OSHA 10 CONSTRUCTION INDUSTRY

Complete Job Aid

Revised November 18, 2026

This job aid provides reminders about information covered in the OSHA 10 Construction online training course. Always abide by local rules, regulations, equipment instructions, and your company's health and safety policies and procedures.

osha30construction.com

Table of Contents

Select the title in the table of contents to be taken to the job aid.

Introduction to OSHA 4
Access to Medical and Exposure Records for Employees 9
Slips, Trips and Falls for Construction 10
Fall Protection Strategies and Techniques 14
Mobile Elevated Work Platforms 16
Scaffold Safety Essentials 18
Personal Protective Equipment (PPE): Hazard Assessment 21
Personal Protective Equipment (PPE) Overview for Construction: Protective Characteristics 25
Personal Protective Equipment Overview for Construction: Using and Maintaining PPE 28
Dust Mask – Voluntary Use Guidelines 29
Struck-By, Caught-Between – Staying Out of the Line of Fire for Construction 32
Work Zone Safety Part 1: Preparing the Area 36
Work Zone Safety Part 2: Managing Operations 38
Excavation and Trenching Safety 40
Concrete and Masonry 43
Basic Rigging Awareness 46
Ladder Safety for Construction: Selection and Inspection 48
Ladder Safety for Construction: Setup and Use 50
Materials Handling Practices for Construction 53
Stacking and Storage Practices for Construction 56
Ergonomics for Construction 58
Hot Work for Construction 61
Fire Extinguisher Safety for Construction Part 1: Fight or Flee 64
Fire Extinguisher Safety for Construction Part 2: Using Extinguishers 65
Preventing Cuts and Puncture Wounds 67
Hand Tool Safety for Construction 70
Power Tool Safety for Construction 72
Electrical Arc Flash Awareness 74
Electrical Safety for Construction Part 1: Cords and Plug-Connected Equipment 76
Electrical Safety for Construction Part 2: Power Lines and Lockout/Tagout/Tryout 79
Safety Signs 82
Hydrogen Sulfide (H2S) Overview 86
Carbon Monoxide 88

Hazard Communication for Construction Part 1: Written Program 90
Hazard Communication for Construction Part 2: How to Use Labels and Safety Data Sheets 92
Health Hazards in Construction: Introduction 96
Health Hazards in Construction: Asbestos Awareness 97
Health Hazards in Construction: Lead Awareness 99
Health Hazards in Construction: Special Concerns 101
Heat Stress 102

Introduction to OSHA

OSHA's Mission

The Occupational Safety and Health Administration (OSHA) works to save lives, prevent workplace injuries, and protect the health of U.S. workers. Under the OSH Act, employers are legally responsible for providing safe and healthy workplaces, and workers have the right to such conditions. OSHA fulfills its mission by:

- Creating and enforcing workplace safety and health standards through inspections
- Maintaining reporting and recordkeeping systems for work-related injuries and illnesses
- Offering training, education, and assistance to improve occupational safety

Nearly all workers in the U.S. fall under OSHA's jurisdiction. Federal exceptions include miners, atomic energy workers, many public workers (police and firefighters), self-employed individuals, and immediate family members on farms that don't hire outside workers.

Workers are covered either by federal OSHA or by OSHA-approved State Plans. State Plans are run by individual states but must be at least as effective as the federal program. There are 22 State Plans covering both private and public sectors, and 7 State Plans covering only state and local government workers.

OSHA Standards

OSHA creates and enforces safety and health standards that employers must follow to reduce workplace hazards. OSHA can cite or even criminally charge employers who fail to meet these requirements. Its standards apply across general industry, construction, maritime, and agriculture, covering hazards such as chemicals, machinery, electrical safety, scaffolding, ladders, and falls.

OSHA standards are published in the Code of Federal Regulations (CFR), Title 29: Labor; particularly in Chapter XVII. These regulations are organized into parts, subparts and sections.

When a specific standard does not exist for a hazard, OSHA uses the General Duty Clause, which requires employers to keep workplaces free from recognized hazards that could cause serious injury or death. Employers can be fined if they fail to correct clearly identifiable dangers.

Employer Responsibilities and Rights

Employers are responsible for identifying which OSHA standards apply to their workplace, complying with them, maintaining safe conditions, keeping workers informed about safety requirements and ensuring workers use required personal protective equipment. OSHA encourages employers and workers to reduce hazards and continuously improve workplace safety and health programs. Employers are required to post OSHA citations and fix violations within the specified timeframe.

Employers must provide safe, well-maintained tools and equipment and ensure workers use it properly. They must warn workers of potential dangers, maintain and update operating procedures, and provide any required training or medical examinations. Employers also need to follow OSHA's reporting and recordkeeping rules, cooperate with compliance officers, avoid retaliation, and provide access to medical and exposure records as required.

Employers must provide and pay for most PPE (hard hats, goggles, welding gear, hearing protection, firefighting gear, steel-toe rubber boots). They are not required to pay for uniforms, ordinary weather gear, or non-specialty safety shoes and eyewear that can be worn off the job.

The OSH Act also grants employers important rights. They can request free OSHA consultations, ask NIOSH for information on potentially toxic substances, and submit comments or attend hearings on OSHA standards. Employers may participate in safety efforts through industry associations, help shape safety programs, and protect their trade secrets.

Worker Responsibilities and Rights

Under the OSH Act, workers must follow safety rules, use required PPE, report hazards and job-related injuries, and cooperate during OSHA inspections. They are required to read the OSHA "It's the Law!" poster at the jobsite.

Workers also have important rights. They are entitled to training and information about workplace hazards, access to OSHA standards, and the ability to view monitoring data or medical records related to exposure. They may request OSHA inspections, participate in hearings, and challenge abatement periods set for employer citations.

Workers are protected from retaliation when reporting safety concerns or participating in OSHA activities. They may refuse dangerous work when they believe they face an immediate hazard. If they believe they've been punished for exercising these rights, they must contact OSHA within 30 days.

Reporting and Recordkeeping

Employers must report any work-related worker death to OSHA within 8 hours. Employers must report work-related inpatient hospitalizations, amputations, or loss of an eye ..... 24 within hours. Reporting timelines can vary by state. (California requires serious injury/illness reporting within 8 hours.) Employers do not need to report certain motor vehicle-related deaths, except those in construction work zones or involving commercial transport.

OSHA's recordkeeping rules help identify high-hazard industries and support workplace safety efforts. Employers must maintain accurate records of all work-related injuries, illnesses, and fatalities and must log fatalities regardless of how much time has passed since the incident.

Required OSHA forms:

- OSHA 300 Log – record of each reportable injury/illness; completed within 7 days of learning about incidents
- OSHA 301 Incident Report - detailed report completed within 7 days
- OSHA 300A Summary - yearly summary used to calculate and post incident rates (certified and signed by a company executive)

Employers must:

- Keep logs updated and retain them for 5 years
- Post the annual OSHA 300A summary from February 1 to April 30
- Provide records during OSHA inspections or when requested by federal/state investigators
- Allow workers access to injury and illness records

Employers with 10 or fewer workers and those in low-hazard industries are exempt from routine log maintenance unless selected for mandatory data collection. Even exempt employers must display the OSHA "It's the Law!" poster and report any fatal workplace incident within 8 hours.

Inspection Priorities

The OSH Act authorizes OSHA to conduct workplace inspections - usually without advance notice - to enforce safety and health standards. OSHA uses a priority system to determine which worksites to inspect first.

1. **Imminent Danger (Highest Priority)**: Imminent danger involves situations where workers face immediate risk of death or serious harm. OSHA may contact the employer immediately to remove workers from danger. An inspection occurs within 1 day of receiving the report.
2. **Fatalities and Catastrophes**: OSHA initiates fatality and catastrophe investigations as soon as possible after any work-related death, inpatient hospitalization, amputation, eye loss, or major incident involving multiple hospitalizations. Inspectors gather evidence to identify causes and violations.
3. **Complaints and Referrals**: Workers or their representatives may file complaints (anonymously if desired) if they believe hazards exist or standards are being violated. Complaints can be submitted online, by phone, fax, email, mail, or in person. Government agencies may also make hazard referrals.
4. **Programmed Inspections**: Programmed inspections are for target industries and workplaces with high injury/illness rates or those in special-emphasis programs. Employers in the Severe Violator Enforcement Program (SVEP) receive at least one inspection within the first two years. Small employers (10 or fewer workers) in OSHA-defined low-hazard industries are exempt from programmed inspections.

Follow-Up and Monitoring Inspections

Follow-up inspections verify that previously cited hazards have been corrected. Monitoring inspections ensure long-term or complex hazard corrections are progressing and that workers remain protected.

Inspection Processes

OSHA prioritizes on-site inspections for high-risk situations; less severe cases may be handled through off-site phone/fax investigations. If an employer's off-site response is inadequate, OSHA conducts an on-site inspection.

Off-Site (Phone/Fax) Investigations

OSHA may conduct off-site (phone/fax) investigations instead of visiting in person. OSHA contacts the employer by phone to describe the alleged hazards, then sends a follow-up letter or fax. The employer must provide a written response within 5 days, explaining hazards found and corrective actions taken. If OSHA is satisfied with the response, no on-site inspection occurs. The worker who filed the complaint receives a copy of the employer's response and may request an on-site inspection if not satisfied.

On-Site Investigations

A typical on-site OSHA inspection begins with the **presentation of credentials** at which time the inspector provides official OSHA identification.

At the **opening conference,** the inspector explains why the workplace was selected, outlines the purpose and scope of the inspection, and reviews procedures. The inspection may be ended if a qualifying OSHA consultation or exemption applies. The employer may designate a worker representative to join the inspection.

During the **walkaround,** the inspector examines the worksite for hazards, reviews relevant records, and interviews workers while maintaining confidentiality of trade secrets. Employers may correct hazards on the spot, but citations can still be recommended. In multi-employer worksites, OSHA determines responsibility based on who created, exposed workers to, or controlled the hazard.

At the **closing conference,** the inspector meets with the employer and worker representative to review findings, discuss possible violations, and explain rights and next steps, including contesting citations within **15 working days**.

Citations and Appeals

After an inspection, the compliance officer reports findings to the OSHA area director, who issues citations and proposed penalties. Employers receive these documents by certified mail. Citations identify the violated standards and specify abatement deadlines. Employers must post each citation at or near the violation site for **at least 3 days** or until the hazard is corrected.

OSHA can issue several types of violations, each with different penalty levels (adjusted annually):

- **Other-than-Serious Violations**: Related to workplace safety/health but unlikely to cause serious harm (penalties up to $16,550 per violation)
- **Serious Violations**: There is a substantial probability of death or serious harm, and the employer knew or should have known about the hazard (penalties up to $16,550, with a minimum of $1,221 each)
- **Willful Violations**: Employer knowingly or intentionally disregards safety laws (penalties are $11,823 to $165,514)
- When willful violations result in a worker's death, the U.S. Department of Justice may bring criminal charges (fines and up to 6 months of imprisonment)
- **Repeated Violations**: OSHA finds a similar violation within 3-5 years (penalties up to $165,514 per violation)

Failure to abate is when an employer does not correct a cited hazard by the deadline. OSHA may add penalties of up to $16,550 **per day** until it is fixed.

Employers have 15 working days from receiving a citation to request an informal conference or to file a written notice of contest to appeal. OSHA may negotiate an informal settlement, which can adjust citations, penalties, or abatement dates.

Contested cases go to the **Occupational Safety and Health Review Commission (OSHRC).** An administrative law judge reviews the case, and both employers and workers may participate. After the judge's decision, any party may request further OSHRC review. Final OSHRC rulings may be appealed to the U.S. Court of Appeals.

Resources

Workers can access safety and health information from sources including co-workers, Safety Data Sheets (SDSs), labels, signs, manuals, training materials, written workplace procedures, healthcare providers, and public libraries.

The **National Institute for Occupational Safety and Health (NIOSH)** offers research, training, and **Health Hazard Evaluations (HHEs)** for workplaces where workers may be getting sick or exposed to hazards. Workers can request an HHE by submitting a written request to NIOSH signed by at least three workers (the requester plus two others).

Additional training and education are available through the **OSHA Training Institute Education Centers (OTIECs)** and university-based occupational safety and health programs. OTIECs provide OSHA courses, community outreach, Spanish-language programs, and youth safety initiatives.

