UL PureSafety

OSHA 30 Construction Industry
Complete Job Aid

Revised November 30, 2021

This job aid provides reminders about information covered in UL online training courses. Always abide by local rules, regulations, equipment instructions, and your company's health and safety policies and procedures.

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Office Safety Awareness

Most office injuries are not serious, but even slight injuries may result in lost workdays, which interfere with normal operations. Working in an office brings with it a set of health and safety concerns. Office safety is everyone's responsibility.

Safety Briefings

At the beginning of any meeting, it is a best practice to conduct a “Safety Briefing” that identifies:

- Room hazards
- Emergency phone numbers
- Locations of exits and fire equipment
- Assembly point for evacuation
- Designated first-aid/CPR-trained responders
- Location of emergency equipment

Common Hazards

Slips, Trips and Falls

Wear proper shoes for the weather (avoid slick soles and high heels) and watch where you walk. In addition, there are specific hazards in various areas in and around the office:

- **Parking lots:**
  - Water, gravel, grease, ice
- **Stairways** (inside and outside)
  - Missing a step, water, ice
  - Hold the handrail
  - If carrying a large or heavy load, take the elevator
- **Entryways and Hallways**
  - Spills of water, other substances
  - Wipe your feet when entering from the outside
  - Watch for caution signs
  - Report uneven and worn floor surfaces or clutter
  - Make sure lighting is good
- **Kitchens/food serving areas**
  - Watch for spilled food or liquids on the floor
  - Use floor mats to control slip hazards
- **Offices and Conference Rooms**
  - Pick up objects that fall
  - Keep pathways clear
  - Be careful not to trip when floor surfaces change
  - Keep all chair legs on the ground
  - Inspect chairs periodically
- **Storage areas**
  - Crowded areas, stacks
  - Keep items waist high or lower
  - Heavy items on the bottom
  - Get help if lifting something heavy
  - Use a stepstool or ladder to reach items overhead
  - Never use a chair for this!

Tools and Equipment

- Storage or file cabinets
  - Don’t overload
  - Fill from bottom to top, heaviest items at bottom
  - Never store materials on top of cabinets
  - Open one drawer at a time

- Ladders or stepstools
    - Never stand on top two steps
    - Face ladder when going up or down – only one person at a time
    - Make sure spreaders are open and use both hands when climbing
- Striking against objects
    - Don't hurry when moving around the office
    - Walk in designated aisles

Electrical and Fire Hazards

- Most offices prohibit smoking or have designated smoking areas
- Use caution around appliances
- Turn off and remove power sources on equipment before servicing
- Replace damaged/broken cords
- Minimize use of extension cords
- Use surge protectors as required

Chemicals

Offices may contain chemicals that are hazardous to health and the environment (e.g., cleaning fluids, copier fluids and toner, inks, oils, solvents). You may need to take a hazard communication course to learn about specific hazards of chemicals you work around.

- Labels will tell you about a product's potential hazards
- Safety Data Sheets (SDSs) give detailed information about a product's hazards and what to do in the event of an emergency involving the product
- Properly store and dispose of flammable and combustible chemicals
- Make sure that flammable storage areas are well-ventilated

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

OSHA Inspections for Construction and Multi-Employer Worksites

Employer Categories

OSHA uses four categories of employers to determine who to cite for hazards and exposures:

- **Creating Employers** creates or cause a hazardous condition that violates an OSHA Standard and exposes any employee to it
- **Exposing Employers** are those whose own employees are exposed to a hazard
- **Controlling Employers** have general supervisory authority over the worksite and must exercise reasonable care to prevent and detect violations for ALL jobsite employees, regardless of company affiliation
- **Correcting Employers** are responsible for using reasonable care and correcting hazards

A single employer may fall into multiple OSHA employer categories.

Citable Entities

When OSHA identifies an issue on a multi-employer worksite, they:

1. Identify the categories that apply to the offending employer.
2. Determine who met or did not meet relevant safety obligations.

Regardless of whom is citable, EVERYONE is responsible for worksite safety.

More than one employer on a multi-employer worksite can be cited for the same violation.

Best Practices

Employers should work together to prevent, detect and resolve safety issues. EVERYONE should report safety issues. Employers must communicate to resolve issues and take steps to protect people. At multi-employer worksites:

- Ensure contractors and subcontractors have proper safety policies
- Check for history of incidents/violations
- Follow the site-specific safety plan
- Collaborate to ensure everyone understands mutual responsibilities and how to avoid hazards
- Prepare for OSHA inspections

OSHA Inspection Process

At multi-employer worksites, employers have rights and steps at each phase of the process.

1. **Arrival**. Alert all employers at the worksite when an inspector arrives.
2. **Opening Conference**. All employers should attend the opening conference. At the conference, ask questions and establish ground rules.
3. **Tour**. All employers have a right to have a representative present during the OSHA inspection tour. Employers may correct problems during the tour. Inspectors may ask employers for permission to expand the inspection, based on findings.
4. **Closing Conference**. At the closing conference, all employers should:
    1. Review inspector observations
    2. Discuss violations
    3. Learn appeal rights
    4. Ask questions

OSHA 300 Recordkeeping Requirements

OSHA Forms

OSHA Form 300 – Log of Work-Related Injuries and Illnesses

- Keeps a running count of injuries and illness for the year
- Classifies work-related injuries and illnesses
- Notes the extent and severity of each case

OSHA Form 301 – Injury and Illness Incident Report

- Records individual work-related injury or illness incidents
- Records specific details about what happened and how it happened
- Employers may use an equivalent worker's compensation or internal forms instead

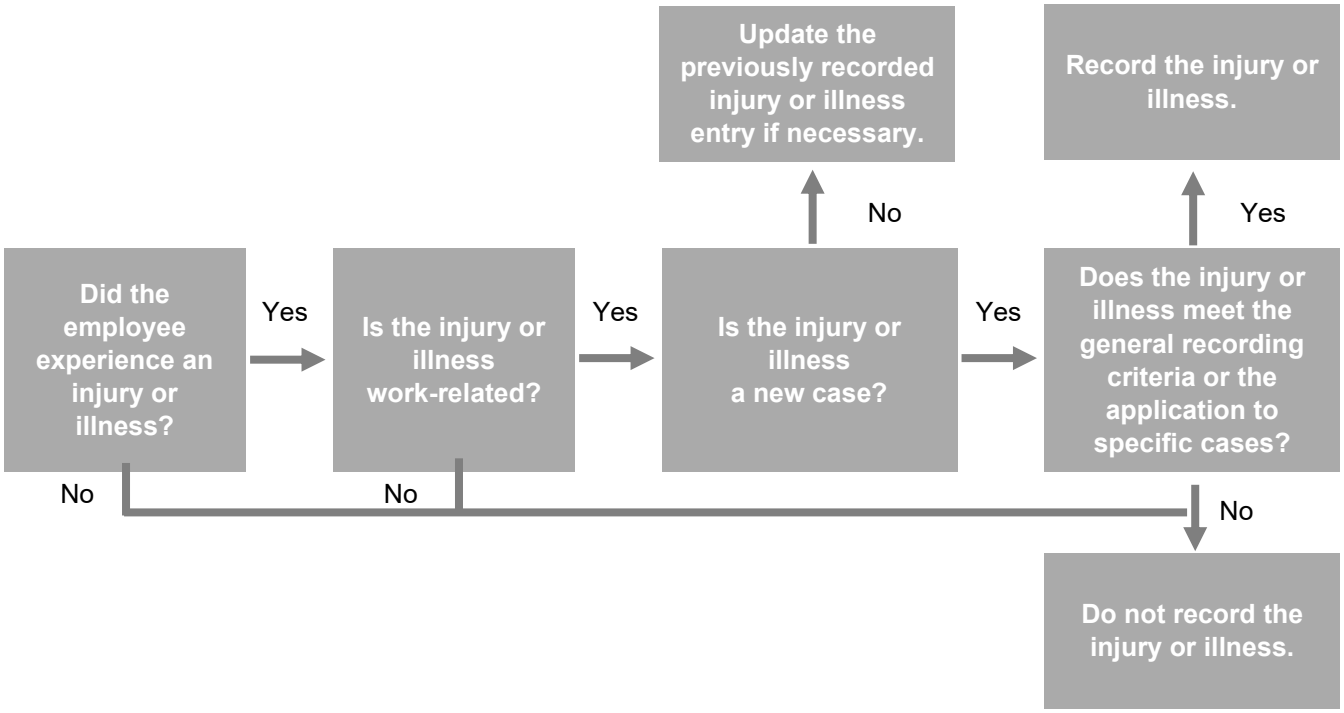
OSHA Form 300A – Summary of Work-Related Injuries and Illnesses

- Includes information from Form 300, average workers/hours and total hours
- Must be posted in visible location
- Makes employees aware of the injuries and illnesses that occurred in their workplace
- A company executive must certify the accuracy of the recorded data
- You may be required to submit this information to OSHA electronically

Recording Criteria

The **recordkeeping rule (29 CFR 1904)** requires each employer to record every fatality, injury or illness that: is work-related; is a new case; and meets one of the recording criteria found in the regulation. If an event or exposure in the work environment caused or contributed to the condition or significantly aggravated a pre-existing condition, it is work-related.

Recording Criteria Decision Tree



What to Record

You must record:

- Death
- Loss of consciousness
- Days away from work
- Restricted work activity or job transfer
- Medical treatment beyond first aid
- Any significant work-related injury or illness that is diagnosed by a physician or other licensed healthcare professional
- Any work-related case involving cancer, chronic irreversible disease, a fractured or cracked bone, or a punctured eardrum (29 CFR 1904.7)
- Any needlestick injury or cut from a sharp object that is contaminated with another person's blood or other potentially infectious material
- Any case requiring an employee to be medically removed under the requirements of an OSHA health standard
- Any Standard Threshold Shift (STS) in hearing
- Tuberculosis infection

Exceptions

OSHA does not consider injuries and illnesses to be work-related (recordable) if they are solely the result of:

- Eating, drinking or preparing food or drink for personal consumption
- Common colds and flu
- Voluntary participation in wellness or fitness programs
- Performing personal tasks at the establishment outside normal work hours
- The employee's presence in the work environment as a member of the general public (rather than as an employee)
- An event that is not work-related
- Personal grooming, self-medication or self-inflicted injury or illness
- A motor vehicle incident during commutes (including parking lots and access roads)
- Mental illness (unless diagnosed as work-related)

Restricted Work

Restricted work activity is something you must record on OSHA forms. It occurs when an employer or healthcare professional keeps, or recommends keeping, an employee from doing the routine functions of his or her job or working the full workday that the employee would have been scheduled to work before the injury or illness occurred.

To count the number of **days of restricted work activity** or the number of days away from work, count the number of calendar days the employee was on restricted work activity or was away from work as a result of the recordable injury or illness. Do not count the day on which the injury or illness occurred in this number. Stop counting days once the total of either or the combination of both reaches 180 days.

Employee Privacy

OSHA's recordkeeping rule, 29 CFR 1904:

- Prohibits employers from entering an individual's name on Form 300 for certain types of injuries or illnesses OSHA defines as privacy concern cases
- Provides employers the right not to describe the nature of sensitive injuries where the employee's identity would be known
- Gives employee representatives access only to the portion of Form 301 that contains no personal information
- Requires employers to remove employees' names before providing the data to persons not provided access rights under the rule

Enter "**privacy case**" in place of the employee's name when an injury or illness involves:

- Intimate body parts
- Reproductive systems
- Sexual assault
- Mental illness
- HIV, hepatitis or tuberculosis
- Potentially contaminated needlestick or cut
- Employee request for privacy

Keep a separate, confidential list of the case numbers and employee names. Use discretion when describing the injury or illness on both the OSHA 300 and 301 forms. Identify the cause of the incident and the general severity of the injury or illness. Do not include details of an intimate or private nature.

Changing Outcomes

If the outcome or extent of an injury or illness changes after you have recorded the case:

- Strike through the original entry
- Add the new entry
- Record the most serious outcome for each case

Classifications

- An injury is any wound or damage to the body resulting from an event in the work environment
- Musculoskeletal disorders (MSDs) affect the body's ability to move (skeleton, muscles, tendons, etc.)
- Skin diseases or disorders are illnesses involving the worker's skin caused by work exposure to chemicals, plants or other substances
- Respiratory conditions are illnesses associated with breathing hazardous biological agents, chemicals, dust, gases, vapors or fumes at work
- Poisoning is the ingestion or absorption of toxic substances into the body leading to abnormal concentrations of toxic substances in blood, other tissues, other bodily fluids or the lungs
- Noise-induced hearing loss is:
    - A change in hearing threshold relative to the baseline hearing test (audiogram) of an average of 10 dB or more in either ear at (2,000/3,000/4,000 hertz)
    - An overall hearing level at 25 dB or more above audiometric zero averaged at 2,000, 3,000 and 4,000 hertz in the affected ear or ears
- You must also record other occupational illnesses, tuberculosis exposure and medical removal under OSHA standards

Employee Involvement

- Employers must establish a procedure for employees to report injuries and illnesses and train their employees to use the procedure
- Employers are *prohibited* from discriminating against employees who report injuries and illnesses
- Employees and their representatives will have access to those parts of the OSHA 301 form relevant to workplace safety and health
- Employees, former employees and employee representatives have a right to a copy of the OSHA 300 Log

Incidence Rates

An **incidence rate** is the number of recordable injuries and illnesses occurring among a given number of full-time workers over a given period.

$$\textbf{Total Recordable Incident Rate (TRIR)} = \frac{\text{Total number of injuries and illnesses}}{\text{Number of hours worked by all employees}} \times 200{,}000$$

$$\textbf{Days Away, Restricted or Transferred (DART) Incident Rate} = \frac{\text{Number of injuries and illnesses that involved days away, restricted or transferred from work}}{\text{Number of hours worked by all employees}} \times 200{,}000$$

NOTE: 200,000 represents the number of hours 100 employees working 40 hours per week, 50 weeks per year would work, and provides the standard base for calculating incidence rates.

You can compare your firm's experience with that of your industry as a whole. The Bureau of Labor Statistics (BLS) conducts a survey of occupational injuries and illnesses each year and publishes incidence rate data by various classifications (e.g., by industry, by employer size, etc.). You can obtain this published data at www.bls.gov or by calling a BLS Regional Office.

Completing and Posting Forms

Post *OSHA Form 300A – Summary of Work-Related Injuries and Illnesses* in a visible location by February 1st of the following year. Keep it posted until April 30th of that year. Do not post the OSHA 300 Log; protect private information.

You must keep the OSHA 300 Log and OSHA 300A Summary for 5 years following the year to which they pertain.

You will submit your OSHA 300A electronically to OSHA every year if:

- Your company is in a listed industry and has 20-249 employees;
- You work in an OSHA-covered entity with 250 or more employees; or
- OSHA or BLS requests that you submit your records electronically

If you aren't sure, contact a safety professional, consult OSHA or refer to the OSHA website at https://www.osha.gov/injuryreporting/.

Reporting Requirements

Companies need to notify OSHA in the event of serious incidents as follows:

- Report fatalities to OSHA within 8 hours
- Report all work-related inpatient hospitalizations, amputations and losses of an eye within 24 hours
- Employers must report fatal heart attacks that occur at work
- Employers do not have to report motor vehicle incidents that occur in a public street outside of a construction work zone
- Employers do not have to report commercial airplane, train, subway or bus incidents
    - Any fatalities and hospitalizations caused by motor vehicle incidents, as well as commercial or public transportation incidents, are recordable if they meet OSHA's recordability criteria

Make these reports orally to the OSHA area office near the incident site or by using the toll-free number, **1-800-321-OSHA (6742)**.

You must also record these incidents in the appropriate OSHA recordkeeping forms.

Access to Medical and Exposure Records for Managers

Knowing about exposure hazards helps employees, employers and medical professionals detect, treat and help prevent occupational disease. Your employees, their representatives and OSHA have a legal right to know the extent and consequences of employee exposure to harmful substances at work.

Exposure Records

Exposure records show how employers measure and monitor employee exposures to toxic substances or harmful physical agents and the results. Exposure records indicate past and potential exposures at the workplace.

Some examples of exposure records include:

- Monitoring and sampling results
- Medical test results
- Safety Data Sheets (SDSs)
- Hazardous material inventories

Medical Records

Medical records concern employee health status. Some examples of medical records include:

- Employment questionnaires or histories
- Exam and test results
- Medical opinions, diagnoses, progress notes and recommendations
- First aid records
- Descriptions of treatments and prescriptions
- Employee medical complaints

Medical records do NOT include:

- Physical specimens
- Health insurance claims
- Records created solely to prepare for litigation
- Separate records for voluntary employee assistance programs

Record Analyses

Employers analyze the data in exposure and medical records to identify weaknesses in their health and safety programs. OSHA standards require that record analyses be available to OSHA and to any employees whose data an employer used to create the analyses.

Before sharing an analysis, the employer must remove **personal identifiers** like: names; addresses; social security and payroll numbers; and age, race and gender.

Employer Requirements

Employers must preserve and maintain employees':

- Exposure records and any record analyses that use them for 30 years
- Medical records for the duration of their employment plus 30 years

The **Health Insurance Portability and Accountability Act (HIPAA)** is a federal law that:

- Adopts national standards for electronic healthcare transactions
- Includes strict protection for individually identifiable health information
- Protects employees' right to privacy

OSHA standards require employers to inform employees when they are hired and at least once a year about:

- The existence, location and availability of medical and exposure records
- Their rights
- Where they can obtain copies of OSHA standards
- The person responsible for maintaining and providing access to their records

Access to Records

Access includes examining and copying records. Employers have 15 days to provide access and access must be free (cost nothing). OSHA has the same right to access as employees.

Employers can provide access to records in three ways:

- Provide copies of the requested records
- Provide the records and the use of a photocopier
- Lend records to employees for copying off the premises

Talk to your human resources or safety department to determine your employer's preference.

When There Are No Records

New employees may request the records of other employees who had or have similar duties or working conditions. These records may help them estimate the amount and nature of exposures to which they may be subjected.

You may share an employee's records **ONLY IF** you have the written consent of the employee AND you remove all personal identifiers. You may also share sampling data if you remove all personal identifiers, like names.

Trade Secrets in Records

Trade secrets are confidential formulas, processes or other information that provide your company with an advantage over its competitors. Employers may:

- Withhold trade secrets from records if they provide other information to protect employee health
- Ask employees to sign confidentiality agreements
- Withhold a chemical or substance's identity if they disclose its effects

Companies must reveal chemical identities if the information is used in any of the following situations:

- Assessing hazards
- Sampling
- Medical surveillance
- Medical treatment
- Selecting personal protective equipment (PPE)
- Designing engineering and other controls
- Conducting studies about health effects

Job Hazard Analysis (JHA)

A job hazard analysis (JHA) or job safety analysis (JSA) is a systematic way of identifying **potential hazards for each step** a person takes to perform a task within their job and actions that can be taken to make the job safer.

When conducting a job hazard analysis, focus on the relationship between the worker, the task, the tools and the work environment. Then ask yourself a series of questions, which could include but are not limited to:

- What can go wrong?
- How could it happen?
- How likely is it to happen?
- What are the consequences?
- What can be done to eliminate the hazard or reduce it to an acceptable level?

Anytime you change equipment, raw materials or processes, or when the environment changes, you need to update the job hazard analysis or perform a new observation based on the amount of change.

Benefits

JHA findings will help you and your employer:

- Implement effective safety controls
  - Create/update safe work procedures
  - Establish best practices for tasks
- Develop valuable training
- Comply with local regulations
- Raise safety and health awareness

This translates into a safer work environment with:

- Fewer injuries/illnesses
- More effective practices
- Increased productivity

Involvement

A team approach helps improve communication among workers and supervisors and promotes worker acceptance or “buy-in” of new processes and procedures.

- **Experienced employees** have a vested interest in their own safety and insight into past incidents and close calls
- **New employees** and **employees who perform similar tasks** in another area or department offer a “fresh set of eyes” to recognize hazards and can recommend effective precautions or controls used in other departments or in past jobs
- **Supervisors** and health and safety committee members bring another perspective to the team and are key players in ensuring that precautions or controls are implemented in a timely manner

Conducting a JHA

Observation

Observe a person performing the task. Being in the environment and watching what takes place will help you get a sense of the “normal” conditions. What you see, hear or smell may alert you to hazards.

When you observe someone:

- Introduce yourself and state your purpose

- Let the person know that your intent is to make their job safer by learning about it
- Find a person who is comfortable with you observing them
- Don't create a hazard (stress, flash photos, unsafe actions, etc.)
- Gather as much detailed information as you can
- Observe fast tasks several times
- Consider photographing or videotaping (don't violate company procedures/policy; let people know you'll be taking photos so you don't distract them)
- Observe the task being performed during normal times and situations
- Take immediate action to protect the people around you if you identify any hazards that pose an immediate danger to their life or health
    - Do this calmly, so you don't alarm people and make the situation worse

Discussion

Discussion is a safe approach when you don't want to put people in jeopardy by asking them to perform new, risky or infrequently performed tasks.

Having pictures or a video of the task being performed and existing work procedures may help prevent miscommunication.

Blended

By observing the task, you can gain a truer picture of the relationship between the worker, the task, the tools and the work environment. This will prompt hazard recognition (e.g., fumes are too strong, noise is too loud, too much dust or particles in the air, etc.). Then you can meet as a group to share your findings and determine the best precautions or control methods.

JHA Process

1. Select and prioritize the jobs and tasks you want to analyze.
2. Break each task down into detailed steps. Use a JHA worksheet to document.
    a. Use action statements that detail the steps and how to perform them
    b. Avoid using vague, general statements
3. Analyze each step and identify the potential hazards.
4. Determine which precautions or controls will eliminate or reduce the hazards and implement them. This may require you to modify equipment or update job processes, procedures and training. Choose precautions in the following order:
    - Engineering controls (e.g., machine guarding, equipment replacement, added or improved ventilation)
    - Administrative controls (e.g., limiting the amount of time workers spend in hot environments) (only reduces risk when used properly)
    - Personal protective equipment (PPE) (only reduces risk when used properly)
5. Re-evaluate the job hazard analysis on a regular basis (e.g., annually) or when work processes change.

After the JHA

- Address any concerns or uncontrolled hazards while observing people, when possible
- Explain actions; **communication throughout the hazard analysis process is key**
- Review the precautions and develop an implementation plan, focusing on high-priority risks first
- Delegate tasks to other departments, as needed

Pre-Job Briefings

What Is a Pre-Job Briefing?

A pre-job briefing is a short meeting that informs the crew of the:

- Nature of the work to be performed
- Sequence of activities to be followed on the job
- Safety issues to keep in mind while working
- Controls in place to protect them from hazards

All jobs are different, even if the same task is being done, because the environment and people can change.

When Does a Pre-Job Briefing Take Place?

- Before the job begins
- When there is a significant change in working conditions

What Does a Pre-Job Briefing Cover?

- Electrical conditions
- Mechanical conditions
- Environmental conditions
- Working space constraints
- Obstructions in the area
- Work procedures
- Energy source controls (including lockout/tagout)
- Personal protective equipment (PPE) to be worn during the job

Who Conducts a Pre-Job Briefing?

The lead worker or supervisor may conduct the briefing because they have:

- The knowledge about the work being performed
- The authority to enforce safe work practices
- The ability to retrieve any necessary safety equipment

How Should a Pre-Job Briefing Be Documented?

It is a best practice to keep a record of the pre-job briefing, which should include:

- Date
- Time
- Attendees
- Topics covered

Culture of Early Reporting

Value of Early Reporting

Early reporting:

- Makes it easier to manage problems in their infancy
- Draws attention to process improvement opportunities
- Enhances vigilance and preparedness
- Enables continuous and systematic learning (more data to analyze)
- Improves productivity
- Reduces time lost due to incidents
- Helps create a culture of safety

Challenges of Early Reporting

EMPLOYEES may perceive early reporting as something that is:

- Not part of their job
- Risky
- Futile
- Time-consuming
- Difficult without knowing what to look for
- Less important than production

From a MANAGEMENT viewpoint, early reporting can be dwarfed by competing priorities.

Strategies to Encourage Early Reporting

Promote the Value of Early Reporting

Promote the value of early reporting by:

- Reviewing corrective and preventive actions to improve work systems
- Sharing best practices that other areas have identified
- Crediting those involved in identifying, reporting and acting upon issues

Create a Culture of Early Reporting

A culture of safety includes:

- Communication
- Learning
- Feedback
- Buy-in
- Teamwork
- Well-qualified, passionate staff
- Positive perception of safety
- High expectations
- Accountability for corrective actions and clear hand-off procedures
- Transparency about safety incidents

Managers/supervisors should:

- Never take the obvious for granted
    - Make sure employees know you have a reporting system
- Make sure employees are never “too busy” to report
    - Make reporting part of the routine/process/job
    - Schedule time for safety
- Demonstrate the value of early reporting
    - Engage employees in devising and implementing corrective actions
    - Communicate when and how problems were solved

Encourage Reporting

Frontline EMPLOYEES are more likely to report when their supervisors:

- Treat them fairly
- View safety as a critical priority
- Regularly encourage reporting

Frontline SUPERVISORS are more likely to report to senior managers who:

- View safety as a priority
- Review safety data frequently
- Assign responsibility for the reporting system to a direct report

Convert Reporting to Learning

Increased reporting results in learning ONLY when it is part of a systematic approach.

For reporting to result in learning:

- A culture of safety has to exist
- Safety and learning must be infused into daily activities and routines

What If? Mentality

A **“What If?” mentality** is looking at any scene or situation and thinking about what could happen based on your observations.

A “What If?” mentality can help you **prevent near-misses and serious incidents** by recognizing dangers and predicting how safe conditions and behaviors can improve safety.

Use EVERYTHING you see when you are observing and think ahead to what could go wrong.

You can even apply “What If?” thinking without people or equipment present.

A “What If?” mentality isn’t always about spotting problems that you need to correct; it can also be about spotting problems that people have already addressed.

Inspections and Observations

Why Inspect and Observe?

The most important reason to inspect and observe is to prevent people from being hurt or killed.

Other reasons to inspect and observe are to:

- Create a culture of safety
- Identify, understand and replicate safe work processes, practices and conditions throughout the organization
- Avoid missing things
- Prevent complacency
- Raise safety awareness
- Eliminate barriers to safe, efficient production
- Meet regulatory requirements and avoid liability

React to Negative Perceptions

To improve negative perceptions of observations and inspections:

- Create an environment free of reprisal for observations
- Encourage EVERYONE to observe
- Recognize good, safe work practices
- Find and fix the *real* reasons for safety issues
- Follow up to make sure hazards are corrected
- Inform affected people of progress

When you are a **safety advocate**, employees:

- Expect you to be an educator and expert
- Demand you take their suggestions seriously
- Rely on you to escalate their concerns
- Believe that you care about them

Prepare for Inspections and Observations

When you plan to inspect and observe:

- Be an expert about company and regulatory requirements
- Use incident and observation records to identify areas to focus on
- Allot a sufficient amount of time (don't rush)
- Involve the right people (experts, other managers, etc.)
- Use checklists to remind you about safety requirements and things to look for

Best Practices for Inspections and Observations

Good observers should:

- Be hyperaware
- Think ahead
- Trust their instincts
- Be open-minded
- Have conversations
- Be OK with finding nothing wrong
- Correct problems and praise good ideas as soon as possible
- Know the process for notifying supervisors

When you inspect or observe:

- Announce your presence to workers
- Warn workers if you plan to take pictures
- Resolve problems immediately, if you can, and document what you did
- Remove or block hazards if you can't resolve them
- Communicate about hazards

When you want to **provide feedback** to someone you are observing:

- Don't be a distraction
- Make eye contact and ask the person to stop

Safe Behavior

If you observe people using safe behaviors:

- Find out why they are doing what they're doing
- Commend them
- Follow up with their supervisor/manager

Unsafe Behavior

If you observe an unsafe behavior or condition:

- Let the worker know what you observed and explain what's wrong
- Find out why it happened
    - Get to the root of the issue
    - There is often a systemic reason for an unsafe condition
- Provide guidance (worker avoidance or company solution)
- Follow up with the supervisor or area manager

Documenting Findings

When you document your findings:

- Be as detailed as possible
- Assign risk classifications to risks and hazards
- Recommend corrective actions that target underlying causes
- Assign corrective actions with due dates

Remember: It's OK to find nothing wrong!

After an Inspection and Observation

To follow up, you should:

- Schedule and monitor corrective actions
- Send formal memos or reports to management
- Provide guidance about budgeting, scheduling and implementing
- Verify and document that corrective actions are in place
- Follow up with employees involved in the process

Continue to inspect and observe!

Giving and Receiving Feedback

To receive feedback:

- Think about how you usually respond to feedback and break bad habits
- Separate the feedback from the person
- Give feedback due consideration
- Start with small changes

Unproductive Ways to React to Feedback

Some bad habits to avoid include:

- Defending yourself
- Arguing
- Hiding your emotions
- Criticizing the messenger
- Ignoring the feedback

How to Give and Receive Feedback

When you **receive** feedback:

- Separate the feedback from the person
- Give feedback due consideration
    - Ask what the observer noticed and expects
- Try advice/change on a small scale first
- Ask about the outcome the person expects
- Ask for one specific thing you can change

When you observe and then **give** feedback, keep the following in mind:

- Enable safe work
- Ensure next steps are clear and agreed upon
- Make sure safety is EVERYONE'S responsibility (not just yours)
- Build relationships

Characteristics of Effective Feedback

DO:

– Explain your purpose
– Assume people may not know the risks
– Lead with the positive
– Be timely and specific
– Stay calm and express concern
– Be personable
– Restate what you heard
– 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

Reporting (Data Entry)

In general, you should **complete reports immediately after your observation and initial mitigation**. You can make revisions to the report when you find more information.

