment and be prepared for anything

Identify "hidden" hazards that could lead to injuries:

- Repetition
- Strain from moving heavy equipment
- Pressure from hand tools
- Vibration from grinders, drills, jackhammers and other vibrating equipment

Avoid these four states of mind...

- Rushing
- Frustration
- Fatigue
- Complacency

...because they can cause critical errors like:

- Eyes not on task
- Mind not on task
- Line-of-fire
- Losing balance/traction/grip

Ergonomic Factors

Repetitive motion situations are common hazards on the job, placing stress on hands, fingers and wrists. Reduce the hazard by:

- Alternating different types of work
- Varying hand, wrist and finger movements
- Cutting down on unnecessary movement
- Keeping hands and wrists in a neutral position to help prevent fatigue
 - Keep them in a straight line as if you were shaking hands
- Avoiding positions that require you to flex or bend your wrist repeatedly
- Arranging your work environment to keep tools and materials within easy reach
- Stretching throughout the day to keep muscles loose and prevent muscle fatigue and ergonomic discomfort

Tool Use

- Be careful of handles that can pinch the hand and lead to compression injuries
 - Avoid using handles with sharp edges or grooves
 - Smooth or padded handles keep the wrist straight and are long enough to extend across the entire palm to avoid pinching nerves
- Tools that require a closed grip (e.g., hammers and files) should have a diameter no larger than 2 inches (5 centimeters) to distribute its weight across the entire palm
- With tools like wire-cutters and pliers, the handle spread should be no more than 4-5 inches (10-13 centimeters)
- Power tools should have trigger switches that allow you to use your middle finger or thumb (rather than your index finger)
- Avoid using tools that vibrate a lot because the rapid movement can lead to damaged circulation, pinched nerves and stressed tendons

Gloves

- Choose a glove that best protects against the hazards you expect (cut-resistant gloves may not be chemical-resistant, etc.)
- Gloves should be long enough to protect wrists and forearms
- Gloves must also fit properly:
 - Too large, they may get caught in moving parts
 - Too small, they will be uncomfortable and may wear out quickly
- Some machines can grab a glove and pull your hand into rotating parts
- Wash gloves regularly, or properly dispose of them, especially after contamination
 - Wash contaminated gloves separately from other items
- Inspect and test gloves for defects such as rips and tears. Exchange or repair them when damaged
- Store rubber and plastic gloves away from heat, sunlight and humidity
- Make sure gloves are kept soft and flexible

Preventing Cuts and Puncture Wounds

A cut, also known as a laceration, is an injury that results in a break or opening in the skin. A puncture wound is a forceful injury caused by a pointed object that penetrates the skin.

Cuts and punctures can:

- Damage organs, nerves, blood vessels, muscles, tendons, ligaments, bones or joints
- Increase the risk of infection
- Result in exposure to bloodborne pathogens for the victim and for others

Machine Tools

Machine tool hazards exist primarily at the point of operation. This is where body parts can come into contact with the moving parts of the machine or be exposed to debris, such as chips or splinters from turning and boring operations. When working around machine tools, make sure all guards are in place and adjusted properly. Any pinch points created by chains and sprockets or belts and pulleys should be guarded.

Another hazard associated with machine tools is handling the parts and by-products of the machining operation. Turnings and metal shavings, also called metal hay or chips, are by-products of the machining process and can cause severe cuts and puncture wounds. **NEVER USE YOUR BARE HANDS TO HANDLE METAL HAY OR TURNINGS.** Wear gloves that are cut-resistant and are woven in a manner that protects your skin from punctures. Whenever possible, use devices such as a hook or pliers, to remove turnings or metal hay.

Powered Hand Tools

Do not operate powered hand tools unless you are familiar with their use and associated risks. When using powered hand tools, always:

- Ensure the guards and safety devices are in place and working properly
- Operate according to the manufacturer's specifications
- Keep your body clear of the point of operation

Extreme care and caution must be exercised when using pneumatic tools that shoot fasteners. These tools are capable of firing a projectile, much like a bullet from a firearm. The pressure setting of the gun must not exceed what's needed for the density and thickness of the material being nailed, otherwise the fastener can shoot through. Powered tools should only discharge a nail or staple when in contact with a solid object.

Hand Tools

Most hand tool injuries are caused by improper use, damaged tools or not using personal protective equipment (PPE).

To reduce your risk potential when using a **knife**, utility knife or box cutter, you should:

- Ensure the blade is loaded properly and the knife is assembled correctly
- Expose just one segment of snap-off knife blades to prevent breakage
- Keep your thumb off of the blade while making the cut
- Keep body parts out of the line of the cut by cutting away from your body

- Replace or sharpen blades whenever they become dull or start to tear rather than cut
- Make several passes when cutting thick material rather than attempting to cut the material with one heavy cut
- Retract blades and re-sheath knives after use

To reduce your risk potential when using a **hand saw**, you should:

- Use a holding device to secure the material to be cut
- Keep your hand and body parts clear of the blade
- Cut using strong, steady strokes
- Maintain a balanced, stable position
- Wear eye protection

To reduce your risk potential when using a **screwdriver**, you should:

- Position your hands to avoid injury if the screwdriver slips
- Use a holding device to secure the part, if possible
- Never use a screwdriver for prying, punching, chiseling or scraping

Hazardous Objects

Objects such as screws, nails, splinters, construction debris and broken glass often have sharp edges and pointed ends that pose a cut or puncture risk.

- **Wooden crates:** always use PPE and the proper tools, use a crowbar or similar tool to safely pry the boards apart, and never place fingers in areas where there is a risk of pinch points
- **Boards with splinters:** wear the proper gloves to avoid a possible puncture wound
- **Materials with exposed fasteners:** take the time to remove the fasteners or bend them over to eliminate the hazard and discard the waste in a safe location
- **Construction materials:** make sure you wear the proper PPE and be extremely cautious of splinters, protruding fasteners and sharp edges
- **Broken glass:** use a broom to sweep the glass pieces into a dustpan, wear hand protection when picking up pieces, and place the pieces in a protective container or wrapping with cardboard before depositing into a waste receptacle

Wire Rope and Metal Banding

Never use your bare hand to check wire rope or cables for frayed strands. Gently pull a rag or paper towel down the wire.