More resources include:

- OSHA website: www.osha.gov
- OSHA's toll-free phone number: 1-800-321-OSHA (6742)
- OSHA State Plans: https://www.osha.gov/stateplans
- "We Are OSHA, We Can Help" brochure: https://www.osha.gov/sites/default/files/publications/3334we-can-help-sm.pdf
- Employers' PPE Responsibilities: https://www.osha.gov/sites/default/files/Handout_2_Employers_Must_Provide_and_Pay_for_PPE.pdf
- Worker Rights as a Whistleblower: https://www.osha.gov/sites/default/files/publications/OSHA3638.pdf
- Workers' Right to Refuse to Work: https://www.osha.gov/workers/right-to-refuse
- All About OSHA: https://www.osha.gov/sites/default/files/publications/all_about_OSHA.pdf
- Mental Health: https://www.osha.gov/sites/default/files/Helping_Your_Coworkers_and_Yourself.pdf
- NIOSH website: http://www.cdc.gov/niosh
- OTIEC website: https://www.osha.gov/otiec

Access to Medical and Exposure Records for Employees

Medical records document your health status and are created or maintained by healthcare professionals. Medical records include:

- Medical and employment questionnaires or histories
- Results of medical examinations and laboratory tests
- Medical opinions, diagnoses, progress notes and recommendations
- First aid records
- Descriptions of treatments and prescriptions
- Employee medical complaints
- Analyses or compilations of data or statistical studies

Exposure records show your exposure to toxic substances or harmful physical agents or the exposure of employees who engage in similar work or working conditions. Exposure records include:

- Workplace monitoring results
- Biological monitoring results (such as blood and urine tests)
- Safety Data Sheets (SDSs)

Records can help:

- Employers and employees identify and control occupational health hazards
- Physicians diagnose, treat and prevent permanent health impairment Courts that request records to establish the cause of illnesses

Follow your company's process for requesting records.

Your employer is required to keep medical records, exposure records and analyses for you for at least 30 years after your employment ends, with some exceptions.

You or, in some cases, a legal or designated representative have a right to get these records, or copies of them, free of charge within a reasonable time frame.

If you have additional questions, you can ask your supervisor.

Remember to make sure your doctor knows what your job is and what it involves. If you are worried about a particular exposure or condition, share your records with your doctor.

Slips, Trips and Falls for Construction

Definitions

- **Slip:** A loss of balance caused by too little friction between a person's foot/feet and the 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. Occurs more often than elevated falls but is 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 heights. Occurs less often than same- level falls but is associated with more serious injuries

Fall Hazards

Causes of Slips and Trips

The following are just some examples of items at the worksite 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

Poor housekeeping, inadequate lighting that is too dark or too bright, and improper use of equipment use can cause slips and trips.

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

Adverse Weather

Adverse weather conditions can cause slips and trips in wet or icy conditions that cause rainwater or mud.

Protect Yourself

What can you do to avoid the causes of slips, trips and falls? **Develop good habits.**

Keep work areas neat

Take responsibility for keeping your work areas neat and minimizing hazards. If you can fix a problem, do it. If you cannot fix a problem, find someone who can.

Eliminate clutter from aisles. Dispose of trash as it is produced. Take care when using cords.

Mark areas to prohibit storage/obstructions and ensure access where mechanical handling equipment is used. Use floor markings and tool shadow boards. Block off or mark hazardous areas.

Keep floors clean and dry. Maintain drainage and use gratings or raised platforms. Use caution signs on wet floors. Use boot brush stations. Eliminate protruding nails, splinters or loose boards.

Keep work areas well-lit

Avoid lighting that's too dark or too bright. Keep work areas, stairs and aisles well-lit. The work area should be lit enough to show any potential hazards (e.g., hazards at eye level, obstructions in the area).

Avoid wearing sunglasses indoors. The same applies for tinted safety glasses.

Use equipment correctly

Know the weight of the equipment and materials you will be using, the location of skylights and floor hole covers, load capacities of structures, and the proximity to any leading edge.

When working at heights, watch out for electrical lines, moving equipment and unguarded mechanical parts.

Ladders If a ladder is required as part of your job, you must have ladder safety training. 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:

- Visually inspect the ladder before use
- 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)

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 0.9 meters (3 feet) 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:

1. Tag it out of use
2. Secure or lock it up so others can't use it
3. Report it to maintenance or your supervisor

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

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 bricks 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 3 meters (10 feet) 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. Check for any material that could decrease traction (e.g., wood chips, metal shavings, plastic sheeting).

Shoes Slip and fall injuries are often caused by a combination of a slippery surface and the wrong footwear. Soles that perform well preventing slips indoors on wet, smooth surfaces may be wholly inadequate at preventing slips in outdoor muddy conditions where lug-sole construction boots and shoes excel.

Check with your employer or safety equipment distributor about the most suitable shoes to wear in your workplace.

If You Fall

Try to keep your wrists, elbows and knees bent. Do not try to break the fall with your hands or elbows. Aim to soften the fall with your forearms.

It is better to land on your arm than on your head. It is better to land on your behind than on your back. If you feel yourself falling backwards, place your hands on the back of your head to prevent impact with the ground or walking surface.

Fall Protection Strategies and Techniques

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. Use fall protection when you are 1.2 to 1.8 meters (4 to 6 feet) or more above the ground or next lower level. Consider using fall protection when guardrails are removed, guardrails/covers are not able to be installed and/or you are working hands-free. Ask your manager, supervisor or a fall protection competent person 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

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

Secondary fall protection will keep you from falling to a lower level if footing, balance, handholds and other primary means fail. It is classified as passive or active.

Passive systems include guardrails, covers and safety nets. Guardrails can be made of wood, pipe, wire rope or manufactured systems. Ensure they are properly installed and are solid and not loose. The top rail needs to be between 99 and 114 centimeters (39-45 inches) above the work surface. The mid-rail needs to be halfway between the working surface and the top rail. Guardrails need to support 90 kilograms (200 pounds) of force. Floor and hole covers need to be able to support 2 times the potential load, secured and marked "hole" or "cover".

Active systems include work positioning, fall restraint, and fall arrest. The choice of which personal fall protection system to use is determined based on your work. 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.

Reporting Unsafe Conditions

If you see any improperly constructed, loose, missing or damaged guardrails or hole covers, follow procedures to report unsafe conditions to your supervisor or competent person. Be aware that you may be asked to guard or barricade the area until repairs can be made.

Fall Protection Planning

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

- **Free fall** - the distance traveled from the point where you start falling to the point where your fall protection system begins to slow you down
- **Clearance** - 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, causing you to swing back under your anchor point like a pendulum

Fall Protection Equipment

Personal fall protection includes body support, connectors, anchor points, and lifelines.

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 a 2,268-kilogram (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, provide protection of lifeline material and increase the chances of self- rescue. **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 or a competent person who is qualified in fall protection.

To keep your fall protection equipment working, you should store equipment properly, never throw it into a storage box, keep it dry and clean and keep it out of direct sunlight.

Rescue

The recommended hierarchy of rescue after a fall is:

1. Self-rescue - Climb or pull yourself to safety
2. Assisted self-rescue - Suspension trauma safety straps and ladders
3. Mechanically aided rescue - Lifts
4. Rescue pick-off (in very rare situations)

Mobile Elevated Work Platforms

Types of Equipment

Aerial lifts raise personnel 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 take up less floorspace than aerial and scissor lifts.

Preparation

Prepare the People

Everyone who uses mobile elevated work platforms needs hands-on training with the equipment and site familiarization **before** they work. Only **trained** and **authorized** persons should operate mobile elevated work platforms. All personnel boarding the equipment must be familiar with safe work practices while on board.

Prepare the Equipment

Select the appropriate lift for the task/capacity/surface. Before operating the equipment, follow manufacturer's instructions to perform and record the **pre-use visual inspection** of the equipment, including the vehicle and lift components. Check for:

- Damaged or underinflated tires
- Cracked welds or hoses
- Missing bolts or fire extinguisher
- Leaking fluids

If there are no issues, proceed with the **operational pre-use inspection** to confirm that operating controls and functions perform smoothly and correctly. If you discover an unsafe condition, tag the lift "Out of Service" and report the issue immediately.

Prepare the Site

Survey travel routes in person to identify hazards (risk assessment). Check 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
- De-energizing powered equipment/utilities

- Performing lockout/tagout/tryout

Safe Operation

The ground or surface must be able to support the weight and forces of the equipment. If the support surface fails, the equipment may tip or fall. The weight is listed on the data plate, but surfaces must also be able to handle forces at certain points under tires or outriggers. Maximum point load is usually in the operator manual and may be marked on the tires or outriggers.

Extended outriggers or stabilizers can help prevent tipping. Use outrigger pads to help distribute the weight.

Follow manufacturer's directions about operating limitations 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 and avoid turning on sloped surfaces. Follow manufacturer's guidance for specific instructions about acceptable slope limits.

Do **not** travel with people on the platform or in the bucket unless the equipment is specifically designed for this type of operation.

Working Safely

Communicate plans to use mobile elevated work platforms. Use the horn to make your presence known. Put a barricade under overhead activity.

Clean slippery substances off of shoes, hands and ladder rungs. Place tools, equipment and materials on the platform before climbing, or hoist tools, equipment and materials up after boarding. Maintain three points of contact when climbing on access ladders. Close and secure the chain or gate 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. When exiting platforms or buckets, follow manufacturer instructions and company policies, but most will advise you to avoid exiting the platform or bucket until it is lowered. Personal fall protection is required when exposed to fall hazards such as work from a surface without standard guardrails.. Employers must have rescue plans that describe what to do if someone becomes incapacitated, the lift stops working in a raised position or someone falls.

Lower the platform and remove the keys from the mobile elevated work platform after each use to prevent unauthorized use.

Scaffold Safety Essentials

A scaffold is a temporary elevated structure that we use as a platform for workers and equipment. Scaffolds are safe and help workers be more efficient when we set them up and maintain them correctly. Your employer will provide you with training about the scaffolds and hazards where you work. This job aid will focus on supported scaffolds and general scaffold safety.

Types of Scaffolds

There are three general types of scaffolds:

- Supported scaffolds
- Rest on the ground
- Have platforms supported by rigid legs, poles, frames or outriggers
- Are usually made of metal poles or systems or of wood
- Are commonly used for construction projects
- Suspended scaffolds
- Have platforms suspended from above by ropes or a non-rigid support
- Are commonly used for window-washing, maintenance activities and high-rise construction
- Mobile elevated work platforms (such as aerial lifts)
- Include vehicle-mounted or self-propelled elevated work platforms
- Are made of metal, fiberglass reinforced plastic or other material
- May be powered
- Are commonly used for short durations or temporary tasks

General Scaffold Hazards

The purpose of scaffolds is to safely allow people to work at heights but working at heights has its risks:

- Falls
- Falling objects
- Instability and collapse
- Collisions (when mobile scaffolds collide with objects or when vehicles or materials collide with scaffolds)
- Electric shock or electrocution when near power lines
- Poor plank condition
- Weather

Competent Person

The competent person has knowledge and experience and is **capable** and **authorized** to predict and deal with scaffold hazards. Competent people are trained and capable of training others about erecting, disassembling, moving, operating, repairing, maintaining and inspecting the scaffold.

Scaffold Requirements

Your employer will enlist competent people and professional engineers to design, construct and maintain scaffolds. **Everyone** must know basic scaffold requirements so that they can identify when something is or could become unsafe.

Stability helps us avoid tip-overs and collapses. Scaffolds should be on stable and level ground with locked wheels and braces. The competent person may require scaffold-grade planks, base plates and mud sills to create a stable surface, as needed.

Use appropriate scaffold **construction** methods with matching components. The scaffold must be able to safely withstand regular use and conditions such as high winds and rain. Work on scaffolding is prohibited during storms and high winds. Scaffolds may collapse because of missing or improper connecting pins. The height-to-base ratio must meet safety requirements. Scaffolds must have safe and proper access methods.

We don't want scaffolds or conductive material on them to be closer to **electricity** than is safe. The competent person will determine safe distances at which to place/use/remove scaffolds. When safe distances are not possible, the competent person must arrange for the electrical utility company to de-energize, ground and/or shield the lines.

Rails must be around access points and open sides and ends to help prevent falls. The competent person knows and will follow safety regulations regarding where and how to install rails.