Benefits of Documenting Observations and Incidents

Reports can help you:

- Identify trends
  - Predict and prevent further incidents
  - Apply global changes
- Provide an objective measure of how often something is happening
- Show commitment to safety
- Increase awareness, correction and closure
- Learn from common experiences
- Recognize and reinforce safe work

Characteristics of Effective Reports

Use positives to drive change, not just negatives. A good rule of thumb is to document four positive observations for every negative observation. Offer praise and share successes.

You still need to report incidents, even when you are able to correct them immediately!

When you use report forms:

- Select the appropriate form for what you have to report
- Include your name (if required), the date and location of the incident, and other details
- Provide pictures, videos and sketches
- Select an appropriate risk rating

When you write report narratives:

- State what you saw
- Explain what you did
- Describe what needs to be done
- Be clear, concise and specific
  - Avoid being general/vague
  - Use simple language
- Be objective
  - Avoid adjectives, opinions, judgment and embellishment
  - Avoid allegations of fault and noncompliance
  - Keep names out of reports and use job titles instead
- Follow up in-person with managers and supervisors

Incident Investigation

By understanding what incident investigation and causal analysis are and how you can help, you can prevent accidents and make a safer workplace – before losses occur.

Concepts and Terms

- **Incident**: Unwanted event that could reduce productivity or cause danger
- **Near miss**: An incident without losses and an indicator that a condition or practice could cause injury/damage
- **Accident**: An incident resulting in loss/injury
- **Causal factors**: Direct or indirect factors contributing to the occurrence of incidents
- **Direct costs**: Immediate costs of an incident, such as property loss
- **Indirect costs**: Secondary costs of an incident, such as lost productivity

Investigation Basics

WHY do we typically conduct incident investigations?

- To comply with laws and regulations
- To help protect us from liability
- As part of the overall insurance claim submission processes
- To prevent the same or similar incidents from happening again

WHEN do we typically conduct incident investigations?

- After incidents
- When people submit observations
- During proactive audits, inspections or observations

WHO should be involved in incident investigations?

- Anyone with input
- A variety of people/perspectives (not just the supervisor or safety professional)

Incident Management

After you've been notified of an incident or observation and addressed all medical issues and secured the scene:

1.	Identify losses (if any) and gather information.	**Investigative Process**
2.	Analyze the information, determine the reasons (or causal factors) and prioritize the risks.	
3.	Develop action plans.	
4.	Track all associated tasks and report corrective action progress.	
5.	Identify and eliminate risks.	
6.	Record and share what you learned during the process.	

Information Gathering

Begin an investigation as early as possible and repeat it to achieve the best results.

Complete information gathering as soon after an incident, near miss or observation as possible. If you need to make changes to improve safety, make note of the “before” and “after” conditions.

Some of the ways you may gather information include:

- Documenting
- Interviewing
- Photographing
- Sketching
- Collecting
- Reenacting

Interviews

During interviews:

- Avoid judgment and be humble
- Collect personal accounts
- Choose a convenient time
- Choose a private place near the scene
- State the purpose of the interview
- State how you’ll use the information
- Show curiosity, interest and concern
- Focus on listening and learning
- Don’t lead witnesses into answers
- Show and explain your notes
- Close with thanks and next steps

Photos/Sketches

When you take photos and draw sketches:

- Make a visual representation of the scene
- Capture relative positioning of evidence, damages and anything that seems out of place
- Consider witness perspectives/vantage points
- Include size and color references if these details are important
- Take pictures BEFORE you collect evidence

For major incidents, don’t delete “bad” photos. If you do so, people may accuse you of trying to prove your opinions are right instead of trying to document the truth.

Physical Evidence

Physical evidence can be used to test causal theories. After incidents, establish a **chain of custody** and protect and preserve physical evidence from damage and contamination. If you have any questions about what evidence to preserve or document, consult your management or corporate counsel.

Benefiting from Investigative Findings

To make the most of your investigative findings, you should communicate incident details and look for trends:

- Multiple near misses predict higher accident probability
- Training about a safety topic may lead to fewer incidents
- Fast corrective actions predict low incident likelihood

Causal Analysis

There are many causal analysis methods. No single method is best for all types of investigations. Regardless of the method you use, it's important to remember that accidents don't simply happen because someone makes a mistake. We need to understand why someone made a mistake. Asking "**Why?**" is a simple causal analysis approach in which you simply ask why as many times as you need to in order to get to the causal factor.

Tasks and Corrective Actions

Structuring Hazard Controls

There are five general methods, in descending order of effectiveness, for controlling hazards:

1. ELIMINATE IT by redesigning the process.
2. SUBSTITUTE IT with a safer process or product.
3. Provide ENGINEERING CONTROLS at the source.
4. REDUCE exposure through administration.
5. USE PPE as a last resort.

The best corrective actions are often a **combination of hazard controls**.

Encourage reporting to identify system weaknesses and hazard control ideas!

Solely relying on training and procedures to address issues that are about work areas and equipment is almost never the best idea; consider adding other controls.

If you determine that training, procedures and counseling are the primary corrective actions being taken, your causal analysis may be too superficial!

Systemic issues can affect multiple people in multiple areas.

Choosing and Implementing Corrective Actions

When you consider how to choose and implement corrective actions, think about:

- Risks/Hazards
- Severity
- Frequency
- Probability
- Cost

Your goal is to mitigate risk to a more tolerable level.

As you plan corrective actions, remember that:

- Workers may need training about the actions you implement
- You may need to update procedures, job hazard analysis forms and training materials to account for changes
- Habits may be difficult to change; practice is necessary

Involve employees BEFORE your decisions about corrective actions to:

- Show that you care
- Take advantage of their experience/expertise
- Get them to own the solution

Make controls as easy as possible. The benefits should exceed the difficulty.

Timelines

Remember:

- The higher the risk, the faster you need to implement corrective actions
- For high or extreme risks, isolate the hazards until a solution is ready
- Document your recommendations on which actions deserve highest priority and funding and provide them to management
- Plan for corrective actions that require capital expenditures
- Identify the appropriate responsible parties for each action and establish a realistic completion timeline
- Systems accountability is critical, especially for long-term solutions

Leading companies take action as soon as possible. You may even be able to implement some corrective actions immediately or within 48 hours.

Monitoring

Monitor and determine the effectiveness of corrective actions.

You may need to adjust your plans and timelines.

Don’t forget to follow up with employees to let them know about progress and completion!

After controls are in place, employees can help:

- Test corrective actions in the field
- Monitor effectiveness over time
- Provide feedback
- Make sure theoretical solutions work well in practice

Evaluating and Prioritizing Risks with a Risk Matrix

Many people use a risk matrix to assess risk before and after corrective actions. The following is a SAMPLE risk matrix.

Likelihood / Consequence	Level	**Rare** The event may occur in exceptional circumstances. Less than once in 2 years	**Unlikely** The event could occur at some time. At least once per year	**Moderate** The event will probably occur at some time. At least once in 6 months	**Likely** The event will occur in most circumstances. At least once per month	**Certain** The event is expected to occur in all circumstances. At least once per week
		1	**2**	**3**	**4**	**5**
Negligible No injuries. Low financial loss.	**0**	0	0	0	0	0
Minor First-aid treatment. Moderate financial loss.	**1**	1	2	3	4	5
Serious Medical treatment required. High financial loss. Moderate environmental implications. Moderate loss of reputation. Moderate business interruption.	**2**	2	4	6	8	10
Major Excessive, multiple long-term injuries. Major financial loss. High environmental implications. Major loss of reputation. Major business interruption.	**3**	3	6	9	12	15
Fatality Single death.	**4**	4	8	12	16	20
Multiple Multiple deaths and serious long-term injuries.	**5**	5	10	15	20	25

Risk Rating	Risk Priority	Description
0	N	**No Risk:** The costs to treat the risk are disproportionately high compared to the negligible consequences.
1 – 3	L	**Low Risk:** May require consideration in any future changes to the work area or processes, or can be fixed immediately.
4 – 6	M	**Moderate:** May require corrective action through planning and budgeting process.
8 – 12	H	**High:** Requires immediate corrective action.
15 – 25	E	**Extreme:** Requires immediate prohibition of the work process and immediate corrective action.

Continuously Improve for Safety Excellence

What Is Continuous Improvement?

Continuous improvement is a quality management concept that starts with the assumption that quality can always be improved.

The goal of continuous improvement is to identify and eliminate EVERY defect, error, inefficiency and process variation, rather than accepting a “reasonable” level of imperfection.

Benefits of Continuous Improvement

Continuous improvement can help organizations:

- Remain competitive
- Provide superior products and services
- Protect the health and safety of employees
- Meet or exceed governmental or other industry compliance
- Apply standard principles to address any issue
- Improve product and service quality
- Improve efficiency and productivity
- Increase employee job satisfaction and morale

Continuous Improvement Workflow

The continuous improvement workflow is:

- **Plan**
  - Recognize an opportunity and plan a change
- **Do**
  - Test the change with a small-scale study
- **Check**
  - Review the test, analyze the results and identify what you’ve learned
- **Act**
  - If the change did NOT work in the small study, go through the cycle again with a different plan
  - If the change DID work in the small study, incorporate what you learned on a wider scale
  - Use what you learned to plan new improvements, beginning the cycle again

Lagging and Leading Indicators

Lagging indicators are metrics that measure and group safety and health data and results from the past, such as:

- Incident rates
- Lost work days
- Workers’ compensation claims
- Losses

Leading indicators focus on present conditions, behaviors and variables that predict future events. They can help us track and correct errors, process flaws and other potential shortcomings *before* serious incidents, injuries and illnesses occur.

Monitoring leading indicators allows you to:

- Highlight the importance of employee efforts to prevent injuries and illnesses
- Improve accountability
- Give credit for work well done
- Take corrective action before an incident, injury or illness occurs

Leading indicators tend to measure ACTIVITIES people can CONTROL.

By looking at both leading AND lagging indicators, a company can tell if its efforts are producing desired results.

The shift to add leading indicators to lagging indicators requires:

- Investing more resources in inspections and observations
- Shoring up reporting practices
- Creating an early reporting culture
- Defining safety systems
    - People responsible
    - Activities performed
    - Means to measure effectiveness

How Quality Management Improves Safety Performance

Companies should consider their workplace, goals and personnel when choosing the tools and combinations of approaches that make sense for them.

For example, they may use:

- Six Sigma
- Lean
- Change management
- Lessons learned

Quality management tools help organizations:

- Improve training effectiveness
- Increase skill level of employees
- Increase employee participation
- Improve the effectiveness of safety management systems
- Investigate incidents sooner

Integrated Systems – Achieving Organizational Excellence

Integrated systems include:

- **Compliance** – Meet regulatory standards
- **Risk Management** – Assess risks and control loss
- **Leadership** – Involve senior managers and drive top-level decisions
- **Culture** – Incorporate safe culture-building activities and regularly measure results

Organizational Best Practices that Support Integrated Systems

Organizational best practices include:

- Encouraging greater cross-functional collaboration between departments
- Integrating health and safety with other functions/departments
- Measuring data and incorporating leading indicators
- Basing decisions and programs on evidence
- Optimizing management systems and processes
- Implementing occupational health and safety (OHS) management technology

Benefits of Integrated Systems

- **Compliance** ensures every company in a given industry meets the same minimum standards
- **Risk management** impacts many competitive variables, from incident-related costs to corporate reputation
- **Leadership** is one area where a company can really distinguish itself from its competitors by making sure senior management makes decisions and creates policies geared toward the same goals
- A **culture** of safety gives companies a clear advantage by proactively preventing health and safety incidents rather than reacting to them after they happen

Ways to Implement or Strengthen Integrated Systems

When creating, analyzing or identifying improvement opportunities in any **management system**, consider:

- Policies
- Health/safety best practices
- Hazard recognition
- Training
- Accountability/enforcement
- Engineering/design
- Risk assessment/acceptance
- Excessive workload/conflicting demands
- Metrics
- Documentation

Evaluate your overall **leadership**:

- Determine the best qualified decision-makers
- Evaluate information flow
- Communicate decisions clearly
- Encourage reporting without fear of reprisal
- Identify and reward individuals who do the right thing

Culture includes the collective values, beliefs, attitudes and norms that shape individual perceptions and behaviors.

A **culture of safety** gives companies a clear advantage by proactively preventing health and safety incidents rather than reacting to them after they happen.

Remember that outcomes depend largely on individual choices and behavior. That's why top performers invariably invest as much effort in strengthening the safety and health culture as they do on other activities.

Benefits of Commitment

Creating a culture of worker safety and health results in:

- Decreased accident rates
- Lower turnover
- Less absenteeism
- Higher productivity

Safety and You for Construction: Encouraging Safe Work

Even with engineering controls, safe working environments and effective policies and procedures, we still encounter employee injury and even death.

Common Reasons for Risks

Most employees are not lazy, stupid or uncaring – they happen to work at-risk for very legitimate reasons.

1. Workplace conditions encourage at-risk behavior
    - Equipment that's hard to use safely
    - Awkward-fitting or ill-maintained PPE
    - Pressures to get the job done at any cost
2. Unaware the behavior is at-risk
    - Never been trained, no regular reminders, unsafe actions have not led to anything bad happening
    - Communicate about safety (toolbox or tailgate talk, pre-task planning discussions, etc.)
    - If you are not reinforcing safety, you are allowing jobsite experience to define safe and acceptable work practices
3. Natural rewards and punishments usually favor unsafe behavior
    - Nearly always faster, more convenient and comfortable
    - Rarely results in injury on any single occasion
    - Human nature to take the risk when rewards are virtually certain and the risk is low

How to Use Rewards Versus Discipline

Potential disadvantages of discipline include:

- No employee buy-in
- Usually not consistent
- Injured people are punished by the injury AND further discipline
- People don't like to deliver it and don't like to receive it
- At best, only affects behavior when the boss is watching; at worst, not at all
- Is a negative approach to safety – supervisors are looking for people doing something wrong

Discipline produces:	Reward produces:
Minimal compliance	Extra effort
Bad feeling	Good feelings
Low morale	High morale

Only use discipline as a last resort when you determine that there is no underlying system issue (training, equipment availability, process, etc.) that caused the unsafe action or inaction.

When people hear "Your supervisor wants to see you," they expect the worst. We want to promote more effective interactions among supervisors and employees.

Without effective feedback and worker involvement, behaviors are not likely to change. Supervisors want to increase the number of safe behaviors and eliminate at-risk behaviors. Ask why people act unsafely to determine underlying system problems (training, equipment availability, processes, etc.).

For most people, **rewards** for desired behaviors in the workplace usually mean pay raises, bonuses, prizes and other material rewards. Others feel that the only source of reward for work performance should be one's paycheck.

Everyday praise:

- Is highly motivating
- Is easy to administer
- Costs nothing
- Can (and should) be used every day

To give supportive, positive feedback:

- Give praise directly to the employee as soon as possible after the behavior
- Identify specific safe behavior rather than using general statements
    - E.g., "Nice job bending at the knees when you lifted that"
    - Better than "Keep up the good work"
- Look for and praise:
    - Extra effort (more time and trouble to do safely)
    - Improvement
    - Consistently safe behavior

How to Effectively Provide Feedback

Regular at-risk behavior guarantees injuries will occur. The only way to prevent injuries is for everyone to work safely all the time. To effectively provide feedback:

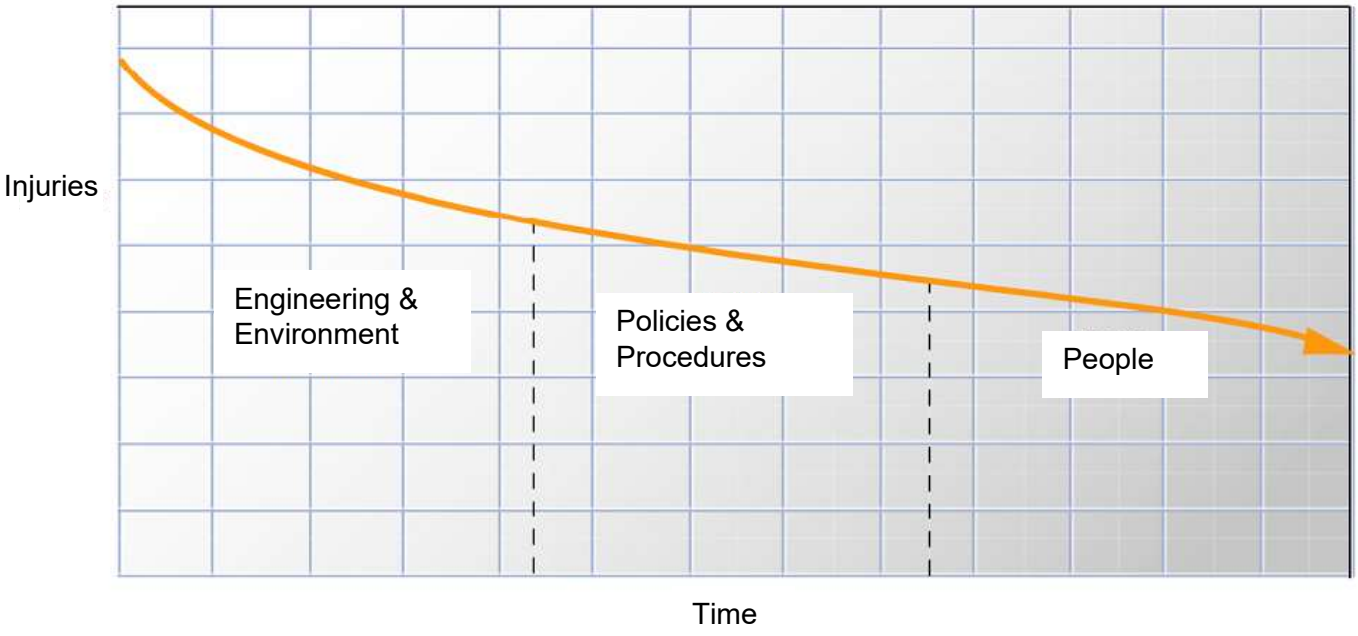
- Correct one-on-one, praise publicly
- Focus on specific at-risk behavior, not attitude or personality
- Discuss, don't accuse or lecture
- If needed, teach how to do it safely
- Have the employee demonstrate the safe behavior, then give praise
- Ask for a commitment to do it the “safe way” next time
- Feedback given constructively with intentions to be helpful may be met with defensiveness
- Don't give in, but don't argue
- If you can't think of a good response, walk away and plan how to handle it next time
- Keep your own emotions under control

Safety and You for Construction: Supervisor Role

You as a supervisor shape the culture in which you work by your actions – that is, by what you do and say. You can even affect the culture by what you do not do. A supervisor is NOT a watchdog trying to catch employees doing something wrong. It is important for a positive culture to provide feedback for doing things right.

Evolution of Safety Performance

Supervisors address all three aspects of safety – the engineering and environment, the policies and procedures, and the people.



Engineering and the environment. We try to eliminate as many hazards as possible in the workplace and working environment. Addressing the environmental exposures and with appropriate engineering controls in place, we should see a reduction in injuries and potential injuries.

Policies and procedures. Once we address engineering and environmental concerns, we develop and implement policies, procedures and management systems to ensure safe work practices, thereby preventing accidents and injuries. When the necessary policies and procedures are in place and employees have been trained on them and are using them effectively, we should see a further reduction in injuries and potential injuries.

People. The actions and attitudes of people operating within and around our work environment determine safety performance.

Managing the Human Element in Safety

Managing the human element in safety simply means helping people perform their jobs more safely. It means better performance, higher morale and increased profitability for your company.

As a supervisor, you interact directly with employees, setting the tone for what does and what does not occur. Employees will look to your efforts to determine if the company cares about their safety. You provide a visible management commitment to safety.

Just as you are accountable for production or performance, you are accountable for the safety and well-being of your employees. Measure and reward safety activities that help to prevent incidents and injuries.

Steps to Improve Safety at Construction Sites

- Clearly define and consistently enforce safety rules
- Set a good safety example
- Identify and correct physical and operational safety hazards
- Conduct accident and near-miss investigations
- Supply the necessary resources
- Give employees a part to play in safety
- Communicate regularly about safety
- Reinforce safe actions
    - Verbal praise works best
    - Deliver positive feedback (praise) five to seven times more frequently than constructive feedback
- Correct at-risk actions or inaction
    - Provide corrective feedback in a positive, helpful way
- Help all employees comply with safety rules and procedures
- Recognize that, when employees identify and correct safety hazards, the stage is set for safety success

If your employer has a **safety director**, he or she will support your performance of these activities by training you, monitoring your performance, and so on. The supervisor is accountable for the activities listed above, NOT the safety director.

Personal Factors in Safety

Experience

Experience gives us an ADVANTAGE because it helps us make better decisions. It helps us spot subtle cues, makes us alert and cautious, and prepares us to react.

Never perform an unfamiliar task. Instead, become familiar first by:

- Discussing the task or asking for help
- Referring to procedures and manuals
- Develop a plan that accounts for what might go wrong and what must go right (pre-task planning)

Experience can work to your DISADVANTAGE. Bad decisions don't always result in immediate safety incidents. As a result, people may miss improvement opportunities and form bad habits.

Eventually, bad habits lead to bad outcomes. Even if you are not getting hurt, if you sense there is a potential hazard, look for safer ways to work.

Judgment

- **Personal**. Be honest about your limitations. Pushing too hard to get work done can get you hurt. Set realistic plans and get help from others when you need it. You need to be mindful of the personal limitations and abilities of your co-workers too so that you will know who to ask for help and who you should be ready to help.
- **Equipment**. Understand and respect the limitations and capabilities of your equipment. Exceeding these limits can get you and others hurt. Take advantage of precautions like personal protective equipment (PPE) and machine safety devices for increased protection against incidental contact. Don't rely exclusively on these devices, because they can fail. Use them with good work practices to keep you away from danger.
- **Risk**. Danger may be greatest when people face a situation for the first time. Try to understand and remember risks. Then take appropriate actions. Becoming desensitized to risk can lead you to use work practices that seem safer than they really are.

Stress

We think and perform less effectively when we are stressed. Minor distractions can become major obstacles to our concentration and losing our focus can lead to bad decisions.

When we are stressed, we may:

- Become rigid and inflexible
- Repeat behaviors
- Break equipment (force it)
- Lose our concentration
- Miss warning signs (tunnel vision)
- Collide with or drop things
- Have jerky fine motor movements
- Tense our muscles (cause injuries)

Not every problem is within your control, so consider:

- Adopting a positive attitude
- Taking problems in stride
- Being positive
- Walking
- Stretching

Fatigue

Mental Fatigue

The causes of mental fatigue may include:

- Extended concentration on a detailed task
- Consuming alcohol or medications
- Having poor sleep habits
- Living an unhealthy lifestyle

The effects of mental fatigue may include:

- Loss of focus
- Dull sense
- Slow reaction times

Physical Fatigue

Physical fatigue can weaken us. Rushing to finish so that we can rest may lead us to:

- Make bad decisions
- Miss hazards
- Forget precautions
- Collide with things

Dealing with Fatigue

If you are fatigued, slow down and allow more distance than usual so that you have extra time and space to react to hazards and obstacles. To prevent fatigue, try to get plenty of restful sleep and live a healthy lifestyle.

Communication

Each team member contributes strengths. Ask for help and take it when offered. If you see someone struggling or being unsafe, say something. Be polite and show concern. We can develop bad habits we don’t even know we have. It helps if someone tells us about bad habits.

When you receive feedback:

- Actively listen (repeat what you heard)
- Reserve judgement
- Respect the person for having the courage to speak to you

Active Shooter: Prevention and Preparation

An active shooter, or active killer, is an individual who is fully engaged in killing or attempting to kill people in a confined and populated area. These individuals are usually motivated by something they are passionate about and often expect to die during their rampage. Active shooter incidents start suddenly and can be over within 15 minutes. It's important that you know the warning signs and how to react during an active shooter incident.

Warning Signs of Violence

Active shooters usually have little or no history of violence, nor do they show signs of violence or give direct threats. However, they often DO display indicators of the potential for violent behavior over time.

Behavior

Some behaviors that indicate someone may become violent include:

- Increased use of alcohol or illegal drugs
- Unexplained increase in absenteeism or withdrawal
- Disengagement or disassociation with co-workers
- Noticeable decrease in attention to appearance and hygiene
- Repeated violations of company policies

Emotions

Some of the emotions a potentially violent person might feel or express include:

- Depression/withdrawal
- Resistance and overreaction to changes in policy and procedures
- Increased severe mood swings
- Noticeably unstable, emotional responses
- Explosive outbursts of anger or rage without provocation
- Suicidal feelings or remarks
- Empathy with individuals who commit violence

Conversations

Some of the things a potentially violent person might talk about include:

- Vague physical complaints
- Comments about "putting things in order"
- Paranoia ("everybody is against me")
- Increasing problems at home
- Escalation of domestic problems into the workplace
- Severe financial problems
- Previous incidents of violence
- Increase in unsolicited comments about weapons and violent crimes

Emergency Action Plans

Emergency action or business continuity plans help businesses decide what actions to take in the event of emergencies such as severe storms, tornadoes, fires, bomb threats, active shooters and other business interruptions.

Input

Representatives from the following groups should be part of emergency action plan development:

- Human Resources department
- Training department
- Local law enforcement
- Emergency responders
- Facility owners or operators
- Property managers

Content

An effective emergency action plan includes details about:

- Methods for reporting emergencies
- Evacuation policies and procedures
- Emergency escape procedures and routes
- Contact information and responsibilities of people who should be contacted
- Contact information for law enforcement and hospitals
- Notification system (including remote locations)
- Business interruption and continuity plans
- Procedures for practices and drills

Active Shooter: Run, Hide, Fight

An active shooter, or active killer, is an individual who is fully engaged in killing or attempting to kill people in a confined and populated area. It's important that you know the warning signs and how to react during an active shooter incident.

What to Do During an Active Shooter Incident

If there is an active shooter in your workplace, there are three ways to react:

- Run
- Hide
- Fight

The goal is to survive the attack. Decide what to do based on:

- Your environment and any possible dangers
- Where the exits are
- Where you are
- Your proximity to secure doors

Run

When you run:

- Have at least two exits in mind
- Leave all belongings
- Call for emergency help only when safe
- Do not post information on social media
- Help others when possible, but do not move the wounded
- Prevent people from entering dangerous areas

Fire Alarms

Consult your emergency action plan and ask experts during training exercises to decide if you should pull the fire alarm. Consider potential advantages and disadvantages

- Advantages:
    - Disorient the killer
    - Cause the killer to panic
    - Quickly alert building occupants to evacuate and call for help
    - Speed up response time
    - Unlock doors linked to the fire system
- Disadvantages:
    - Confuse building occupants
    - Direct people toward the shooter
    - Mask sounds of the attack

Running to Law Enforcement

DO:

- Follow law enforcement instructions
- Keep hands visible
- Make it clear you are not the shooter
- Give actionable intelligence

Do NOT:

- Argue with officers
- Stop officers for help or directions
- Reach out to officers

Hide

Your hiding place should:

- Be out of the active shooter's view
- Provide protection
- Make yourself less vulnerable if discovered
- Keep options open to relocate or escape

Secure your hiding place by any means possible.

Avoid being noticed by the shooter – stay out of sight and remain quiet. If you call for help, make sure your voice or the voice of the dispatcher will not attract the shooter.

Fight

Only fight when your life is in imminent danger!

If you decide to fight:

- Commit to your actions
- Don't hesitate
- Act quickly
- Use excessive force
- Fight aggressively and violently
- Work in groups, when possible
- Use anything available as a weapon

Active Shooter: Law Enforcement

An active shooter, or active killer, is an individual who is fully engaged in killing or attempting to kill people in a confined and populated area. It's important that you know the warning signs and how to react during an active shooter incident.

What to Expect

Law enforcement may:

- Arrive in teams of four
- Be armed with guns and other weapons
- Push people to the ground for their safety
- Shout commands
- Wear tactical equipment, patrol uniforms or plain clothes
- Use pepper spray or tear gas to control the situation

Respond to Law Enforcement

Do what you can to help law enforcement stop the threat.

- Remain calm
- Make no sudden movements
- Avoid physical contact with officers
- Put down any items in your hands
- Raise your hands and keep them visible
- Follow officers' directions and do not argue
    - Officer will give directions urgently
    - Officers may detain you and others
- Law enforcement may use disorienting techniques or stun grenades
- Do NOT stop to ask officers for help or directions when evacuating
- Proceed in the direction from which officers are entering the premises

Once you are safe:

- Stay at your safe location or assembly point until you have permission to leave
- Do not talk to anyone other than law enforcement, including the media
- Do not post on social media, as this can lead to misinformation and further confusion

Be an Effective Witness

Law enforcement may ask:

- Where is the shooter?
- How many shooters are there?
- What does the shooter look like?
- What weapons does the shooter have?
- How many victims are there?

State the facts and avoid speculating or guessing.

Active Shooter: Victims

An active shooter, or active killer, is an individual who is fully engaged in killing or attempting to kill people in a confined and populated area. It's important that you know how to provide medical assistance to victims while waiting for professional help to arrive.

Assist Active Shooter Victims

Consider taking training and including a trauma kit in your first aid supplies if you are interested in providing aid to others. Trauma kits are specially designed to instantly stop severe bleeding and can make the difference between life and death for some gunshot victims.

Only treat victims if you are in a safe area! Wear gloves before touching any victim. If gloves are not available, you may be able to protect your hands from bloodborne diseases using plastic wrap or bags.