- Wear gloves when banding and when disposing of banding material
- Use the correct tools to cut the bands and keep your body off to the side and out of the recoil path of the banding
- Cut straight across the band to avoid creating a sharp point
- Consider plastic banding as a replacement for steel banding material

Safe Practices

Be alert to potential hazards before an accident happens. Perform a quick risk assessment and take steps to eliminate or minimize risks.

- Recognize unguarded pinch points

- Use the right tool for the job, the right way every time
- Inspect tools and equipment to confirm good operating condition
- Follow lockout procedures before repairing or cleaning machinery
- Follow all safety precautions even if you are in a hurry
- Use the appropriate personal protective equipment (PPE)

Injury Response

Should a minor injury occur, here are some simple steps to follow until your injury can be evaluated:

- First, check to see if the object that caused the wound is intact. If a piece is missing, it may be stuck in the wound
- Then, wash the wound with soap and water to prevent infection
- Allow the wound to bleed freely, unless the bleeding is too heavy to stop on its own. If this is the case, apply pressure until the bleeding stops
- Apply antibacterial ointment and cover the wound with a bandage
- Monitor a healing wound for increasing redness, warmth, tenderness and swelling that might indicate the presence of an infection; seek medical attention early if you might have an infection
- Report all cuts and punctures, no matter how minor, to your employer

Whenever you receive a cut or puncture wound, you need to get a tetanus shot as soon as possible if your tetanus shots are not up-to-date. You need to have had a tetanus shot within the last 5 years if your wound has been contaminated by dirt. Otherwise, you need to have had a tetanus shot within the last 10 years.

For serious injuries, seconds count, so be sure to know how to summon medical assistance, including emergency phone numbers. Remain calm and be prepared to provide emergency responders with information such as your location and the nature of the injury. Only properly trained personnel should provide first aid.

Hot Work for Construction

Hot work refers to any type of work that produces or uses a spark, flame or heat sufficient for combustion. Because of the potential for fire and injury presented by hot work, it requires certain special procedures that you need to know about.

Precautions

- Whenever possible, avoid hot work. Employ alternative methods
- When hot work must take place, move it away from any building (e.g., to a pre-fab area that's been designated for hot work activities)
- When the work cannot be moved, make the area safe for hot work Relocate movable combustibles within a 35-foot (11-meter) radius to a safe location
- Use safeguards to protect immovable combustibles and nearby personnel from the heat, sparks, fumes and light
- Inspect designated areas before beginning hot work. These areas must be free of rags, cardboard, oils, grease, solvents and other combustibles
- Make sure sprinklers, fire hoses and extinguishers are available, appropriate and working
- Combustible materials within a 35-foot (11-meter) radius of the hot work should be either removed or shielded from potential heat, sparks or flame
 - Remove flammable liquids, paper, wood shavings, dust and oil deposits
 - Eliminate explosive atmospheres in the area
 - Sweep floors clean of sawdust, scrap wood and other debris (kindling)
 - Wet down and cover combustible floors with damp sand or fire-resistant sheets
 - Remove all other combustibles whenever possible, or protect them with fire-resistant blankets or metal shields
 - Cover all wall and floor openings with fire-retardant or noncombustible material – this includes doorways, windows and even cracks in the floors and walls
 - Suspend fire-resistant blankets beneath the work area where there is a chance sparks, slag and other hot work pieces may fall to a lower level
 - Shield and/or shut down duct and conveyor systems that might carry sparks
 - Another approach is to "box in" the hot work area with screens so no ignition sources will escape the work area
- When work is to take place on walls, ceilings and/or enclosed equipment:
 - Move, shield and/or watch combustibles on the other sides of the walls
 - Purge containers of flammable liquids/vapors
- Use trained, equipped and authorized **fire watchers**
 - Fire watchers observe the hot work operations to anything/anyone doesn't catch fire
 - Fire watch must be in place during and for at least 60 minutes after hot work, including during any breaks
- After hot work is finished, the hot work area should be monitored for up to 3 hours

Responsibilities

ALL workers are expected to look for things that are unsafe, but some people have specific responsibilities relative to the hot work permitting process.

Company Management

Company management is responsible for:

- Designating personnel who will authorize permits and ensure hot work is conducted safely

- Making sure that workers involved in hot work (including subcontractors) is familiar with jobsite hot work requirements
- Informing subcontractors of site-specific flammable materials, hazardous processes or conditions, and other potential fire hazards

Permit Authorizers

Management designates permit authorizers who are responsible for:

- Knowing where flammable materials, hazardous processes or other potential fire hazards are likely to be present
- Moving work to a location that's free from combustibles
- If the work cannot be moved, moving the combustibles to a safe distance or having them properly shielded against ignition
- Coordinating activities to prevent work with solvents and other flammable materials near hot work operations
- Preventing hot work from taking place if conditions are not safe and stopping hot work if conditions become unsafe
- Making sure that fire extinguishing equipment is properly located at the site
- Ensuring that a fire watcher is ready and able to perform as needed

Hot Work Operators

Welders and other hot work operators are responsible for duties such as

- Getting permits approved before starting hot work
- Ensuring hot work equipment is in safe operating condition
- Stopping work and notifying others if unsafe conditions develop

Fire Watchers

Fire watchers will:

- Be in place during and for at least 60 minutes after hot work, including during any breaks
- Understand hazards
- Ensure that safe conditions are maintained during hot work
- Stop work if unsafe conditions develop
- Have fire extinguishing equipment and know how to use it
- Get help in the event of a fire

Typically, the watch takes place within 35 feet (11 meters) of the hot work but potentially further for falling sparks and materials carried by wind or draft. Multiple fire watchers are needed if a single fire watcher cannot see all areas where sparks and heated materials travel.