Scaffolds may have **toe boards, screens or chutes** along with **barricades** and **limited access** to protect people below from dropped material.

Planking and **decking** should be in good repair and should not have visible bowing. Planking and decking should be free of cracks, dry rot and slick materials (snow, ice, mud, etc.). Planks must be secured, not just laid down. Platforms must be fully planked from front to rear. There should not be any gaps between boards. Planks must have adequate overlap, as determined by the competent person. Overlaps should be on bearers.

The braces, couplers, connections, mud sills, base plates, leveling screws and tie-ins must be strong enough to support the scaffold, the people, the materials and the work. Many scaffold **systems** are prefabricated/engineered so that their components work together. If you notice that parts seem mismatched, please alert the competent person. Even slight leaning can cause hardware failure and collapse, so please report it immediately.

Safe Work Strategies

Safe work on and around scaffolds includes:

- Limited and appropriate access. Only authorized people should be on or around scaffolds. Access scaffolds using designated ladders, stairs, ramps and walkways, **not** unapproved parts of frames and cross-braces. Take care when climbing on or off scaffolds
- Protection from falling objects. Protect people below from tools, materials, equipment, or other objects that may fall from a scaffold. Practice good housekeeping and keep objects away from edges. Wear a hard hat on construction sites, especially when you are on or around scaffolds
- Moving mobile scaffolds safely. Do not move scaffolds when people are on them. Before you move a scaffold, check for obstructions overhead and for debris or holes on ground

- Personal fall arrest systems (PFASs). If you use a personal fall arrest system (PFAS), your employer will train you to inspect, use and store it safely. Use the anchor or tie-off points designated by the competent person. **Never** tie off to a standard scaffold guardrail
- Training and inspections. The competent person will provide training and will perform safety inspections and tag scaffolds to indicate if they are safe for use

Unsafe Conditions

When you work on or around scaffolds:

1. Recognize potential problems.
2. Address them, block them, and/or stop work.
3. Report them.

Personal Protective Equipment (PPE): Hazard Assessment

A hazard assessment is a process of identifying hazards, evaluating the risks presented by those hazards and managing the risks of the hazards. The hazard assessment will tell you about the hazard and what type of PPE you need. A hazard assessment must happen before PPE selection.

Types of Hazards and PPE

Common hazards include electric shock, sharp objects, falling objects, flying sparks, chemicals and noise. PPE used to protect against these hazards may include gloves, safety glasses, shoes, earplugs, hard hats, respirators, coveralls, vests and full-body suits.

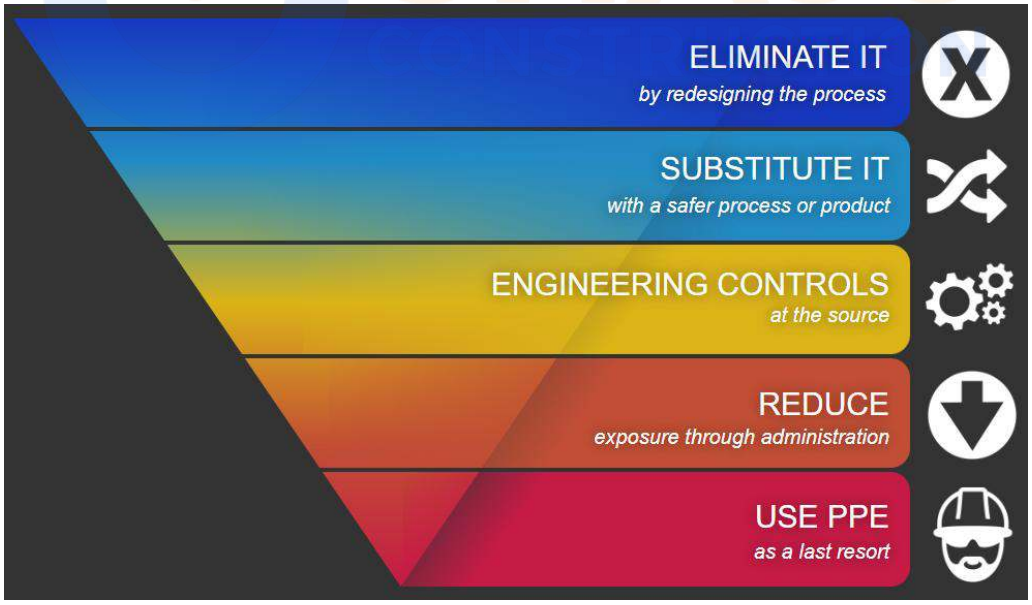
Many people evaluate and prioritize risk with a risk matrix. See Appendix A below.

PPE and Other Controls

Engineering controls are structures or devices that physically protect workers from hazards or reduce workers' exposure to them. Common examples include machine guards, exhaust or wetting systems, and ergonomic workstations.

Administrative controls involve changing how and when workers do their jobs. Common examples include job rotation schedules or adding relief workers.

Always use PPE for activities as a supplement to other controls, not as the only control. PPE is the last barrier that protects you from hazards when other controls are not completely effective.



Important: Be sure to look for safety signs, warnings and labels around your work area. These are important reminders about a hazard and the PPE requirements that will help keep you safe.

PPE Selection

Selecting the proper PPE should take into account a variety of factors including:

- Type of hazard present (e.g., electricity, sharp parts, noise or chemical exposure)
- Body part
- Route of potential harm to workers (e.g., electric shock or burn, inhalation, skin absorption, ingestion, injection, or eye or skin contact)
- Performance of the PPE materials, seams and construction in providing a barrier to these hazards

In hazardous waste operations and emergency response, there are four levels of protection that combine multiple pieces of PPE to create a level of protection based on the associated potential exposure.

- **Level A**: provides the greatest level of skin, respiratory and eye protection
- **Level B**: provides the highest level of respiratory protection but a lesser level of skin protection
- **Level C**: is used when the concentration and type of airborne substances are known and the criteria for using air-purifying respirators are met
- **Level D**: provides the minimum protection required

Check the manufacturer's label or marking on your PPE to make sure it will protect you from the potential hazard. If you feel that you aren't completely protected, stop work and talk to your supervisor.

Fit Test

PPE shouldn't move around or fall off while you work and shouldn't be too tight or constricting. To get a good fit:

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

PPE Inspection

If your PPE is worn out or damaged, it will not protect you when you need it. Inspect your PPE before and after each use. If it's unsafe to use, either permanently replace it or find a replacement while it's being repaired. Inform your supervisor and follow your employer's procedures to mark it "out of service." Some PPE, such as electrical gloves and respirators, require a written inspection/testing program.

Training Requirements

Employers must train workers who are required to wear personal protective equipment on how to do the following:

- Use protective equipment properly
- Know when PPE is necessary
- Know what kind of PPE is necessary
- Understand the limitations of PPE in protecting workers from injury
- Put on, adjust, wear, and take off PPE
- Maintain protective equipment properly including any required testing and recertification

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				
			Rare The event may occur in exceptional circumstances.	**Unlikely** The event could occur at some time.	**Moderate** The event will probably occur at some time.	**Likely** The event will occur in most circumstances.	**Certain** The event is expected to occur in all circumstances.
			Less than once in 2 years	At least once per year	At least once in 6 months	At least once per month	At least once per week
		Level	**1**	**2**	**3**	**4**	**5**
Consequence	**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 fatalities 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.

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.

Dust Mask – Voluntary Use Guidelines

For serious hazards, workers are REQUIRED to wear respirators for protection. This job aid focuses on good practices for the VOLUNTARY use of disposable dust masks and filtering facepiece respirators (FFRs).

Types of Respirators

A respirator is a device that protects you from inhaling airborne substances such as dust, vapors, gases and fumes. Respirators offer varying levels of protection, so it's important that you can tell the difference between the types and understand how each works.

Atmosphere-Supplying Respirators

Atmosphere-supplying respirators supply breathable air directly to the user from a source other than the hazardous atmosphere.

Because these respirators provide their own air, they don't have filters.

- Self-contained breathing apparatuses (SCBAs) use their own air tank to supply clean air and are used in toxic and oxygen-deficient atmospheres
- Air-line respirators provide clean, fresh air to the user from a stationary source, such as a compressor or compressed air cylinder

Air-Purifying Respirators (APRs)

Air-purifying respirators (APRs) have filters or cartridges that remove contaminants from the air as they pass through the air-purifying element before reaching the user. They can be full-face or half-masks with mechanical or chemical cartridges.

APRs do NOT protect against oxygen-deficient atmospheres because their canisters or cartridges do not provide clean air. APRs must not be selected for atmospheres that are toxic and immediately dangerous to your life or health. **Filtering facepiece respirators and dust masks are types of APRs.**

Filtering Facepiece Respirators (FFR)

A filtering facepiece respirator (FFR) is a particulate respirator that cleans particles out of the air as you breathe. While these are the most common respirators, they are also the least protective. They would be dangerous if used in situations that require more substantial masks.

A dust mask is a type of filtering facepiece respirator. The terms "dust mask" and "filtering facepiece respirator" are often used interchangeably.

Filtering facepiece respirators:

- Have a filter as the main part of the facepiece
- Are designed and tested to meet standards, such as those set by the National Institute for Occupational Safety and Health (NIOSH)
- Are marked with a rating such as KN95 or N95
- Have two loops for attaching to the face – one above the ear and one below

Dust masks:

- May not be certified by a testing agency
- May be voluntarily worn for comfort against non-toxic, nuisance dust
- Often have one ear loop only
- Should not be relied upon for health and safety protection

Filtering facepiece respirators are classified by their:

- 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 is most affected by the presence of oil mists. It is commonly available for voluntary use. Look for the mask's efficiency and oil resistance ratings and suggested use on the packaging. Look for the testing agency's logo or name on the mask itself or on the straps.

Surgical masks, medical masks, procedure masks and other face coverings usually do not prevent leakage around the edge of the mask when the user inhales. These masks are usually just intended to prevent the release of potential contaminants FROM THE USER into their immediate environment.

Selecting a Mask

If the use of respiratory protection is mandatory, your employer will have a qualified person select the appropriate type of protection you need.

FFRs may be **mandatory** when working around elevated levels of lead dust or silica dust. You might **voluntarily** wear a mask around nuisance dust during activities that produce nonhazardous dust like sanding, mowing or sweeping, or when you feel discomfort from low levels of pollen and other mild allergens.

To ensure that an FFR does not present a hazard:

- Read and follow all instructions provided by the manufacturer
- Be sure it bears a mark verifying it has been tested and meets PPE standards
- Don't wear an FFR in atmospheres it's not designed for; FFRs are for dust, not for gases, vapors, fumes or smoke
- Keep track of your FFR so that you only use yours

Usage Guidelines

Some general guidelines for using a filtering facepiece respirator include:

- Your employer needs to ensure that masks are not dirty or contaminated and that their use does not interfere with the ability to work safely
- Limit the use of filtering facepiece dust mask respirators to 8 hours (continuous or intermittent)
- Try different brands, models and sizes to get a comfortable fit
- People with pre-existing pulmonary or cardiovascular issues may have trouble wearing masks that restrict breathing. Discontinue use and notify others if you experience dizziness or difficulty breathing

- Follow the manufacturer's instructions:
- Use ear loops correctly
- Use both head straps for FFRs, making sure they are correctly positioned and adjusted
- Make sure the facepiece is snug
- Mold the nosepiece to your face

Care Guidelines

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. A filtering facepiece respirator should have two elastic straps, a moldable nosepiece and, if equipped, a functioning exhalation valve.

Discard respirators if they are or become soiled, contaminated or damaged or don't allow you to breathe freely.

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

Hazards cannot be avoided or controlled unless they can be recognized. Once you recognize hazards, assess risk and implement controls to eliminate or reduce the risks.

Monitor the proximity and motion of equipment and people around you. Be aware of warnings. Follow safety instructions. If you have questions or concerns, STOP until you get clarification.