To assist victims:

- Calm victims to reduce their heart rates and the severity of their bleeding
- Check consciousness and pulse to assess victims and determine next steps
- Perform cardiopulmonary resuscitation (CPR), if needed
- Control bleeding

If there are multiple victims, you must **treat people who can be saved FIRST**. For example, if one victim has no pulse and is not breathing but another is conscious and bleeding, you need to treat the bleeding victim first.

Tourniquets

A makeshift tourniquet can cause complications, including death. A tourniquet is a last resort to control life-threatening bleeding!

Before applying a tourniquet, try raising the injured area and applying pressure to control bleeding.

If you must apply a tourniquet:

- Use one from your first aid kit
- Apply it about 6 inches (15 centimeters) above the wound
- Record the amount of time the tourniquet has been applied
- Do not leave a tourniquet unattended
- Do not remove a tourniquet

Egress and Emergency Action Plans

A **means of egress** is an unobstructed way of exit travel from any point in a building to a public way. It includes vertical and horizontal ways of travel such as doorways, hallways, stairs and scaffolds.

Components of an Exit Route

- **Exit access:** Phttp://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9724&p_text_version=FALSE - 1910.36%28a%29%283%29ortion of the means of egress that leads to an exit
- **Exit:** Portion of the means of egress that is generally separated from other areas by construction or equipment and provides a protected way of travel to the exit discharge
- **Exit discharge:** Portion of the means of egress between the termination of an exit and a public area

Fundamental Egress Requirements

Exits and other safeguards must be designed so that a person's safety *will not depend on any single safeguard*.

Building safeguards must include:

- An illuminated exit sign (so it can be seen if the lights in a building go out); illumination can be external, internal, or via photo luminescence
- Safety lights that turn on in the event of a power loss
- More than one exit (all with exit signs)

Egress Elements

1. **Clearly identified**
    - Every exit must be clearly visible and marked
    - Access to exits must be conspicuously and unmistakably identified
    - Doorways or passageways that do *not* lead outside must be arranged or marked to minimize their possible confusion with real exits
2. **Illuminated**
    - Adequate and reliable illumination shall be provided for all exit facilities: both exit access and exits
    - Every required sign designating an exit or way of exit access must be readily visible
    - No decorations, furnishings or equipment may impair visibility of an exit sign
    - No other distracting displays or signs may be put near or in the line of vision to a required exit sign
3. **Unobstructed and unblocked**
    - No lock or fastening may prevent free escape from the inside of any building
        - That means that exit doors should not have locks on the outside

    - Free and unobstructed egress from all parts of the building must be available at all times when it is occupied
4. **Configuration**
    - When more than one exit is required from a story, at least two of them must be remote from each other
    - Doors leading to exits or exit access must be side-hinged and swinging
    - Such doors must swing WITH the flow of exit travel when the room is occupied by more than 50 persons or if the room is used for high-hazard occupancy
    - Exit access must not pass through a bathroom or other room subject to locking unless the exit is required to serve only the locked room
5. **Exterior considerations**
    - Access to an exit may be by means of any exterior roof, porch or balcony that conforms to the regulations
    - Exterior ways of exit access must have smooth, solid, substantially level floors and guards on the unenclosed sides
    - Areas subject to accumulations of snow or ice must be covered, unless they are the sole means of access and are regularly cleared of snow or ice
    - A permanent, unimpeded, reasonably straight path of travel must be maintained over the exterior way of exit access
    - All exits must discharge directly to the street or a yard, court or other open space that gives safe access to a public way
    - Streets, yards, courts or other open spaces must be of adequate width and size
    - Stairs must be arranged to make the direction of egress to the street clear
    - Exit stairs that continue beyond the floor of discharge must “force” persons to make the right choice when presented with a right and wrong way to the street

Emergency Action Plans

An **emergency action plan** is a plan for a workplace describing procedures that employer and employees must take to ensure employee safety from fire or other emergencies.

Alarms

An **alarm** is a trigger that sets an emergency action plan into motion.

- Different signals are used for different situations
- Employers are required to establish an alarm system
- Employers must maintain and test alarms regularly

Information in Emergency Action Plans

At a minimum, your emergency plan must include:

1. Procedures for reporting a fire or other emergency (e.g., emergency phone number, manual pull stations)
2. Procedures for emergency evacuation
3. Procedures to be followed by employees who remain to perform critical operations before they evacuate
4. A plan for accounting for all employees after evacuation

5. Procedures to be followed by employees performing rescue and medical duties
6. The names and job titles of every employee who may be contacted by employees who need more information about the plan or an explanation of their duties under the plan

Employer Responsibilities

Employers must:

- Designate and train employees to assist in a safe and orderly evacuation of others
- Review the emergency action plan with each covered employee when the employee is initially assigned to a job as well as when the employee's responsibilities under the plan change
- Keep the written plan at the worksite, up-to-date and available to employees

Employers with 10 or fewer employees may communicate the plan orally and are not required to maintain a written plan.

Fire Extinguishers

If portable fire extinguishers are provided, they must be mounted and identified so workers can access them. Fire extinguishers must be:

- Maintained in a fully charged and operable condition
- Kept in their designated places at all times except during use
- Inspected during annual maintenance checks

Record the annual fire extinguisher maintenance date and retain this record for one year after the last entry or the life of the shell, whichever is less.

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

Consider flame-resistant (FR) clothing if you work in an environment where injury due to fire, heat or electrical incidents is possible.

Arc-rated (AR) clothing helps protect the body against the intense heat of electrical arc flash that may potentially occur with high voltage electrical work.

All arc-rated clothing is flame-resistant, but not all flame-resistant clothing is arc-rated.

FR and AR clothing and equipment is rated based on the degree of protection provided. Proper laundering and maintenance are necessary to preserve FR and AR protective qualities.

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.

Latex Allergy Awareness

You can help prevent dangerous latex reactions by reducing exposure to latex and recognizing reaction symptoms early.

Definitions

Natural Rubber Latex

Natural rubber latex is found in a variety of plants but is mainly harvested from the rubber tree. It contains proteins primarily responsible for the symptoms of latex allergies. Natural rubber latex is flexible, strong and biodegradable.

Synthetic Latex

Synthetic latex is created through chemical processes. It may be in products such as latex house paint. If you experience a reaction after you are exposed to synthetic latex, it is likely caused by trace amounts of chemical additives and residues, NOT natural rubber proteins.

Refer to a product's label or Safety Data Sheet (SDS) to learn if it contains natural rubber latex. Report any reactions you experience to your supervisor and/or doctor.

Products Containing Latex

Latex may be present in a variety of products, such as:

- Tires, sealants, gaskets and adhesives
- Conveyor belts, rubber hoses, bands and tubes
- Electrical and vibration insulators
- Catheters, dental dams, exam gloves and other medical items
- Protective equipment for chemical and disease prevention
- Shoes, rainwear and certain elasticized fabrics

If you have reactions or allergies, disclose them to your employer so he or she can make appropriate accommodations. For example, you may be able to use powder-free latex gloves or use vinyl or nitrile gloves instead.

Routes of Exposure

There are two major routes of latex exposure: skin contact and inhalation.

Skin contact exposure occurs when a person comes into physical contact with natural rubber latex. An example might be touching a tire with your hands or arms when you change or repair it.

Inhalation occurs when a person breathes in airborne latex. For example, latex gloves often have a powder that can become airborne when you put the gloves on or take them off. Anyone nearby may inhale the powder and become exposed in this way.

Exposure and Reaction Risks

Sensitization is the process of developing reactions of increasing seriousness with each exposure.

If you are frequently exposed to latex, your risk of reacting to it increases with every use.

Workers who are often exposed to latex may include:

- Law enforcement and other first responders
- Medical and dental professionals
- Staff members who handle or prepare food
- Service and maintenance technicians
- Laboratory personnel
- Workers at sites that manufacture or use rubber products

Workers with the following may have an increased risk of latex allergy:

- Multiple personal allergic conditions
- Spina bifida
- Certain food allergies, especially:
    - Avocados
    - Potatoes
    - Bananas
    - Tomatoes
    - Chestnuts
    - Kiwifruit
    - Papayas

Reactions and Symptoms

Exposure to latex may result in reactions such as:

- Irritant contact dermatitis
- Allergic contact dermatitis
- Other hypersensitivity reactions

Symptoms may appear seconds, minutes or even days after exposure and include:

- Dry, itchy, cracked, split or irritated skin
- Hives or blisters
- Itching, crusting or oozing lesions
- Nasal congestion, runny nose or sneezing
- Red and itching eyes
- Swelling of lips
- Shortness of breath
- Anaphylaxis (in rare, severe cases)

Hearing Conservation

Most occupational hearing damage happens gradually due to exposure to high noise levels over time. The good news is that you CAN prevent hearing loss.

Noise and Hearing

Loud noises, as well as noise over time, can damage your ability to hear.

- A short-term (acute) exposure to moderate noise could result in a temporary loss of hearing *(Temporary Threshold Shift)*
- A short, intense sound, such as an explosion, may cause immediate hearing loss, which can be permanent *(Acoustic Trauma)*
- Most hearing loss, however, happens gradually upon exposure to high noise levels over a period of time *(Permanent Threshold Shift)*

Signs of Hearing Loss

Because hearing loss typically appears gradually over time, you may not even realize that you are losing your ability to hear. You may notice that:

- Sounds become muffled or distorted
- Conversations become more difficult to understand
- You have trouble hearing in noisy areas
- You experience ringing, hissing or pulsing in your ears

Hearing Conservation Program

The Occupational Safety and Health Administration (OSHA) requires your employer to administer a hearing conservation program whenever employee noise exposures equal or exceed an 8-hour time-weighted average sound level of **85 decibels**.

Monitoring Noise Levels

- Your employer will monitor noise exposure levels to identify employees who are exposed to noise at or above 85 decibels averaged over 8 working hours
- Your employer will repeat monitoring whenever changes in production, process or controls have the potential to increase exposure to noise

Conducting Hearing Tests

- Affected employees will take an initial baseline hearing test and annual hearing tests thereafter
    - Your employer must provide these audiometric tests at no cost to you
- Your baseline test shows what your normal hearing is, and is used as a reference for future tests to determine whether loss of hearing is occurring

Complying with Recordkeeping Requirements

- Your employer will:
    - Keep noise exposure records for at least 2 years
    - Maintain records of your hearing test results for the duration of your employment

Offering Annual Training

- Your employer must train you annually on:
    - The effects of noise on hearing
    - The purpose of audiometric testing, with an explanation of the test procedures
    - The purpose of hearing protection

Providing Hearing Protection

- Your employer may be able to reduce worker exposure to hazardous noise by changing equipment and work schedules
- If your employer cannot reduce or eliminate the level of hazardous noise, hearing protection (such as earplugs or earmuffs) must be worn

Types of Hearing Protection

Type	Advantages	Disadvantages
Single-Use Earplugs	• Convenient to use, even with other hearing protection • Inexpensive and disposable • Comfortable for long-term use in hot environments	• Require more time to put in • More difficult to insert and seat correctly • Are easily lost or misplaced • Require clean hands to handle and roll • Can cause ear infections when unclean
Pre-molded Earplugs	• Washable and reusable • Easy to insert properly • Don't require the user to handle the tips	• Are easily lost or misplaced • Can cause ear infections when unclean • Require trial and error to find a plug that fits • Custom-molded earplugs are expensive
Canal Caps	• Convenient and simple • When it is quiet, you can leave the band hanging around your neck	• Not all canal caps have tips that adequately block all types of noise • Some people find the pressure from the band uncomfortable

Earmuffs	• Come in many models and provide different levels of protection
	• The variety of styles makes it easy to find a comfortable pair
	• Easier to slip on and off than earplugs
		• Require a good seal
		  ○ Long hair, eyeglasses and safety glasses may make it difficult to get a good seal
		  ○ Facial movements such as chewing may reduce the protective value
		• Can be uncomfortable in hot environments

Inserting Earplugs

To insert a single-use earplug:

1. Roll the plug into a thin, smooth tube using both your thumb and fingers or by rolling it across your palms.
2. It should be thin enough to allow half of its length to fit easily into your ear canal.
3. Insert it by reaching over your head with one hand to pull up on the top of your ear.
4. Then use your other hand to insert the plug with a gentle rocking motion until you have sealed the ear canal.
5. It's generally advisable to maintain light pressure on foam plugs while they expand to ear canal contours. Otherwise they may move out of position before a good seal is formed.

To insert a pre-molded earplug:

1. Reach over your head with one hand to pull up on the top of your ear.
2. Then use your other hand to insert the plug with a gentle rocking motion until you have sealed the ear canal.
3. Because directions for fitting each model of pre-molded plugs may differ slightly, consult the manufacturer's directions.

Use and Care of Hearing Protection

<table>
<tr><th>Type</th><th>Pre-Use Inspection</th><th>Cleaning</th></tr>
<tr><td>Single-Use Earplugs</td><td rowspan="2">• Check for dirt, damage or extreme hardness
• Check pre-molded earplugs for deterioration and discard if cracked or not forming a good seal</td><td>• Discard after every use</td></tr>
<tr><td>Pre-molded Earplugs
Canal Caps</td><td rowspan="2">• Clean after each use
○ Wipe down with mild soap and warm water, and gently pat dry
○ Do not submerge earmuffs in water
○ Do not treat with any other substances
○ Keep hearing protection inside a case between uses</td></tr>
<tr><td>Earmuffs</td><td>• Check for cracks and leaks in the earcups or cushions
○ Replace damaged cushions
○ Discard earcups if damaged
○ Discard earmuffs when the headband no longer holds the cups tightly against the ear</td></tr>
</table>

Respiratory Protection Awareness

Respiratory protection programs set rules that protect the health of employees from harmful dusts, fogs, fumes, mists, gases, smokes, sprays or vapors. If your workplace contains dangerous chemicals, you may need to know about respirator use.

Employer Responsibilities

- Identify and evaluate respiratory hazards
- Attempt to eliminate or reduce hazards using controls
- Select and provide appropriate respirators based on the remaining hazards to which workers may be exposed

Worker Responsibilities

- Always use an appropriate respirator in potentially hazardous environments
- Follow proper procedures and safe work practices when wearing a respirator
- Exit hazardous atmospheres immediately, without removing the respirator, if you suspect an improper fit or device failure

Prerequisites

Medical Evaluation

- Breathing through a respirator may require more effort than normal breathing
- Medical evaluations are a way to determine a worker's ability to SAFELY use a respirator

Fit Testing

- The proper fit of a respirator is essential to its effectiveness
- Workers need to be fit tested with a respirator before they use it
- Workers must ensure that the protective seal is intact
    - Facial hair, glasses and PPE may interfere with the seal

Types of Respirators

Disposable Dust and Particulate Respirators (Dust Masks)

- Designed to protect lungs from low concentrations of dust, mists, pollen, animal dander and fibrosis-producing dusts and mists, such as coal dust
- Do not protect against gases, vapors and oxygen-deficient atmospheres

Air-Purifying Respirators (APRs)

- Have filters, cartridges or canisters that remove contaminants from the air by passing the ambient air through the air-purifying element
- Do not supply oxygen; therefore, must not be used in oxygen-deficient atmospheres
- Have an end-of-service-life indicator to indicate when to change out the air-purifying elements

Self-Contained Breathing Apparatus (SCBA) Respirators

- Provide clean air from a high-pressure cylinder carried on the user's back
- Provide the maximum degree of protection available from airborne contaminants

- Have a limited service life, often providing no more than 40 minutes of air
    - Strenuous work and rapid or heavy breathing will use up the air faster

Air-Line Respirators

- Provide clean, fresh air from a stationary source
- May be used for long periods of time and provide a high degree of protection from a variety of air contaminants
- May limit mobility and the hose could be punctured or pinched off

Staying Safe

Immediately Dangerous to Life or Health (IDLH) Atmospheres

- Put your life at immediate risk, irreversibly damage your health or make it difficult to escape
- All toxic and oxygen-deficient atmospheres are IDLH
- Any person entering an IDLH atmosphere must wear an atmosphere-supplying respirator

Inspection and Maintenance

Inspection

- All respirators should be inspected per manufacturer recommendations before each use and during cleaning
- Ensure that all components are present and operable
- Note the condition of the various parts including, but not limited to, the facepiece, head straps, valves, connecting tube, and cartridges, canisters or filters
- Respirators that fail an inspection must be removed from service and then discarded or repaired by trained personnel
- Fit tests and inspections help ensure a proper seal. Respirator users will receive additional information about seal checks to be performed prior to use

Cleaning and Storage

- Workers must clean their respirator to maintain its sanitary condition
- Regular cleaning and inspection prolongs the respirator's useful life and assures users that it is working as efficiently as possible
- Respirators should not be passed from one person to another without first being cleaned and sanitized
    - When not in use, respirators should be stored per manufacturer recommendations to prevent conditions that can damage or deform the facepiece
- Protect the respirator from excessive exposure to dust, sunlight, extreme temperatures, excessive moisture or damaging chemicals

Crystalline Silica Awareness

What Is Crystalline Silica?

Silica is an abundant mineral that makes up the Earth's crust. Crystalline silica is a basic component of soil, sand, granite, quartz and many other minerals.

Where Is Crystalline Silica?

When crystalline silica is crushed into small enough particles, it can become airborne. You can breathe it in or it can get in your eyes or on your skin. Crystalline silica that you can breathe is known as **respirable crystalline silica**.

Cutting, sawing, drilling or crushing concrete, brick, rock, mortar, industrial sand or other stone products can produce respirable crystalline silica. Activities such as cutting a granite countertop, core drilling through a concrete floor, and even sweeping a street can stir up crystalline silica into the air.

What Are the Health Effects of Crystalline Silica Exposure?

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

What Is 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 include:

- Shortness of breath
- Fever
- Fatigue
- Loss of appetite
- Chest pain
- Dry, nonproductive coughing
- Respiratory failure (may cause death)

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

People with silicosis are also at high risk for developing the active form of tuberculosis (TB).

How Can I Protect Myself from Crystalline Silica Exposure?

Engineering controls:

- Choose a material that doesn't contain crystalline silica
- Install and use ventilation
- Use containment methods
- Use wet sawing/drilling

Administrative and Work Practice controls:

- Exclude non-essential personnel from potential exposure areas
- Schedule cutting tasks when fewer people will be present
- When possible, position yourself so dust blows away from you
- Avoid the use of compressed air when cleaning
- Sweep after wetting the area to suppress dust
- Use a vacuum system with high-efficiency filters Take a shower and wear clean clothes before leaving work

Personal protective equipment (PPE):

- Respirators
- Safety glasses

What Do I Do If I've Been Exposed to Crystalline Silica?

If you get crystalline silica **in your eyes**, flush them immediately with lukewarm water while holding your eyelids open. If irritation persists, seek medical attention.

If you **breathe in large amounts** of respirable crystalline silica, move to fresh air at once. Keep warm and at rest. Get medical attention as soon as possible.

If someone inhales crystalline silica and **stops breathing**, perform CPR and follow your site's emergency procedures.

Hexavalent Chromium: Locations and Compounds

The following is a list of some potential hexavalent chromium exposures and compounds not mentioned in the course:

Locations and Uses of Hexavalent Chromium	Types of Compounds
Pigments for paints, inks and plastics	Lead chromate (chrome yellow, chrome green, molybdenum orange), zinc chromate, barium chromate, calcium chromate, potassium dichromate, sodium chromate
Anti-corrosive coatings (including chrome plating and spray coatings)	Chromic trioxide (chromic acid), zinc chromate, barium chromate, calcium chromate, sodium chromate, strontium chromate
Leather tanning	Ammonium dichromate
Wood preservation	Chromium trioxide, chromated copper arsenate (CCA), acid copper chromate (ACC)
Textile dyes	Ammonium dichromate, potassium chromate, potassium dichromate, sodium chromate
Stainless steel	Hexavalent chromium is given off when stainless steel is cast, welded or torch cut

Lead Poisoning

Lead is a highly toxic metal. Many alternatives to lead have been identified, but it is still used in some industries. To stay safe and healthy, we must limit and monitor exposure to lead.

Sources

Lead is a naturally occurring, bluish-gray metal in the Earth's crust. People may inhale lead dust or fumes in the air or ingest it when they touch lead and then consume food or drinks. Lead may be pure, or it may combine with other elements to form compounds. Pure lead does not dissolve in water, but some lead compounds can dissolve.

Sources of lead may include:

- Batteries
- Metal products
- Paint
- Ammunition
- Cable covering
- Gasoline/petroleum
- Burning solid waste/coal/oils
- Emissions from iron/steel production
- Lead smelters

Health Effects

Your body can absorb lead when you inhale it in the air, ingest it due to contaminated items/hands or expose open wounds to it. The health effects of lead are the same no matter how it enters your body. However, the body absorbs lead most easily when people breathe it in. Lead may reach various organs and body tissues through the bloodstream. Your body will store any lead it can't get rid of in your teeth, bones, organs and tissues where it can cause irreversible damage to cells, organs and whole-body systems. Stored lead continues to cause damage even after the initial exposure.

The **initial symptoms** of overexposure to lead may include:

- Confusion or memory loss
- Abdominal pain
- Constipation
- Fatigue
- Headache
- Irritability
- Nausea or loss of appetite
- Pain or tingling in the hands/feet
- Weakness

Because these are common conditions, people may not realize they are due to lead poisoning.

Long-term effects of lead include:

- Anemia
- High blood pressure
- Heart, kidney and brain damage
- Seizures
- Cancer
- Infertility
- Coma
- Death

If you are pregnant, lead can harm your baby. It can cause neurological effects and disabilities in babies or cause the mother to experience miscarriage or stillbirth.

Safety Measures

Your employer will determine when lead exposure is a concern and will then **monitor** your exposure to lead using testing devices such as air sampling, surface wipes and portable x-rays on surfaces. They must make sure lead doesn't exceed occupational exposure limits set by industry standards and your government to protect your health and wellbeing.

Employers must **record all monitoring results** and make them available to employees. Ask your supervisor if you have any questions or concerns about the monitoring and recordkeeping processes.

Ventilation systems may remove lead from the air or dilute it to safe levels.

Check with your supervisor to learn the specific lead exposure hazards in your workplace. Look for and respect **signs** that warn about lead and precautions to take.

Keep all surfaces **as free as possible from accumulated lead dust**. Vacuum with a high efficiency particulate (HEPA) filter. Do NOT use compressed air to clean floors and other surfaces.

When lead is in the air, it may settle on your clothes and body. If you don't **clean**, everywhere you go becomes contaminated too. If you eat, drink, apply cosmetics or use tobacco with lead on your hands or face, you risk ingesting it.

Your employer must provide you with free **protective clothing and equipment** in areas that exceed the occupational exposure limit for lead. This includes:

- Coveralls or full-body work clothing
- Gloves
- Hats
- Shoes or disposable shoe covers
- Face shields
- Vented goggles
- Respirators

Your employer will provide you with training and fit testing, as needed.

When lead levels exceed the occupational exposure limit, use a **designated change room** to:

1. Carefully remove contaminated clothing.
2. Place it in labeled containers and close them.
3. Shower.

Your employer provides **designated break areas** that have filtered air. This is the only place you may consume food or drinks or use cosmetics or tobacco products.

Overexposure

Immediately notify your employer if you:

- Develop signs or symptoms of overexposure
- Want medical advice concerning a current/past exposure

Your employer will provide you with appropriate medical examinations or consultations.

If you have been exposed to lead above the occupational exposure limit, your employer may be required to provide you with medical surveillance that includes an exam by a physician and a blood test.

Check with your supervisor or government to learn about your rights and your employer's responsibilities regarding potential exposure to lead.

When you have been overexposed to lead, your employer may be required to reassign you to a job that has low or no lead exposure.

The reassignment should not result in any loss of earnings, seniority or other employment rights or benefits.

You may not be reinstated to work around lead unless or until your blood tests reveal that the lead is no longer present at unsafe levels.

REMEMBER: Check with your supervisor or government to learn about your rights and your employer's responsibilities regarding potential exposure to lead.

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.

Bench Grinder Safety

Common Causes of Injury

Bench grinders are powerful tools that require precision and precaution. A jagged wheel fragment can fly fast enough to penetrate the soft tissue of your neck, eyes and face.

In addition to projectiles from wheel disintegration, other common hazards are:

- Contact with the wheel
- Burns and fires from sparks and hot parts
- Exposure to loud noise and grinding dust
- Entanglement in rotating equipment

Safety Features of a Bench Grinder

- The **tongue guard** (spark guard) is adjustable and helps contain sparks and particles thrown from the wheel
- The **flange** is designed to grip the grinding wheel more securely and distribute contact stresses applied during tightening – stresses on the side of the wheel that can damage or break it
- The **spindle guard** (side guard) covers the side surfaces of the wheel and protects the operator from abrasions, entanglement and thrown particles in the event of wheel failure. It also protects against inadvertent contact with the wheel sides, which can lead to wheel disintegration
- The **eye shield** is considered “optional” equipment, but removing it may void the warranty and place your company and you at risk
- The **work rest** (tool rest) helps steady the material being worked by the grinder

General Precautions and Safe Use

Some general precautions you can take for your safety include:

- Inspecting the grinder before each use
- Not wearing anything that may get caught in moving parts, such as loose clothing, gloves and jewelry
- Containing long hair and avoiding overreaching
- Never leaving the grinder running unattended
- Keeping the work area clean
- Working in well-ventilated areas with approved safety equipment
- Wearing eye and face protection at all times and body, foot and hearing protection as required. If your hands must be close to the wheel, DO NOT wear gloves

Tips for Safe Use

- Ensure the grinder is mounted on a solid bench or pedestal and securely bolted to a rigid mounting surface
- Make sure that the switch is in the “off” position before plugging in the grinder
- Grind only on the grinding face of the wheel to prevent weakening or breaking the wheel or injury

- Whenever possible, use the work rest to support the work piece during the grinding operation. Turn the grinder off if it jams
- Don’t feed the nip! The grinding wheel should always rotate into the object being sharpened
- Gradually increase the feed rate as the wheel comes to speed and warms up. Never force the work piece into the grinder

Wheel Maintenance, Selection and Testing

- Dress the wheel face periodically
- Never grind soft metals like aluminum
- Replace the wheel when it is:
    - Completely coated with soft metals
    - Cracked and chipped. In this instance, replace the wheel IMMEDIATELY
    - Worn and the maximum gap cannot be maintained
        - The maximum gap is 3.175 millimeters (1/8 inch) at the work rest and 6.35 millimeters (1/4 inch) at the tongue guard. At some point, guards will not adjust inward enough to maintain these tolerances
        - A good practice is to replace after the diameter is reduced in size by 5 centimeters (2 inches)
- Choose a grinding wheel of a suitable size and speed for the grinder, as indicated by the grinder’s data plate and wheel markings, and the dimensions listed in the owner/operator manual
- Conduct a ring test by suspending the wheel on a string or on the shank of a screwdriver, tapping the outer edge with a nonmetallic object and listening for a “ring”
    - Rotate the wheel 45 degrees and repeat the test
    - Discard any wheel that doesn't “ring” as it probably has an internal defect
- Store wheels vertically and in a rack to avoid damage

Wheel Replacement

Follow these steps ONLY AFTER REMOVING THE POWER:

1. Tighten the spindle nut just enough to prevent the wheel from slipping, but not so much that the wheel may disintegrate from the stress.
    a. Reattach the side guard so that it covers the spindle, flange, nut and at least 75% of the grinding wheel periphery
2. Readjust the tongue guard and work rest clearance to the MINIMUM clearance of 1.6 millimeters (1/16 inch) so the work piece doesn't become wedged in between.
3. Position the eye shield so that it is in the line of sight to the work rest.
4. Turn the wheel by hand, making sure it is clear of obstructions and that it turns freely.
5. Remove adjusting tools, check that the controls are switched off and restore power.
6. Watch for vibration: Stand aside for 1 minute of rotation at full speed. If the grinder doesn't come up to speed smoothly and without vibration, shut it off immediately and determine the reason.

Machine Guarding

Any machine part, function, or process that may cause injury must be safeguarded. If a machine has been designed with a guard in place, do not tamper with or remove it!

Your supervisor is responsible for providing you training when any new safeguards are put into service or when anyone is assigned to a new machine or operation.

Mechanical Hazards

All machines have three fundamental hazards:

- **Point of operation** – The area of a machine where the work is being performed
- **Power-transmission apparatuses** – All components of the mechanical system that conduct energy to the part of the machine tool doing the work including flywheels, pulleys, belts, chains, couplings, spindles, cams, gears, connecting rods and any other machine components that transmit energy
- **Other moving parts** – Machine components that move during the machine operation such as reciprocating, rotating and transverse moving parts, as well as auxiliary machine parts

Despite all machines having the same basic characteristics, their safeguarding needs widely vary due to their differences in design and operator involvement.