Fire watchers try to extinguish fires only when it is obvious that they can be put out with the available equipment. They will immediately get help if the fire cannot be handled with the available equipment

Hot Work Permits

When it is established that hot work must take place outside of a designated pre-fab area, a written permit has to be issued by a permit authorizer. No hot work can take place without a permit (unless done in an area specifically designated for hot work). Hot work permits are posted at the jobsite in an accessible and conspicuous location.

Fire Extinguisher Safety for Construction: Fight or Flee

One of the most important things you need to know about fire extinguishers is when to use them and when NOT to use them.

Every fire has unique challenges and every extinguisher has limitations.

Know the Risks

Fighting a fire can stop its spread and keep evacuation routes clear, but there are risks. Fires can increase in size and intensity in SECONDS, blocking exit paths and creating a hazardous atmosphere. Portable fire extinguishers contain a limited amount of extinguishing agent and can be discharged in a matter of SECONDS.

Fight or Flee?

Ask yourself:

- Is the fire too big for a portable fire extinguisher?
- Is the environment too hot and smoky, making it difficult to breathe?
- Is there a safe evacuation route?
- Do you know the fire size and is any of it hidden (behind walls/ceilings)?

You may be able to **FIGHT** the fire:

- The fire just started and is limited to the original material ignited
- There is a clear evacuation path behind you

You may need to **FLEE** if:

- The fire involves a large amount of flammable solvents
- Heat is too intense to get within 10-15 feet (3-4.5 meters) of the fire
- Smoke is quickly filling the area
- You must crawl on the ground due to heat or smoke

REMEMBER: If the fire is not contained and fire, heat or smoke may block the evacuation path, flee as quickly as possible.

Fire-Fighting Overview

IMPORTANT: To effectively use fire extinguishers, you need additional training and hands-on practice. This is just give you an overview of best practices for fighting fires.

In general:

- Activate the emergency plan and clear the area
- Fight the fire if it is safe to do so
- If the fire becomes too dangerous or you are unable to put it out, evacuate immediately

Fire Extinguisher Safety for Construction: Using Extinguishers

To effectively put out small fires, you need to CHOOSE and USE the right extinguishers.

How Fire Extinguishers Work

For fire to exist, the following elements must be present at the same time:

- Heat
- Oxygen
- Fuel

Fire extinguishers expel extinguishing agents when you press down on their handles.

The extinguishing agent will do one of the following:

- Cool burning fuel
- Displace or remove oxygen
- Stop the chemical reaction so a fire cannot continue to burn

Fire Extinguisher Types

Using the wrong extinguisher can be ineffective and may make the fire worse or cause new hazards.

- **Class A** fires involve ordinary combustibles such as paper, cloth, cardboard and wood. They require extinguishers labeled A, such as air-pressurized water and foam extinguishers. While portable fire extinguishers are the primary focus of this course, it's worth noting that water hoses and water barrel and bucket approaches may also qualify as Class A means to extinguish site fires.
- **Class B** fires involve flammable liquids such as gasoline, oil, grease, paint, lacquer and solvents. Carbon dioxide, or CO₂, extinguishers are an example of class B and C extinguishers.
- **Class C** fires involve electrical equipment such as wiring, fuse boxes, energized electronics, motors, appliances, computers and other electrical sources. Halogen or clean agent extinguishers are an example of class B and C extinguishers.
- **Class D** combustible metals – such as aluminum, magnesium, titanium and sodium – require special extinguishers labeled D, such as dry powder extinguishers.
- **Class K** fires involve cooking oils and greases such as animal fats and vegetable fats. They require a wet chemical extinguisher labeled K. You will most likely not come across this type of extinguisher in the construction industry unless the work creates an ignition source in an existing kitchen area.

Heat and embers from Class A combustibles, such as scrap wood, sawdust and similar materials, can be difficult to extinguish completely. Just as campfires often re-ignite, these jobsite combustibles may do the same. Drench and monitor extinguished materials until re-ignition is no longer a threat.

Fire-Fighting Overview

IMPORTANT: To effectively use fire extinguishers, you need additional training and hands-on practice. This is an OVERVIEW of best practices for fighting fires.

1. Alert others of the fire by whatever accessible means you can and ask someone to notify the appropriate people, such as the fire department and site security.
2. Evacuate the immediate area.
3. Notify others of your intent.
4. Identify a safe evacuation path.
5. Choose the appropriate type of fire extinguisher.
6. Stand a safe distance from the flames (check extinguisher label).
7. Discharge the extinguisher using the PASS (pull, aim, squeeze and sweep) technique.
8. Back away from the extinguished fire.

If the fire becomes too dangerous or you are unable to put it out, evacuate immediately.

PASS Method

To use the PASS method:

1. PULL the pin.
2. AIM toward the base of the fire.
3. SQUEEZE the handle.
4. SWEEP from side to side at the base of the fire.

Watch the area. If the fire re-ignites, repeat the aim, squeeze and sweep steps.

Best Practices

Be sure to:

- Seek hands-on training in addition to the online course and this job aid
- Keep the right class of extinguisher for the materials in each area
- Make sure extinguishers are accessible and easy to locate
- Don't stack materials in front of extinguishers
- Document periodic extinguisher inspections
- NEVER re-mount a used extinguisher

Confined Space Awareness for Construction

A confined space:

- Is large enough and configured so that an employee can enter
- Has limited or restricted means of entry or exit
- Is NOT designed for continuous occupancy



On construction sites, these spaces may include, but are not limited to:

- Vaults
- Condenser pits
- Manholes
- Pipes and pipe assemblies
- Attics
- Crawl spaces

Confined Space Hazards

- Physical injury from hazards such as mechanical devices
 - Moving parts
 - Extreme heat
 - Noise
 - Vibration
- Hazardous atmospheric conditions
- Engulfment hazards such as debris or gas that can overcome a confined-space entrant or a worker who is adjacent to a confined space

Hazardous Atmospheres

Since deaths in confined spaces often occur because the atmosphere is oxygen-deficient or toxic, a **qualified person** should test a confined space before entry to determine whether the confined space atmosphere contains any types of hazards.