To control struck-by and caught-between hazards, in order of preference, we:

1. ELIMINATE THEM by keeping people out of the line of fire
2. SUBSTITUTE safer equipment and processes
3. Provide ENGINEERING CONTROLS at the worker level
4. REDUCE exposure through safe work practices, training and job rotation
5. USE PPE for added protection

Worker-Level Control

- Complete safety training and use methods to safely operate equipment
- Pay attention to information from your employer 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

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 a predictable fashion
- Debris chutes and refuse containers are filled

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

Work Zones

There is a lot of movement on a construction site requiring your awareness and coordination to prevent incidents. Work zones should have marshalling plans that include who will safely direct vehicle movement. 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 them. 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 shift the load and the operator may lose control of the material being transported

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
- Know the paths of escape or egress in the immediate area

Overhead/Scaffold Work

Scaffold failures can be catastrophic to a worksite and worker safety. Scaffolds must be inspected and tagged daily. If a scaffold doesn't look or feel right, do not use it and report it to your supervisor. 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 daily and 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, fires 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 that complies with ANSI/ISEA 107 or equivalent international standards 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 the fall radius in every direction (where pieces 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 or other material

Projectile and Entanglement Hazards of Tools/Equipment

Projectiles may be created by the interaction of materials, tools and equipment. They may come from adjacent work, even above and below you. 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 people are hammering, chipping, and using pneumatic or powder-actuated tools in your work area
- Observe clearances and heed warnings at blasting sites
- Never use compressed air to clean people

- Check with your supervisor before using compressed air to clean equipment and areas (specific regulations and controls apply)

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 contact with mechanical hazards
- Ask your supervisor for help determining tools and work practices to use when guards must be removed for tasks
- 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, 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 sidewalls and materials sloughing off of the side walls)
- Making sure spoil piles/equipment are back from the edge by at least 0.6 meters (2 feet)
- Noting the position of equipment that could slide into the trench and catch you between the equipment and the ground
- Making sure you have means of quick egress from the trench, such as ladders or ramps

Work Zone Safety Part 1: Preparing the Area

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, Occupational Safety and Health Administration (OSHA) safety requirements, and may have additional requirements that you and your employer must confirm before beginning work.

Work zones must contain clear, consistent signs, markings, and other visual cues. If there are any issues with signage and/or markings, workers must report them.

Workers in work zones must follow the traffic control plans, perform routine day and night inspections, and be aware that conditions can change unexpectedly.

Traffic control plans should include all types of traffic, be in writing, communicated, 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 internal and external traffic control plan safety instructions where you work.

Five Areas of Work Zones

Work zones are divided into five distinct areas.

1. The ***advance warning area*** warns the public with increasingly specific signs as they approach the work area. The spacing and placement of signs will vary depending on speed and visibility.
2. The ***transition area*** is where traffic moves from its normal path via detours, lane changes, and tapers.
3. The ***buffer area*** gives motorists who cross over traffic control devices time to react and stop before striking anyone. Keep free of materials, equipment, and people.
4. The ***work area*** 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 and proper lighting.
5. The ***termination area*** is where traffic passes beyond the work area and resumes normal movement. Tapers should be about 100 feet (30.5 meters) long and use 5 to 6 traffic control devices per lane. Many termination areas include termination signage.

Work Area Safety Guidelines

Keep personnel clear of paths used by entering, backing, and exiting vehicles and equipment. Ensure safe entry and exit routes for workers from parking areas, toilet facilities, and break areas. Ensure even lighting throughout. Designate specific entry and exit points for construction vehicles, avoiding conflicts with personal access points (internal traffic control plan). Inform all work zone employees about the internal traffic control plan.

Large Trucks

Large trucks pose significant risks to workers on foot. Large trucks have extensive blind spots. Mirror adjustment helps but is not sufficient. Drivers of large trucks should use spotters and understand backing hand signals. Before moving, drivers should check blind spots and the area around the truck. If not equipped with backing alarms, activate the horn twice before backing; stop if the spotter is no longer visible.

Outside Delivery

Instruct delivery drivers and equipment operators on entering, maneuvering within, and exiting the work zone before work begins. Ask drivers to turn off radios and keep windows open to better see and hear workers. Workers should only approach equipment after the operator signals it is safe.

Nighttime Operations

Understand that people are hard to detect when immediately next to or behind large vehicles. Ensure uniform lighting and avoid shadowy and dark areas. Identify a specific side of the vehicle for each operation where a worker should walk; be consistent.

Work Zone Inspections

Perform routine daily and nightly inspections, even when work is stopped. Drive by the work zone yourself and assess whether advance warnings are easy to see and instructions are easy to follow. Pay attention to issues caused by worksite lighting (glare), and adjust lighting as needed.

Check 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: Managing Operations

Keeping everyone safe in work zones requires tools, practices, and personnel. Designing traffic control and management plans requires in-depth knowledge of the *Manual on Uniform Traffic Control Devices (MUTCD)*, evaluation of many factors, and coordination with state and local agencies.

Traffic Control Devices

Traffic control devices provide advance warning to motorists, delineate travel paths, and separate traffic from workers. Examples include signs, barrels, cones, message boards, chevrons, barricades, concrete barriers, and traffic lights.

At a minimum, traffic control devices must be clean, maintained, and made of approved materials (not homemade). Purchase signs and other traffic control devices from your local safety and industrial supply company.

Ensure traffic control devices are applicable and don't have conflicting instructions/information. Ensure they have directions/arrows pointed where traffic should go and are placed/distanced appropriately.**Traffic cones** must be orange, reflective or lighted (for night use), and at least 28" (71 cm) tall (states may require taller).

Barrels must not be made of metal, such as recycled 55-gallon (200-liter) barrels. They must be lightweight and flexible and at least 36" tall by 18" wide (91 cm tall and 46 cm wide). They must be reflective with orange and white stripes and have closed tops and drain holes to prevent water and debris buildup.

Traffic control devices need enough weight to be stable, but not so much that they can become dangerous projectiles. Place weights low. Do not place weights on top of the traffic control device or use weights made of concrete.

Positive protection (concrete jersey walls) are **required** where high-operating speeds (45 mph/72 kph or greater) are anticipated and there is no means of escape from passing vehicles. These devices are **recommended** for long-duration work zones, projects with high anticipated operating speeds even when there is a means of escape, and when work operations place workers near travel lanes.

Safe Practices

Wear **high-visibility apparel** in work zones (day or night). Choose Type R, Class 2 or 3 high-visibility garments. Class 2 is the minimum requirement; however, Class 3 is recommended and has the most reflective surface area around the torso, sleeves, and legs.

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. Wear garments fully zipped and not covered by outer layers. Keep traffic vests and reflective garments clean, maintained, and visible.

Generally, wash garments in cold water with mild detergent, avoid bleach and fabric softener, and air dry or use the lowest heat setting in a dryer. Avoid washing high-visibility clothing along with rough fabrics or items with rough finishes, as these can damage the reflective material.

When you are in a work zone, face oncoming traffic (even when resetting displaced barrels and cones), and be aware of construction vehicles and equipment (listen for backup alarms). Stay out of the buffer area, and do not cross open lanes of traffic.

Correct problems immediately. When you notice problems that you can't fix immediately, inform your supervisor, and follow up to ensure resolution. When inspecting/traveling, stay in the vehicle cab and wear your seat belt.

Know emergency procedures and warning signals for uncontrolled vehicles. For motor-vehicle accidents in the work zone, follow company procedures, assist people carefully, and be aware of 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. Check floodlight placement by driving through the illuminated area from each direction on all approaching roadways after setup, at night, and periodically.

To increase the visibility of operations at night, wear vests over other clothing and use lights aimed away from motorists.

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 trained/knowledgeable about work/safety, and certified.

Place advance warning signs before flagging stations. These may include ROAD WORK AHEAD, FLAGGER AHEAD, or PREPARE TO STOP. Make sure stations are visible and well- lit at night; 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" (46 cm x 46 cm) octagons with 5' to 7' (1.5- to 2.1-meter) handles. Only use flags in emergencies.

Flaggers must be visible at all times.

Flaggers should avoid mingling with other workers, wear distinctive vests and gear, and stand at all times.

Do not park vehicles near flaggers. Vehicles and fixed objects can impair visibility and block escape routes in case motorists don't respond to directions.

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/excavations if water has accumulated or is freely seeping in.

Vibration caused by equipment and processes 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 (0.6 meters) from the excavation or trench edge (keep them further away if required/reasonable).

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 Classifications

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.

Stable rock is natural, solid mineral. It is more stable than any type 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 that is 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. Benching describes a method where soil is stepped back to meet sloping ratios. 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. Benching is not used for Type C because of the instability of the soil.

Sloping ratios:

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

Shoring is a mechanical support system used when appropriate sloping is not possible.

Shielding involves portable or permanent protective structures. Shields used in trenches are often referred to as **trench boxes.** Trench boxes should extend at least 18 inches (0.5 meters) 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 at least 4 feet (1.2 meters) 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 level. When ladders are used with trench boxes, they need to be placed within the box and extend out the necessary 3 feet (1 meter). 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 (when possible, barriers and signage should mark the area of a fall hazard). 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

Competent persons must contact utility companies or owners 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, such as hydro excavation or daylighting in which equipment is used to make and vacuum slurry to create trenches without digging.

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 the start of work daily and as needed after rain showers and any other event which changes the conditions of the excavation.

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.

Work activities that can contribute to hazardous atmospheres 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 a location that is 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.

Hierarchy of Controls

Use the hierarchy of controls to avoid collapses and other dangers. It identifies the controls, starting with the most effective, that protect you. Use all the required controls, as directed by your employer.

1. **Eliminate** (ex: choose alternative construction methods that do not require excavation, such as directional drilling or boring)
2. **Substitute** (ex: use prefabricated components or sections that can be assembled without the need for extensive excavation)
3. **Engineering controls** (ex: shielding, shoring, benching, sloping, ventilation, pumps, hydro excavation)
4. **Administrative/Work practices** (ex: training, signs, written programs/procedures, competent person program, reporting)
5. **Personal protective equipment (PPE)** (ex: respirators, hard hats, fall protection, electrical protection)

Emergency Procedures

Employers should have a site-specific emergency plan on-site, and they should train all employees who will be exposed to excavation and trenching hazards about this plan.

Collapse happens quickly. Initial collapses may lead to secondary collapses, making rescue difficult or unsafe.

Evacuate the excavation, get to safety, call emergency services and secure the area. Rescues should be undertaken by specially trained medical or emergency rescue personnel **only.**

Concrete and Masonry

Note: Qualified professionals must coordinate technical safety matters.

Hazards

Concrete and masonry materials contain crystalline silica which can irritate your eyes, and inhaling too much of it can cause cancer. Contact with concrete mixes can cause blisters, swelling, bleeding and chemical burns.

Physical health hazards include ergonomic and heat stress related injuries. Improperly lifting concrete and masonry materials can cause painful injuries. If you are working in extreme heat or cold, you are at risk for conditions like heat stroke or frostbite.

General safety hazards that construction workers may experience during concrete and masonry construction include accidents, injuries and fatalities resulting from:

- Premature removal of formwork
- Failure to brace masonry walls
- Failure to support pre-cast panels
- Incorrect operation of equipment
- Failure to guard reinforcing steel
- Inadequate shoring, which can lead to formwork collapse

Controlling Hazards

Use the hierarchy of controls to identify the precautions, or controls, that protect you, starting with the most effective. Use multiple controls for your work. Use all the required controls, as directed by your employer.

1. Elimination
2. Substitution
3. Engineering controls ○ Examples: tools with dust suppression/capture built-in; lifting equipment (forklifts); automatic shutdown switches; insulated handles; machine guards
4. Administrative controls and work practices ○ Examples: keep hoses low; programs and procedures (qualified person, dust suppression, lockout/tagout/tryout); maintain exclusion and limited access areas; stay hydrated; remove contaminated clothes and protective equipment immediately, clean up, wash skin and eyes, seek medical help (if needed)
5. Personal protective equipment (PPE) ○ Examples: coveralls (or long sleeves and pants), protective boots, gloves, safety googles or safety glasses, hearing protection, respiratory protection

Safe Work Practices

Do not place **construction loads** on new concrete surfaces until a qualified person (typically engineers with civil or structural engineering credentials) certifies them to carry the weight.

Guard all protruding **reinforcing steel** to prevent impalement (square caps, wood troughs). Prevent unrolled wire mesh from recoiling (secure each end of the roll or turn the roll over).

During **post-tensioning operations**, the sudden release of energy from failed equipment presents severe risk to personnel. 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 under tension.

Do not **work under loads** that are moved or supported by cranes. Avoid working near elevated workloads, when possible. Do not work under concrete buckets or ride buckets. Wear hard hats and eye protection.

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 buggy handles must not extend beyond the wheels on either side. Secure **tremies/hoppers** with wire rope in addition to regular connections.