Hazardous Motions and Actions

Many mechanical motions and actions can be hazardous. The basic types of hazardous mechanical motions and actions include:

Motion/Action	Description	Example
Rotating	Circular movement of couplings, cams, clutches, flywheels and spindles as well as shaft ends and rotating collars that may catch your clothing or otherwise force a body part into a dangerous location	
Reciprocating	Back-and-forth or up-and-down action that may strike or entrap you between a moving part and a fixed object	

Transversing	Movement in a straight, continuous line that may strike or catch you in a pinch or shear point created between the moving part and a fixed object	
Cutting	Action generated during sawing, boring, drilling, milling, slicing and slitting	
Punching	Motion resulting when a machine moves a slide (ram) to stamp or blank metal or other material	
Shearing	Movement of a powered slide or knife during metal trimming or shearing	
Bending	Action occurring when power is applied to a slide to draw or form metal or other materials	

You should also be aware of non-mechanical hazards, including:

- Potentially dangerous power sources (electrical and hydraulic)
- Unwanted sound or noise
- The use of cutting fluids, coolants and other potentially harmful substances

Requirements for Safeguards

At a minimum, safeguards must meet these following general requirements:

- **Prevent contact** – Safeguards must minimize the possibility of you or your co-workers placing your hands into hazardous moving parts
- **Remain secure** – You should not be able to easily remove or tamper with the safeguard
- **Protect from falling objects** – Safeguards should ensure that no objects can fall into moving parts
- **Create no new hazards** – A safeguard defeats its purpose if it creates a hazard of its own
- **Create no interference** – A safeguard should not create an unacceptable obstruction

- **Allow safe maintenance and lubrication** – It should be possible to lubricate the machine without removing the safeguard

Guards

Guards are barriers that prevent access to danger areas. There are four general types of guards with which you should be familiar:

- **Fixed** – A fixed guard is a permanent part of the machine. It's not dependent upon moving parts to perform its intended function. This guard is usually preferable to other types
- **Interlocked** – When this type of guard is opened or removed, the tripping mechanism and/or power automatically shuts off or disengages. This means the machine can't be started until the guard is back in place
- **Adjustable** – Adjustable guards are useful because they allow flexibility in accommodating various sizes of stock
- **Self-adjusting** – The size of the openings of this type of guard is determined by the movement of the stock

Guards designed and installed by the manufacturer (builder) offer two main advantages – they usually conform to design and function of the machine, and they can be designed to strengthen the machine in some way or to serve some additional purpose. However, user-built guards are sometimes necessary.

Safety Devices

Safety devices help prevent contact with points of operation and may replace or supplement guards. The most common types are:

- **Presence-sensing devices** – Use a system of light sources and controls that can interrupt the machine's operating cycle. If the light field is broken, the machine stops and will not cycle. This device must be used only on machines that can be stopped before the operator can reach the danger area
- **Radio frequency (capacitance) devices** – Use a radio beam that is a part of the machine control circuit. The operating principle is similar to presence-sensing devices
- **Electromechanical sensing** – Uses a probe or contact bar that descends to a preset distance when you start the machine cycle. If an obstruction prevents it from descending its full distance, the control circuit won't allow the machine to start
- **Safety mats** – Function similarly by detecting worker presence on a pressure-sensitive mat which will either enable or disable equipment cycling control functions
- **Two-hand controls** – These devices require constant pressure by the operator to activate the machine. The operator's hands are required to be at a safe location (on the control switches) and at a safe distance from the danger area while the machine completes its cycle
- **Gate** – This device is a movable barrier that protects the operator from the point of operation *before* the machine cycle can be started. Gates are often designed to be operated with each machine cycle

Other Safeguarding

- **Location or Distance Safeguards** – Sometimes the location of the machine or your distance from mechanical hazards can be used as a safeguard
- **Potential Feeding and Ejection Methods** – Many feeding and ejection methods don't require you to place your hands in the danger zone
- **Awareness barriers, shields and special hand tools** – While these don't necessarily give complete protection from machine tool hazards, they will provide you with an extra margin of safety

Document your inspections and keep records. Your documentation should identify the machine, inspection date, problems noted, and any corrective action taken. Noting problems helps to ensure that corrective action will be taken.

Lockout/Tagout (LOTO) Programs and Procedures

Energy powers industrial machines and systems. Many people may hear the word “energy” and think of electricity. However, many other forms of energy are hazardous. For example, energy may be: electrical, mechanical, hydraulic, pneumatic, radiation, thermal or chemical. See your supervisor or safety professional or review lockout/tagout procedures to learn about forms of hazardous energy where you work.

An **energy-isolating device** physically prevents the transmission or release of energy by blocking or isolating it. Examples include a manually operated electrical circuit breaker, a disconnect switch, a conductor switch, a line valve, a block, a blank flange, or a bolted slip blind. The power button on a machine or piece of equipment is NOT an energy-isolating device.

Lockout is locking the energy-isolating device so that people CANNOT operate the equipment or restore power until the lockout device is removed. A lockout device holds an energy-isolating device in a safe position. Examples include padlocks and hasps.

Tagout is tagging the equipment to indicate that people MAY NOT operate it or restore power until the tagout device is removed. Tagout is not a physical restraint. A tagout device, such as a tag, warns people not to operate equipment. Use tagout devices in addition to lockout devices. When lockout is not possible, we must still tag out. Tagout devices must be legible, durable and secure. Attach tagout devices to (or as close as possible to) the energy-isolating device.

Lockout and tagout devices must be durable (able to withstand environment/use), standardized (consistent in color, shape, size, print and format), substantial (able to withstand 50 lbs or 23 kg of force, hard to accidentally remove or miss) and identifiable (easy to recognize and understand).

Energy Control Program

Employers use an **energy control program** to ensure that equipment is de-energized and isolated from its energy sources before people perform service and maintenance. The program includes information that employees need to know so they may safely perform lockout/tagout. Programs are written to meet the needs of the workplace and the types of equipment people will maintain or service.

Energy control programs include:

- **Energy control procedures** including: how to use the procedure; steps to shut down, isolate, block and secure equipment; steps to place, remove and transfer lockout/tagout devices; responsibilities during procedures; and requirements for testing equipment to verify energy control.
- **Inspection requirements**. At least once per year, employers conduct formal inspections of their energy control procedures to make sure they are effective, and that people are using them appropriately. The inspection may include reviewing procedures and responsibilities with employees to ensure their understanding of the energy control program. Inspection documentation include the name of the inspector, the date of the inspection, and the equipment and people included in the inspection. The inspector and responsible people note any defects, correct those defects and document their corrective actions, per their employer's requirements.
- **Training requirements**. Energy control programs outline training and retraining requirements employees must meet depending on their exposure to equipment, types of energy and hazards.

In addition to refresher training, employees receive training when inspections reveal defects and when assignments, equipment or procedures change.

As you are using the energy control program, if you identify a problem, you must stop. Make sure you or a qualified person addresses any issues before you continue working.

Applying Locks and Tags

Please use your employer's specific energy control program and procedures. Only authorized employees apply locks and tags. If you have any questions about your authorization or the energy control program, please ask your supervisor. The authorized employee will:

1. Notify affected employees.
2. Prepare for shutdown.
3. Shut down equipment.
4. Isolate energy.
5. Apply locks and tags.
6. Make stored/residual energy safe.
7. Verify de-energization.

Removing Locks and Tags

Please follow your employer's specific energy control program and procedures when removing lockout/tagout devices. Only the authorized employee who installed the locks and tags can remove locks and tags. In rare cases in which the authorized employee is not available/ reachable, follow the energy control program guidance to identify a designee to remove the locks and tags and inform the original installer.

The authorized employee will:

1. Inspect the work area.
2. Keep people away.
3. Remove lockout/tagout devices.
4. Notify affected people.

Other Considerations for Lockout/Tagout

There are some situations when your energy control program will have unique procedures you must follow.

These may include:

- **Energization required for testing**. Some servicing or maintenance operations may require equipment or components to be energized. In these cases, the energy control program may require the authorized person to clear the area, remove the devices, test the equipment and then, eventually, reapply locks and tags using standard procedures.
- **Outside personnel being on-site**. When outside personnel, such as contractors, are on-site, the employers should inform each other of their respective lockout or tagout procedures. Each employer ensures that their employees understand and comply with all the procedures, restrictions and prohibitions in their energy control programs.
- **Shift changes**. Use the procedures in the energy control program during shift or personnel changes to ensure the continuity of lockout or tagout protection.
- **Group lockout/tagout procedures**. Please consult your employer's energy control program for procedures for group lockout/tagout. These may include identifying a person responsible for group lockout/tagout; describing personal lockout or tagout device and processes; and using a group lockbox or lockout device

Hydraulic Safety

Hazards

Hydraulic system hazards include:

- Struck-by or caught-between injuries
- Severe cuts
- Injections of hydraulic fluid
- Crashes, falls and flying objects
- Burns
- Fires and explosions

Safety Programs

Proper installation, inspection and maintenance help prevent the release of pressurized fluids due to the failure of hydraulic system components.

Employers should establish a program for qualified employees to regularly inspect and replace hoses, fittings and other components in accordance with manufacturer instructions.

Operators should visually inspect hydraulic systems before using equipment.

Inspections

Leaks

Look for leaks on hoses and at couplings. Note that discoloration, dirt and greasy buildup may indicate a leak.

If you find leaks, do NOT use the equipment; consider hose and fitting replacement.

NEVER touch or examine a failed hose assembly. Qualified employees will service a damaged hose when they are sure that the hose no longer contains fluid under pressure.

You may use an object, such as a long piece of cardboard or wood, to check for leaks.

Blisters and Deformations

Look at the outer covering of hydraulic hoses, paying particular attention to:

- Areas where hoses bend
- Areas where hoses fasten to moving parts
- Coupling junctions
- Hoses near hot surfaces
- Hoses in high-wear areas

Remember: Look for problems at a distance. Use a flashlight, if needed.

If you find blisters or deformations, do NOT use the equipment. Your maintenance team may consider hose and fitting replacement.

Cuts, Damage and Corrosion

Look for:

- Cuts, excessive abrasion or scrubbing on hoses
- Cracked, damaged or badly corroded fittings

A qualified employee may re-route and re-secure hoses to eliminate the interference.

Protect hoses with abrasion and heat-resistant spiral wrapping, sleeves and guards.

Problems While in Use

If…	Then…
Hydraulic system jams	Stop, call for maintenance and stay out of the way
Hoses or systems fail during use	Shut down equipment and leave the area until pressure has been completely released from the hose assembly

Safe Work Practices

Personal Protective Equipment

You need to protect your **eyes and face** from hydraulic spray as well as flying hoses/objects.

Standard **work gloves** may help protect against dirt, grease, heat and sharp or rough edges. However, remember that gloves are no match for a hydraulic leak!

Precautions

When you work around hydraulic systems:

- Consult the Safety Data Sheet (SDS) for fluids
- Clean up spills and keep the work area clean to avoid slips and trips
- Be aware that fluid may be hot when disconnecting lines
- NEVER hold or restrain pressurized hoses
- Shield hydraulic lines from welders and torches
- ALWAYS replace hose assemblies if they fail (Do NOT repair!)

Replacement Parts

Choose replacement parts with the proper pressure capacity, temperature ratings and compatibility (equipment and chemical).

Lock Valves

Lock valves store pressure in hydraulic lift components to prevent loads from accidentally dropping if they lose power or if hydraulic lines suffer damage or burst.

You must use special procedures to release pressure before working with valves, lines or cylinders of any of the hydraulic systems involved in lifting or stabilizing the machine. Failure to follow safety procedures can result in high pressure sprays!

Lockout/Tagout

Your employer has specific lockout/tagout procedures for the equipment at your workplace. Talk to your manager if you have questions.

In general, to control hazardous hydraulic energy, you will:

1. Turn off equipment
2. Bleed pressure
3. Verify that equipment is de-energized and isolated

There are some general safety tips you should use for hydraulic system lockout:

- Do NOT work under equipment/apparatuses being supported by hydraulics
    - Use stops, safety pins, blocking, cribbing and grounding
- NEVER assume there is no pressure in the system just because hydraulic pump equipment has been shut off
- Do NOT assume it is safe to loosen a connector or vent stored pressure to the atmosphere
- To verify de-energization, select gauges rated higher than the system working pressure
- Eliminate air entrapment, pressurize to full system pressure and check for proper function and freedom from leaks before releasing systems to operation following de-energization and repairs

Injuries Caused by Hydraulic Fluid

Every company should have a plan for hydraulic fluid incidents and injuries.

If anyone has a hydraulic fluid injury, call for emergency medical help and then consult the SDS for appropriate first aid treatment.

To help medical professionals determine the best treatment, bring the SDS and any other supporting documents your employer may provide to the treatment facility.

Compressed Air Safety Awareness – Supervisor Supplement

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

Inspections

Periodically, walk through the areas in which workers use compressed air. Ask yourself:

- Are workers wearing appropriate protective equipment? (minimum: safety glasses/goggles and ear protection)
- Is there any dust or potential shrapnel in the area?
- Are hoses stored and are hose ends secured?

Follow-up Questions to Ask Workers

After workers complete the training, take time to verify that they understand how what they learned applies to their tasks.

You may ask them:

- Do you have any questions about how to safely work with compressed air?
- Do you understand what protective equipment you need to wear when you work with compressed air?
- Do you know where to find information about pressure limits on components and tools?
- Do you know the pressure limits of the tools and systems with which you work?
- Have you noticed any safety issues with this work area or the tools and systems in it?

Remind workers to tell you if they see any problems. Emphasize that they should remove damaged components or tools and lock and tag them so others can't use them.

Worker Observation

After workers take the course, observe them to make sure they are working safely. 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

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.

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

Lithium-Ion Battery Awareness

Lithium-ion batteries are everywhere and power many items that you use daily. Small electronics like cell phones and power tools and bigger items like electric or hybrid vehicles can be powered by lithium-ion batteries.

What Is a Lithium-Ion Battery?

A lithium-ion battery is a rechargeable power storage device in which lithium ions move through an electrolyte from a negative electrode to a positive electrode during battery discharge. When the battery is charging, the process is reversed.

Lithium-ion batteries need warning labels during shipping, but are not always individually labeled. Owner/operator manuals and chemical inventory lists should identify lithium-ion batteries.

Unique Properties

- Stores a large amount of power in a small, lightweight package
- Fast charge
- Slow discharge

Unique Advantages

- Battery-powered devices are easier to operate, transport and store because they are lighter and less bulky
- Ready to use sooner
- More likely to be ready for use after periods of idleness

Unique Hazards

- Electrolyte is flammable, toxic and corrosive
- Thermal runaway fires are possible and difficult to extinguish
- Fires emit toxic smoke

Hazards

Defect-free lithium-ion batteries are not flammable or toxic during normal use, but can fail and be dangerous if not handled with care.

What Could Happen?

- Fires and explosions
- Chemical exposure
- Electric shock

Incident Prevention

Identify warning signs of battery failure to prevent safety incidents:

- Physical damage
- Hot
- Swollen
- Leaking fluid
- Emitting foul odors or hissing sounds

Safe Work Practices

- Wear safety glasses during battery maintenance or service
- Remove conductive jewelry and items from pockets
- Use non-conductive tools
- Follow manufacturer recommendations
- Do not mix old, new, charged and uncharged batteries
- Replace like-for-like batteries
- Use batteries, chargers and devices bearing the mark of a recognized testing laboratory

Safe Charging

- Use compatible chargers – incompatible chargers can overcharge the battery
- Charge batteries in a safe place
    - Non-combustible surface
    - Uncovered to allow venting of heat
    - Away from direct sunlight and heat
- Unplug the charger after the battery is fully charged

Batteries Outside of Devices

- Store in a cool, dry place
- Cover terminals to prevent short circuiting
    - Use electrical tape to cover each terminal, and/or
    - Enclose each battery in a durable, plastic, zip-top bag

Battery and Device Disposal

- Recycling is preferable over trashing
- Do NOT recycle or trash batteries with uncovered terminals

Incident Response

Fire or Explosion

- Assess the situation
    - Extinguish small fires if trained to do so
    - Leave large fires to a professional
        - Do NOT fight a fire unless you are trained to do so!
- Evacuate the area
- Call for help or extinguish the fire
- Keep extinguished batteries away from combustibles; they could reignite

Other Incidents

- If there isn't a fire or explosion, but a battery shows signs of malfunction, unplug the charger if it is safe to do so
- In case of skin, eye or respiratory contact:
    1. Move to fresh air.
    2. Flush the area with water.
    3. Seek medical attention.

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.
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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

Electrical Arc Flash Awareness

Significance of the Arc Flash Hazard

The deadly arc flash hazard can generate:

- An explosion with a temperature of up to 19,000 °C (35,000 °F)
  - Vaporizes metal
  - Burns clothing and fuses synthetic material to skin
- A blast strong enough to knock you off your feet and rupture your eardrums

Victims suffer from their injuries and painful surgeries for the rest of their lives – if they survive.

Arc Flash Definition

An arc flash is a phenomenon where a flashover of electric current leaves its intended path and travels through the air from one conductor to another, or to ground. The flash creates an arc fault that generates an instantaneous blast and pressure wave of significant:

- Energy
- Heat
- Debris
- Sound

An arc flash can be caused by many things, including:

- Dust that builds up and is then disturbed
- Material in the electrical equipment, such as dirt, debris, tools or foreign objects
- The accidental touching of equipment
- Equipment that is faulty due to failure or corrosion

Common Causes of Injury

There are many elements in an arc flash that can cause injury. In addition to the intense heat and light from the flash, an explosion (or blast) can generate dangerous:

- Flying debris
- Molten metal
- Fire
- Hot gases
- Shock waves

Workers can be crushed by materials, equipment or even buildings. They can also be severely burned, thrown across rooms or knocked off ladders or platforms.

General Precautions and Safe Work Practices

Precautions

To help prevent an arc flash:

- Never open an electrical panel or attempt to reset a breaker unless you have been trained and authorized to do so
  - Be aware that these actions may put you at risk of an arc flash
  - Resetting breakers without knowing what activated these protective devices is DANGEROUS

- Unqualified workers should not enter or block access to electrical rooms
- Understand and respect arc flash labels, which identify safe boundaries

If you are qualified to perform electrical work, then follow all guidelines and requirements related to work area barricading. All other workers must stay clear of electrical work.

PPE

If you are not authorized to work on electrical systems or components, you still need to be aware of the types of PPE that must be worn by authorized employees. The type of PPE required is determined by the amount of risk, voltage and current available.

Typical arc flash PPE includes:

- Electrically rated eye/face protection
- Balaclava
- Smock or electrically rated suit
- Hearing protection
- Gloves

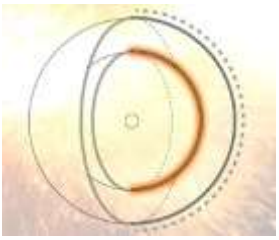
Labels

To protect workers from electrical hazards such as arc flash, employers should conduct an arc flash assessment and label hazardous electrical equipment with pertinent information from the assessment.

- Warning labels provide information about:
  - Arc flash protection
  - Shock protection
  - Required PPE

Boundaries

Boundaries are identified on warning labels.



- The Arc Flash Protection boundary is also known as the outer boundary – the point farthest away from the energized equipment that PPE must be worn to protect against 2nd-degree burns or worse if an arc flash occurs
- The Limited Approach boundary indicates where barriers should be placed to protect unqualified people from an electrical shock hazard. The higher the voltage, the greater the distance. Unqualified people should not cross this boundary unless they are escorted by a qualified person and are wearing the proper PPE
- The Restricted Approach Boundary *(pictured)* can only be crossed by a qualified person wearing appropriate PPE because of the increased risk of electric shock

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, Part 1: Preparation

When you work construction on or near roadways, pedestrians and motorists are a factor that you must consider. Work zone safety protects the public and workers from accidents and minimizes the negative impact of the project on the community.

Traffic Control Standards and Plans

The most common traffic control standard in the United States is the **Manual on Uniform Traffic Control Devices (MUTCD),** part 6. States follow MUTCD and may have additional requirements that you and your employer must confirm before beginning work.

Workers in work zones must:

- Follow the traffic control plan
- Provide clear, consistent signs, markings and other visual cues
- Perform routine day and night inspections
- Be aware that conditions can change unexpectedly

Traffic control plans should include ALL types of traffic, be in writing and be approved by local authorities. The agency that has jurisdiction over the work zone must approve modifications to the plan. Your employer will provide traffic control plan safety instructions where you work.

Five Areas of Work Zones

The five areas of work zones are the:

- **Advance warning area**. It warns the public with increasingly specific signs as they approach with work area. The spacing and placement of signs will vary depending on speed and visibility.
- **Transition area**. It is where traffic moves from its normal path via detours, lane changes and tapers.
- **Buffer area**. It gives motorists who cross over traffic control devices time to react and stop before striking anyone. Keep free of materials, equipment and people.
- **Work area**. It contains workers, tools, equipment, material, vehicles and debris. Ensure that there are safe ways to enter and exit the work area that dissuade or prevent unauthorized entry.
- **Termination area**. It is where traffic passes beyond the work area and resumes normal movement. Tapers should be about 100-feet long and use 5 to 6 traffic control devices per lane. Many termination areas include termination signage.

Work Zone Inspections

Perform routine daily and nightly inspections, even when work is stopped. Look for skid marks, damaged barricades, dirty/displaced traffic control devices and material, equipment and debris infringing on traffic lanes. Failure to inspect and correct issues can lead to liability and accidents.

Include other workers in inspections. Fix problems as soon as you find them, if you can. Block hazards to prevent accidents. Document inspections and corrective actions.

Work Zone Safety, Part 2: Operations

Keeping everyone safe in work zones requires tools, practices and people.

Traffic Control Devices (TCDs)

Traffic control devices (TCDs) provide advance warning to motorists, delineate travel paths, and separate traffic from workers. Examples include:

- Signs
- Drums
- Cones
- Message boards
- Chevrons
- Barricades
- Concrete barriers
- Traffic lights

At a MINIMUM, TCDs must be clean, maintained and made of approved materials (not homemade). Specific requirements for TCDs are in your work zone safety plan, which should meet or exceed the *Manual on Uniform Traffic Control Devices* (*MUTCD*) standards.

Ensure TCDs:

- Are applicable
- Don't have conflicting instructions/information
- Have directions/arrows pointed where traffic should go
- Are placed/distanced appropriately

Traffic cones must be:

- Orange
- Reflective (for night use)
- At least 28” tall
  (states may require taller)
- Weighted or doubled to stay upright, as needed

Drums must:

- NOT be recycled 55-gallon drums
- 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

Traffic control devices need enough weight to be stable, but not so much that they can become missiles. Place weights low, and do NOT place weights on top of the TCD or use weights made of concrete.

Safe Practices

Wear **high-visibility gear** in work zones. Choose fluorescent colors that contrast with your surroundings as much as possible. You may need to wear garments that reflect light off fronts, sides and back. Keep traffic vests and reflective garments clean, maintained and visible.

When you are in a work zone:

- Face oncoming traffic (even when resetting displaced drums)
- Instead of bending near open traffic lanes, use your foot to position traffic cones
  - Be aware of construction vehicles and equipment (listen for backup alarms)
- Stay within the work zone and out of the buffer area
- Do not cross open lanes of traffic

Correct problems immediately. When you see problems that you can't fix right away, tell your supervisor and follow up to ensure resolution. When inspecting/traveling, stay in the vehicle cab and wear your seatbelt.

Know emergency procedures and warning signals for uncontrolled vehicles. For motor-vehicle accidents in the work zone, follow company procedures, assist people carefully, and watch out for secondary collisions.

Night Operations

Night operations may enjoy less traffic, but there are also dangers of which you should be aware, including: reduced visibility, speeding drivers, impaired/fatigued/inattentive drivers/workers and lights blinding drivers/workers. To increase the visibility of operations at night:

- Wear vests OVER other clothing
- Use lights aimed away from motorists
- Give flaggers light wands or chemical light sticks
- Lay flares on the ground (do not hold them)

Flaggers

Flaggers alert motorists to the presence of a work zone and communicate to them about where to stop and how to proceed. They should be:

- Experienced
- Healthy
- Professional
- Assertive
- Trained/ knowledgeable about work/safety
- Certified (in some states)

Place advance warning signs before flagging stations. These may include: "Road Work Ahead," "Flagger Ahead," or "Prepare to Stop." Make sure stations are visible; consider all conditions and factors. Plan an escape path in case something goes wrong.

Use stop/slow paddles that meet or exceed *MUTCD* and other applicable standards: 18” x 18” octagons with 5' to 7' handles. Only use flags in emergencies. Contractors may be exposed to liability if a non-standard device is involved in an accident. Signals and directions to motorists must be clear and distinct. Only give **three commands: stop, go, and slow down**.

Flaggers must ALWAYS be visible:

- Don’t mingle with other workers
- Wear distinctive vests and gear
- STAND UP
- Do not park vehicles near flaggers

Flaggers should:

- Remain professional and polite
- Keep conversations brief
- Stay visible to all traffic

Vehicles and fixed objects can impair visibility and block escape routes in case motorists don't respond to directions.

Dealing with Angry Motorists

When dealing with angry motorists, alert the crew, record what happened, note the vehicle description/plate and driver description, and call the police. Do NOT argue, retaliate or try to stop the vehicle.

Blasting Area Awareness

Workers use explosives and blasting agents in construction. It's important that the people who work on sites that have blasting know the hazards, process and what to do in emergencies.

Hazards

Flyrock is any object that travels outside the blast area. It can weigh from a few ounces to several tons. Flyrock can travel very far and is responsible for the most serious injuries on sites where blasting occurs.

Flyrock is a concern for EVERYONE on blast sites, not just those near the explosion.

Other blasting site hazards include:

- Noise
- Vibration
- Pressure waves
- Heat
- Fumes
- Dust

The closer you are to the blast, the greater the risk of these hazards.

Planning

The blaster-in-charge will communicate the blasting plan to site personnel and will conduct a pre-blast meeting to go over:

- When a blast will occur
- Number of blasts planned
- Signals prior to and after a blast (all-clear)

Working near where blasting personnel prepare charges can cause premature detonation.

Immediately follow any instructions you receive from the blaster-in-charge or guards.

Signs

Signs may indicate blasting procedures, warning signals and may also warn personnel about blasting activities:

- BLASTING ZONE AHEAD: the road or path leads to a blasting zone
- TURN OFF TWO-WAY RADIOS AND CELL PHONES: turn off devices that could cause a premature detonation
- END BLASTING ZONE: indicates the terminating edge of the blasting zone

The blaster-in-charge or authorized agent will cover or remove the signs when no explosives are in the area or explosives are otherwise secured.

Blasting procedure signs tell you what different signals that the blasting crew will use mean.

Signal Systems, Barricades and Guards

Signal systems must:

- Be audible, simple and understood by EVERYONE
- Include at least two warnings prior to a blast (preferably with sirens or horns)
- Include an "all clear" signal when the area is safe again

Barricades and guards control the flow of traffic into and through the blast zone.

Re-Entering the Site

Silences does NOT equal safety! A **misfire** is a charge that does not detonate or only partially detonates. A **hangfire** explosion is a blast that occurs after the blaster-in-charge expects it to happen.

The blaster-in-charge will conduct a post-blast inspection.

Wait for the "all clear" signal to re-enter the blast site.

Emergencies

Expect that the blaster-in-charge may suspend operations due to:

- Severe weather
- Unauthorized personnel on-site (report to your supervisor immediately)

If you see someone ignore warning signs and go into an unsafe blasting area, alert your supervisor immediately.

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 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 – ¾ to 1
        - Type B – 1 to 1
        - Type C – 1½ 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

Blocking and Cribbing

A lot of work requires the use of lifting tools such as hydraulic jacks, cranes and hoists. Any lifting tool can potentially fail and if you happened to be under a load during such a failure, chances are you would be injured or killed. Never get under raised equipment or components unless they have been properly blocked or cribbed.

- **Blocking** involves placement of wooden blocks, other designated blocking materials, or jack stands under equipment and components to keep them secure and stable while they are raised
- **Cribbing** is placement of a machine or component on alternating tiers of blocks

The support base that cribbing creates is larger than that created by blocking, which offers more stability. This is particularly important for loads above surfaces that are not perfectly firm and level.

Materials and Equipment

- Oak is the best type of wood for blocking and cribbing, because it is particularly hard and able to withstand heavy weight. If they are in good condition, 6-inch by 6-inch (140 millimeter by 140 millimeter) oak blocks can handle extreme weights
- Never use soft wood; it can easily split, chip or weaken under heavy loads
- All blocks used for a job must be the same size for stability
- Inspect blocks before each use
- Look for defects such as splits and rounded edges

Jack stands are appropriate for blocking on firm, level surfaces, such as concrete. Before using a jack stand for blocking, always inspect it for damage to ensure it is in good condition and make sure the jack stand's weight rating is greater than the weight of the the load it will need to support.

General Precautions

- Always compare the weight rating of your lifting device to the weight of the load and do not exceed lifting device capacity
- Establish and maintain multiple blocking and cribbing support points as necessary for a stable base under raised equipment
- Raise and lower equipment and components slowly from a position of safety
- Equipment with functional onboard hydraulic systems may be used to lift equipment so blocking and cribbing can be placed
- Never rely on hydraulics to support attachments
- Whenever possible, move equipment to a place where the ground is firm and level because hard surfaces reduce the likelihood of settling, instability and equipment upset
    - When you absolutely must crib on rough or uneven ground, you need to level out the machine in a safe manner
- Whenever possible, you should place a jack on a hard surface such as concrete

- Jacks can also be placed on blocks on the ground
- If you must, you can use cribbing to lift by jacking stages

Safety Principles

Cribbing When Lifting by Jacking Stages

Whenever possible, you should place a jack on a hard surface, such as concrete. Jacks can also be placed on blocks on the ground. If you must, you can use cribbing to lift by jacking stages:

- Put as many tiers of cribbing as possible under the load before you lift it
- Build a crib for the jack, high enough for the jack to extend enough to lift the load
- Create a platform for the jack out of hardwood timbers. Place the platform in the center of the cribbing and make sure it provides a base at least one and half times as wide as the jack's footprint
- Place the jack on the platform and use the jack to lift the load enough so you can add an additional tier to the cribbing under the load; add the tier
- Repeat this process as many times as necessary

Cribbing on Rough or Uneven Terrain

When you absolutely must crib on rough or uneven ground, you need to level out the machine. The precise method you should use will depend on the exact nature of the terrain. You may not be able to determine exactly what you will need to level the machine until you are on site, so bring plenty of equipment.