Employer Responsibilities

- Identify and evaluate confined spaces
- Reduce hazards within confined spaces
- Provide employees with training and information about the nature of the hazards, necessary precautions and use of protective and emergency equipment

Worker Responsibilities

- Recognize confined spaces and understand their potentially fatal hazards
- Heed signs that say “Danger – Permit-Required Confined Space, Do Not Enter”
- Follow safe work practices and established procedures

- Worker responsibilities vary by role:
 - **Authorized entrants** go into the permit-required confined space and communicate with the attendant about their status and changing conditions
 - **Attendants** are stationed outside permit-required confined spaces, monitor authorized entrants and keep unauthorized people away from the space
 - **Entry supervisors** are responsible for entry into confined spaces; they make sure emergency rescue services and a means of summoning them are available
- **NEVER enter a confined space or attempt to rescue personnel inside a confined space unless trained to do so**

Training

- Because of the serious potential for injury when anyone enters a confined space, all employees involved in confined space entry need to be trained
- Confined spaces with atmospheric and serious physical hazards may require a permit, a structured approach, and more precautions than a regular confined space
- For permit-required confined spaces, employees who require training include, but are not limited to:
 - Entrants
 - Attendants
 - Entry supervisors
 - Emergency personnel
- Workers must be trained before they can work in a confined space and must be retrained whenever hazards change

Hydrogen Sulfide (H₂S) Awareness

What Is Hydrogen Sulfide?

Hydrogen sulfide (H₂S) is a toxic, potentially deadly gas that is formed in nature when organic materials decay. Hydrogen sulfide is also a by-product of various industrial and chemical processes.

It is colorless. It smells like rotten eggs and is sometimes called sour gas, swamp gas or sewer gas. **Even though it has a distinct odor, it can instantly inhibit your sense of smell so that you cannot detect it.**

Hydrogen sulfide is heavier than air, so you should expect to find it in low areas, especially sewer lines, pits and cellars.

If you ignite hydrogen sulfide, the fire will flash back to the source of the gas.

Health Effects

Since hydrogen sulfide can impair your sense of smell, the first indication you may notice is burning or irritation of the eyes, throat and respiratory tract. This may cause you to cough, have a metallic taste in your mouth, cause your eyes to burn or water, give you a headache, and make you feel sleepy.

Hydrogen sulfide is both an irritant and a chemical asphyxiant and poses several health effects, such as:

- Temporary loss of your sense of smell
- Metallic taste
- Headache
- Labored breathing
- Unconsciousness
- Asphyxiation (can cause brain damage, cardiac arrest even death)

<u>IMPORTANT:</u> In high concentrations, hydrogen sulfide can cause IMMEDIATE unconsciousness followed by death.
--

What Protection Should I Use?

Your employer may require tests to check the atmosphere where hydrogen sulfide may be present.

Use atmosphere-supplying respirators like SCBAs and air-line respirators that provide clean air from a bottled source or compressor.

Escape-only air packs may be available for you to use **ONLY** when exiting a toxic atmosphere.

You should receive additional training about respiratory protection, a fit test and a medical evaluation BEFORE you use any respiratory equipment.

What Should I Do?

You should receive training about the emergency response plan for your employer and location.

If you suspect hydrogen sulfide is present:

1. ENSURE YOUR OWN SAFETY.
2. Call for assistance.
3. Wear a atmosphere-supplying respirator (NOT an escape-only air pack).
4. Move the victim to a safe area with fresh air.
5. Begin cardiopulmonary resuscitation (CPR).
6. Get professional medical care for the victim as soon as possible.

Hazard Communication for Construction: Written Program

The purpose of the **Hazard Communication (HazCom) Standard** is to ensure that employers and employees know about work hazards and how to protect themselves to reduce the incidence of illnesses and injuries due to hazardous chemicals.

The Standard covers chemical manufacturers, importers, distributors, employers and employees exposed to chemical hazards. It applies to general industry, shipyards, marine terminals, longshoring, construction and healthcare.

The purpose of the **Globally Harmonized System of Classification and Labelling of Chemicals (GHS)** is to reduce confusion and, therefore, worker injury and illness. It standardizes an international approach to the HazCom Standard. It also sets specific criteria for hazard warning labels and a 16-section format for Safety Data Sheets (SDSs).

Types of Hazards

- **Physical hazards** can cause serious accidents and injuries (ex: flammable/explosive)
- **Health hazards** can affect a person's short-term or long-term health (ex: toxic)

Responsibilities

Chemical **manufacturers** must:

- Evaluate the hazards of the chemicals they manufacture
- Label products according to the HazCom Standard and provide a safety data sheet (SDS) with each chemical they ship

Importers and distributors of chemicals must ensure proper labeling and transmit an SDS with each chemical they ship.