Bull floats need non-conductive/insulated handles to reduce the risk of electrical shock. **Masonry saw** guards with a semicircular enclosure over the blade are designed to retain the blade and material fragments. Dust suppression systems limit exposure to silica dust.

Follow **lockout/tagout/tryout** procedures. Do **not** service equipment unless it is properly locked out, tagged and tested. Tags must read "DO NOT OPERATE" or similar. Tryout is to test that it cannot unexpectedly start.

Cast-In-Place and Pre-Cast Concrete

Formwork must be able to support all loads. The placement and rate of pour must be consistent with the 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 by a qualified person 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

Support reinforcing steel for walls, piers, columns and similar vertical structures to prevent them from overturning and collapsing.

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. Make sure 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 materials can result in severe injuries or death. Workers who aren't needed to lift, move and secure panels must keep away.

Workers involved in lifts must take precautions to avoid pinch/crush hazards. Do not position yourself under a panel while it is being tilted, on the blind side of the panel while the crane is traveling with it, or between the crane and the panel. Do not reach between the panel being lifted and an adjacent panel or under panels to adjust shims and bearing pads.

Make sure qualified crane operators/riggers verify the lifting equipment condition and capacity. Use taglines to guide pre-cast panels and help the ground crew avoid pinch/crush areas. Do not release lifting lines prior to completing bracing.

Suspend lifting operations in strong wind, heavy rain and other adverse weather conditions. Do not attempt to use taglines to steady loads during adverse weather to continue working.

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 the slab foundation/footing has capacity for pre-cast loads and the weight of cranes operating on the pad
- Verify that temporary base restraints are in place to prevent kick-out
- Ensure that panels are 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 (more than 48 kilometers or 30 miles per hour), immediately evacuate scaffolding and the danger area, including the limited access zone.

Basic Rigging Awareness

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.

Types of Equipment

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

- Preconfigured rigging devices – mechanical devices, such as lifting beams, that enable rapid and consistent load connection
- Slings – short lengths of wire rope, chain or synthetic fibers used between lifting devices and connectors
- Connectors – hooks, eyebolts and shackles used to link pieces of rigging together
- Adjusters – chain hoists and come-a-longs used to balance loads

Inspections

Riggers must inspect all rigging equipment before and after every job (frequent inspections). At regular intervals, rigging equipment must undergo more thorough checks (periodic inspections). Periodic inspections differ from frequent inspections in two ways:

- They are more thorough and time-consuming
- Written records document the physical condition of each piece of equipment

At a minimum, you should look for:

- Missing or illegible sling identification
- Acid or caustic burns
- Melting or charring of any part of the sling
- Holes, tears, cuts or snags
- Broken or worn stitching in load bearing splices
- Excessive abrasive wear
- Knots in any part of the sling
- Discoloration and brittle or stiff areas on any part of the sling
- Pitted, corroded, cracked, bent, twisted, gouged or broken fittings
- Other conditions that cause doubt as to continued use of a sling

Where any such damage or deterioration is present, remove the sling or attachment from service immediately.

Care and Storage

The most common misuse of rigging is dragging and/or dropping equipment on the floor. Abusing equipment can cause disastrous results.

When slings (web or wire rope) are dragged on the floor, this can cause excessive wear to the strands or fibers in the rope or sling, which can cause the sling to break. Dirt, chemicals and oil may be infused in the synthetic sling webbing or the wire rope. The dirt or chemicals can cause excessive wear on the inside of the sling, a place that usually cannot be inspected. Certain chemicals can break down fibers leading to a failure.

When rigging equipment is dropped, it can cause moderate to severe damage, such as cracks in the housing which can cause failure of the equipment.

Slings may be stored in a rack or tray, but it is preferred to hang them vertically, whenever possible. Slings should not be stored outside where they may be exposed to the elements.

Best Practices and Precautions

Safety should be the first priority when performing lifting operations. It's important for you to know the capabilities and limitations of the equipment. Know the weight of the load, including the rigging hardware. Know your rigging equipment's safe working load limit. Know your lifting device's safe working load limit. Overloading the weakest link in the system can cause sudden and violent component failure.

Only use appropriately rated and engineered lifting points for attaching rigging equipment.

When telehandlers and other mobile lifting equipment are used as the lifting device, avoid the use of free-rigging slings. This can affect the capacity of the system and creates an unstable attachment point. Only use manufacturer-approved lifting devices for lifting purposes.

Fiber rope is not approved for use as a load-bearing rigging tool.

Pull along the plane of an eyebolt, not in the other direction.

Add pads and corner guards to prevent sling damage when making sharp turns.

Job Preparation

- Planning a rigging job requires four basic parts:
- Determine the weight of the load
- Find the balance point of the load (or center of gravity)
- Check clearances for moving the load
- Select rigging equipment to be used

Important: Riggers are qualified according to tasks they are skilled at performing. Consider the rigger's qualifications when making plans to rig complex loads.

Choosing Your Equipment

Choosing the right equipment is essential for a safe lifting operation. The choice of appropriate equipment is based on:

- The weight, shape and nature of the load
- The environment (temperature, type of exposure, available height)
- The lifting method, attachment points and the equipment available

Organizing the Crew

Every rigging job should have **one** person in charge, often a manager or supervisor. It is the responsibility of the person in charge to ensure that the job is performed safely. This includes:

- Verifying proper equipment inspections are performed
- If lifting outside, checking weather conditions and how that will affect the lift
- Verifying safe working load limits for all equipment

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 strenuous or pushing and pulling work
- Ladders should be used for brief work and occasional access to higher work surfaces
- Use fiberglass ladders around electricity
- Check safety label for information about:
- Type
- Grade
- Duty rating (weight capacity)
- Model or ID number
- Highest standing level

Note that aluminum and lightweight fiberglass ladders are typically rated for 200-300 pounds (90-136 kilograms). This includes the weight of the person, any tools or materials being carried, and the force of movement as you climb and descend.

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
- Damage to ladder hardware (locks, brackets, hinges) including rust or bending
- Defective rungs, steps, surfaces or side rails
- Damaged or missing feet or supports
- Missing non-slip pads (without these, ladders can move and slide out from underneath workers)
- On extension ladders, check for missing or damaged:
- Extension ladder mechanisms
- Rung dogs or locks
- Pulley system
- Ropes and rail guides
- Braces, end caps or closures

- On stepladders, check for:
- Damaged pail shelves (items may fall on people below)
- Damaged spreaders or spreader assemblies
- On platform ladders, check for:
- Missing, warped, frozen, uneven casters, wheels, stops or locks on platform ladders
- Corroded, bent or not-level standing surfaces
- If a ladder is defective, remove it from service. Tag it, secure it and report defects to your supervisor/foreman
- You may be asked to put a lock and chain around an unsafe ladder to physically prevent use prior to replacement or repair

Ladder Safety for Construction: Setup and Use

Moving a Ladder

When you move a ladder, retract or collapse all parts, fully close the ladder, and lock everything in place. Carry the ladder horizontally. Always check for obstacles at each end before making a turn. You may also need someone to walk ahead of you to open doors in your path.

When carrying a ladder by yourself:

1. Put your arm through the ladder
2. Rest it on your shoulder
3. Grab a forward rung with your other hand
4. Keep the center balanced

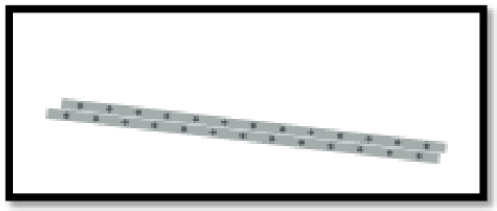
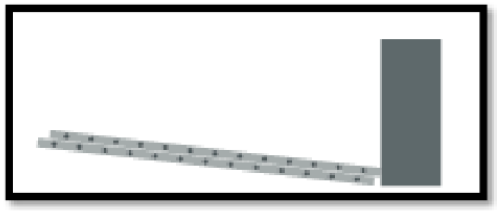
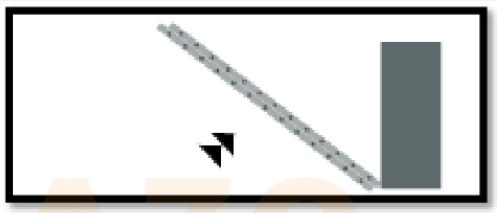
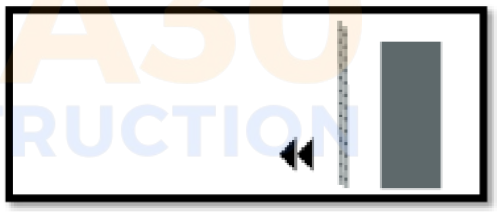
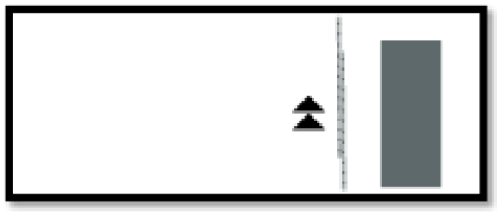
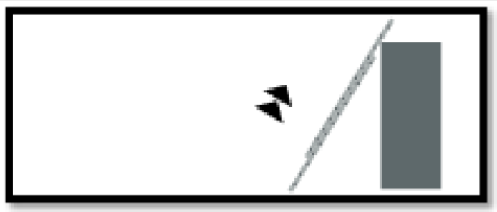
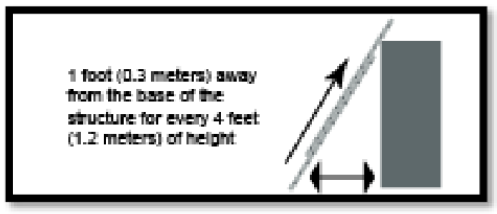
When possible, ask a co-worker for help carrying a ladder. Both people can carry the ladder with their arms through it and the side rail on their shoulders. Another common two-person technique is carrying the ladder much like a suitcase with each person's arms down at their sides. Very heavy or very long ladders may be carried using three people with the ladder flat on their shoulders.

Setting Up a Ladder

- 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
- Assess if you will need **fall protection**
- Never set ladders on top of boxes or bins to add height
- Never set ladders on top of a vehicle or machinery that can move
- Set ladders on a non-slippery, even surface
- Sweep away sand and dirt that could cause the ladder to slip
- Secure the ladder at the base anytime you must use it on a smooth or potentially slippery surface
- 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
- 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)

Raising an Extension Ladder

Raising an extension ladder can be a two-person job, but one person can raise a single or multi-section ladder by walking it into position using a hand-over-hand technique.

1. Close the ladder and position it with the base section on top of the fly section.	
2. Block the bottom of the ladder against a fixed object (such as a wall) or another person's foot.	
3. Check for overhead clearance and power lines, and "walk" the ladder up to a vertical position.	
4. Keep the ladder vertical and move it away from the supporting structure several feet or meters.	
5. Raise the fly section using the rope and pulley system, placing one foot on the base rung.	
6. Carefully lean the ladder against the supporting structure.	
7. Place the base of the ladder **1/4 of the working length of the ladder away from the base of the structure**. This equals roughly 1 foot (0.3 meters) away from the base of the structure for every 4 feet (1.2 meters) of height.	

- The distance from the base of the ladder to the 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
- Ensure that the upper section rests on (or is in front of) the bottom section with enough overlap. The bottom section and rung dogs should face the supporting structure
- Rest both side rails on the top support
- Ensure the ladder leans against something substantial
- Ensure ladder side rails won't slide across smooth wall surfaces

Verify Safe Setup

- On stepladders, make sure spreaders are fully open and locked
- Make sure the tallest point to be reached from the stepladder is accessible from the second rung from the top
- Regardless of the type of ladder, all ladder sections and parts need to be locked in place before climbing
- Physically secure the ladder whenever repeated or extended use is expected and when any aspect of setup and use presents a risk that requires extra stability
- Lash or otherwise secure the side rails at the landing surface so they don't move when people step onto or off ladders

Securing a Ladder

- To secure the base of a ladder, screw or nail a 2-foot x 4-foot (0.6-meter x 1.2-meter) cleat to the decking behind the ladder's feet to prevent the ladder from slipping backward
- A staked cleat can be used behind the ladder's feet on soft ground
- Another method is to lash or brace the ladder's side rails to a solidly anchored object or directly to the structure on which the side rails are resting
- Lashings should connect low on the ladder, ideally around the lowest rungs
- Stakes can be driven into the ground if there is no suitable structure to tie to

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

Prevent Falls

- 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!