Load Securement for Heavy Equipment

The North American Cargo Securement Standard was designed to ensure cargo transported on the highway remains on the vehicle carrying it. The Standard applies to commercial vehicles in the United States and Canada. It requires all cargo to be contained, immobilized or secured so it does not fall from or blow off the vehicle, leak, spill or shift so much that the vehicle's stability or handling is impaired.

Force Requirements

The securement requirements are based on the amount of forward, backward, sideways and upward force cargo is actually likely to experience.

- Cargo experiences the most force in the forward direction. This force is created from braking while driving straight ahead. In order to counteract this force, the securement system must be able to withstand force equal to 80% of the cargo's weight in the forward direction
- Cargo experiences a significant amount of backward force from activities such as accelerating, shifting gears while climbing a hill, or braking while backing. So, the securement system must be able to handle force equal to 50% of the cargo weight in the rearward direction
- When a vehicle turns, changes lanes or brakes while turning, a significant amount of force pushes cargo to the side. So, the securement system must be able to restrain sideways force equivalent to 50% of the cargo's weight
- Cargo experiences some upward force when the vehicle hits a bump or crests over a hill. So, the securement system must be able to withstand force equivalent to 20% of the cargo's weight

Securement Systems

A securement system involves at least one of three elements: vehicle structure, securing devices, or blocking and bracing equipment. These elements may be used alone or in combination.

Vehicle Structure

Vehicle structural elements include:

- Floors
- Ramps
- Anchor points

Before loading heavy equipment on a trailer, inspect each structural element. The vehicle's structural elements must be able to support the weight of the equipment as well as forward, backward, sideways and upward forces of the equipment and securement system.

Securing Devices

A securing device is designed to attach or secure cargo to a vehicle or trailer. Securing devices include, but are not limited to chains, binders, hooks, clamps, latches, blocking and bracing. We must use a combination of devices to form tiedowns and secure the load.

Tiedowns are securing device assemblies that attach to one or more anchor points and secure the cargo.

Blocking and Bracing

Heavy equipment can potentially split or crush inadequate securement materials. Make sure sufficiently strong materials are used for blocking, bracing, chocks and cradles. If you use wood materials for blocking and bracing, use hardwoods and make sure the wood is properly seasoned and the grain runs lengthwise. Inspect the wood to make sure it is free from:

- Rot
- Decay
- Knots
- Knotholes
- Splits

Loading and Unloading

Loading

Before you load heavy equipment, check the vehicle and trailer. Complete a walk-around inspection, looking for any damage or leaks. Keep the weight of the equipment evenly distributed and aligned on the trailer. Once the machine is properly loaded, lower all attachments or implements. Set the parking brake and shut off the machine. Chock the wheels and tie down the machine to prevent it from rolling. Be on the lookout for **low-friction situations**, such as metal tracks on a metal trailer.

Unloading

When receiving heavy equipment, you should complete an initial inspection before unloading it. Look for any water or oil leaks and check the overall condition of the equipment. Low friction means low traction. Go slowly anticipating wheel or track spin. Immediately reduce power at first indication of spinning to prevent side shifting that can send equipment off the side of the trailer.

Receiving

When receiving heavy equipment, you should complete an initial inspection before unloading it. Look for any water or oil leaks. Check the overall condition of the equipment. Talk to the driver to gather any additional information about the equipment. If the equipment is new or a rental, make sure you identify any damages and document them on the bill of lading.

Tiedowns

The strategic placement of properly rated tiedowns helps you meet the “force” standards, which counteract any forward, backward, side-to-side and vertical movement of the cargo. When you secure a front-end loader weighing approximately 20,000 pounds, the securement system should be capable of withstanding:

- 80% or .8 g forward force of 16,000 pounds
- 50% or .5 g rear and sideways force of 10,000 pounds each
- 20% or .2 g upward force of 4,000 pounds

You determine the number of tiedowns according to the weight of the equipment and the rated strength of the tiedown. A **working load limit**, or WLL, is the maximum load that can be safely applied to a securement system component. A tiedown’s WLL is only as great as the smallest

WLL among its parts and the anchor points to which it is attached. The securement system must have a WLL equal to at least half the weight of the cargo it secures. If you need to eliminate cargo movement completely, use greater tiedown capacity.

A minimum of 4 tiedowns must be symmetrically attached to the front and rear of the equipment or to mounting points on the equipment. Ideally, the angle of the tiedown should be less than 45 degrees for direct tiedowns and greater than 45 degrees for indirect tiedowns. Additional tiedowns may be needed.

The combined WLL of all the devices used to secure cargo is called the **aggregate WLL**. A securement system's aggregate WLL must be at least half the weight of the cargo it secures. Suppose a machine weighs 40,000 pounds and each tiedown has a working load limit of 4,000 pounds. The aggregate working load limit of the securement system must equal at least 50% of 40,000, which is 20,000 pounds. If you divide 20,000 pounds by 4,000 pounds, you'll see you need 5 tiedowns to give you the aggregate working load limit of 20,000.

Loads exceeding 8.5 feet (2.59 meters) in width are **oversized loads**. Equipment this large may present overweight issues. Refer to state-specific requirements concerning permits, flagging, warning lights, escort vehicle, and other transportation considerations.

Inspections

The driver must inspect the cargo and securing devices before driving, within the first 50 miles (80 kilometers), whenever the driver's duty status changes, and at 3-hour intervals or every 150 miles (240 kilometers), whichever comes first. If the cargo is in danger of shifting or falling, you should adjust the securing devices, add additional securing devices or perform a combination of these adjustments.

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	– 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	– 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	– 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	– Do not work under objects moved or supported by cranes (includes concrete buckets and pre-cast concrete panels)
Personal protective equipment (PPE)	– 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	– 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	– Handles must not extend beyond the wheels on either side
Tremies/Hoppers	– Secure with wire rope in addition to regular connections
Bull floats	– Non-conductive or insulated handles reduce risk of electrical shock
Masonry saws	– 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	– 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.

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	• Remove nails before stacking • Stack and level on solidly supported bracing • Should be stable and self-supporting
Bricks	• 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	• 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	• Band or hold in place using cross-ties or shrink wrap
Drums and barrels	• 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	• Some cannot be stored together; check with your supervisor or general contractor if you are unsure
Combustible materials	• Store away from areas in which workers are welding or doing hot work
“Unstackable” materials	• Unstackable materials (due to size, shape or fragility) may be safely stored in cargo containers or bins
Cylindrical materials	• Example: structural steel, bar stock, poles • Stack and block
Pipes and bars	• Do not store in racks which face walkways

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

Rough Terrain Forklift Safety - Part 1: Readiness

Rough terrain forklifts are complex machines that require careful preparation to ensure worksite safety. They have:

- Forks to lift loads from the bottom
- Vertical mast
- Pivoted variable/fixed boom
- Cab with overhead guards
- Combustion engine
- Tires for rough terrain
- Variety of steering modes

Personal Readiness and Training

Many regulators require hands-on training for rough terrain forklift operators. During hands-on training, you will learn about specific equipment:

- Operating controls
- Labels
- Warnings
- Capabilities and limitations
- Manuals and standards
- Jobsite hazards

Operators should be rested, alert and free of impairment (medications, alcohol, drugs, etc.).

Area Readiness

Survey the area and identify, mark and address potential hazards:

- Low overhead clearances are collision hazards you should identify and avoid
- Power lines are collision/electrical hazards
    - Minimum 3 meters (10 feet) approach to 0-50KV lines
    - >50KV require more distance
    - Use flag lines and spotters
- Soft soils, unprotected drop-offs and obstructions/debris are tipping hazards
    - 0.6 meters (2 feet) separation from edges/obstructions (mark or barricade)

Weather

Gusty or sustained winds are tipping hazards that may cause load swing and dangerous side loads. Suspending lift operations is required when wind speeds ≥ 24 kph (15 mph, 13 Knots).

Wet, dark or foggy conditions reduce visibility (increasing risk of collisions) and require operating at slow speeds or suspending operations.

Additional Hazards

- Plan lifts during low traffic periods, barricade lifting areas, and assign signalers to avoid collisions with pedestrians/vehicles
- Use equipment that is specially approved for flammable or combustible atmospheres to avoid explosions
- Ensure adequate ventilation and avoid idling the engine in enclosed areas to prevent carbon monoxide poisoning

Critical Lift Plans

Work with your supervisor or safety professionals to develop critical lift plans if you cannot resolve hazards or you have other serious concerns.

Equipment Readiness

Inspect equipment at least once each day and follow your company's procedures for inspection and documentation. **Immediately remove equipment from service and report damages and unsafe conditions.**

During visual inspection of the rough terrain forklift, check for:

- Damage
- Fluid leaks
- Loose or missing parts
- Cracked or bent forks
- Illegible load charts and labels
- Improper tire condition and pressure

Perform operational inspections on firm, level ground that is away from hazards. Slowly test controls and functions:

- Horn, backup alarm, mirrors, lights
- Lift and tilt systems
- Load-engaging means
- Boom angle and chassis level indicators
- Brakes and steering

Load Capacity

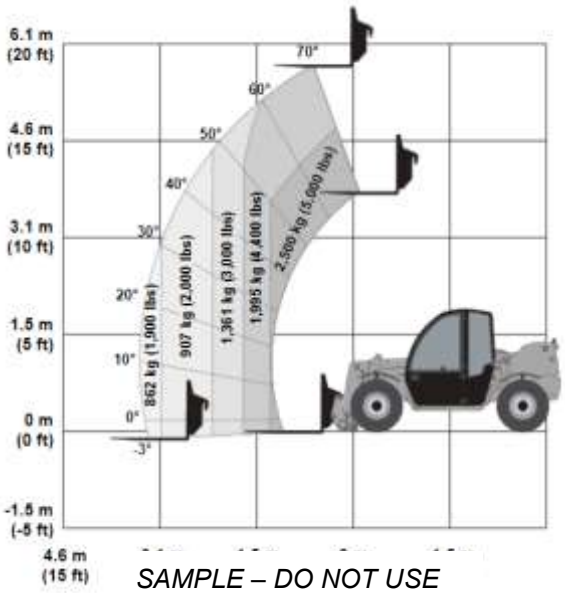
Overloading is a common cause of tip-overs. The load capacity is the amount of weight a rough terrain forklift can lift safely when:

- On firm ground with the frame level
- Forks are positioned evenly on the carriage
- Load is centered on the forks
- Proper size tires are properly inflated
- Lift is in good operating condition

The equipment may tip if it is deficient in ANY of these aspects.

Using a Load Capacity Chart

1. Determine weight of the load you plan to lift.
2. Determine the location at which you want to place the load:
    - Use the X-axis to find the HEIGHT at which you will place the load
    - Use the Y-axis to find the DISTANCE from the front tires to where you will place the load
3. Find the point at which the height and distance meet.
4. Determine the limits of the load zone:
    - The load zone in which the height and distance meet is the maximum weight capacity for the lift
    - If the height and distance cross at a division between zones, use the smaller number



SAMPLE – DO NOT USE

IMPORTANT: The number in the load zone must be greater than or equal to the weight of the load to be lifted.

Rough Terrain Forklift Safety - Part 2: Operation

Improperly prepared and operated rough terrain forklifts can result in collisions, tipping and losing loads.

Starting the Rough Terrain Forklift

Before starting the rough terrain forklift shift to neutral, set the brakes and fasten your seat belt.

Avoid Collisions

As you move:

- Look in the direction of travel
- Be aware of where your view is obstructed
- Travel with the load trailing or use a spotter
- Slow down and sound the horn at intersections and when your vision is obstructed
- Ensure adequate clearance for rear tail and front fork swing
- Stay inside of the operator's compartment (avoid being pinned/crushed)
- Do NOT stand or pass under parts of the rough terrain forklift
- Heavy loads dropped from a distance may injure you, even in the cab

Preventing Tip-Overs

Tip-overs may be more likely due to:

- Unstable surfaces
- Rocks
- Potholes
- Load or boom raised
- Operating near capacity

Under- and over-inflation increase risk of tire failure and tip-over. Maintain manufacturer recommended tire air pressure.

Slopes and Grades

When **loaded**, travel with the load upgrade. When **unloaded**, keep load-engaging means downgrade.

When you ascend or descend a grade:

- Keep loads low and tilted back
- Downshift to a lower gear
- Engage four-wheel drive

To prevent tip-overs, **avoid:**

- Speeding
- Abrupt movements/braking
- Tight/fast turns
- Turning on slopes
- Driving with the load raised

If the rough terrain forklift begins to tip:

1. Brace yourself.
2. Lean away from the impact.
3. Stay in the cab.

Lifting

Before lifting, consult the manual, load capacity chart, and data plate for safe lifting practices and load capacities for the rough terrain forklift you will operate.

Before lifting:

1. Stop on a stable surface.
2. Set the parking brake.
3. Shift the transmission into neutral.
4. Level the forklift.
5. Lift the load.

Leveling

Use leveling functions and outriggers to improve stability, if possible.

Never lift a load more than 1.2 meters (4 feet) above the ground unless the rough terrain forklift is completely level at 0°, unless otherwise noted on capacity chart.

Lifting without leveling leads to tip-overs.

Never make leveling adjustments with the load raised more than 1.2 meters (4 feet).

Watch for changes in footing or shifting conditions.

After the load is in the air, bring the load back down before re-leveling the rough terrain forklift.

Parking

When the lift is complete:

1. Retract the boom.
2. Lower forks to the carry position.
3. Park on a flat surface where you will not block fire aisles, stairways or safety equipment.
4. Place directional controls in neutral.
5. Apply the parking brake.
6. Position forks or attachments flat on the ground.
7. Turn off the engine.
8. Remove the key to prevent unauthorized operation.

Preventing Back Injury

The back protects the spinal cord nerves and anchors the legs, hips, ribs, arms and head. When there are back problems, these connected areas can be affected as well. The opposite is also true; issues with connected parts can stress the back

How the Back Works

- **Spinal nerves** carry motor, sensory and autonomic signals between the spinal cord and the body
- The **spinal cord** extends from the brain. It has three major functions:
    - Transporting motor information
    - Conducting sensory information
    - Coordinating certain reflexes
- The spine has interlocking bones called **vertebrae** that are held together by the muscles of the back and abdomen, often called core muscles
- Vertebrae are separated by **discs**, which act as cushions

Types of Injuries

Common injuries include:

- Strain and fatigue
- Fractured vertebrae
- Spinal cord nerve injury
- Pressure on nerves
- Tears in discs
- Disc fractures and ruptures
- Weakness

Risk Factors

Conditions that can increase the chance of an injury:

- Aging
- Poor physical fitness
- Body weight
- Strength
- Flexibility
- Physical stress
- Bad posture

Aging

- Degeneration of the spine
- Inappropriate alignment
- Loss of strength

Physical Condition

- Strong and flexible muscles and joints reduce your risk of injury
- Weak ligaments and muscles may cause discs to be susceptible to injury
- Strong core muscles will add extra support when handling objects
- Excess body weight puts extra strain on your back
- Excess body weight can cause damage because the back operates on a 10:1 ratio

Physical Stress

- Unwanted physical strain or pressure put on the body
- Stress may keep our muscles in a state of tension or contraction
- Stressed muscles are more susceptible to strains, sprains and spasms

Bad Posture
Posture is the balance and alignment of your body.
- “S” or curved shape is the natural position of the spine
- Improper posture leads to musculoskeletal problems

Causes of Injuries
Identifying and understanding the following causes can be your best defense in preventing injury.

Overexertion
- You overexert your back when you strain or fatigue it
- Overexertion can compromise posture, lifting technique and balance - all of which can lead to injuries
- Limits for overexertion depend on the individual's risk factors
- Signs of overexertion include spasms and pain
- Don't ignore the physical limitations of the body

Improper Lifting
- Bending over
  - Using only your back muscles strains the back
- Unnatural body position, like reaching above shoulder height
  - Causes tension and overexertion
- Twisting
- Holding objects away from the body's center
- As the object moves farther from the body, the applied weight of the object and necessary exertion increase

Poor Environmental Conditions
Environmental conditions are the physical surroundings and situations. Potential hazards include:
- Path of travel
  - Wet floors
  - Uneven surfaces
- Arrangement of workplace
  - Reaching above shoulders or below knees increases risk of injury

Prevention
The following can prevent a back injury from occurring.

Proper Lifting Techniques
1. Assess the situation: What are you lifting and from where? Is your path clear? Are you ready? 2. Test the weight of the object; if it’s too heavy, get help or use a mechanical device
3. Bend your knees. Get a good grip. Tighten the muscles in your arms, legs and abdomen.
4. Look straight ahead. Hug the object. Turn with your feet; don’t twist at the waist.

When you lift bagged items, crouch over them with one leg braced and another kneeling. Lean the bag onto the kneeling leg, then slide it up to the braced leg. As you stand, keep the bag close to your body.

Carrying

When you carry items:

- Wear appropriate gloves (gloves with rubber dots may improve grip while loose/thick gloves may make it hard to grip)
- Use handles, grips and handholds, if they are available
- If you use one hand, alternate between left and right
- Pad your shoulders if you carry loads on them

Proper Equipment

- Adjust your workplace (follow principles of good ergonomics)
- Wear comfortable shoes with slip-resistant heels and soles
- Use mechanical aids when lifting heavy or bulky objects
- Get help from a co-worker

Personal Prevention Strategies

- Maintain good posture
  - Don't slump, slouch or hunch over
- Outside work:
  - Exercise
- Sleeping:
  - Use a firm mattress
  - If you sleep on your side, keep knees slightly bent with a pillow between them
  - If you sleep on your back, keep a pillow under your knees
  - Avoid sleeping on your stomach with your head resting on a stack of pillows
- Reduce stress
- Know the facts about back injuries
  - Injuries are cumulative
  - Don't ignore minor back pain

Before you work and throughout your day, make time to stretch to reduce muscle fatigue and maintain flexibility.

NOTE: Stretching should provide muscle relief. If you feel more than a brief twinge of discomfort, or if you feel numbness or tingling, you may have an injury. Do not force movement. Instead, stop and consult a physician.

Strengthening the Back

- Exercises that stretch and strengthen the muscles of your spine can help prevent back problems
- If your back and abdominal muscles are strong, you can maintain good posture and keep your spine in its correct, most natural position
- Do exercises even if you've worked a long day

Injury Response

Most minor strains will go away in time if you stay limber and active. If you suffer an injury or if your back pain includes numbness or tingling anywhere on your body, you should see a medical professional.

Remember to:

- Report the injury to your supervisor immediately
- Follow workplace policies regarding medical care and/or treatment
- Follow medical advice about medications, treatment and physical activities

Lifting Technique Checklist

Ask a supervisor or co-worker to observe your lifting technique to identify what you are doing right and what you can improve upon using the checklist below.

IMPORTANT: These lifting techniques are only for lightweight loads that can easily fit between your knees. Ideally, you should lift from a position higher than the floor.

Boxed Items

Yes	No	Observation
☐	☐	Pre-lift stretching complete
☐	☐	Bent the knees, not the back
☐	☐	Tested the load before lifting
☐	☐	Good grip
☐	☐	Lifted close to the body
☐	☐	Pushed up with legs
☐	☐	Stood, keeping the bag close to the body
☐	☐	Looked straight ahead while moving
☐	☐	Turned with feet, not waist

Bagged Items

Yes	No	
☐	☐	Pre-lift stretching complete
☐	☐	Crouched over the bag with one leg braced and another kneeling
☐	☐	Tested the load before lifting
☐	☐	Good grip
☐	☐	Slid the bag onto kneeling leg and then over to the braced leg
☐	☐	Stood, keeping the bag close to the body
☐	☐	Looked straight ahead while moving
☐	☐	Turned with feet, not waist

Comments

Housekeeping on the Job

Housekeeping includes maintaining order, keeping things in designated spaces and ensuring that areas are neat and clean.

Effects and Benefits

Hazards of poor housekeeping include:

- Trips, slips or bumps into items
- Non-secure items falling
- Pest attraction
- Protruding item injuries
- Fires and chemical exposures
- Hazards concealed by clutter
- Wasted time and unsafe shortcuts
- Underestimation of hazards

Good housekeeping:

- Improves safety
- Reduces fire hazards and pests
- Boosts morale
- Saves time and effort
- Shows high standards and a commitment to quality and safety
- Attracts and pleases customers
- Is part of regulatory requirements

Planning and Inspection

- Document inspections with formal checklists
- Install and secure anti-slip **flooring** in areas that get wet or are difficult to clean
- Replace worn, ripped or damaged flooring
- Avoid placing cords and cables where people could trip over them
- Extension cords are for short-term use (consider installing a new receptacle instead)
- Make sure **aisles, stairs** and **platforms** are well-lit, clean, uncluttered and repaired
- Make sure aisles are wide enough to safely accommodate people/vehicles/materials
- Install warning signs and mirrors at blind corners
- Keep **walls** and other **painted surfaces** clean to reflect light
    - Make sure **safety paint** (such as yellow for hazards and obstructions) is clean and clearly visible.
- Prevent **spilled liquids**, which can cause slips, material damage and health hazards
    - Use appropriate containers
    - Keep lids closed when they aren't in use
    - Use secondary containers, as needed
    - Consult the Safety Data Sheet (SDS)
- Clean and maintain **machines** and **equipment** regularly
- Use drip pans, guards and oil pans where drips, leaks and spills are likely
- Be aware that materials such as dust, oil and fibers on electronics and motors can lead to overheating and fires
- Replace burned-out light bulbs immediately for security and safety
- Replace or fix items such as broken windows, damaged doors, defective plumbing and damaged flooring as quickly as possible

Designated Areas

Select **storage areas** that are convenient without compromising work or safety. Never allow stored materials to obstruct emergency equipment, first aid stations, aisles, stairs or exits. Make sure the area around sprinkler heads and electrical panels is clear. Take only the materials you need for the task at hand to your work area.

Keep **eating, drinking and smoking areas** away from flammable or toxic materials. Clean eating and drinking areas at every shift. Food and beverage waste can produce unpleasant smells and can also attract pests. Never smoke in any non-smoking areas; look for signage to indicate where you may or may not smoke. Designated smoking areas help protect air quality, prevent fires, and prevent chemical inhalation or ingestion. After they cool, empty ash receptacles regularly to prevent fires.

Maintain clean, sanitary **washrooms and other sanitary facilities** to protect health and safety.

Organization and Storage

- Set up suitable fixtures with marked locations for tools
- Put tools away immediately after using them
- Stack pallets horizontally so they won't fall
- Limit pallet stacking height (fire hazard)
- Keep vehicle interiors free of clutter
- Clearly mark all storage areas
- Keep storage areas clean and organized
- Keep storage doors and drawers closed
- Store frequently used items between knee and shoulder height

Cleaning

When a spill occurs, clean it up right away following the safety guidelines of your employer and the Safety Data Sheet (SDS) of the material. Safely dispose of used cleaning materials and use signs to alert people to wet floors, as needed.

NOTE: Never clean up any hazardous substance without the appropriate training and equipment. You may receive specialized training about hazardous waste disposal.

Don’t allow combustible waste materials to build up; remove them. Discard oily rags in covered metal containers. Keep hot areas particularly clean and never store combustible materials there. Make sure nothing ever blocks the ability of a fire door to close completely.

Dust, Dirt and Chips

- Enclosures and exhaust ventilation systems can collect dirt, dust and chips
- Use gloves and other protective equipment to protect against splinters/cuts
- Use a standard vacuum cleaner, broom or mop to remove light dust or dirt
    - If you mop, use warning signs to alert your co-workers to the wet floor
    - Dampen floors before sweeping to reduce airborne dust
- Industrial vacuum cleaners are appropriate for heavier jobs or areas such as walls, ceilings, ledges and machinery
- Special-purpose vacuum cleaners and training are needed to clean up combustible dusts and other hazardous substances
- **Do not use compressed air on dust, dirt or chips**
    - It is ineffective and may result in clouds of combustible dust
    - Airborne particles may get into your eyes, strike you or you may breathe them in

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

Stepladders 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 upgrade
- 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

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

Walking/Working Surfaces

Slips and falls on walking and working surfaces are a major source of workplace accidents. Elevated platforms, runways, ladder rungs, stairs, steps, scaffolds and outdoor areas are commonly overlooked walking and working surfaces. Wear shoes with soles suitable to working conditions.

Housekeeping

Housekeeping is an important factor in all work environments and plays a vital role in maintaining a safe workplace. Keeping walking and working surfaces tidy can prevent people from slipping, tripping or falling due to clutter or slick surfaces.

Walkways and Floors

Keep aisles clear and in good repair. Aisles should be sufficiently wide where mechanical handling equipment is used. Use covers or guardrails to protect personnel from the hazards of:

- Open pits
- Tanks
- Vats
- Ditches

Floor Loading Protection

Do not place a load on the floor or roof of a building or other structure if the load is heavier than the load rating limit. Check with your supervisor if you are concerned about heavy loads that you need to place in or carry through an area.

Ladders and Steps

Portable Ladders

Maintain ladders in good condition. Inspect ladders frequently and before each use, and withdraw them from service if they have defects.

- Tag or mark defective ladders as “Dangerous, Do Not Use”

Place ladders on level, solid ground unless you secure or stabilize them to prevent accidental displacement. Secure any ladder that must be placed on a slippery surface. If you use a ladder to access a roof or other area, make sure it extends at least 3 feet (0.9 meter) above the point of support.

When climbing or descending a ladder:

- Face the ladder
- Keep both hands on the ladder
- Do not carry objects that can interfere with your ability to grasp the ladder
- Remember that the top of a regular stepladder is not safe for standing

Fixed Ladders

It’s common to find cages and wells on tall ladders, but these protections are often ineffective at stopping falls. Newer ladders have systems that stop or prevent falls. A ladder safety device is any device, other than a cage or well, designed to eliminate or reduce accidental falls and

may incorporate such features as friction brakes and sliding attachments. Landing platforms provide a means of interrupting a free fall and serve as a resting place during long climbs.

Step Bolts and Manhole Steps

- Step bolts and manhole steps must be uniformly spaced and in good condition
- Do not exceed the maximum intended load
- Inspect each step visually before use; report any issues, such as a bent or missing step, or if you slip or lose your grip

Stairs and Steps

Standard stairs provide access from one walking-working surface to another when operations necessitate regular and routine travel between levels, including access to operating platforms for equipment. When using stairs and steps:

- Keep a clear view of your footing
- Make sure you have good lighting so you can easily see the next step
- Keep a hand free to grab the stair railing if you lose your footing
- Don't carry anything that keeps you from seeing the next steps
- Know that wet or slippery shoes are as dangerous as a wet or slippery surface

Scaffolds

- Follow the specific safety guidelines for the type of scaffold you use
- The footing or anchorage for scaffolds or planks must be sound, rigid and capable of carrying the maximum intended load without settling or displacement
- Maintain scaffolds in a safe condition; do not use damaged or weakened scaffolds
- Do not alter or move scaffolds while they are in use or occupied
- Install guardrails, midrails and toeboards on all open sides and ends of platforms more than 10 feet (3 meters) above the ground or floor; install wire mesh between the toeboard and the guardrail along the entire opening where persons are required to work or pass under the scaffolds

Dock boards and Ramps

- Secure loading ramps and dock boards (bridge plates) to prevent slipping
- Newer dock boards have raised edges on the sides to prevent accidental runoff
- Use handholds on portable dock boards to permit safe handling when the dock board must be repositioned or relocated

Falls and Falling Objects

Open-sided work platforms and surfaces present a risk of falls to lower levels or falls onto or into dangerous equipment. Prevent or stop falls with:

- Guardrails
- Work positioning
- Restraint systems
- Safety nets
- Personal fall arrest systems

Guarding Floor Holes and Wall Openings

Terms

- Handrail: A single bar or pipe supported on brackets from a wall or partition, as on a stairway or ramp, to furnish persons with a handhold in case of tripping
- Stair railing: A vertical barrier erected along exposed sides of a stairway to prevent falls
- Standard railing: A vertical barrier erected along exposed edges of a floor opening, wall opening, ramp, platform or runway to prevent falls
- Toeboard or screen: A vertical barrier at floor level erected along exposed edges of a floor hole, wall opening, platform, runway or ramp to prevent tools or materials from falling over the edge

Holes

Holes are any opening measuring 2 inches (5 centimeters) or more in its smallest dimension, in any floor, roof, horizontal walking/working surface or other similar surface. Examples include:

- Hatchways
- Stair or ladder openings
- Pits
- Large manholes
- Cutouts for skylights
- Floor cutouts and drilled holes for pipes or ductwork

Guarding

- Stairway floor holes should be guarded by a standard railing on all exposed sides (except at the entrance to the stairway)
- Ladderway floor holes should be guarded by a standard railing with a standard toeboard on all exposed sides (except at entrance to hole), with the passage through the railing provided with a swinging gate or so offset that a person cannot walk directly into the hole
- Skylight floor holes must be guarded by a standard skylight screen or a fixed standard railing on all exposed sides (use fall arrest, travel restraint and hole covers if screens or railings are not present)
- Every hatchway and chute floor hole must be guarded by one of the following:
    - Hinged floor-hole cover and a fixed guardrail system that leaves only one exposed side
    - A removable railing with toeboard on no more than two sides of the hole and fixed standard railings with toeboards on all other exposed sides
    - When operating conditions necessitate the feeding of material into any hatchway or chute hole, use guardrails or a travel restraint system to avoid falling through the hole.

Wall Openings

A wall opening is a gap or open space in a wall, partition, vertical walking/working surface or similar surface that is at least 30 inches (76 centimeters) high and at least 18 inches (46 centimeters) wide through which a worker can call to a lower level.