Companies must:

- Identify and list hazardous chemicals in the workplace
- Obtain safety data sheets and labels for each hazardous chemical, if not provided by the manufacturer, importer or distributor
- Implement a written HazCom program, including:
 - Hazard classification
 - The written program
 - SDSs and labels
 - Training

Hazardous Chemical Inventory

Companies must:

- Identify and list all hazardous chemicals to which workers could potentially be exposed
- Consider chemicals in all forms (liquids, solids, gases, vapors, fumes and mists)
- Identify chemicals in containers (including pipes) and consider chemicals generated in work operations, such as welding fumes, dusts and exhaust fumes

Written Program

The written program must include all of the following:

- The hazardous chemicals present at the jobsite
- Who is responsible for the various aspects of the program
- Where written materials will be made available
- How information will be exchanged at multi-employer jobsites
 - How site owner, general contractor, and subcontractors coming onsite will communicate
- How the jobsite meets the requirements for:
 - Container labels and other forms of warning
 - Providing access to SDSs
 - Providing information and training
- How employees will be informed of non-routine task hazards
- The ways in which pipes and piping systems are marked

Training

Companies must train workers about the hazard communication program:

- Before potential exposure or work with a hazardous chemical
- Whenever the hazard changes
- Whenever a new hazard is introduced into their work area

Expect to learn about:

- Where hazardous chemicals are present
- Where to find the written program, hazardous chemical inventory and SDSs
- The physical and health hazards of chemicals
- How you can protect yourself from chemical hazards
- How to detect the presence or release of a hazardous chemical

Hazard Communication for Construction: How to Use

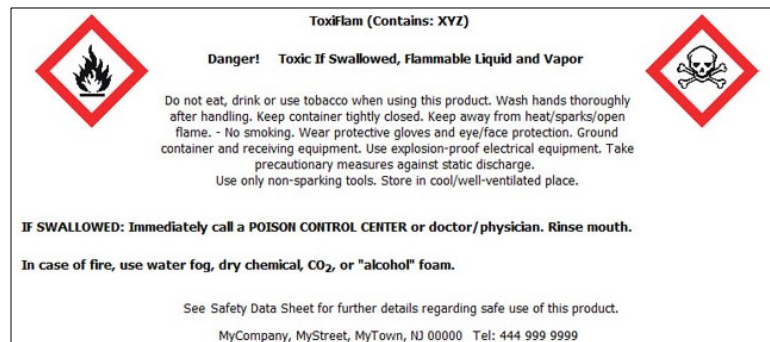
Safety Data Sheets (SDSs)

- Have a specific 16-section format required by the GHS
- Are to be prepared by the chemical manufacturer, importer or distributor and must describe:
 - Physical hazards, such as fire and explosion
 - Health hazards, such as signs and symptoms of exposure
 - Routes of exposure
 - Precautions for safe handling and use
 - Emergency and first aid procedures
 - Control measures
- Must be in English (other languages are optional) and include information regarding the specific chemical identity and common names
- Must provide information about the:
 - Physical and chemical characteristics
 - Health effects and first aid
 - Carcinogenicity (cancer-causing ability)
 - Identification (name, address and telephone number) of the organization responsible for preparing the sheet
- Must be readily accessible to employees in their work area

Manufacturers must evaluate the hazards of chemicals. If no SDS has been received for a hazardous chemical, your employer must contact the supplier, manufacturer or importer to obtain one and maintain a record of the contact BEFORE you use the hazardous chemical.

Hazard Warning Labels

- Labels must be legible, in English (plus other languages, if desired), and prominently displayed
- Labels include:
 - Product name or identifier
 - Pictograms (symbols)
 - Signal words (“Danger” is more severe than “Warning”)
 - Hazard statements describing physical, health and environmental hazards
 - Supplemental information
 - First aid statements
 - Precautionary measures
 - Name, address and telephone number of the supplier



Sources of Carbon Monoxide

Which of these do you have in or around your home?

- Gas appliances, such as:
 - Furnace/boiler
 - Water heater
 - Oven/range/stove
- Car, truck or other vehicle
- Fuel-powered equipment, such as:
 - Lawn mower
 - Leaf blower
 - Chainsaw
- Wood-burning or outdoor cooking/heating sources, such as:
 - Fireplace
 - Wood-burning stove
 - Portable gas stove or camping stove
 - Charcoal grill
 - Portable, flameless chemical heater
- Portable generator

Staying Safe: Gas Appliances

- Have appliances serviced by a technician every year
- Ventilate them properly
- Never use a gas oven to heat a home
- Never patch a vent pipe with tape, gum or anything else not intended for that purpose

Staying Safe: Fuel-powered Equipment

- Buy only equipment carrying the seal of an international testing agency, such as UL
- Do not leave equipment or vehicles running in enclosed spaces such as garages or sheds

Staying Safe: Fireplaces and Outdoors

- Inspect and clean fireplaces and wood-burning stoves yearly
- Never use portable camping stoves, charcoal grills or portable, flameless chemical heaters indoors

Staying Safe: Portable Generators

- Never use a generator inside your home, basement or garage
- Place generators at least 6 meters (20 feet) from windows, doors or vents

Health Hazards in Construction: Introduction

A **health hazard** is any chemical or substance that may produce acute (short-term) or chronic (long-term) health effects in exposed employees.

Examples

Examples of health hazards include:

- Irritants
- Corrosives
- Sensitizers
- Hepatotoxins (chemicals that cause liver damage)
- Nephrotoxins (chemicals that cause kidney damage)
- Neurotoxins (chemicals that damage the nervous system)
- Agents that act on the lungs, skin, eyes, blood or mucous membranes
- Carcinogens (chemicals that may cause cancer)
- Toxic or highly toxic agents
- Reproductive or genetic toxins

Some places on construction sites that have health hazards include:

- Drilling rock (silica dust)
- Old, peeling paint (lead)
- Exposed insulation around pipes (asbestos)
- Sheets of fiberboard (chemically treated wood)
- Container of degreaser (solvent)
- Board with rusty nails (bacteria)

Particularly dangerous health hazards in construction include:

- Silica
- Lead
- Asbestos
- Dusts, solvents and fumes

Routes of Exposure

You may be exposed to health hazards through:

- Inhalation (airborne contaminants)
- Absorption (entry through the skin)
- Ingestion (food or drink)
- Injection (being punctured by a sharp object)

Health Hazards in Construction: Asbestos Awareness

Asbestos is a natural mineral consisting of crystals. When asbestos is broken down into individual fibers, it is light enough to remain suspended in the air and behave similar to an invisible gas. This makes asbestos a serious **inhalation hazard**.