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 need to 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 must 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
- Exclude general site workers from the fall zone where hooking/unhooking loads are taking place. These areas are limited to authorized employees who are directly involved with hooking and unhooking loads
- A fall zone is the area (including but not limited to the area directly beneath the load) where it is reasonably foreseeable that partially or completely suspended materials could fall in the event of an accident.
- Help watch for dangers such as winds, storms and power lines
- Do not use cranes in severe weather conditions
- Stay out of the swing radius of the counterweight

Slings

When working with slings, rigging or other materials-handling equipment, knowledgeable employees must ensure that they are visually inspected before use and during operation, especially if used under heavy stress. Qualified riggers or other knowledgeable employees conduct or assist in the inspection because they are aware of how the sling is used and what makes it unserviceable.

Remove damaged or defective slings from service. Use slings according to the manufacturer's instructions. Store slings in an area where they will not be subjected to mechanical, chemical or ultraviolet damage or extreme temperatures. Do not shorten slings with knots or bolts. Remove kinked sling legs from service. Do not load slings beyond their rated capacity.

Keep suspended loads clear of all obstructions. Crane operators must avoid sudden starts and stops when moving suspended loads. Employees must remain clear of loads about to be lifted and suspended.

Rough 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

Riggers, signal persons, lift directors and equipment operators need hands-on and equipment-specific training about the equipment's safety requirements, design, maintenance and use.

Safety Considerations

Perform a hazard assessment. Use spotters, tag lines and other precautions to maintain the required separation distances between overhead power lines, lifting equipment and loads being lifted.

Watch out for low spots or holes in the driving path. Drive straight up or down a slope rather than diagonally or horizontally to avoid tip-over. Watch out for other workers or equipment near the driving path. Pay attention to areas with limited visibility.

Read the load charts to ensure the load is within the equipment's maximum capacity. Balance the load. Avoid carrying the load too high.

If equipped with outriggers, verify they are placed correctly and securely cribbed to prevent settling.

Slings are not allowed to be attached directly to the forks of a forklift/telehandler (commonly referred to as free rigging).

Restricted Access Zones (Fall Zones)

For activities such as crane lifts or utilizing a telehandler to move materials, restrict access to the fall zone. Only authorized employees are allowed access inside the fall zone. Barricade or rope off the swing radius of the crane. Block off areas below overhead material loading and unloading to limit possible exposure to falling materials.

Materials handling at elevated heights brings additional risk to workers, such as:

- Using trash chutes for material disposal
- Stacking material overhead
- Removing scrap bulk material
- Walking in areas that are not covered or protected from falling materials

Safety and Health

Ergonomics

Ergonomics not only improves jobsite safety but also makes performing certain tasks easier. Ergonomic principles for materials handling may require controls to mitigate stresses and strains on the body. Such controls include:

- Reducing the size or weight of the objects lifted
- Arranging material delivery to reduce carrying distance

- Using forklift rather than manually moving materials
- Moving concrete using a pumper truck or concrete buggy

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 it
- Consider using a dolly, cart, wheelbarrow or other assistance in moving heavy materials long distances

When you lift a load manually:

- 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

Additional factors to consider:

- Can I get a good grip on the load?
- Is the item wet? (wet bags of soil can increase their weight by nearly 50%)
- Is the item covered with dust or any other material that could limit a strong grip?

Avoid the risks associated with moisture or dust by:

- Covering the material with polythene sheets when delivered to the site
- Using straw-filled matting and polyurethane foam to protect materials from the effects of frost and snow
- Using a dry goods storage area to protect the material from bad weather

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 and scrapes; crushed fingers, hands and feet; and even death.

Potential Hazards and Injuries

Workers can be injured by falling objects, improperly stacked materials, and sharp, abrasive or heavy materials and equipment.

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

- Strains and sprains such as back injuries due to improper lifting
- Fractures and breaks caused by being struck by materials or caught in pinch points
- Cuts and bruises caused by falling materials or incorrectly cutting ties or other securing devices

Moving, Handling and Storing Material

You should get help moving a load when you cannot properly grasp, lift or control it; see around or over it; or safely handle it. Help moving a load can be accomplished by utilizing a two-person lift, finding the appropriate mechanical equipment to move the load, or breaking down the load into a smaller size.

Best Practices

Ensure that no part of your body is under a raised 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-toe safety shoes or boots.

Blocking materials should be large and strong enough to support the load. Do not stack or store any materials closer than 18 inches (45 centimeters) from sprinkler heads.

When moving materials with mechanical equipment, avoid overloading the equipment. Note the equipment-rated capacity on each piece of equipment and how elevating the load and irregular load size can change that capacity. Pay attention to ground conditions, and 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
- The height the material is being lifted directly impacts the lifting capacity
- At the lowest position for traveling
- Correctly piled, if stacked

Stacking Materials

Lumber

Remove nails and screws before stacking. Stack and level on solidly supported bracing and ensure stacks are 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 bags and bundles 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 boxed materials in place using cross-ties or shrink-wrap.

Drums and barrels

Stack drums and barrels symmetrically. If they are stored on their sides, block the 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 hazardous materials cannot be stored together. Check with your supervisor or general contractor if you are unsure.

Combustible materials

Store combustible materials 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

Cylindrical materials like structural steel, bar stock, poles, and pipes should be stacked and blocked to prevent spreading or tilting.

Pipes and bars

Do not store pipes and bars in racks that face walkways. Ideally, store them in low-traffic areas.

Ergonomics for Construction

Most workers have had occasional back, hand and joint pains, sprains and strains. These injuries are preventable. Ergonomics is the study of how to make workers comfortable and efficient so that they can avoid or reduce injuries.

Damage and Symptoms

Musculoskeletal means muscles and skeleton. It includes muscles, nerves, bones and connecting tissues, like tendons and ligaments.

Musculoskeletal damage includes musculoskeletal disorders (MSDs), repetitive motion injuries (RMIs), repetitive strain injuries (RSIs), cumulative trauma disorder (CTD), tendonitis and carpal tunnel syndrome. You don't have to know what these terms mean, just that they are about musculoskeletal damage.

The symptoms of musculoskeletal damage often begin subtly. They may be easy to ignore, but they will get worse over time without treatment. Symptoms of musculoskeletal damage include:

- Decreased grip strength, range of motion and muscle function
- Pain, stiffness and burning sensations
- Numbness, tingling sensations and pale fingers or toes
- Inflammation (swelling, heat and pain)

People often damage the neck and back by straining muscles, tearing ligaments and compressing nerves/discs. Discs may also become misaligned (herniated). People often strain joints, causing inflammation (swelling, heat and pain).

Ignoring symptoms or waiting to treat them makes injuries more likely and increases recovery time. Minor musculoskeletal damage usually heals with adequate rest, over-the-counter pain medications, hot/cold therapy, and gentle stretching and strengthening exercises. People who experience severe pain after a sudden injury or who are not able to perform daily activities should seek medical attention.

Risk Factors

A lack of ergonomics causes musculoskeletal damage or makes it worse. Damage often begins subtly. It gets worse over time and lasts a long time if it is untreated. To prevent damage and pain, identify activities that may cause damage. Apply ergonomics to prevent serious or long-term damage.

Risk factors are conditions that put stress on bodies and can cause musculoskeletal damage. They can exist at work or at home. **Repetition** is making the same motion over and over again, such as hammering or sawing. **Forceful motion** happens when people use a lot of force or effort to perform a task, such as when they lift heavy objects. **Stationary positions** are those in which people stay in one position for too long, such as when they hold up construction signs. **Awkward postures** are when people bend their joints in uncomfortable ways or for a long time. Examples include squatting and reaching. **Contact stress** is when people put direct pressure on the body by pressing it against a surface or edge. An example is pressure on the knees from kneeling on the ground. **Temperature** is a risk factor when people work in extreme heat or cold, such as when they work outside. **Vibration** restricts the blood

supply to muscles. Examples include using vibrating equipment, such as jackhammers. **Stress,** such as working too long without adequate breaks, can increase the chance of musculoskeletal damage.

Some tasks involve multiple risk factors. Combining risk factors at work and at home increases the risk for musculoskeletal damage. The risk for musculoskeletal damage is higher when the person is exposed to risk factors for a long time or in intense conditions, is exposed to them often, is in poor physical condition or doesn't spend enough time recovering.

Controls

Use the hierarchy of controls to avoid musculoskeletal damage. It identifies the precautions to use to prevent musculoskeletal damage, starting with the most effective. Your workplace may have multiple controls. Use all the required controls as directed by your employer.

Your employer will **eliminate** conditions that aren't ergonomically friendly whenever possible. For example, they may set up work areas with tables or benches that raise tasks off the ground.

They will also **substitute** processes and products with more ergonomic alternatives. For example, they may purchase ergonomic hand tools.

Engineering Controls

Engineering controls are equipment, devices and strategies that remove conditions that create ergonomic hazards. The risk factors of lifting objects and digging with shovels may include forceful motion, awkward postures, contact stress and repetition. Engineering controls for lifting may include handles or slots in packages and mechanical lifting equipment, such as hand trucks, powered dollies, forklifts, hoists and cranes. To reduce the risk factors of digging with shovels, workers may use earth moving equipment, such as trenchers or excavators.

Administrative and Work Practices

Administrative and work practices are procedures and recommendations that you can follow to work ergonomically. Your employer should have a written ergonomics program that assesses risks and explains how to control them. It should include information about training, equipment, tools, healthcare and reports. Check with your supervisor if you have any questions or concerns about your employers' ergonomics program.

Think about how you can make your tasks easier before you begin. Adjust work to a comfortable height, if possible. Place the tools and materials that you will use frequently within easy reach. Check your line-of-sight and lighting. Make sure you have enough clearance to use your full range of motion.

Exercise (brisk walk for 5-10 minutes) and then stretch before you perform any intense activity. Ease your body into rest by gently exercising (slow walk for 5-10 minutes) and then stretching. If you experience pain while stretching, report it to your supervisor.

There are some work practices you can use to avoid specific risk factors. To avoid **repetition,** perform a mix of tasks and take turns. Avoid **forceful motion** by limiting manual lifts to objects that are less than 22.6 kilograms (50 pounds). Keep objects close to you and, if needed, lift as a team. Avoid **stationary positions** by alternating sitting and standing or using footrests.

Take turns performing the work. Use anti-fatigue shoes, shoe insoles and mats. Avoid **awkward postures.** Turn your entire body instead of twisting. Keep frequently used items at a level between your waist and shoulder. Use engineering controls like reaching tools. Adjust equipment and work surfaces so that you don't touch edges to avoid **contact stress.** Pad surfaces and edges and wear knee or shoulder pads. Wear warm or cool clothing to maintain a comfortable **temperature.** Work in short intervals of time if you use tools that create **vibration.** Reduce **stress** by adjusting equipment speeds to a comfortable pace. Allow time for your body to adjust to work after you return from an absence or change tasks.

Stay healthy and fit to reduce the risk of musculoskeletal damage. Exercise regularly and stretch at least daily. Avoid smoking and unhealthy foods. Rest injured muscles and joints. Wear comfortable clothing that does not restrict movement or circulation.

Personal Protective Equipment (PPE)

Personal protective equipment (PPE) is a final barrier between workers and ergonomic risk factors. Wear anti-fatigue insoles or orthotic shoes and knee or shoulder pads to reduce **contact stress.** Wear vibration-reducing gloves when you use tools that create **vibration.** Check labels to verify that they meet ANSI S2.73 or ISO 10819 standards. Be aware of how personal protective equipment may affect your **temperature.**

If you wear braces, wrist splints, back belts and similar devices, be alert for additional strains they may place on the body.

Reporting

Report ergonomic ideas, concerns and injuries to your employer. Support your co-workers by offering to help them with tasks and encouraging them to report. Be prepared to report when symptoms started, how it feels, where it hurts, when the pain occurs, how long the pain lasts, and what motions or activities cause the pain or symptoms.

Early detection and treatment are the only ways to prevent musculoskeletal damage from becoming much worse over time. Report symptoms right away, regardless of where they happened.

Your supervisor will help you avoid exposing injuries to more risk factors and may also advise you about healthcare options that your employer provides.