Guarding

- Employers must provide protection on walking/working surfaces near openings if the inside bottom edge of the opening is less than 39 inches (99 cm) above the walking/working surface and the outside bottom edge of the opening is 4 feet (1.2 meters) or more above a lower level
- A **hoist area** is an elevated access opening to a walking/working surface through which equipment or materials are loaded or received. Protect falls of 4 feet (1.2 meters) or more above a lower level with guardrails, gates or chains. Use additional protections if guards are removed and a worker must lean through or over the edge of the access opening to facilitate hoisting.

Platforms, Runways and Open-Sided Floors

- Platform: Working space for people that is elevated above the surrounding ground level
- Runway: Passageway for people that is elevated above the surrounding ground level

Open-sided Floors or Platforms:

- When 4 feet (1.2 meters) or more above an adjacent floor or ground level, must be guarded by a standard railing on any open side (except where there is entrance to a ramp, stairway or fixed ladder)

Runways:

- May have the railing on one side omitted where operating conditions necessitate such omission, providing the falling hazard is minimized by using a runway of 18 inches (46 cm) wide or wider; and
- Each employee must be provided with and use a personal fall arrest system or travel restraint system
- NOTE: Personal fall arrest systems are not sufficient protection against short falls into dangerous equipment; guardrail protection is needed

Stairways, Railing and Toeboards

Every **flight of stairs** that has at least three treads and four or more risers must be equipped with standard stair railings or handrails and the width of the stair should be made clear of all obstructions except handrails.

A **standard railing** must consist of a smooth-surfaced top rail, intermediate rail and posts.

- Anchoring posts and framing of members for railings of all types must be constructed correctly, leaving the completed structure capable of withstanding a load of at least 200 pounds (91 kilograms) applied in any direction at any point on the top rail

Handrails must be mounted so that the completed structure is capable of withstanding a load of at least 200 pounds (91 kilograms) applied in any direction at any point on the rail.

A standard **toeboard**:

- Must be 3 ½ inches (8.8 cm) tall from its top edge to the level of the floor, platform, runway or ramp
- Should be securely fastened in place with no more than ¼-inch (0.6-cm) clearance above floor level
- May be made of any substantial material, either solid or with openings not over 1 inch (2.5 cm) in greatest dimension

Where **doors or gates** open directly on a stairway:

- The stairway must have a platform
- The swing of the door must not reduce the effective width of the platform to less than 22 inches (56 centimeters)

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/manufacturer 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 ¼ 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

Crane Operator Safety

Worksite Preparation

- Determine safe site access
- Investigate support surfaces
  - Use blocking and cribbing
  - Ensure level surfaces
  - Be aware of hidden or invisible hazards like underground tanks
  - Near an excavation with vertical sides, never allow the crane to get closer to the gap than the depth of the excavation (for loose soil, the depth × 1.5)
- Check for utility lines and transmitters
  - De-energize transmitters
  - Choose synthetic taglines to reduce the risk of shock
  - Allow a minimum clearance of 60 cm (2 ft) around all objects
- Arrange the work area
  - Use signs/barricades/signalers
  - Control public access
  - Wear high-visibility clothing
- Set up the crane appropriately
  - Maintain equipment
  - Check for corrosion/damage/wear-and-tear
  - Ensure that adequate space is available for the crane to be assembled and operated safely

Equipment Around Power Lines

When working near overhead lines:

- Survey the work area for hazards
- Locate equipment/activities a safe distance from power lines
- Notify the owner before work begins
- Consider a line energized unless the power company confirms it is not AND it is visibly grounded
- Ensure flagged warnings are in place to mark horizontal and vertical clearance distances
- Use tag lines only when the load might spin into lines, and use polypropylene instead of wire rope
- Observe clearance minimums
- Use non-conductive tools

Be sure the utility company has confirmed the voltage and safe working distance from the power lines. Also, if crane work activities come within 6 meters (20 feet) of lines, you will need:

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

Learn about specific precautions to follow where you work.

Emergency Procedures for Power Line Contact

- Stay in the crane except in cases of fire or arcing
- If necessary, jump clear of the crane

- Do not touch the crane and the ground at the same time
- Take small steps; shuffling away with your feet together and on the ground will minimize the potential for electric shock
- Avoid touching the crane or load
- Be aware that power may go off and on
- Break contact if safely possible

Minimum Clearance Distances

Voltage (nominal, kV, alternating current)	Minimum clearance distance
Up to 50 kV	3 meters (10 feet)
Over 50 to 200 kV	4.5 meters (15 feet)
Over 200 to 350 kV	6 meters (20 feet)
Over 350 to 500 kV	7.6 meters (25 feet)
Over 500 to 750 kV	10.6 meters (35 feet)
Over 750 to 1,000 kV	13.7 meters (45 feet)
Over 1,000 kV	Must be established by the power line owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution

Operation

Avoid **tipping** by never exceeding limits specified on the load chart and range diagram and using outriggers. Maintain visibility of the boom and load block and use a signal person, as needed.

Signaling

- Make sure hand signaler is visible
- Repeat and confirm voice commands before operation is performed
- Stop operations if:
    - A "Stop" command is given
    - More instructions are needed
    - Instructions are misunderstood or unclear
    - Operator is unable to see/hear the signaler

Special Operations

Review safe operations and practices for special operations, such as:

- Pick and carry
- Clamshell and dragline
- Pile driving and drilling shafts
- Demolition work
- Barge work and turning a load
- High-voltage scrap magnets

Conditions Affecting Operations

There are certain conditions that can affect the normal course of operations. The most common of these are the environment, side loading, dynamic loading, and equipment condition.

Cold and freezing temperatures:

- Reduce crane strength
- Increase load weight

- Freeze parts to ground

Wind:
- Increases load instability at higher levels
- Causes power lines to swing

Water and wet conditions:
- Affect mechanical parts
- Alter load weight
- Obscure and weaken support surfaces

Extreme temperatures:
- Cause power lines to sag

Poor visibility:
- Slows down operations
- Masks obstructions
- Obscures hand signals; use voice signals instead

Side loading:
- Must be limited to the amount caused by a freely suspended load
- Capacity must be reduced for loads not listed in the load chart
- Never deliberately pull or drag a load sideways

Dynamic loading:
- The faster you move, the more dynamic forces you create
- The greater the weight of the load, the greater the dynamic load
- The faster the speed of operation, the greater the dynamic load

Crane Terms

Ball	Used in conjunction with the boom hoist drum to change the crane's boom angle
Block	The block contains the pulleys and the hook that attaches the load to the crane
Blocking	The placement of wooden blocks, other designated blocking materials, or jack stands under equipment and components to keep them secure and stable
Boom	The "arm" that extends to give the crane the ability to lift a load over an area
Boom point	Where the jib connects to the boom
Cab	The operator’s compartment on a crane
Clutch	A device for the engagement or disengagement of power
Cribbing	The placement of a machine or component onto alternating tiers of blocks that act as a support base to create stability
Dragline bucket	Dragline attachments are used to excavate or hoist material that is below the grade on which the crane is placed, such as underwater
Drum (winding drum)	The cylindrical object that the hoist wires wrap around to raise and lower the load

Dynamic loading	Extra force applied to the crane that is not accounted for in the load chart. The forces produced by wind, swinging the load, and abrupt stopping are examples of dynamic loading.
Extension	A boom extension or "fly." Generally weaker than the main boom.
Float	A rigid support that attaches to an outrigger to spread the surface load weight
Fly jib	An extension attached to the boom for added length to carry the load. Also referred to as jib or boom extension.
Guy line	A tensioned wire cable used to support and stabilize the crane by counterbalancing
Hoist	The action of lifting and lowering the load
Holding line	The line that holds the load block
House	The house covers the machinery mounted on the upper revolving frame
Jib	An extension attached to the boom for added length to carry the load. Also referred to as fly jib or boom extension.
Jib backstay	Works with the strut to raise and support the jib
Jib strut	Works with the backstay to raise and support the jib
Load block	The block contains the pulleys and the hook that attaches the load to the crane
Lower	The portion of the crane located below the turntable bearing at the top of the crane tower
Lower sheave	A wheel with a groove for a wire rope to run on. The lower sheave is located above the hook
Outriggers	The parts of the crane that extend outward to stabilize it by increasing the footprint over which the load is carried
Pick and carry	The lifting of a load and traveling with it suspended
Power pin	Secures the connection of two booms or of a boom and jig
Reeving	The passing of ropes over pulleys or sheaves
Side loading	Using the crane to pull or push a load horizontally when the load is not free to swing with the crane
Slewing platform	The part of the crane that contains the cab and that allows the crane to rotate
Swing brake	Controls and stops excessive swing of the load lines
Tag line	The tensioned line that keeps the load in line with the crane and helps reduce swinging. Also, a rope used by personnel on the ground to help guide a load into place.
Upper	The portion of the crane located above the turntable bearing at the top of the tower
Upper sheave	A wheel with a groove for a wire rope to run on. The upper sheave is located at the upper rip of the boom or jig.

Crane Signaling Awareness

The person directing lifting operations (**Lift Director**) is ultimately responsible for the crane's work. The **crane operator** manipulates the equipment controls. The **signal person** directs crane movements using hand or voice signals. Only one person should give signals, except emergency stop, which anyone may give.

Crane signalers help crane operators avoid obstructions. The operations that crane signalers direct can affect crane capacity and the swing of the load. Operating crane safely truly is a team effort!

Effects of Crane Movement

Capacity: The boom and radius must be as short as possible to lift the maximum weight. Changing the crane position and extending the boom length and/or radius will decrease the capacity of the crane.

Dynamic Loading: Heavy or fast-moving loads take more time to stop than light or slow-moving loads. Signalers must give advance notice so that operators may stop loads gradually and safely.

Boom Deflection: Boom deflection means that as you apply lifting forces on a load, the boom bends down slightly. The rigging must be pulled tight and the boom must deflect completely before the load leaves the ground. When lowering the load, the signal person must ensure the boom is NOT deflected before it's safe to detach the load.

Stuck Loads: Lifting loads that are stuck can strain the crane or cause sudden movement that can lead to damage or tip-overs. Signalers must let crane operators know when they are trying to lift a stuck a load so that the operator knows what to expect.

Multiple Functions: Some cranes are unable to perform boom and hoist functions at the same time smoothly or safely. The signaler and operator must understand equipment limitations and plan accordingly.

Two Blocking: Two blocking occurs when the headache ball or hook block contacts the boom tip. It is especially common on telescopic boom cranes when telescoping the boom.

Side Loading: Side load occurs when the center of gravity of a load is not directly under the crane hoist. Too much side load can cause the boom to collapse.

Methods

Crane signalers communicate with crane operators using clear and constant standardized hand signals and voice commands. Prior to beginning operations, the team will meet to:

- Review the work plan and hazards
- State the crane capability/limitations
- Identify each other
- Agree on signals/commands

Hand Signals
Hand signals require:

- Positioning (same side of boom as operator)
- Visibility (distance, weather, light, etc.)
- Exact delivery

Voice Signals
Voice signals require:

- Tested systems (clear, reliable, dedicated channel, hands-free for operator)
    - Free of interference
    - Will not detonate remote explosives
- Clear, slow, deliberate words
- Directions given from the operator's perspective (operator's left/right)

Voice signals begin with an identifier when there is more than one crane. The signaler must then deliver voice commands in this standard order:

1. Function and direction.
2. Distance and/or speed.
3. Function stop.

Example: "North crane, swing right 10 meters. 5 meters…4…3…2…1. Load stop."

IMPORTANT: Anytime the operator cannot see, hear or understand the signaler, work should immediately stop.

Resources
Before work begins, a designated person will test signalers to make sure they have a basic understanding of crane operation and limitations and know standard hand/voice signals. **Hand signal charts** should be posted on the equipment or in the vicinity of hoisting operations.

Communication Barriers
Weather/Vision. Rain, fog and dust can impede the crane operator's ability to see a hand signaler. Wind can muffle radio operators' voices. The glare of the sun at certain positions may make it difficult for crane operators and signalers to see each other. Check forecasts and consider how weather and visual impediments may impact communications. Discuss these issues prior to beginning the work.

Language/Speech. If a voice signaler has a strong accent or speech impediment, it's important to ensure that the crane operator can clearly understand him or her. Consider using hand signals instead, if language or speech could cause confusion.

Interference. Other radio devices and lightning can cause radio interference. Hand signalers in busy areas may be distracted. It's important to test equipment and make everyone on the site aware of where signalers are located so that they can avoid distracting them or using devices that may interfere with their equipment.

Decisiveness/Confidence. If something doesn't seem right, people need to speak up and alert others to potential issues. Signalers must be able to make decisions with confidence and stop work, if needed. Signalers without these qualities can put people and property at risk.

Stop Work

EVERYONE has the responsibility and authority to stop work if they feel that unsafe conditions are present or if they do not understand directions.

The signal for an emergency stop is to extend both arms horizontally with palms down. Then, swing the arms back and forth.

The voice and hand signals for stops and emergency stops should be part of the pre-work briefing.

ANY interruption in communication between the crane operator and the signaler should result in an immediate stop.

The operator should stop crane movement to communicate or obtain clarification from the signal person, as needed.

Basic Rigging Principles – Part 1

Rigging is the process of moving heavy loads with slings, chains, hoists and other special tools. The equipment used for lifting and moving loads is also called rigging.

Rigging Equipment Basics

Chain

- Chain is used on hoists and as a sling to attach a load to a lifting device
- Chain has some disadvantages when compared to wire rope
    - Chain weighs more than a wire rope with the same capacity
    - Chain also has a lesser ability to stretch
- These disadvantages are balanced by a chain's ability to turn around tight corners without suffering undue wear or damage

Wire Rope

- Wire rope is different in construction than fiber rope
- The individual wires are wound into strands that are formed around a central core
- The core may be made of metal, plastic and, in some cases, natural fiber
- The core provides support for the outer strands during operation of the rope
- One 360° turn of the rope strands is called a "rope lay"

Fiber Rope

- One of the oldest tools used for rigging
- Not approved for use as a load-bearing rigging tool
- Should be used as a tagline to control the load after it has been lifted

Inspection and Service

- Riggers must inspect all rigging equipment before and after every job (frequent inspections)
- At intervals varying from a month to a year, rigging equipment must undergo more thorough checks (periodic inspections)
- Tool room personnel are often responsible for performing periodic inspections
- Periodic inspections differ from frequent inspections in two ways:
    - They are more thorough and time-consuming
    - Written records are kept to document the physical condition of each piece of equipment
- All documentation required by the inspection must be available to all inspectors performing required inspections

Rigging Equipment

Rigging equipment, in general, can be grouped into four categories:

- Lifting devices – chain hoists and come alongs provide lift
- Slings – short lengths of wire rope, chain or synthetic fibers used between lifting devices and connectors
- Connectors – hooks, eye bolts and shackles used to link different pieces of rigging together
- Adjusters – chain hoists and come alongs used to balance loads

Lifting Devices

- Hoists and come alongs work by providing a mechanical advantage
- Both are commonly used in rigging work

Chain Hoists

- Chain hoists use two chains during operation
- The load chain is attached to the load and is positioned by a special pulley through a reduction gear
- The reduction gear is operated by pulling on a hand chain
- Pulling in one direction will raise the load, and the opposite direction lowers the load
- The gear reduction provides smooth action and the mechanical advantage necessary to perform the lift

Come Alongs

- Come alongs are lifting devices operated with a handle instead of a hand chain
- They have a small body with a top hook, a long handle and a load chain with a hook
- They can be used for vertical lifts, horizontal pulls, or as adjusters for balancing a load
- A come along is much lighter and much smaller than a hoist of the same capacity
- The advantages are offset by some limitations:
    - Not available in very high capacities and most will not lift more than a few tons
    - Most have relatively short load chains, so they can only be used for short lifts
    - The jacking action is not smooth and this can cause problems

Inspecting Chain Hoists

- Manually operated chain hoists should undergo frequent inspections at intervals ranging from daily to monthly
- Periodic inspections of chain hoists are usually much more elaborate and can include disassembly of the unit for inspection of internal parts
- The periodic inspection consists of checks for:
    - Loose nuts, bolts or rivets
    - Cracked or damaged hooks (dye-penetrant or magnetic-particle tested)
    - Damaged hardware associated with the hook (collars, pins and retaining nuts)
    - Excessive chain wear or stretch (2.5% is the maximum allowable stretch)
    - Worn or damaged sprockets, shafts, gears, bearings or suspension bolts
    - Damaged anchor pins or bolts
    - Damage to brake mechanism (worn, glazed or oily friction discs, worn or damaged pawls, cams or ratchets)
    - Illegible or missing warning and rating labels
    - Damage to supporting structure or trolley, if used
- When the hoist is reassembled, it should be tested under load for proper chain feed and sprocket action
- Periodic lubrication should be performed according to the manufacturer's schedule

Slings

- Slings made from short lengths of wire rope, chain or synthetic fibers are used to attach the load to a lifting device and between lifting devices and connectors
- There are several methods to rig each type of sling; each method is called a "hitch"
- Note: Slings must have a capacity tag permanently attached to them

Chain Slings

- Chain slings must be constructed of alloy steel and have a permanently affixed identification and capacity tag
- The manufacturers' proof test certifications must be kept on file

- Chain slings must be thoroughly inspected at least annually; the inspection must be documented

Inspecting Chain Slings
- Periodic inspections begin with a visual check of each link for cracks, corrosion and wear
- Condemn the entire sling if there are any links that have cracks or do not hinge freely with adjacent links
- Attachments such as hooks and rings should be checked at the same time

Chain Sling Wear
- An exact determination of chain wear is obtained by measuring the diameter of the chain stock with a set of calipers or micrometer
- Measurements should be taken at several points along the chain, especially where the wear is most apparent to the eye
- The maximum acceptable amount of wear can be found in the manufacturer's chain wear table
- If the amount of wear exceeds the maximum allowable wear, the chain is no longer safe to use
- If a link is nicked, it can be ground down and smoothed out, as long as the amount of metal removed does not exceed the maximum wear figure

Chain Sling Stretch
- All chains can be expected to stretch a certain amount, but the maximum allowable stretch can be determined only by checking the manufacturer's specifications for the chain in question
- Most manufacturers list the maximum allowable stretch in terms of length
- A five-link section should be measured with a rule, and the measurement should be compared with the manufacturer's specifications
- If the measurement exceeds the specifications, the chain is no longer safe and must be destroyed so that it is not accidentally used

Wire Rope Slings

Inspecting Wire Rope Slings
- Wire rope slings must be visually inspected each day by the person who will be handling them
- The interval of periodic inspections is determined by a combination of factors, including the severity and frequency of use
- Remove wire rope from service when the following conditions exist:
    - Outside wires worn away to two-thirds of their original size
    - Evidence of heat damage or arc strikes
    - Corrosion
    - Kinking, crushing or birdcaging or any other damage resulting in the distortion of the rope structure
    - Cracked, deformed or worn attachments
    - Six randomly distributed broken wires in one rope lay or three broken wires in one strand in one lay

Care and Storage
- Wire rope slings are lubricated at the factory, and most of this lubricant will stay in place under normal conditions of use
- If wire rope slings are used in adverse conditions, then they should be lubricated at a frequency recommended by the manufacturer
- This can be accomplished by using any of these four methods:
    - Oil bath
    - Spray

- Drop and swab
- Brush

Fiber Slings

- Manufactured from a variety of materials
- Light and strong, but not as durable as wire rope or chain slings
- May be made with single-ply or multi-ply construction
- The ply (thickness), width and material all figure into the capacity of the sling
- Synthetic slings are more easily cut than wire rope or chain
- 29 CFR 1926.1404(r) requires that synthetic fiber slings must be protected from:
    - Abrasive, sharp or acute edges
    - Any configurations that might affect the sling's rated capacity

Inspecting Fiber Slings

- Periodic inspections must not be more than a year apart and should be more frequent if the sling is used especially often or under harsh conditions
- The first part of the inspection is a visual check for broken stitches, snags, punctures, cuts, acid or caustic burns, and melting or other signs of heat damage
- Some synthetic slings are manufactured with red threads inside the material that indicate excessive wear when visible on the surface. If the red threads can be seen, the sling must be removed from service

Care and Storage

- Synthetic slings should not be subjected to extremes in temperature (above 180°F or below -20°F), caustics, acids or prolonged exposure to direct sunlight (e.g., storage areas)
- In order to be used for rigging, synthetic slings must have a tag attached with:
    - Name of the manufacturer
    - Rated capacity
    - Material

Types of Slings

Slings can be manufactured in two basic types:

- Endless slings
- Single-leg slings

Endless Sling Hitches

- Endless slings are continuous loops with no connectors at all
- The three hitches commonly used with endless slings are:
    - Vertical hitch
    - Cradle hitch
    - Choker hitch

Single-Leg Sling Hitches

- Single-leg slings are slings that have eyes or loops at each end
- In single-leg wire rope slings, the eyes often contain an insert called a thimble to help retain the shape of the eye
- Inspect all slings for damage before use
- The six hitches commonly used with single-leg slings are:
    - Vertical hitch
    - Choker hitch
    - Double-wrap choker hitch
    - Basket hitch
    - Double-wrap basket hitch
    - Multiple-leg bridle hitch

Hitches and Slings

Vertical Hitches
- A vertical hitch using a single-leg sling is essentially the same as a vertical hitch made with an endless sling
- The load is lifted from a single point, usually an eye, on the top of the load
- To lift the load in a balanced position, the eye must be directly above the load's center of gravity

Choker Hitches
- Formed by passing one end of the sling around the load and coupling it to the upright portion of the sling with a free-running shackle or sliding hook
- When a shackle is used, the shackle pin should always ride on the sling's eye
- Threaded shackle pins may become loosened if they ride on the running end of the sling

Double-Wrap Choker Hitches
- Used to give the sling an extra grip on the load
- The additional wrap around the load prevents the choker from slipping

Basket Hitches
- The sling passes around the bottom of the load and its two eyes are gathered together at the load hook
- Basket hitches are almost always used in pairs for stability
- A double-wrap basket hitch grips the load tighter and keeps the sling from slipping

Multiple-Leg Hitches
- Multiple-leg hitches may be made with two, three or more legs
- Each leg usually attaches to an eye on the load with a shackle
- Typically, the legs are gathered at a ring that attaches to the load hook of the lifting device
- Multiple-leg slings are often made-up in advance for one particular job
- Loads with different balance will require legs of different lengths

Sling Tension
- Sling tension, or the amount of strain each sling is subjected to during a rigging job, is affected by several factors:
    - Number of legs
    - Type of hitch bends in the sling
    - Sling angle

Number of Legs
- The number of sling legs obviously affects sling tension
- The more sling legs there are to support a load, the less tension is concentrated on a single leg
- Caution: This does not hold true when a single sling is used as a multiple-leg bridle

Types of Hitch Bends in the Sling
- The type of hitch used can increase or decrease sling tension
- Basket hitches affect tension in the opposite way

Sling Angle

- Tension concentrates wherever slings must go around sharp corners or bends
- A general rule of thumb for wire rope is that tension increases whenever the bend radius is less than ten rope diameters
- The tighter the bend, the more tension is produced
- Tension is least when slings are vertical
- The more a sling's angle departs from the vertical, the more tension is produced
- Once a sling angle passes 60° from the vertical, the tension on the sling is greater than the weight of the load

Sling Storage

- All rigging equipment should be stored in a clean, dry place
- The preferred method is to hang slings straight, vertically when possible
- Slings may be hung on pegs on the wall or a rack. or laid in a rack or tray
- Synthetic slings should be stored out of direct sunlight
- Do not lay wire rope directly on a concrete floor

Sling Capacity Ratings

- All slings are rated for maximum safe working load (SWL), also known as working load limit (WLL) or the rated capacity
- The rated capacity is lower than the amount of tension that would cause the sling to fail
- The difference between the rated capacity and the point at which the sling would fail is called the design factor
- The capacity must be clearly legible on the nametag
- CAUTION: Slings should never be loaded above their rated capacity!

Connectors and Adjusters

- Connectors are used to connect a load to a lifting device, and adjusters are used to control the length of individual legs in a rigging job to level the load
- Connectors include, but are not limited to hooks, eye bolts and shackles
- Adjusters include turnbuckles, come alongs or chain hoists

Using Hooks

- Often used as connectors on hoists, cranes, adjusters and slings
- Can be connected to shackles, eye bolts or directly to the eye of a sling
- For added safety in lifting, hooks shall be equipped with safety latches wherever possible
- Safety latches help prevent accidents by positively securing a sling or shackle to the hook

Hook Inspection

All hooks, whether they are used on hoists, slings, turnbuckles or load levelers, must be inspected for three kinds of damage:

1. Spreading
2. Cracking
3. Damage to the safety latch

Spreading

- Spreading of the throat of a hook is the first sign of overloading
- The size of the throat should be measured at its smallest point with a gauge or rule
- If the opening is more than 15% larger than the nominal throat measurement for a hook of that capacity, the hook is not safe to use
- The plane or straightness of the hook must be inspected
- If the hook is bent out of plane more than 10°, it must not be used

Cracking

- Cracking is an indication of overloading and is often found on the inside of the shank close to the hook's bend
- Cracks too small for the naked eye can be detected only with special methods, such as liquid-penetrant testing

Safety Latches

- Several kinds of safety latches are used on hooks
- Verify the operating condition of safety latches by engaging and then disengaging the mechanism
- The latch should have a firm, positive feel
- Spring latches should be checked to ensure that the spring has not been weakened so much that the hook's throat is not completely closed off

Shackles

- U-shaped connectors with pins that are used to couple slings to hooks, slings to eyes, and hooks to eyes
- Can also be used to make a choker hitch with a single-leg sling
- The most commonly used type of shackle is the screw-pin shackle
- A screw-pin shackle has two parts: a body (bow) and a pin
- The body is used to collect the ends of slings if you have more than one sling
- The pin must be placed on the crane hook or through the eye of an eye bolt

Inspecting Shackles

- The shackle pin and body (bow) are subject to damage from normal wear and abuse
- The body must be checked for bending, cracking and damaged threads
- Cracking is especially likely near the eyes of the body
- The pin must be checked for straightness, and its threads are also inspected for stretching or stripping
- CAUTION: Never substitute a bolt for a shackle pin. Substituting a bolt for a shackle pin is dangerous because ordinary bolts are much weaker than a hardened steel shackle pin

Eye Bolts

- Threaded connectors installed on loads to provide a place for slings to be attached
- Two kinds of eye bolts are typically used in rigging work:
    - Straight-shank eye bolts
    - Shouldered eye bolts

Inspecting Eye Bolts

- Eye bolts must be inspected for four kinds of damage
    - Cracking
    - Stripped threads
    - Bending
    - Distortion of the eye

Adjusters

- When an unbalanced load is lifted, it may be necessary to compensate by changing the length of the slings in order to place the load hook directly above the load's center of gravity
- Adjusters are rigging attachments designed for this task
- They are grouped by the amount of sling length compensation that they allow:
    - Come alongs and chain hoists
    - Turnbuckles

Large Adjustments

- Chain hoists and come alongs are used as adjusters when large adjustments must be made
- In multiple-leg rigging arrangements, chain hoists or come alongs may be used on as many legs as necessary to compensate for the unbalanced condition

Turnbuckles

- Turnbuckles have a threaded body and two screws, and they are especially useful for making small adjustments in the length of a sling
- One screw is threaded opposite to the other so that when the turnbuckle's body is rotated, the screws move either outward or inward, shortening or lengthening the sling
- The most significant limitation of turnbuckles is that they are not capable of compensating for large adjustments

Inspecting Turnbuckles

- A turnbuckle's body and both of its screws must be inspected before every use
- Turnbuckle bodies are subject to three kinds of damage: bending, stripped threads and cracking
- Screws must be checked for straightness and thread damage, and screw ends must be inspected for cracks, wear and, in the case of hooks, spreading

Care and Storage

- The most common misuse of rigging is dragging or dropping equipment on the floor
- Slings being dragged on the floor can cause excessive wear to the strands or fibers
- If slings are allowed to drag on the floor, dirt, chemicals and oil may be impregnated into the synthetic sling webbing or the wire rope

Dropped Equipment

- When rigging equipment is dropped, this can cause moderate to severe damage
- If a come along or chain hoist is dropped on the floor, the result may be cracks in the housing
- Cracks in the housing can cause failure of the equipment
- Abusing the equipment can cause very disastrous results

Basic Rigging Principles – Part 2

A rigger's work begins long before lifting a load. A great deal of thought and preparation is necessary to ensure that everyone stays safe.