Asbestos was widely used in the earlier part of the 20th century for:

- Pipe and boiler insulation
- Non-fiberglass/mineral wool insulation
- Spray-on fireproofing
- Floor tile and floor mastics
- Resilient flooring
- Transite pipes and wall sheeting
- Gaskets, caulks, putties, joint compounds
- Roofing, mastics, roofing felts, shingles
- Bricks

IMPORTANT: Only work on materials when you know that they DO NOT contain asbestos. If you are unsure, ask your supervisor for help.

Work Activities

Work that may result in asbestos exposure includes: demolition, renovation, operations and maintenance (insulation repair, cable pulling, plumbing repair, and replacing light fixtures or smoke detectors).

Health Effects

Exposure can cause:

- Asbestosis
 - Lung scarring
 - Can take 20+ years to develop
 - Symptoms include shortness of breath, coughing and fatigue
- Lung cancer (even with low exposure)
- Mesothelioma
 - Cancer of the lining of the chest cavity
 - 40+ years to develop
 - Symptoms include shortness of breath and pain in the chest or abdomen

Report symptoms and suspected exposures to your employer immediately and see a doctor if you suspect that you may have inhaled asbestos, especially if you experience shortness of breath, coughing or fatigue.

Precautions

If you are expected to remove or otherwise handle asbestos-containing materials (ACM) or presumed asbestos-containing materials (PACM), you will receive additional training and will wear a respirator. This training will cover specific work practices and control measures in place at your jobsite.

Prevent asbestos fibers from becoming airborne:

- Never use sanding or abrasive equipment
- Consider wet methods to suppress dust
- Do NOT use air hoses or blowers

Practice good hygiene in areas suspected of containing asbestos materials. This includes washing your hands before you handle anything you put into your mouth (e.g., food, drink, cigarettes or cosmetics).

Health Hazards in Construction: Crystalline Silica Awareness

Where Is Crystalline Silica?

Crystalline silica is found in soil, sand, granite, quartz and many other minerals. Crystalline silica dust is generated via activities such as:

- Chipping, hammering and drilling rock
- Crushing, loading, hauling and dumping rock
- Abrasive blasting using silica sand as the abrasive
- Abrasive blasting of concrete (regardless of the abrasive)
- Sawing, hammering, drilling, grinding and chipping concrete or masonry
- Demolishing concrete and masonry structures
- Dry sweeping or blowing pressurized air on concrete, rock or sand dust

What Are the Health Effects?

Getting crystalline silica in your eyes can cause irritation.

Inhaling respirable crystalline silica can cause:

- Kidney disease
- Chronic obstructive pulmonary disease (COPD)
- Lung cancer
- Silicosis

Silicosis is a respiratory disease caused by inhaling silica dust. **There is no treatment or cure for silicosis and it CAN kill you!**

Symptoms

If you believe you've been exposed to crystalline silica and notice any of these symptoms, see your doctor:

- Shortness of breath
- Fever
- Fatigue
- Loss of appetite
- Chest pain
- Dry, nonproductive coughing

What Precautions Should I Take?

To protect yourself from crystalline silica:

- When sawing concrete or masonry, use wet saws that provide water to the blade
- During rock drilling, use water through the drill stem
- Use equipment with integrated dust collection systems
- Minimize exposures to nearby workers (frequently clean work areas, move others upwind, schedule dusty work to occur at times when others won't be present)
- Use abrasive blasting materials containing less than 1% crystalline silica
- Use respirators in combination with dust suppression and other dust control measures; **respirators should not be the primary method of protection**

Health Hazards in Construction: Lead Awareness

Lead is a toxic metal found in building materials, such as old paints and piping. You may be exposed to lead during:

- Welding, cutting, soldering, brazing and torch burning
- Demolition or salvage of structures
- Removal or encapsulation of lead materials
 - Scraping, sanding, heat gun stripping and cleanup
 - Rivet busting, abrasive blasting and cleanup
- Installation of lead mortar and other lead-based products
- Transportation, storage and disposal of material on the construction site

Health Effects

Lead can be inhaled as a dust, fume or mist. Handling food, cigarettes, chewing tobacco, and makeup with lead on your hands will contribute to ingestion. Most forms of lead are not easily absorbed through the skin. **Repeated low-level inhalation of dust and fumes that contain lead is the most common exposure in construction settings.**

A short-term exposure to a high concentration of lead can cause abdominal pain, irritability, headaches, pain or tingling in the hands and/or feet, fatigue and weakness, among other afflictions. Long-term exposure to low concentrations of lead can damage the blood-forming, nervous, urinary and reproductive systems; cause behavior changes; cause weight loss; decrease sex drive and cause infertility and long-term reproductive damage.

Early symptoms of lead exposure:

- | | | |
|----------------|--|---------------|
| • Nausea | • Gastrointestinal irritation and pain | • Colic |
| • Headaches | • Diarrhea | • Weakness |
| • Sluggishness | • Loss of appetite | • Dehydration |
| • Vomiting | | |

If you suspect you've been exposed to lead and experience any of these symptoms, report it to your employer and see your doctor.

Prevent or Limit Exposure

Prevent lead exposure by using chemical stripping on paint rather than scraping or sanding it.

Your employer will perform tests when lead is suspected. Positive test results may require controls such as:

- Do NOT take lead-contaminated clothes off the jobsite
- Wear coveralls, if available
- Use change rooms, shower facilities and laundering services, if available
- Wear an effective respirator
- Wash your hands and face prior to eating, drinking, smoking or applying cosmetics

When housekeeping, use high-efficiency filtration vacuum cleaners. Avoid sweeping, shoveling or brushing and NEVER use compressed air in lead contamination areas.