Hot Work for Construction

Hot work is any type of work that produces or uses a spark, flame or enough heat to start fires. Examples include welding; torch cutting; grinding; brazing, soldering, and sweating pipe; thawing pipe; and torch-applied roofing. Because of the potential for fire and injury presented by hot work, it requires certain special procedures that you need to know about.

Buildings under construction may have incomplete fire prevention and suppression systems or fire-resistant features. Sites are also likely to have openings in the building envelope for air and combustible materials, like wood, dust and debris. Fires are likely to start and spread quickly without proper precautions or controls. Completing fire safety features, such as suppression systems and seals, should be a high priority.

Precautions

Whenever possible, avoid hot work. Use alternative methods such as using manual hydraulic shears instead of cutting with a saw or torch; mechanical bolting instead of welding; using screwed, flanged, or press fit pipe instead of sweat soldering; using a reciprocating saw instead of a high-speed radial saw; or installing a roof covering system that is not torch-applied instead of one that is torch-applied.

Follow the site permitting process to make an area suitable for hot work. When hot work must take place, move it away from any building, such as to a prefabrication area that's been designated for hot work activities. When the work cannot be moved, make the area safe for hot work by relocating movable combustibles within an 11-meter (35-foot) radius to a safe location.

Use safeguards to protect immoveable combustibles and nearby personnel from the heat, sparks, fumes and light. Prioritize completing fire safety features, such as suppression systems and seals. Inspect prefabrication areas and other designated hot work areas before beginning work. These areas must be fire safe and 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 11 meters (35 feet) in any direction from the hot work or within a 22-meter (70-foot) diameter of the hot work should be either removed or shielded from potential heat, sparks or flame.

Remove flammable liquids, paper, wood shavings, dust and oil deposits. Eliminate explosive atmospheres in the area. Sweep floors clean of sawdust, scrap wood and other debris (kindling).

Wet down and cover combustible floors with damp sand or fire-resistant blankets or pads. Remove combustibles whenever possible or protect them with fire-resistant blankets or metal shields. Cover openings with fire-retardant or noncombustible material. Suspend fire-resistant blankets beneath the work area where sparks, slag or hot work pieces may fall to a lower level. Shield or shut down duct and conveyor systems that might carry sparks. Use screens to prevent ignition sources from escaping the work area.

Make sure the construction and any covering or insulation on walls, ceilings and enclosed equipment is noncombustible. Hot work cannot take place if any part of the construction is combustible.

When work is to take place on walls, partitions, 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 and surrounding area to ensure fires don't start. If fires start, they sound the alarm, stop the hot work and make the area safe again if a fire starts or the area becomes unsafe. Fire watchers must be in place during and for at least 60 minutes after hot work.

After hot work is finished, the hot work area should be monitored for up to 3 hours.

The permit authorizing individual (PAI) will assess the risk of hot work to determine timeframes for fire watch and monitoring. The PAI may reduce the watch to as little as 30 minutes or may extend it.

Responsibilities

All workers are expected to check for things that are unsafe. Some people have specific responsibilities related to the hot work permitting process.

Company Management

Company management is responsible for:

- Designating personnel who will authorize permits
- Making sure that workers (including contractors) are familiar with hot work requirements
- Informing contractors of site-specific flammable materials, hazardous processes or conditions, and other potential fire hazards

Permit Authorizing Individuals (PAIs)

Management designates PAIs who are responsible for knowing where flammable materials, hazardous processes or other potential fire hazards are likely to be present. They support moving work to a location that’s free from combustibles or arranging for someone to move them a safe distance or properly shield them.

If the work cannot be moved, PAIs are responsible for moving the combustibles to a safe distance or having them properly shielded against ignition. They assess the risk of operations and determine timeframes for fire watch and monitoring, as well as required safety separation distances.

PAIs coordinate activities to prevent work with solvents and other flammable materials near hot work operations. They prevent hot work from taking place if conditions are not safe and work with the fire watchers to stop hot work if conditions become unsafe.

They make sure that fire extinguishing equipment is nearby and ensure that fire watchers are ready and able to perform their duties.

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:

- Help to prevent or extinguish small fires and ensure the hot work operator's safety
- 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 or other emergency

Typically, the watch takes place within 11 meters (35 feet) of the hot work. Multiple fire watchers are needed if a single fire watcher cannot observe 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 they cannot handle a fire with the available equipment.

Hot Work Permits

A written permit has to be issued when it is established that hot work must take place outside of a designated prefabrication area. No hot work can take place without a permit unless it is done in an area specifically designated for hot work.

Permits may vary in appearance, but most versions list the precautions required to make an area safe for hot work in a checklist format.

The permit authorizing individual must verify that the checklist on the permit is complete, and that hot work operators and fire watchers have what they need to comply with procedures. The PAI determines how long the permit is valid; it may not exceed 24 hours. The PAI must inspect the area at least once per shift while the permit is in effect to ensure that it remains fire safe.

Hot work permits are posted at the jobsite in an accessible and conspicuous location and stored with safety records after the permit is complete.

Fire Extinguisher Safety for Construction Part 1: 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 whether the fire is too big for a portable fire extinguisher and whether the environment is too hot and smoky to breathe safely. Consider if there is a safe evacuation route and whether you are properly trained and confident in your abilities.

Important: To effectively use fire extinguishers, you need additional training and hands-on practice.

You may be able to **fight** the fire if the fire just started, is limited to the original material ignited, and there is a clear evacuation path behind you.

You may need to **flee** if the fire is too big for a portable fire extinguisher, such as when it is about half the size of a car or larger. You should also leave if the fire involves or has the potential to ignite flammable solvents. Flee if flames are higher than your head or the heat is too intense to get within 10-15 feet (3-4.5 meters) of the fire. If smoke is quickly filling the area or if heat or smoke forces you to crawl on the ground, leaving immediately is the safest choice.

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

Fire Extinguisher Safety for Construction Part 2: Using Extinguishers

To effectively put out small fires, you need to choose and use the appropriate extinguisher.

How Fire Extinguishers Work

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

- Heat
- Oxygen
- Fuel
- Chemical chain reaction

Fire extinguishers expel extinguishing agents when you press down or squeeze 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 extinguishers. Class A combustibles can be difficult to extinguish completely so be sure to monitor them for re-ignition.
- **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. Class K extinguishers are commonly mounted in or near a commercial kitchen and discharge automatically.

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.

Before fighting a small fire using a fire extinguisher:

1. Alert others of the fire by following your employer's emergency response plan (may include activating an alarm).
2. Ask someone to notify the appropriate people, such as the fire department and building security.
3. Notify others of your intent to fight the fire.
4. Evacuate everyone except first responders from the immediate area.
5. Identify and maintain a safe evacuation path.

When you fight the fire:

1. Choose the appropriate type of fire extinguisher.
2. Stand a safe distance from the flames (check extinguisher label).
3. Discharge the extinguisher using the PASS (pull, aim, squeeze, and sweep) technique.
4. 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.

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

Best Practices

- Get hands-on training in addition to the online course and this job aid
- Keep the appropriate class of extinguisher for the materials in each area
- Make sure extinguishers are accessible and easy to locate
- Maintain clear access to fire extinguishers and other emergency equipment
- Don’t stack materials in front of extinguishers
- Document periodic extinguisher inspections
- Inspect the pin, gauge, and nozzle for damage, obstructions, or evidence of tampering
- Do not re-mount a used extinguisher; instead, take it out of service and replace it with a fully charged extinguisher

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

Use hand tools safely by selecting the correct tool, inspecting it before use, and following your company's hand and power tool policies. Remove damaged tools from service, store tools after use, and ask a supervisor or consult safety guidance if you are unsure which precautions apply.

General Hand Tool Hazards and Controls

Hand tool hazards include cuts, scrapes, punctures, falling objects, trips, electrical shock, noise, ergonomic stress, and injuries from slips or flying debris. Prevent injuries by keeping work areas clear, maintaining control of tools, and using the correct PPE.

Storage, Falling Objects, and Defective Tools

Use toeboards and screens on elevated work surfaces to help prevent tools from falling. Secure tools in a tool belt or container, or tie them off when needed. Store tools in designated areas immediately after use.

Inspection and Correct Use

Do not use defective tools, including tools with loose heads that could break free or handles with splinters, burrs, cracks, or splits. Tag worn, damaged, or defective tools and mark them "out of service." Use the correct tool for the job; do not use screwdrivers as chisels, utility knives as screwdrivers, hammers as pry bars, or cheater bars to force tools.

Tool Types, Hazards, and Safe Practices

Striking tools

Claw hammers, framing hammers, roofing hammers, sledgehammers, and mallets can cause injuries from flying chips, broken handles, projectiles, or missed strikes. Do not strike with the side of a hammer or use a hammer as a wedge or pry bar. Keep hands and handles free of oil, grease, and moisture. Wear eye protection at a minimum. Ear protection may also be needed.

Driving Tools

Use screwdrivers to tighten or loosen screws. Hazards include cuts, punctures, eye injuries, electrical shock near live parts, and strain from repeated motion. Repeated use can cause muscle strain. Fit the screwdriver to the job, keep fingers away from the tip, avoid using pliers or a hammer on the screwdriver, take breaks, and wear eye protection and gloves.

Use wrenches and sockets to tighten nuts and bolts. Slippage can injure hands or knuckles, and excessive force can strain the back or shoulders. Do not use bent, cracked, or chipped wrenches; cheater bars; pipes; or shims. Pull rather than push, keep tools clean, lightly oil them to prevent rust, store them in a dry place, avoid metal wrenches near electrical sources, and wear eye protection and gloves.

Cutting tools

Utility knives, hacksaws, hand saws, shears, snips, chisels, files, and similar tools can cause cuts, punctures, amputations, eye injuries, and repetitive-motion injuries. Avoid chisels with mushroomed heads, control saws by releasing downward pressure, and keep blades sharp. Cut away from your body, keep others out of the work range, and carry a cutting tool by the

handle not the blade. Do not point blades toward yourself or a co-worker, and wear cut-resistant gloves.

Gripping tools

Pliers, clamps, and vises are designed to hold, clamp, or manipulate objects securely. Hazards include cuts, slips, flying debris, and pinch-point injuries. Do not use damaged vises or pliers, C-clamps for hoisting, clamps for permanent fastening, pliers as wrenches or hammers, or cutters around energized wires. Select the correct tool, and wear eye protection and cut- resistant gloves.

Prying tools

Prying tools include crowbars and pry bars, and are often used for demolition, lifting, and pulling nails. Hazards include cuts, eye injuries, loss of balance, sudden release of force, and back or shoulder strain. Use a crowbar with a grip and heel, and do not use makeshift crowbars.

Digging Tools

Shovels are used to dig tough soil, move loose materials, break up dirt, and dig trenches or post holes. Main hazards include musculoskeletal injuries and physical strain. Avoid twisting your spine; lift with your legs, not your back or shoulders. Keep the shovel and your shoes free of mud, grease, or other slippery materials. Before digging, call the power company to check for electrical hazards; in the U.S., call 811.

Power Tool Safety for Construction

Power tools can cause serious injuries when they are misused or modified, including cuts, scrapes, amputations, and even death. Following basic safety guidelines can help prevent these injuries.

Power Tool Hazards

Hand tools and power tools share several hazards. Both can create tripping hazards on walking and working surfaces, fall onto people below when used at heights, and penetrate underground or embedded cables and pipes. Power tools can also cause injury when they are misused, modified, or used for the wrong application. Because power tools operate with greater energy and speed, they are often less forgiving than hand tools when used incorrectly.

Hazards associated with power tools include cuts, scrapes, and punctures. Moving parts can catch loose clothing, hair, or fingers. Some tools also create inhalation and projectile hazards.

The type of **power source** used can create additional hazards. Electric and battery-powered tools can cause electrical shock, and even brief exposure may result in severe injury, heart failure, or death. Gasoline- or diesel-powered tools can create fire or explosion hazards, and lithium-battery-powered tools can do the same if they are damaged or misused. If the air hose on a pneumatic power tool is punctured, cut, or attached with the wrong fitting, it can cause uncontrolled whipping of the hose. Hydraulic-powered tools can cause serious injuries, including high-pressure fluid injection and crushing from unexpected tool or equipment movement. Cartridge-powered tool hazards include accidental discharge, projectile penetration through materials, ricochet, and high-noise exposure.