Safety

- Never place any part of your body under a suspended load
- Limit access to the work area; use barricades to keep out unauthorized personnel
- Keep the load low and slow
    - When moving objects with cranes or hoists, the load should never be raised any higher than necessary for the job at hand
    - The slow travel speed allows time for miscalculations to be corrected before someone gets hurt
- Avoid lifts over personnel or equipment whenever possible
    - A less-direct route is preferable to one that could lead to worker injuries or damage to expensive equipment
- Steady the load
    - In most cases, a rigger should attach a tagline to the load and hold it to control the load's motion in the air
    - If taglines are impractical or may increase hazard potential, check with your supervisor to determine safe alternatives
- Never ride on the load or crane hooks
- Avoid pinch points
    - Learn to anticipate and avoid pinch points while handling the hook and tensioning slings
    - Remember, when positioning a sling as tension is applied, it is possible for fingers or hands to get caught between the sling and the load
- Protect slings from contact with sharp or abrasive surfaces during use
    - One of the most common causes of rigging failure is improper selection of padding or softeners between the rigging and the load
    - Sharp corners can be padded with sections of relatively large-diameter pipe that have been cut so that their cross-sections resemble 3/4 of a circle, and can be placed at the corners of the object to spread the tension out over a larger area of the sling

Personal Protective Equipment (PPE)

- A hard hat, safety glasses, gloves and safety shoes are required for most rigging jobs
- Additional PPE, such as fall protection devices, must be used to ensure worker safety when performing elevated work
- Special precautions must also be taken when working near energized electrical equipment and overhead power lines

Pre-job Briefing

A pre-job brief must be conducted before every job. At a minimum, pre-job briefs should cover:

- Tasks to be accomplished
- Expected results
- The responsibility of each individual
- Methods of communication
- Special environmental concerns
- Previous operating experience and any lessons learned
- Job hazards, special precautions and appropriate PPE
- Appropriate procedures, drawings or other reference documents
- Identification of energy source controls
- Input, questions and concerns of all personnel in attendance

Job Planning

Planning a rigging job requires four basic steps:

- Determine the weight of the load
- Find the balance point (or center of gravity) of the load
- Check clearances for moving the load
- Select the rigging equipment to be used

Load Weight

- Knowing the weight of the load is important because it determines the minimum weight (rated capacity) that each piece of rigging equipment must be able to support
- The rated capacity of a load is also known as the Safe Working Load (SWL)
- If rigging is subjected to a load greater than its SWL, it may fail

Determining Load Weight

The weight of a load can be determined in several ways:

- It may be listed on the equipment nameplate, the technical manual, or drawings furnished with the equipment
- Shipping papers are also a good source for weight information
- When none of these sources list the weight of the load, the weight must be estimated
- **Caution**: Loads of unknown weight should not be lifted

Balance Point and Clearance

- Every object has a point at which it will balance perfectly: its center of gravity, or balance point
- If it is unknown, the balance point can be determined by test lifting the load a small distance
- If the load is not balanced, set the load down and readjust the slings, then test lift again until the correct balance point is determined
- **Caution**: If the rigging is attached below the center of gravity, the load may flip over when lifted
- Before a load is moved, the load path must be checked to ensure adequate clearance

Preparation

- Before the rigging can be attached to the load, everything must be inspected and the crew must be organized
- These preparations incorporate important safety precautions:
    - Damaged equipment must not be used
    - Crew members must know exactly what is expected of them if they are to perform their jobs safely and accurately

Equipment Inspection

All rigging equipment must be inspected before every use. To make sure that all equipment is properly inspected, a checklist can be used.

Crew Organization

- Every rigging job should have one person in charge, referred to as the Director
- It is the responsibility of the Director to ensure that the job is performed safely
- The Director must:
    - Review all procedures
    - Understand the procedures
    - Organize and verify that crew members understand their tasks, overall responsibilities and associated hazards

Selecting Equipment

Capacity

- The weight of the load dictates what the minimum rated capacity should be for each piece of rigging equipment used
- Lifting devices, slings, connectors and adjusters must have sufficient capacity to support their part of the load
- The weight of the rigging itself must be considered as part of the total weight of the load
- To provide a reasonable safety margin, select rigging with a rated capacity 1.5 to 2 times the weight of the load

Load Angle Factors

A very important consideration when selecting rigging is tension – Load Angle Factors (LAF).

- The least amount of tension is applied on the rigging when it is used in a vertical configuration
- To prevent overloading, the load angle must be no greater than 60° from vertical, and tension should be factored in when making decisions about required rigging capacity

D/d Ratio

Another factor that must be considered is the D/d ratio

- "D" stands for the diameter of the object being lifted, or the minimum bend diameter that the sling will be wrapped around when making a lift
- The small "d" stands for the diameter of a wire rope sling, or cross-sectional width of a synthetic sling, that will be used to make the lift
- Although there is no standard number that can be used, this factor must be considered when using slings
- For synthetic slings, it is recommended that the D/d ratio be no less than 1:2, where the diameter of a shackle or hook is no less than half the width of the sling

Attaching Rigging

- A good, time-saving practice involves making permanent rigs that can be used repeatedly for loads that must be moved frequently; this practice is called **pre-rigging**
- You may need to mount equipment on a load that has not been pre-rigged

Attaching Eye Bolts, Shackles and Slings

- The first step in mounting the rigging on the load is attaching the slings to the assembly with a shouldered eye bolt and shackles
- Thread the eye bolt into the hole in the pump casing and "seat" it
- Attach shackles at the designed lifting points in the machine foundation
- Connect slings to the machine foundation by the shackle
- Insert the shackle pin through the designed lifting point in the machine frame

Attaching Hooks

- When hooks are used on the ends of the legs of a bridle hitch, they must be placed so that their throats point away from the load or outward, not inward facing the load

Attaching Rigging to the Hook

- Collect the slings in a large shackle and then pin the shackle to the lifting device hook
- Use a chain hoist as a load leveler and attach it to the lifting device hook by a sling and shackle
- Attach the chain hoist load chain to the eye bolt by a shackle
- Once the rigging is attached to the load, use a level to make sure the load is lifting levelly

Taglines

Taglines are essential to safety; they are used for controlling loads that must be lifted above head level. Half-hitches and bowline knots are preferred for attaching taglines to the load.

- **Caution**: Never wrap a tagline around any part of your body

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

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

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

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

Industrial Hygiene Awareness

What Is Industrial Hygiene?

Industrial hygiene is:

- The art and science of preventing/controlling conditions that may expose people to workplace contaminants and physical agents that can harm their health
- A job title or part of a job description
- A focus area or principle in all occupational health and safety programs

We can use the science of industrial hygiene in all industries to protect workers, their families and the community.

What Does Industrial Hygiene Target?

Contaminants and physical agents that can harm people's health may include:

- Air contaminants (pollution, particles, vapors)
- Chemical hazards (products, pesticides, metals)
- Biological hazards (blood, mold, sewage)
- Physical hazards (noise, temperature, radiation)

Workers may be exposed to contaminants or hazards by:

- Inhalation (breathing things in)
- Ingestion (eating/drinking/smoking contamination)
- Injection (sharp objects and open wounds)
- Absorption (skin/eye/mouth contact)

The health effects of an exposure may be:

- Acute (immediate)
- Chronic (long-term)

The duration and intensity of the exposure may be a factor in health effects.

Occupational exposure limits (OELs) are how much of contaminants or physical agents an average worker may be exposed to at work over a set period before they may suffer harmful health effects. There may be limits for full or partial shift exposures.

The limit at which harmful health effects may occur may be lower for people with:

- Chronic diseases (autoimmune, cancer, asthma)
- Pregnancy
- Advanced age
- Excess weight
- General health problems

People who have any of these risk factors may need to work within limits that are lower than the OEL. In recognition of individual susceptibility differences, some companies adopt limits which are more stringent than those required by law.

Many contaminants and physical agents can be difficult to see/measure. We may need to use special measuring devices to determine their presence and concentration.

How Does Industrial Hygiene Work?

There are five general methods, in descending order of effectiveness, that we can use to apply industrial hygiene and reduce exposures to contaminants and physical agents that can harm health.

- **Eliminate** it by redesigning the process (example: outsource tasks to specialists)
- **Substitute** it with a safer process or product (example: use robots instead of people or choose safer chemicals)
- Provide **engineering controls** at the source (example: use exhaust vents/hoods)
- Reduce exposure through **administration** (example: mandate breaks and assign people in shifts)
- Use **personal protective equipment (PPE)** for added protection (examples: wear gloves when handling bodily fluids and put on hearing protection before entering noisy areas)

The best way to keep people safe and healthy is to use a **combination of controls**. The protection provided by controls can be additive, and if one control fails, other controls may be able to reduce exposure severity or prevent harmful health effects.

Handwashing Awareness

Handwashing helps stop germs and harmful substances from being passed around. Wash your hands for better health!

Wash Your Hands for Better Health

The eyes, nose and mouth are pathways through which substances enter the body. People frequently touch these body parts and may transfer germs and chemicals without even realizing it.

Germs and chemicals can also get into food and drinks being prepared or consumed.

Handshakes and being in contact with frequently touched surfaces are ways that germs and chemicals pass from one person to another. Things touched by people can transfer germs, for example:

- Doorknobs
- Stairway handrails
- Bathroom sinks
- Subway hand holds
- Money
- Elevator buttons
- Tools
- Children's toys

You cannot see tiny germs and the smallest traces of chemicals. Wash your hands anytime you feel that they might be dirty, but always wash your hands when performing tasks such as:

- Medical care and dental care
- Food handling, food preparation and food service
- Contact with anything potentially unclean (animals, garbage)
- Use of tobacco products, using restrooms, applying cosmetics and lip balm, eating, drinking or consuming medications, and inserting or removing contact lenses

Handwashing Techniques

Hand Sanitizers

Alcohol-based hand sanitizers can be considered in addition to proper handwashing and when handwashing is not possible.

- Use a hand sanitizer with at least 60% alcohol
- Apply the sanitizer to the palm of one hand and rub it all over the surfaces of both hands until your hands are dry

Soap and water are needed when hands are visibly soiled or greasy or when they are contaminated with chemicals or irritants. Hand sanitizers do not eliminate all types of germs, such as norovirus, a major cause of gastroenteritis or stomach flu.

Handwashing Techniques

Follow these handwashing procedures:

1. Wet your hands with clean, running water and lather with soap.
2. Scrub all parts of your hands and under your nails for at least 20 seconds.
3. Rinse them under clean, running water.
4. Dry them using an unused towel or air.

Drying Hands
Drying is critical to reducing recontamination. Dry your hands with a single-use towel. Paper towels are a more hygienic way to dry your hands because they can physically remove contaminants with less chance of recontamination.

Buttons, levers and crank towel dispensers are sources of recontamination. Touch-free faucets, soap dispensers and towel dispensers minimize cross contamination.

Handwashing Tips
The sink, including the faucet controls, may be contaminated. Consider turning on and off the faucet using a dry paper towel.

Wash around and under rings, but know that rings and jewelry may be prohibited in some workplaces. You cannot be sure jewelry isn't harboring germs and other contaminants.

Protect your hands from touching dirty surfaces as you leave the bathroom.

Employers need to determine alternate methods of handwashing if sinks and a public source of cleaning running water are not available. There are options to bring in clean water and set up handwashing stations.

Healthy Skin and Nails
Healthy skin is a barrier to infection, whereas compromised skin is vulnerable, so report any discomfort from handwashing. Gentler soaps may reduce chapping and irritation. Moisturizing lotions may help, but some lotions degrade rubber gloves, so always follow your employer's recommendations. Diligently clean and trim fingernails since they may harbor dirt and germs.

Gloves

Wearing gloves does not replace the need for adequate, effective handwashing!
- Gloves may have small, undetectable defects
- Gloves may be torn during use
- Do not wash your gloves as a way to avoid changing them
- Wash your hands before putting on gloves since bacteria can multiply in the warm environment inside of gloves
- Wash your hands immediately after removing gloves

If you work in a healthcare setting and use disposable gloves, change your gloves after each patient contact and wash your hands after removing your gloves! When you remove your gloves, you may contaminate your hands. Practice proper removal techniques to minimize touching the outside of a glove with your bare hand. Remember also that gloves can pick up bacteria from dirty surfaces and transfer them to food and others. Gloves need to be changed according to your employer's policies and procedures.

Using Eyewashes and Emergency Showers

Eyewashes and emergency showers:

- Are used to flush contaminants from your eyes, face or body
- Are a form of first aid equipment to be used in the event of an accident
- Are NOT a substitute for safety precautions and good work practices
- May reduce damage caused by chemicals
- Must be located close to areas where exposures might occur
- Must function flawlessly, without delay
- Are not used frequently and may become neglected

Recognizing Eyewash and Emergency Shower Neglect

Signs of neglect include:

- Clogged, broken or missing nozzles
- Inoperable activating valves
- Improper water pressure – too high or low
- Foreign particles in bowls or basins
- Missing nozzle dust covers
- Low fluid levels in self-contained eyewashes
- Visible debris/discoloration in cleansing solutions

Correcting Common Eyewash and Emergency Shower Problems

Make them visible and unobstructed by:

- Posting signs prominently
- Applying floor markings
- Removing obstructions, as necessary

Maintain them by:

- Keeping nozzles clean (dust covers help)
- Keeping water clean
- Checking water flow rates (streams meet in the middle of an eyewash, but don't overshoot the bowl)

Safely Using Eyewashes and Emergency Showers

The following are some best practices for eyewashes and emergency showers:

- Get trained
- Help others
- Flush for the appropriate amount of time
    - For most exposures, the recommended flushing time is 15 minutes or longer
    - Check the Safety Data Sheet (SDS) for specific first aid recommendations for each material
- Remove clothing and PPE to flush properly, as needed
- Hold eyes open while washing eyes
- Remove contact lenses as soon as possible
- Be aware that wetting dry powders may make chemicals more hazardous

REMEMBER to:

- Refer to manufacturer instructions for your specific eyewashes and emergency showers
- Read the Safety Data Sheet for each material

Bloodborne Pathogens (BBP)

Bloodborne pathogens (BBPs) are microorganisms that cause disease. BBPs are transmitted through contact with infected blood or other potentially infectious materials (OPIM).

Assume that all blood and OPIM are contaminated and handle them accordingly.

The three BBPs that pose the greatest risk in your workplace are the hepatitis B virus, the hepatitis C virus and the human immunodeficiency virus (HIV). There is NO CURE for hepatitis B or HIV.

Hepatitis B and Hepatitis C

Hepatitis is inflammation of the liver. The two strains that pose the greatest risk in your workplace are hepatitis B and hepatitis C.

Hepatitis B and hepatitis C symptoms include:

- Flu-like symptoms
- Jaundice
- Weakness
- Lack of appetite
- Vomiting, stomach pain, diarrhea
- Liver inflammation/disease/cancer

There is a vaccine available for hepatitis B, but not for hepatitis C.

Human Immunodeficiency Virus (HIV)

HIV attacks the white blood cells that play a major role in the body's immune system. HIV can eventually lead to acquired immunodeficiency syndrome (AIDS). Even without visible HIV symptoms, you can still infect others. There is no vaccine for HIV.

HIV symptoms include:

- Swollen glands
- Chronic fatigue
- Yeast infections
- Night sweats
- Fever
- Diarrhea
- Loss of appetite/weight

Routes of Exposure

Three routes of workplace exposure for BBPs include:

- Puncture wounds
- Open cuts and skin abrasions
- Eyes, nose and mouth

Safe Handling Procedures

Personal Hygiene

Properly cover open cuts and skin abrasions. In potential exposure areas, NEVER:

- Eat
- Drink
- Store food
- Smoke
- Handle contacts
- Apply cosmetics

Wash your hands and exposed skin with soap and running water:

- Immediately after an exposure incident
- After removing gloves or other PPE
- As soon as possible after an alternative hand-washing method

Engineering Controls

Engineering controls isolate or remove BBP hazards from the workplace by removing, eliminating or isolating them. Examples include sharps disposal containers, biohazard bags and containers, self-sheathing needles and biological safety cabinets.

Personal Protective Equipment (PPE)

Keep the following in mind when handling blood or other potentially infectious materials (OPIM):

- Wear gloves when handling blood or OPIM
- Wear eye protection if there's any chance of splash
- Check PPE for tears, holes or punctures
- Ensure PPE is clean and fits properly
- Remove PPE properly to avoid self-contamination
- Place used PPE in the proper containers

Good Housekeeping Practices

To clean up blood or OPIM:

1. Carefully cover surface spills with paper towels
2. Gently pour a 10% (or 1-to-10) bleach to water solution over towels/equipment
3. Allow the bleach solution to remain in place for at least 10 minutes
4. Disinfect or properly discard any cleanup supplies

Remember:

- Sharp items go in sharps containers
- Blood, OPIM and medical waste go in infectious waste or biohazard containers
- Do not recap needles unless you have to
- Use mechanical means (such as a broom and dustpan) to pick up broken glass

Emergency Procedures for Blood or OPIM Exposure

If you may have been exposed to a BBP, immediately:

- Clean wounds with soap and water
- Flush eyes and mucous membranes with water or normal saline solution for 15 minutes
- Alert your supervisor and any other appropriate personnel
- Complete applicable exposure incident reports

You may also receive:

- Education and access to any additional disease-preventing measures
- Hepatitis B vaccine or booster
- Blood tests
- Counseling

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

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	• 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	• 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	• Also known as prickly heat • Likely in hot, humid environments • Sweat ducts become plugged • Uncomfortable **skin rash** • Discomfort may reduce work performance	• Keep skin **cool and dry** • Let skin air-dry after bathing
Heat cramps	• Painful spasms of the muscles due to body's water and salt loss	• Rest briefly and cool down • Drink liquids with salt or electrolytes, such as sports drinks

Disorder	Description and Symptoms	Treatment
Heat exhaustion	• Sweat more (clammy, moist skin) • Develop a headache • Notice dark urine • Feel nauseated/dizzy • Faint	• 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	• Red skin
	• Sweating that suddenly stops
	• Vomiting
	• Rapid heartbeat
	• Confusion/delirium
	• Convulsions
	• Loss of consciousness
	• **Death can occur**
		• Get medical help **immediately**
		• While you wait for help:
		  ○ 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

Cold Stress

Whenever temperatures drop decidedly below normal for your region, and as wind speed increases, heat can leave your body more rapidly. **Cold stress** is the loss of body heat to the environment.

Sources of Heat Loss

- **Radiation** - loss of heat to cold air (most heat is lost through head)
- **Conduction** - loss of heat due to contact with something cold (use insulated tools to prevent conduction heat loss)
- **Convection** - transfer of heat from a hot area to a cooler area (such as wind chill)
- **Evaporation** - heat lost from sweating and respiration (increased susceptibility to hypothermia and other cold injuries)

When You Are Exposed to Extreme Cold

Watch for these symptoms that someone is too cold:

- Decreased alertness
- Loss of mobility/dexterity
- Feeling extremely tired
- Feeling effects of cold more quickly
- Slurred words
- Clumsiness
- Irritability or anger

When it is cold:

- Don't rush to get out of cold
- Safety glasses can fog up
- Snow, rain and sleet increase the risk of slips, trips and falls
- Remember that heaters increase the risk for fires or carbon monoxide poisoning

Hypothermia

Hypothermia occurs when someone has an abnormally low body temperature.

Symptoms	Treatment
• Unable to move well or think clearly • Disorientation • Intense shivering • Exhaustion or drowsiness • Confusion or memory loss • Slurred speech • Euphoria • Collapsing	• Immediate medical attention • Bring the person to a warm room or shelter • Remove any wet clothing • Warm the center of the body first – chest, neck, head, groin, armpits – using skin-to-skin contact under loose dry layers of blankets, clothing, towels, sheets, hot packs or warm bottles • Provide warm beverages only if the person is conscious • Perform CPR, if needed • **DO NOT** immerse hypothermic individuals in warm or hot water. It may stop a victim's heart.

Frostbite and Trench Foot

Frostbite occurs when skin tissue freezes. The nose, ears, cheeks, chin, and fingers or toes are most susceptible. Damage can be permanent. Trench foot occurs when you combine cold with water exposure. Keep feet/shoes/socks dry to avoid trench foot.

Symptoms	Treatment
• An initial burning sensation • Coldness, numbness or tingling • White or grayish-yellow skin • Skin that feels unusually firm or waxy	• Seek medical attention as soon as possible • Get into a warm room as soon as possible • Do not walk on frostbitten feet or toes, if possible • Immerse area in warm – **not hot** – water • Warm the affected area using body heat • **DO NOT** rub/massage area • **DO NOT** expose the area to a heat source (heat pad/lamp, fire, stove, etc.)

Factors that Contribute to Cold Stress

Cold stress is more likely with sudden weather changes and if you have pre-existing health conditions or diseases. Some other factors that may impact how cold affects you are:

- Your age and health
- The activity you are doing
- The temperature
- The wind chill

Prevent Cold Stress

Use the following work practices to minimize cold stress:

- Create wind/warming shelters
- Gradually build up your time in the cold
- Take rest breaks in warm areas
- Schedule work at warmer times
- Avoid metal chairs and tools
- Stay hydrated by drinking warm, sweet drinks or broths
- Increase your food energy intake (i.e., more calories/kilocalories/kilojoules)
- Limit or stop use of nicotine, caffeine and alcohol
- Monitor how medicine impacts your response to cold

Clothing

- Keep your clothes dry
- Dress in layers
  - **Inner layer**: Use materials like wool, silk or polypropylene that draw moisture away and tend to hold more body heat than cotton
  - **Middle layer**: Use well-insulated material or wool that provides warmth without weight
  - **Outer layer**. Wear material that protects against water and wind. Wear a hat! Remember that you lose most of your body heat through your head. Protect your hands by wearing insulated gloves

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 (H_2S) Awareness

What Is Hydrogen Sulfide?

Hydrogen sulfide (H_2S) 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)

IMPORTANT:	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.

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

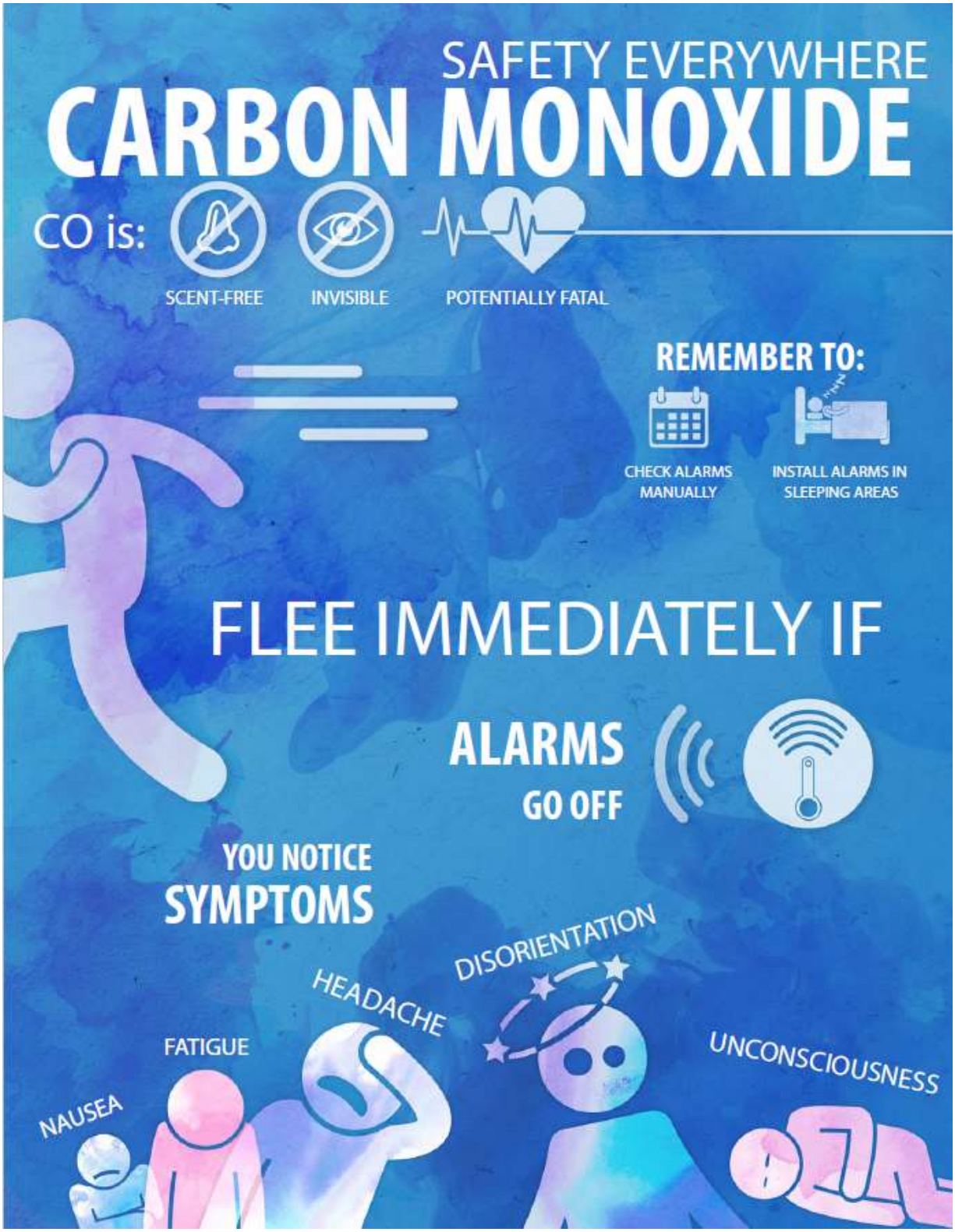
Staying Safe: Gas Appliances
- Have appliances serviced by a technician every year
- Ventilate them properly
- Never use a gas oven to heat a home
- Never patch a vent pipe with tape, gum or anything else not intended for that purpose

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

Safety Everywhere: Carbon Monoxide



Compressed Gas Cylinder Safety

Industrial and laboratory operations require compressed gases for a variety of uses and applications. You can minimize, if not completely eliminate, hazards presented by compressed gas cylinders.

Hazards

Physical Hazards: A highly pressurized container may become a projectile or fragmentation bomb. Some of the physical hazards posed by these are:

- Severe cuts, bruises and burns
- Broken bones and loss of limbs
- Spinal-cord injuries

Chemical hazards are also present:

- Reactivity due to incompatible gases
- Toxicity/Poisoning
- Asphyxiation

Identification

Before beginning any work with compressed gas, always identify the contents of a cylinder. Read the label; the cylinder must be stenciled, stamped or labeled. Never rely on cylinder color! Cylinder color varies depending on the supplier.

Colors

Label color is a reliable indicator of a cylinder's contents and is used to indicate hazardous properties:

- Flammability
- Toxicity
- Presence of corrosive substances

Do NOT rely on valve-cap color. Valve caps are interchangeable so the valve cap on a cylinder may not belong on that cylinder!

Cylinder Storage

Always store cylinders in a well-protected, well-ventilated, dry location that is:

- Free of flame, sparks or electrical current
- Level and designed for gas cylinder storage
- Away from elevators, stairs or gangways

Never allow the temperature to rise above 120 °Fahrenheit. It is also important to keep cylinders away from extremely low temperatures, as metal contracts when cold, which could lead to cylinder failure.

Segregation

Segregate cylinders by hazardous gas:

- Store incompatible gases by hazard class in separate areas
- Store upright and at least 20 feet from highly combustible materials
- Oxygen cylinders (full or empty) must never be stored near flammable gases
    - A minimum separation of 20 feet must be maintained
    - A 5-foot-high firewall must separate the storage areas
    - Never place greasy or oily materials near oxygen

Restraints and Signs

Secure the cylinder at all times to a wall, holding cage, heavy work bench or lab bench, or no-tip base. Fasten restraints on the upper half of the cylinder, above the center of gravity, using:

- Chains
- Sturdy straps or cylinder straps
- Cables
- Clamps
- Floor-stand cylinder support

Post signs in all areas where flammable compressed gases are stored:

- "Hydrogen"
- "Flammable Gas"
- "No Smoking"
- "No Open Flames"

Handling and Transportation

Before handling any compressed gas cylinder, locate the Safety Data Sheet (SDS) for the gas you are using. Follow these simple guidelines when transporting cylinders:

- Remove the regulator. Never move a cylinder with the regulator still in place
- Replace the valve cap. Never lift a cylinder by the valve or protective cap
- Secure the cylinder to a suitable hand truck or cart in an upright position
- Never drag or slide the cylinder or strike cylinders against each other
- Move only one cylinder at a time

Personal Protective Equipment (PPE)

- Always wear safety glasses and face shield
- Use gloves or other PPE if required

Valve and Regulator Safety

- The main cylinder valve should be closed and valve caps must be on when the cylinder is not in use
- The valve threads may vary in diameter, internal or external, right-handed or left-handed
    - Right-handed threads are used for non-fuel and water-pumped gases
    - Left-handed threads are used for fuel and oil-pumped gases

- Only use CGA standard valves and fittings
- Do not assemble miscellaneous parts

Handling Cylinders

- Make sure a cylinder's valve is accessible whenever you are working with it
- Never leave the main cylinder valve open when the equipment is unattended or not operating
- Never use pliers to open a cylinder valve!
- Check if a valve requires a washer

Handling Regulators

Follow these simple steps to avoid hazards:

- Attach the regulator to the cylinder valve outlet
- Turn the delivery pressure adjustment knob counterclockwise
- Ensure the flow control valve is in the closed position
- Slowly open the cylinder valve until the regulator registers the cylinder pressure
- Turn the delivery pressure adjustment knob clockwise
- Regulators are gas-specific and not necessarily interchangeable
- Always make sure that the regulator and valve fittings are compatible

Inspections

Regularly inspect all cylinders. Check for the following:

- Are there signs of defects?
- Is there any deep rusting?
- Does it contain the correct gas in the designated usage area?
- Are all hoses and other equipment free from leaks?
    - Apply soapy water to check all connections for leaks

Leaks and Repairs

If a leaking cylinder is discovered:

- Move it to a safe place (if it is safe to do so)
- Inform your supervisor
- Have qualified personnel perform repairs
    - Under no circumstances should you attempt to repair a leaking cylinder or valve!

Welding, Cutting and Brazing for Construction: Methods

While there are some universal dangers, different hot work methods also have unique dangers of which you should be aware.