Health Hazards in Construction: Special Concerns

Wood and Wood Dust

- Formaldehyde and arsenic are wood additives that present a health risk
 - Exposure can cause burning in the eyes, nose and throat and other symptoms
- Large wood dust particles can be trapped in the nasal passage and cause nasal cancer
- Inhaling wood dust also causes chronic lung disease
- Many types of wood (such as oak and western red cedar) and wood contaminated with mold can irritate the eyes, nose and cause an asthmatic allergic response

To minimize your exposure to wood dust:

- Consider tools and equipment with vacuum-filtered dust extraction systems
- Wear personal protective equipment (PPE) such as dust masks and eye protection
- Frequently clean work areas

Solvents

- Solvents are found in cleaners, degreasers, epoxies, glues, paints and varnishes
- Many solvents are easily evaporated and exposure to the vapor/liquid can present health risks
- Exposure to solvents is through breathing; can also be absorbed through the skin

Short-term high concentration exposure to solvents will cause headaches, mood changes, nausea, drowsiness and skin problems. You may develop long-term damage to the kidneys, liver and skin. Behavior changes, sleep disorders, short-term memory loss and dementia can also occur from solvent exposure.

Check product labels and the safety data sheet (SDS) of the products you use to determine the hazards, precautions and exposure protocols.

Welding and Cutting Operations

- Generates gas, fumes and smoke
- Exposure to metal, coatings, solvents and degreasers (can be turned to highly toxic phosgene)

Health effects include:

- Eye, nose and throat irritation
- Dizziness and nausea
- Lung, kidney and nervous system damage
- Ulcers
- Cancer
- Suffocation/asphyxiation
- Metal fume fever (flu-like symptoms and metallic taste)

To prevent or limit exposure:

- Clear surfaces of coatings, residues and paints
- Position yourself upwind to avoid fumes and gases
- Use ventilation systems
- Wear respiratory protection

Dust Mask – Voluntary Use Guidelines

Types of Respirators

A respirator is a device that protects you from inhaling airborne substances such as dusts, vapors, gases and fumes. Some respirators even supply breathable air.

Respirators offer varying levels of protection so it's important that you can tell the difference between the types and understand when it's necessary to use each.

- **Particulate respirators** clean particles out of the air as you breathe
- **Chemical cartridge/gas mask respirators** filters chemical gases out of the air as you breathe
- A **self-contained breathing apparatus (SCBA)** uses its own air tank to supply clean air



Types of Dust Masks

Just as there are different types of respirators, there are different types of dust masks. They are classified by the mask's:

- Efficiency at stopping small particles, from lowest to highest – 95, 99 or 100
- Level of resistance to the effects of oil – not resistant (N), resistant (R) or oil-proof (P)

For example, an N95 mask has the lowest level of efficiency and no resistance to oil. It is the most common type for voluntary use.

Your employer will have a qualified person select the appropriate type of required respirator. They can also help you choose the right respirator for voluntary use.

Rules for Voluntary Use

To ensure that the respirator itself does not present a hazard:

- Read and follow all instructions provided by the manufacturer
- Choose a respirator that's certified for protection against the contaminant you're concerned about
- Don't wear a respirator in conditions for which it's not designed; dust masks are for dust, not for gases, vapors, fumes or smoke
- Keep track of your respirator so that you only use yours

The instructions that come with your dust mask will provide the information you need to use and care for your mask.

Usage Guidelines

Some general guidelines for using a dust mask include:

- Limit use of disposable masks to 8 hours (continuous or intermittent)
- Try different brands, models and sizes to get a comfortable fit
- Follow the manufacturer's instructions:
 - Use head straps
 - Make sure the facepiece is snug
 - Mold the nosepiece to your face

Care Guidelines

Manufacturer's instructions will advise you about how best to care for your mask.

In general:

- Store respirators where they're protected from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture and damaging chemicals
- Inspect respirators before use to ensure they are clean and have all parts
- Discard respirators if they:
 - Are or become soiled, contaminated or damaged
 - Don't allow you to breathe freely

Be aware that humidity and very dirty and dusty workplaces impact breathing resistance and shorten the life of your mask.

Summary

If you're not sure whether a respirator is required for the task you will be doing, talk to your supervisor, safety professional or respiratory protection program coordinator before entering the work area. They can also help if you have questions about what kind of respiratory protection you should be wearing or how to care for it, put it on or take it off.

Heat Stress

How the Body Handles Heat

To get rid of excess heat, our brains tell our bodies to change our blood circulation and produce sweat.

Blood Circulation

The heart pumps more blood and the vessels close to our skin expand so that heat leaves the body at the skin's surface. Our muscles and organs may receive less blood while the body is cooling off. We feel weaker, more tired and less alert. Blood may pool in our lower extremities, causing us to faint. Move around to prevent fainting and lie down while recovering.

Sweat

When sweat evaporates, it sends heat away from our bodies. The moisture in humid air makes it harder for sweat to evaporate and move heat away from the body.

Health and Safety Concerns

Heat can affect you inside buildings as well as outdoors. It can be especially dangerous in places that lack proper airflow or absorb heat, such as in a car or on black pavement.