Oxyacetylene Torch Safety

Oxygen	Acetylene
• Oxygen helps objects burn • Keep gloves, oxygen fittings and connections free from oil or grease because oxygen reacts explosively with these substances • Store oxygen and flammable gases at least **6 meters (20 feet)** apart or use a half-hour fire-rated partition at least 1.6 meters (5 feet) tall to separate storage areas	• Acetylene is the most commonly used fuel gas • It is very flammable and can ignite at a wide range of concentrations • Acetylene becomes unstable at high pressures, so NEVER use acetylene at pressures above **104 kPa** (kilopascals) or **15 psi** (pounds per square inch) • Keep acetylene cylinders in an upright position because acetylene is stabilized in acetone liquid that may spill or get into the regulator if a cylinder is stored on its side

Before you open oxyacetylene welding gas cylinders:

- Perform a visual pre-use inspection
- Gather tools (if needed)
- Blow out the cylinder valve before connecting the regulator (open valve slightly and close it)
- Check for leaks after making new connections

When you open oxyacetylene welding gas cylinders:

- Open cylinder valves slowly to guard against regulator failure
- Stand to one side of the regulator to avoid any potential flying debris
- Keep any adjustment tools nearby so you can quickly close valves in an emergency

Before you light an oxyacetylene torch:

- Purge oxygen and acetylene passages individually BEFORE lighting the torch
- Keep the tip pointing away from your body

To safely light an oxyacetylene torch:

- Keep the nozzle pointed away from your body
- Light the flame with a long-handled flint striker
- Open and light the acetylene first, then open and adjust the oxygen to a neutral flame

When you finish the job:

- Close the oxygen torch valve first, then the acetylene torch valve
- Close the valves on both cylinders
- Open the oxygen torch valve 1/2 turn and purge the oxygen
- Close the oxygen torch valve and turn the regulator adjusting screw off

- Open the acetylene torch valve 1/2 turn and purge the gas
- Close the acetylene torch valve and turn the regulator adjusting screw off
- Neatly coil the hoses and properly store the equipment

Welding Gas Cylinder Safety

- Always keep gas cylinders secured-during storage, transportation and use
- Keep protective caps over cylinder valves except during use
- Remove regulators and replace caps before you transport cylinders
- NEVER store full or empty oxygen cylinders with flammable gases

Arc Welding

Arc welding is a common type of welding that uses electricity as the energy source. Arc welding creates an electrical arc hot enough to melt metal. When arc welding, be aware of the danger of burns, fires and electrical shock. Electrical shock can cause injury or death, so it's important to take the risk seriously.

Follow these arc welding guidelines:

- Use well-insulated electrode holders and cables that are in good condition
- Make sure welding cables are dry and free of grease and oil
- Keep the ends of welding cables apart
- Wear dry, hole-free gloves; clothing should also be dry
- Never touch the electrode or metal parts of the electrode holder with skin or wet clothing
- Dry any insulation between your body and metal

Remember: Stick electrodes are always electrified, even when you are not welding.

Positioning and Personal Protective Equipment

Position your body to avoid fumes, sparks and slag.

SAFE CLOTHING	UNSAFE CLOTHING
• Wool, denim, canvas or heavy cotton • Fitted • Long-sleeve shirts, welding jackets or coveralls	• Synthetic fibers • Frayed or worn • Unbuttoned cuffs or open pockets • Material with grease and solvents

For any welding, cutting or brazing work, wear appropriate personal protective equipment including:

- A welding helmet or welding goggles
- Insulated welding gloves
- Fire-resistant (FR) sleeves
- Fire-resistant or leather cape or shoulder covers (for overhead work)
- Leather shoes
- A respirator and earplugs or earmuffs (for some operations)

Make sure welding helmets or goggles have the appropriate filter lens for the job at hand. Never use a helmet if the filter plate or cover lens is cracked or broken.

Welding, Cutting and Brazing for Construction: Health Concerns

Welding, cutting, brazing and other hot work can result in health hazards associated with welding fumes and light exposure.

Welding Fume Hazards

During hot work you may encounter these chemicals in welding fumes. You need to know WHERE they may be and WHAT they can do to you.

Welding Fume Chemical	Source	Health Hazards
Zinc	– Brass, galvanized metals and various other alloys – Welding or cutting zinc-coated metals may create zinc oxide fumes	– Flu-like symptoms – "Metal fume fever"
Cadmium	– Rust-preventive coating on steel – Alloying element – Paint	– Lung irritation – Pulmonary edema (fluid in the lungs) – Emphysema – Kidney damage – Cancer – Death
Beryllium	– Alloying element with copper and other base metals – Coal slag abrasive blasting	– Chemical pneumonia – Shortness of breath – Chronic cough – Weight loss – Fatigue – General weakness
Iron	– Principal alloying element in steel manufacturing – During welding, iron oxide fumes arise from base metal and electrode	– Irritation of nasal passages, throat and lungs – Iron pigmentation of the lungs

Welding Fume Chemical	Source	Health Hazards
Mercury	– Coating on metals to prevent rust or foliage growth (such as in marine paints) – Arc or gas flame will produce mercury vapors	– Stomach pains – Diarrhea – Kidney damage – Respiratory failure – Tremors – Emotional instability – Hearing damage
Lead	– Lead-based paint	– Lead poisoning – Metallic taste – Loss of appetite – Nausea – Abdominal cramps – Insomnia – Anemia – Weakness – Damage to brain, central nervous system, circulatory system, reproductive system, kidneys and muscles
Paints and coatings	– May or may not be lead-based	– Toxic fumes
Fluorides	– Flux coatings	– Irritation of eyes, nose and throat – Pulmonary edema – Bone damage – Skin rashes
Chlorinated hydrocarbon solvents	– Removing oils from metals prior to painting – Degreasing or cleaning operations	– Damage to lung tissue via phosgene gas
Carbon monoxide	– Fuel combustion – Inert gas shield	– Pounding of the heart – Dull headache – Flashes of light in your vision – Dizziness – Ringing in the ears – Nausea – Weakness – Altered thinking and confusion – Unconsciousness – Death

Welding Fume Chemical	Source	Health Hazards
Ozone and nitrogen oxides	– High-intensity ultraviolet light reacting with air	– Irritation of the mucous membranes – Headache – Chest pain – Dryness of upper respiratory tract – Pulmonary edema
Hexavalent chromium	– Stainless steel – Chrome-finished parts	– Asthma – Damage to the nasal passages and skin – Increased risk of lung cancer

Welding Fume Hazard Controls

Personal protective equipment, such as respirators, should NEVER be the only protection you have against welding fumes.

Safe Clothing	Unsafe Clothing
• Wool, denim, canvas or heavy cotton • Properly fitted • Long-sleeve shirts, welding jackets or coveralls	• Synthetic fibers • Frayed or worn • Unbuttoned cuffs or open pockets • Material with grease and solvents

Depending on the hot work operation, you may need to wear:

- Welding helmets
- Goggles or safety glasses with side shields
- Respirators
- Hearing protection
- Insulated welding gloves
- Leather shoes

Choose the appropriate shade levels for specific hot work exposures.

Radiation and Light Hazards

Ultraviolet Radiation (UV)

Electric arc in welding generates ultraviolet radiation (UV), which can cause:

- Severe skin burns
- Damage to eyes
- Skin cancer

For protection against UV, wear welding helmets and protective clothing.

Infrared Radiation (IR)

Electric arc and flame-based cutting equipment generate infrared radiation (IR), which may cause thermal burns.

For protection against IR, wear welding helmets or goggles and protective clothing.

Visible Light

Arc welding generates intense, visible light that can damage the retinas of your eyes when you see it or its reflection.

Wear appropriate welding helmets, safety glasses or goggles when you are arc welding.

To protect people who will be around potentially damaging visible light, use welding curtains and post warning signs.

Welding, Cutting and Brazing for Construction: Safety Concerns

Hot work is any work that involves open flames, sparks, molten metal, slag and work surfaces hot enough to ignite other materials.

Work Area

Many companies require a written permit system for hot work. Permitting systems help ensure everyone takes appropriate precautions prior to hot work.

Precautions you should take for **hot work** include:

- Inspecting and preparing the work area
- Moving or protecting combustibles
- Assigning a dedicated fire watch with an extinguisher

To prepare the **work area**:

- Inspect and control the hot work area BEFORE you start the work
    - The safest work area is outside and away from buildings (e.g., a pre-fabrication area that is designated for hot work activities)
- Do NOT weld, cut or braze in the presence of combustible or flammable fluids or atmospheres (gases, vapors or dusts)
- Inspect cracks and holes in floors, walls and ceilings of the work area

Check the work area for **combustible materials**:

- Remove all objects (such as oily rags) that could catch fire
- Move all combustible material at least 35 feet (11 meters) horizontally from where the hot work will take place
    - Prepare accordingly when hot work will take place overhead, since slag falling to lower levels can be dangerous for greater distances
- If you cannot move remaining combustibles, protect them with appropriate guards and covers
- If you cannot move or protect combustibles, do NOT weld, cut or braze in the area

Welders are responsible for ensuring that the environment around them is free of hazards to protect the safety of all employees and property in the immediate area.

If you have any questions or concerns, do NOT engage in hot work until a qualified person inspects the area and addresses any hazards.

Fire Safety

Fire extinguishers must be:

- Accessible
- In good working order
- Appropriate for the hazard

All hot work personnel should be trained to use portable fire extinguishers and how to sound alarms.

Check **sprinklers and escape routes**:

- Do NOT cut, weld or braze inside a building if you have reason to suspect the sprinkler system (if present) is not working properly
- Be familiar with escape routes in case of fire

Welding or Cutting Containers

Check for **explosion hazards**:

- Do NOT perform hot work operations on anything containing flammable or toxic material or residue
- Grease, tar, acid or other materials may produce flammable or toxic vapors
- Sealed containers may burst when they are heated
- Opening a hatch, flange or lid is a simple way to prevent pressure buildup

Check **empty containers**:

- Treat any empty containers as flammable or toxic
- Clean containers ensure no flammable or toxic materials are present
- Verify that containers are free of residue on the bottom or in crevices

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 immoveable 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
    - Seep 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.

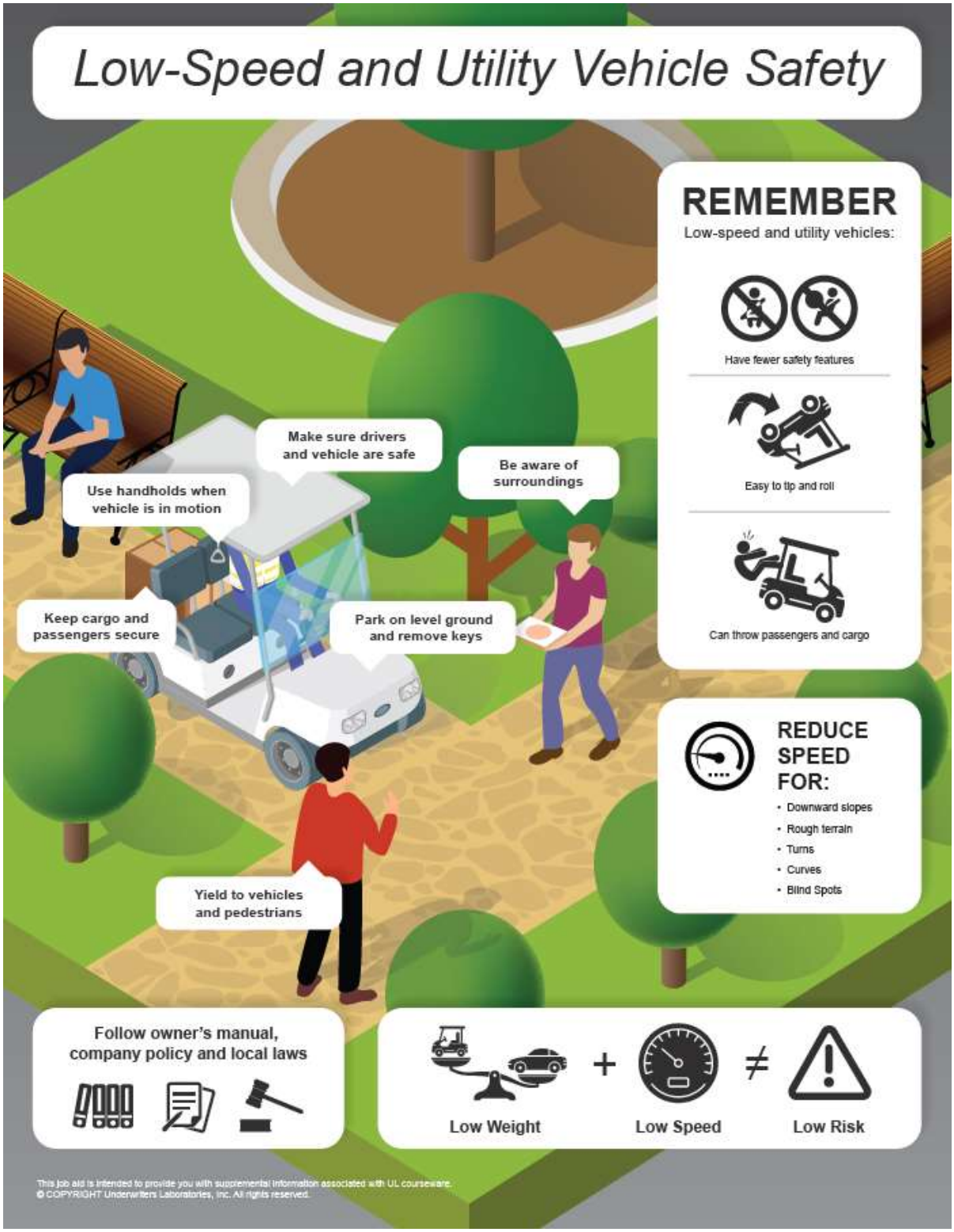
Watch the area. If the fire re-ignites, repeat the aim, squeeze and sweep steps.

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

Low-Speed and Utility Vehicle Safety



Vehicle Inspections

Vehicle inspections help you ensure your safety and the safety of others, maintain vehicles and keep them in a good operating condition, and avoid fines and accident or liability costs.

When, Where and How to Inspect

Inspect your vehicle at least once per day and as required by your employer. Use your employer's checklists and forms, as required.

Inspect your vehicle in an area that is:

- Open (not enclosed, where carbon monoxide can poison you)
- Isolated (away from traffic)
- Safe (well-lit, secure)

Inspections include:

- Driver readiness
- Visual inspection
- Operational inspection

Drivers should be:

- Licensed
- Alert
- Focused
- Free of substances
- Familiar with the vehicle
- Trained

Visual Inspection

When you visually inspect your vehicle, move around the vehicle and look from the ground up. Address any issues before you drive. If your employer owns the vehicle, they may require that it goes to a specific vendor or location for service.

Tires and Wheels

- Check the **air pressure** in the tires and make sure it is within the boundary set in the owner's manual
- Tire **tread depth** should be adequate. Most tires need at least 1/16-inch (1.5 mm) of tread depth. Some tires have wear indicators that become visible when tread is too shallow. Uneven wear may indicate improper inflation or the need for an alignment
- Look for **problems** like bulging tire walls, rim damage, loose or cracked lug nuts, embedded objects or debris. Debris, such as mud or ice, can strike other vehicles if it dislodges while you are driving

Undercarriage

Look under the vehicle. Pooled oil or fluid, chemical smells and residues may indicate that service is required. If you run over objects or animals or if you hear your car scrape along steep surfaces, check the undercarriage for damage or have a qualified mechanic check. Do NOT touch fluids, residues or areas that may be hot.

Exhaust
A properly maintained exhaust system helps reduce noise and emissions. If you notice odd sounds, excessive soot build-up or damage to your exhaust, consult a qualified mechanic.

Engine
Only look at engines with vehicles off and keys secured. Don't touch hot engine parts or unknown liquids or residues. In the engine compartment:

- Belts should not be worn, loose, cracked, frayed or glazed
- Wires/hoses/connections should be secured and not broken, frayed or corroded
- The battery should be free of chalky residue, corrosion, cracks and bulging
- The engine and filters should be clean and free of debris and built-up residue
- If you check and adjust fluids, let the engine cool first and avoid contamination

Exterior
- Check the body and bed of the vehicle for cracks, dents or damage (note *all* damage)
- Make sure mirrors, windows and light covers are attached and unbroken
- Verify that any inspection and registration stickers or decals are current and in place

Interior
- Make sure the interior is tidy. Secure loose items
- Remove things that could distract you, such as cell phones. Set global positioning system (GPS) destinations before you drive
- Note any damage

Operational Inspection

During the operational inspection, drivers will test their vehicles and familiarize themselves with the controls. Test your vehicle in a safe area, away from people and activities. This helps you focus on the inspection and avoid injuries and damage if the inspection fails.

- Make sure your **seatbelt** extends, retracts and clips in place securely. Wear the seatbelt, even during inspections
- Check and adjust **mirrors**. Center your rearview mirror and position the side mirrors so that you can just see the rear edge of your vehicle. Mirror configuration may vary, depending on vehicle type
- Look and listen for **warnings** and consult the owner's manual, as needed. Address any warnings before you drive. If your employer owns the vehicle, they may require that it goes to a specific vendor or location for service
- Check **fuel** and/or **charge** levels. Running out of power can ruin batteries, cause drivers to lose control of the vehicle and require towing, refueling or recharging on-the-spot.
    - Vehicles may be powered by gas, diesel, electricity or a combination. Know which type of fuel your vehicle requires. The wrong type can permanently damage your vehicle
- Test your **horn**, **lights** and **signals** to make sure they function as expected. To verify that your lights are working, you may need to enlist help or use reflective surfaces

- To test **brakes**, drive slowly forward while applying the brakes and then repeat the process while driving in reverse. Apply the emergency or parking brake and check for a visual indicator on the dash. Consult a qualified mechanic if it is too hard or easy to press the brakes, if they don't reset to the raised position quickly or if braking results in sounds (squeaking, etc.) that may indicate a problem
- Test the **steering system** by rotating the steering wheel from side to side to make sure it is smooth and responsive

If you find anything unsafe during your visual or operational inspection, follow your company's procedures to report it. If you discover a serious issue that may make the vehicle unsafe to drive, speak with your supervisor to determine next steps.

Defensive Driving – Small Vehicles

Preparing to Drive Safely

Inspect the Vehicle

Before you move the vehicle:

- Check for obvious signs of damage
- Inspect the tires
- Clean the interior
- Adjust the seat and wheel
- Check for appropriate documentation in the glove box
- Test brakes, wipers, headlights, turn signals and brake lights
- Remove mud, ice and snow off the vehicle and windshield

Adjust the Mirrors

A blind zone is an area you can't see due to configuration, vehicle obstructions or other visual limitations.

To minimize blind zones:

- Adjust the **left** and **right mirrors** to point away from your vehicle
  - You should barely see the body of your own vehicle in the reflection
- Position your **rearview** mirror so that the view outside your back window is centered

Remove Distractions

Before your trip:

- Plan your route
- Allow adequate time
- Put away your mobile devices
- Finish food, drinks and cigarettes
- Set the vehicle controls

Assess Your Condition

Wear your seat belt. Don't drive if you:

- Are upset
- Have been drinking alcohol
- Have taken medicine/drugs that impair your judgment/reaction time or cause drowsiness
- Are drowsy

Best Practices for Driving Safely

To drive safely:

- Pay attention to your speed and the speed limit
- Keep an eye on what's ahead of you
- Use the "3-second rule" for following the vehicle in front of you
  - Increase to 6 seconds or more in inclement weather and poor conditions
- Allow tailgaters to pass you (do NOT honk or slam or tap brakes)
- Begin slowing down as soon as you see an obstruction, stop sign or intersection
- Avoid backing whenever possible (use mirrors and spotters when you must back up)
- Stay away from aggressive/angry drivers

Intersections

At intersections:

- Slow down or stop for yellow lights
- Never assume you have the right-of-way
- Never attempt to pass other vehicles
- Delay acceleration when it's your turn to go
- Use caution at train and commuter rail crossings

Changing Lanes

When you change lanes:

- Signal well in advance
- Be aware of blind zones – yours and others'
- Remember that traffic already in the lane has the right-of-way
- Only change one lane at a time
- Do not weave in and out of traffic
- Avoid passing on another driver's passenger side
- Never pass on the shoulder

Remain Calm

No matter what is happening, remain calm while you drive:

- Avoid aggressive driving and road rage
- Do not pressure other drivers to go faster or get out of the way
- Do not cut people off
- Avoid honking and gesturing at other drivers
- Drive safely, steadily and predictably

In Case of an Accident

Know your company's accident procedures. If you are involved in an accident:

- First, assess the safety of the current situation
- Provide medical care, if needed
- Cooperate with emergency personnel
- Complete required reports/forms with as much detail as possible
- NEVER admit fault or guilt

Distracted Driving

A distraction is any activity that takes your:

- MIND off driving safely,
- EYES off the road and your surroundings, and/or
- HANDS off the wheel or gear shift.

Avoiding Distractions

- Get plenty of rest before you drive
- Do not drink or take drugs before driving
- Wear your seat belt
- Let go of stress before and during driving
- Don’t drive aggressively
- Maintain safe space between vehicles
- Stay alert for hazards, conditions and other drivers
- Take care of your vehicle
- Inspect your vehicle before every trip
- Get fuel and anything else you need before trips

Outside Distractions

Distractions outside your vehicle can include: construction, pedestrians, billboards, other vehicles (moving and stopped) and police activity. To avoid them:

- Remain focused on the road ahead
- Resist distractions
- Scan for potential hazards
- Avoid turning to look at accidents
- Slow down in work zones
- Reduce your speed and leave space around vehicles
- Pay attention to changing traffic patterns and emergency personnel

Inside Distractions

Distractions inside your vehicle can include: eating and drinking, adjusting the radio, adjusting mirrors, dialing/texting on a cell phone, bending to pick up an object that has fallen or shifted in transit, turning to deal with children or pets, grooming activities such as shaving or applying makeup, and reading a map or directions. To avoid these, before you drive:

- Adjust seats/mirrors/controls
- Review map/directions
- Plan your route
- Program navigation devices
- Set up audio entertainment
- Secure objects that may move or fall
- Make sure passengers/pets are secure
- Perform any grooming tasks

While driving:

- Stop before retrieving fallen items
- Don’t turn around or engage in arguments or unruly behavior
- Pull over to resolve passenger issues
- Stop to eat and drink
- Don’t attend to grooming tasks
- Call ahead if you think you will be late (don't rush!)
- Do not read anything (device, paper, etc.) or take pictures

Cell Phones

Phone use of any kind – handheld or hands-free – slows your reactions. This is especially true of **texting**. Find a safe place to pull off the road and park if you are forced to take a call that becomes lengthy or emotionally heated.

You’ll avoid possible legal liability that may accompany cell-phone-related accidents. An attorney can subpoena your cell phone records.

Know and follow the local laws that apply to where you live and drive.

Mental Distractions

Keep your mind on your driving rather than daydreaming or on other distracting thoughts. If you lose focus, pull over in a safe place and take a break.

Keep stress levels low by being well-rested, leaving plenty of time to reach your destination and making sure you’re not hungry or thirsty before you set out.

Postpone phone conversations and heated discussions until you’re out of the vehicle or can pull over safely.

Drugs and Alcohol: The Facts

Substance abuse is the use of illegal substances (cocaine, ecstasy, etc.) or the misuse of legal substances (alcohol, prescriptions and over-the-counter drugs). It may be recreational, social or based on addiction. Legal substances may be obtained illegally by users who intend to misuse them via large over-the-counter purchases, prescription fraud, stealing and reselling.

Substance Abuse in the Workplace

Workplace alcohol, tobacco and other drug-related problems cost companies due to:

- Accidents and injuries
- Time lost from work
- Processing substance abuse cases
- Insurance costs
- Legal counsel
- Productivity losses

Taking over-the-counter cold medicines before driving a commercial vehicle is considered substance abuse. Different industries and organizations have specific regulations regarding drug and alcohol testing and related penalties. Positive test results can jeopardize your current job and impact future job opportunities.

Effects of Substance Abuse

Substance abuse:

- Causes physical, mental and emotional damage to the individual
- Hurts not only the person who uses, but also everyone with whom the person is involved
- Creates shame, embarrassment, and career, legal and medical problems

Alcohol

- Most widely used and abused substance or drug
- Is a major factor in suicides, homicides, domestic violence and accidents
- Is involved in a significant number of all motor vehicle accident fatalities
- Can cause lost workdays, industrial fatalities and industrial accidents
- Majority of alcohol-related workplace incidents are caused by light to moderate drinkers

Cannabis

- Energy loss
- Impaired judgment and skills for up to 24 hours
- Short-term memory loss, paranoia, hypersensitivity, loss of motivation, and other mental and emotional effects

Cocaine

- Stimulates the central nervous system
- Causes an adrenaline rush
- Elevates blood pressure and heart rate
- Constricts arteries to the heart
- Leads to deterioration of membranes of nose and lungs
- Causes heart attacks, liver damage and/or brain damage

- ONLY ONE USE CAN CAUSE DEATH

Amphetamines

- Stimulates the central nervous system
- Raises blood pressure, heart rate
- Lowers the appetite
- Can cause anxiety, panic, acne, malnutrition, dizziness, fever, convulsions, blurred vision, loss of coordination and frequent illness

Ecstasy

- Spikes in body temperature and heart rate
- Muscle tension, involuntary teeth clenching
- Nausea, blurred vision, rapid eye movement
- Faintness, chills or sweating
- Sleep deprivation
- Decreased awareness of bodily functions and needs
- Anxiety, paranoia, depression, memory deficits, and other mental and emotional effects

PCP

- Shallow breathing
- Increased blood pressure, heart rate and temperature
- Loss of balance and slurred speech
- Depression, paranoia, and other mental and emotional effects

Opiates

- Some are illegally manufactured or imported, but others are used in a number of prescription drugs
- Variety of forms and colors and may be ingested or injected
- Euphoria followed by drowsiness
- Lowered breathing and constricted pupils
- Nausea
- Withdrawal can cause severe cramps, chills and fever
- Confusion, mood swings, and other mental and emotional effects

OxyContin

- Contains oxycodone, a narcotic like morphine
- Abusers may commit theft, armed robbery, fraud to sustain their habits
- Has narcotic effect and causes physical dependence
- Inability to concentrate, fogginess, drowsiness and impaired judgment

Reducing the Risk of Substance Abuse

To reduce the risk of substance abuse, **employees** can:

- Learn coping skills
- Drink soda, water or juice instead of alcohol
- Take medications prescribed for them, not for other people
- Seek counseling to improve their mental and emotional health
- Handle little problems before they become big

Resources for Education, Prevention and Intervention

To reduce the risk of substance abuse, **employers** can:

- Create effective drug policies
- Implement pre-employment screening
- Make an Employee Assistance Program (EAP) available to employees
- Provide targeted support for employees facing difficult life events
- Create a healthy corporate culture

When you know someone who won't seek help for a substance abuse problem:

- Stop covering up for them
- Intervene when they are sober – with several people present
- Be specific – use examples of the problem
- State the results of their not getting help
- State what you will do to protect yourself
- Call on others to talk to the person
- If it's work-related, consult management first

Cannabis Awareness

For any substance, including cannabis, "legal" does not always mean "harmless." Follow the laws and company policies in place where you reside, travel and conduct business.

Properties of Cannabis

- Cannabis = Weed = Pot = Marijuana
- Cannabis has many names, but they usually refer to the same substance
- Different strains of the plant may have different properties
- Delta-9-tetrahydrocannabinol (THC) is the primary intoxicating chemical in cannabis
- Hemp is a type of cannabis with little to no THC
- Cannabidiol (CBD) does not produce a high
- Hash is a substance made from the resin of the cannabis plant and contains THC

Uses

- People harvest, dry and cure cannabis buds
- People consume cannabis via inhalation (such as smoking or vaping), ingestion (such as edibles) and absorption (such as salves and patches)
- Hemp is used to make fiber or food products
- Many people consume CBD oil or apply it topically for health reasons
- Cannabis may be used to treat muscle spasms, inflammation, pain, anxiety, seizures, nausea or to improve appetite

Effects

Different People/Plants/Methods = Different Effects

Pleasant Effects
- Relaxation
- Heighten perception
- Laughter
- Altered sense of time
- Increased appetite

Unpleasant Effects
- Anxiety
- Fear
- Distrust
- Panic

The THC in cannabis can affect:

- Movement (slow reactions, reduced coordination)
- Thinking (distorted perception, trouble concentrating)
- Physical condition (fast heart rate, increased blood pressure, dry mouth, red eyes)

The effects of THC typically last 2 to 4 hours after someone *inhales* cannabis smoke or vapors. When someone *ingests* cannabis, the effects take longer to start and may last 4 or more hours. Stored compounds can cause subtle effects for days after use and cause positive THC test results even if effects are not apparent.

Testing

Hair testing can detect THC for 90 days after it enters your body. Blood, urine and saliva testing methods are for more immediate use.

The way someone uses cannabis and individual factors may influence timeframes for detection.

Testing positive means there is threshold quantity of THC that indicates use, even effects are not apparent.

Employers and authorities may need more information to prove substance-related impairment.

Some jurisdictions recommend not driving or operating machinery for **6 hours** after inhaling or **9 hours** after ingesting cannabis products.

Employers may ask workers who perform safety-sensitive tasks, such as driving vehicles, operating machines or heavy equipment or handling hazardous materials to abstain from using **any** THC-containing substances.

Abuse

Repeated or unmoderated use of cannabis can cause the brain to become dependent on THC as a source of pleasure or satisfaction.

Signs that someone may be developing a dependence on cannabis:

- Using more frequently and/or in increasing amounts
- Being unsuccessful at attempts to control use
- Spending significant money or time obtaining, using or recovering

THC withdrawal symptoms include:

- Irritability
- Irregular mood and sleep
- Decreased appetite
- Cravings
- Restlessness
- Physical discomfort

Cannabis smoke contains chemicals that are harmful in high concentrations.

Strategies

Employer policies are conditions of employment. In some countries, employers can prohibit having or using cannabis at work. Employers may ban ALL types of smoking and vaping in the workplace.

Workers in regulated or safety-sensitive positions, such as commercial drivers, pilots and pipeline operators, should NOT use cannabis.

Positive test results, even without impairment, may result in immediate termination.

Employers are required to provide a workplace that is free from recognized hazards; they must intervene if they suspect impairment.