Safety Concerns

- Sweat may cause slips
- Heat lowers alertness
- Irritability can distract
- People may rush to get out of heat

Health Concerns

Disorder	Description and Symptoms	Treatment
Sunburn	<ul style="list-style-type: none">• Skin is burned by UV rays (strongest in late morning and afternoon)• Can burn even on cloudy days• All skin colors can burn• Overexposure to sun can cause skin cancer	<ul style="list-style-type: none">• Keep skin cool and moisturized as it heals• Wear sunscreen• Protect sunburned skin from further burning• Seek medical attention for severe sunburns, dehydration, high fever and extreme pain
Heat rash	<ul style="list-style-type: none">• Also known as prickly heat• Likely in hot, humid environments• Sweat ducts become plugged• Uncomfortable skin rash• Discomfort may reduce work performance	<ul style="list-style-type: none">• Keep skin cool and dry• Let skin air-dry after bathing
Heat cramps	<ul style="list-style-type: none">• Painful spasms of the muscles due to body's water and salt loss	<ul style="list-style-type: none">• Rest briefly and cool down• Drink liquids with salt or electrolytes, such as sports drinks

Disorder	Description and Symptoms	Treatment
Heat exhaustion	<ul style="list-style-type: none"> • Sweat more (clammy, moist skin) • Develop a headache • Notice dark urine • Feel nauseated/dizzy • Faint 	<ul style="list-style-type: none"> • Rest in a cool place and drink liquids (avoid caffeine and alcohol) • Prompt treatment is important because untreated heat exhaustion could lead to heat stroke
Heat stroke	<ul style="list-style-type: none"> • Red skin • Sweating that suddenly stops • Vomiting • Rapid heartbeat • Confusion/delirium • Convulsions • Loss of consciousness • <u>Death can occur</u> 	<ul style="list-style-type: none"> • Get medical help <u>immediately</u> • While you wait for help: <ul style="list-style-type: none"> ○ Move victim to cool area ○ Remove unnecessary clothing ○ Soak person/clothing with water ○ Fan their body ○ If possible, give them fluids and help them to drink • Do NOT give the victim aspirin or acetaminophen

Reducing the Likelihood of Heat Stress

Bring and use sunscreen, wide-brimmed hats, sunglasses, protective clothing and bottled water when working outside.

Heat disorders are more likely among people who are not used to or acclimated to heat. It takes 4 to 14 days to get used to heat. If possible, **increase heat exposure gradually** over this time. When temperatures jump 10 °F (5 °C) from the previous 5-day period, be prepared for heat stress. Allow workers acclimatized to heat to perform the more strenuous tasks.

Make hot jobs easier, lessen job duration, take frequent short breaks, and postpone non-essential tasks. Exhaustion reduces heat tolerance, so **get plenty of sleep.**

Look out for each other and enlist **additional workers** to help perform tasks in the heat more efficiently. When temperatures go above 90 °F (32 °C), make sure people don't work alone or are supervised in case they need help.

Rest Areas

Take advantage of shade, ventilation and heat shielding to **reduce the heat around you.** When work happens at or above 80 °F (26.6 °C), employers may provide rest areas under trees or in shelters. If you need to rest outside of regularly scheduled breaks, alert your supervisor. Do not return to work until you feel sufficiently cooled and confident that you can do so safely.

There are many ways you may be able to cool your work area. Your employer may provide:

- Permission to work in the shade
- Canopies
- Fans/blowers (if they don't spread heat)
- Misters
- Wet towels
- Insulation
- Windows
- Ventilation

Vector-Borne Disease Awareness: Mosquitoes, Ticks and Other Pests

Definitions

Vectors: Living organisms that can transmit infectious diseases between humans or from animals to humans.

Vector-Borne Disease: Human illness caused by parasites, viruses and bacteria that are transmitted by vectors/pests.



Bloodsucking Pests ingest a disease-producing microorganism during a blood meal, and then inject a new host during a future blood meal.

Vector/Pest	Most Active Time	Diseases Carried	Where are they found?
Mosquitoes	Day and night	Malaria, yellow fever, West Nile Virus and many others	Worldwide, except Iceland and Antarctica
Ticks	Day and night	Lyme disease, Rocky Mountain spotted fever and many others	All over the world because they can live anywhere their host lives
Triatomine bugs (kissing bugs)	Night-usually to attack sleeping people	Chagas disease	Southern U.S. and Latin America, not including Caribbean island
Sand flies	Dusk until dawn	Leishmaniasis	Parts of Africa, the Middle East, Europe and Asia, as well as parts of Mexico, Central America and South America
Black flies	During the day when windspeeds are high	River blindness	Worldwide

Mechanical Vectors are found worldwide and physically carry (usually on the feet) a disease-contaminated agent and deposit it where a human can ingest it (usually food or drink).

Common Vectors

- Cockroaches
- Houseflies

Common transmitted diseases

- Dysentery
- Typhoid fever
- Cholera

Environment

- Inspect your area for:
 - Evidence of insects
 - Places insects like to live
- Make that area less hospitable to pests

Pest Management

- Seal openings
- Establish a barrier
- Eliminate breeding grounds
- Use insecticides as a last resort

Personal Factors

Awareness

- Be aware of the pests that surround areas where you work, live and travel
- Learn about foreign countries you visit – receive recommended vaccines and immunizations

Limit Exposure

- Wear long pants and sleeves to limit exposed skin and prevent insect bites
- Wear light-colored clothing
- Apply insect repellent to exposed skin and clothing
- Use a fan
- Use LED lights instead of incandescent
- Avoid wearing fragrances and using scented laundry or bath products

How to Remove a Tick

1. Gather supplies – Fine-tip tweezers and rubbing alcohol. If you don't have rubbing alcohol, soap and water can be substituted.
2. Using clean hands, clean the area around the tick with rubbing alcohol or soap and water.
3. Use the tweezers to slowly and carefully pull the tick out. Pull the tick straight up to prevent breakage.
 - Avoid squeezing on the body of the tick
4. Release the tick into a jar or zip-lock bag and take it to the doctor for testing. If you aren't going to have the tick tested, carefully dispose of it.
5. Clean the bite area and your hands with alcohol or soap and water.
6. For the next several weeks, monitor for a reaction. See a doctor if you experience a rash, fever, fatigue, headache, muscle pain or joint swelling and/or pain.

Report Exposure

- If you think you have a vector-borne disease, do not panic
- If your exposure was at work, report it to your employer
 - Your employer can assess the situation and decide if professional pest control is needed
- If your symptoms are severe enough to see a doctor, your doctor will report necessary information to the appropriate public health organizations