Precautions

All Power Tools

Do not yank a cord out of the wall or pull on a connected hose when trying to disconnect them. 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 not actively using a tool, servicing a tool, and when you are changing accessories. To prevent unintentional starting, disconnect the energy source before carrying a tool. Unplug the tool or remove the battery when it is not in use.

Keep tools sharp, clean, and well maintained. Keep all safety guards in good working order, and avoid modifying equipment by taping down triggers, removing or disabling guards, or bypassing other safety devices. Use clamps and vises to secure the work.

Tag worn, damaged, or defective tools and remove them from service. Store them in a secure area, and mark them "out of service" or apply lockout/tagout equipment. Dispose of tools or parts that cannot be repaired according to company policy.

Wear appropriate personal protective equipment (PPE) for the task. Use safety glasses, goggles, or a face shield to protect against flying particles, sparks, and debris. Wear head protection and protective footwear when there is a risk of falling or dropped objects. Use a dust mask or respirator when exposed to dust or airborne contaminants. Wear gloves to protect against sharp edges, chemicals, and electrical or temperature hazards. Do not wear gloves near rotating equipment unless specifically required.

Electrical Tools

Use double-insulated and grounded tools, and store them in a dry area. When working in damp or potentially wet locations, use ground fault circuit interrupters (GFCIs).

Wear properly rated gloves, hard hat, eye, and face protection, and protective footwear.

Battery-Powered Tools

Charge lithium-powered tools away from combustible materials.

Powered Abrasive Wheel Tools

Perform ring tests before mounting a grinding wheel. . A wheel in good condition makes a clear, metallic ring. If the wheel makes a dull thud, treat it as unsafe because it could come apart during operation. Make sure guards are in place and appropriately adjusted.

Make sure the wheel is compatible with the material being worked on, and check the user's manual for spindle and wheel size requirements. Run the equipment for at least 30 seconds to confirm the wheel is mounted correctly.

Wear eye and face protection, restrain hair, and wear tight-fitting clothing.

Pneumatic Tools

Secure hoses with positive locking devices and safety clips. Keep the tool firmly against the work surface before firing, and point pneumatic tools away from yourself and others.

Wear hearing, eye, and face protection.

Hydraulic Power Tools

Use only the fluid recommended by the manufacturer. Before applying pressure, confirm that connections are tight and fittings and hoses are not damaged. Use the manufacturer's recommended safe operating pressures for hoses, valves, pipes, filters, and other fittings. Do not use equipment that shows wear, cracks, or other damage.

Never use your hands to check for leaks; use a piece of cardboard or wood instead. Relieve pressure before disconnecting lines.

Cartridge (Powder or Explosive) Tools

Do not use cartridge tools in explosive or flammable atmospheres or on thin materials such as plywood or drywall. Choose the correct cartridge for the tool and application.

Never point the tool at yourself or anyone else. Don't load the tool until you're ready to use it, and never leave a loaded tool unattended. Keep your hands away from the barrel end. Hold the tool firmly against the work surface before firing, perform a test fire, and unload it immediately after use.

Wear eye, face, and hearing protection.

Electrical Arc Flash Awareness

Significance of the Arc Flash Hazard

An arc flash can generate an explosion with a temperature of up to 19,000 °C (35,000 °F) which vaporizes metal, burns clothing and fuses synthetic material to skin. It can also generate 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 and Arc Blast Definitions

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 instantaneous pressure wave of significant heat, debris and sound.

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

- Conductive dusts coating surfaces near energized parts or dust that builds up and is then disturbed
- Material in the electrical equipment, such as moisture from condensation, dirt, debris, tools, foreign objects or pest infestations
- The accidental touching of equipment
- Equipment that is faulty due to improper installation or maintenance, loosened parts, connections or corrosive decay

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 and 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. They could also experience hearing and vision loss.

General Precautions and Safe Work Practices

To help prevent an arc flash, do not 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.**

Do not enter electrical rooms unless you are qualified and authorized to do so.

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.

Personal Protective Equipment (PPE)

Even 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 qualified and 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
- Hearing protection
- Gloves
- Smock or arc-rated suit
- Hood and neck cover

Labels

To protect workers from electrical hazards such as arc flash, employers conduct an arc flash risk assessment and then label hazardous electrical equipment with pertinent information from the assessment. Warning labels provide information about arc flash protection, electrical shock protection and required PPE.

Boundaries

Boundaries are identified on warning labels.

The Arc Flash Protection boundary, also known as the outer boundary, is usually the point farthest from the energized equipment that PPE must be worn to protect against 2nd-degree burns or worse if an arc flash occurs. Barricades provide a warning and help limit unauthorized access.

The Limited Approach Boundary is the outermost of two electrical shock boundaries. The higher the voltage, the greater the distance. Unqualified people must not cross this boundary unless they are escorted by a qualified person and are wearing the required PPE.

The Restricted Approach Boundary is the innermost and closest boundary with arc hazards and electrical shock as a grave concern. It can only be crossed by a qualified person wearing required PPE because of the increased risk of electrical shock.

Electrical Safety Programs

Electrical safety programs are designed to help people make the right decision when they are working around electricity. Elements of an electrical safety program include:

- Lockout/tagout procedures
- Procedures for identifying hazards and eliminating or controlling them
- Procedures for performing electrical shock and arc flash hazard analyses
- Use of signs, barricades and/or attendants to enforce approach boundaries
- Work permits for when work must be performed on equipment that must remain energized
- Clearly identified and properly labeled equipment
- Regular inspections of electrical testing equipment
- Inspections of newly installed or modified equipment and systems
- Maintenance of equipment according to manufacturer recommendations

Electrical Safety for Construction Part 1: Cords and Plug- Connected Equipment

Using electricity around construction sites is so common that it's easy to forget it can cause everything from minor electrical shocks to electrocution and explosions. You need to be able to identify electrical hazards and protect yourself from them. It's not just people working directly with electrical systems who are at risk. Many other types of workers may be exposed to serious electrical hazards while carrying out non-electrical tasks.

Electrical Hazards

Electrical hazards 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 electrical 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]** Electrical 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 shrapnel and 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 compounded by melted or burning clothing
- 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.

General Safety Precautions

To protect yourself from electrical hazards, you can:

- Use ground-fault circuit interrupters (GFCIs)
- Inspect portable tools and extension cords
- Use cords, 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

Proper Use of 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-prong type, are not designed for hard usage, or have been modified. Do not use cords as a substitute for fixed wiring, and ensure that cords do not cause a tripping hazard.

Properly use and maintain cords, cord connectors, receptacles and cord- and plug-connected equipment. Do not use damaged cords. Make sure insulation is intact and electrical conductors are not exposed.

Do not run cords through holes in walls, ceilings, or floors. Do not attach cords to building surfaces. 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.

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

Keep cords and cord connectors dry. Keep cords away from heat, oil and sharp edges.

Connect cords to devices and fittings in ways that prevent tension at joints and terminal screws. Tension on cords can cause wires to loosen under plug terminal screws, resulting in conductors becoming loose inside the cord, touching, short circuiting and starting fires.

Flexible cords used with temporary and portable lights must be designed for hard use and are marked with conductor or wire size (AWG), number of conductors, cord type, AMP rating and the manufacturer's name or trademark.

Tool Safety Tips

Inspect tools for missing or damaged prongs, cuts or separation, abrasions, flattened/crushed sections and damaged insulation prior to using them. Remove damaged tools from use.

Do not carry a tool by the cord. Do not yank a cord to disconnect a tool, pull the plug instead. Disconnect tools when not in use and when changing accessories.

Store tools in a dry place. Do not use tools in wet/damp environments. Keep working areas well-lit to spot potential hazards.

Use double-insulated tools. Even when a power system is properly grounded, the condition of electrical equipment can become hazardous because of extreme conditions, rough treatment and misuse. Wear appropriate footwear and a voltage-rated hard hat.

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 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, tools 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 tool or extension cord after confirming it is properly grounded. This way, workers can visually confirm when the item was inspected. Remember that pre-use visual inspections are still needed, even if the tape indicates a recent inspection.

The AEGCP will:

- Include specific grounding procedures
- Explain how competent persons complete required equipment inspections and tests
- Ensure tests are performed before first use, after any repairs, after suspected damage and at least every three months

Electrical Safety for Construction Part 2: Power Lines and Lockout/Tagout/Tryout

Using electricity around construction sites is so common that it's easy to forget it can cause everything from minor electrical 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. Overhead, wall or ceiling/floor embedded, and buried power line contact is a major electrical hazard on construction sites.

Contact with Power Lines

Overhead, wall or ceiling/floor embedded, and buried power lines carry extremely high voltage. Risks associated with them include electrocution (death) though direct contact with lines or arcing through the air, 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 electrical shocks and arcing. Death is likely if you contact them.

General Power Line Best Practices

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

Before working near overhead power lines, survey work areas for hazards such as electrical 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 nonconductive

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 (6 meters) of lines, you will need:

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

These devices are not a substitute for de-energizing and grounding lines or maintaining safe line clearances. Learn about specific precautions to follow where you work.

Ladders

Use nonconductive ladders and be sure to retract them before moving. Adopt a "ladders last" approach. Consider ladders last when scaffolding, aerial lifts and portable stairs are not available or feasible.

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. Coordinate with the competent person responsible for excavation safety if you have questions or need any assistance in locating utilities
- Hand dig or use other safe means such as hydro excavation 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

Emergency Procedures

If your equipment contacts an overhead power line, the operator should move in the reverse direction from where the contact occurred. If the equipment cannot be moved away from contact, the operator should remain inside the cab until the lines have been de-energized. Stay away from the equipment's metal frame. Warn others to stay at least 35 feet (10.7 meters) away until the lines have been deenergized. Report the incident to local emergency dispatchers.

Follow a similar process for underground electrical utility strikes. Remain in the equipment until the line has been de-energized if you cannot break contact. Shut off running equipment and leave the area in the event of a natural gas strike.

If you must exit the equipment:

- Don't run!
- Jump clear with both feet together
- Don't touch any part of the equipment when you're on ground
- Shuffle away with small steps, keeping your feet together

Electrical Shock Injuries

- In the event of an electrical shock, disconnect electrical power if safe to do so
- Electrically trained personnel may separate someone who is being shocked using a rated nonconductive "hot stick"
- Once power is off and the victim is in a safe place, check for breathing and pulse
- If qualified, start cardiopulmonary resuscitation (CPR) and automatic external defibrillator (AED) use, as needed
- Arrange for transport to qualified medical care

Lockout/Tagout/Tryout

Lockout/tagout/tryout 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 energy near workers.

Seven steps are followed to establish lockout/tagout/tryout protection:

1. Notify others that the equipment will be locked out and tagged out.
2. Prepare for shutdown by reviewing energy sources.
3. Shut down the equipment by normal means.
4. Isolate equipment using valves, disconnect switches or other means.
5. Apply locks and tags to energy isolation devices (e.g., switches, valves).
6. Manage stored or residual energy.
7. Verify de-energization of the equipment (tryout step).

Four steps are followed to remove lockout/tagout/tryout protection.

1. Inspect the area.
2. Keep people away.
3. Remove locks and tags.
4. Notify people that LOTOTO has ended.

Employer Requirements

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

- Ensure overhead power line safety
- Locate and isolate energized circuits, exposed or concealed, before starting work
- Post warning signs
- Advise workers of locations, hazards and protective measures
- Enforce lockout/tagout/tryout safety-related work practices
- Provide employees with tools, equipment and electrical safety training to do the job safely

Safety Signs

Purpose

Signs

- Safety signs provide important information to make safe decisions
- Signs need to be:
- Visible
- Legible
- Placed in the proper area (e.g., before the hazard is reached)
- Accompanied by appropriate controls

Hazards

- Signs provide visual cues and are a reminder about hazards and precautions
- Signs are NOT intended to replace guarding or other forms of hazard elimination and risk control
- In addition to signs, training and routine communication are other ways to communicate hazardous conditions and safety requirements

Report Missing Controls

- If you see a sign, look for safety controls nearby
- Safety controls are physical barriers or devices designed to keep you safe
- Guardrails
- Fences
- Locks
- Doors
- If you see something wrong, such as an open manhole with a safety sign but no guardrails, fix it if you can and notify a qualified person
- Safety is everyone's responsibility

Meaning

Signs can vary from site to site. However, some characteristics are the same. The color and signal words have the same meaning even if the size, shape and arrangement are different. Risk drives the signal word and color selection.

Colors and words

- Danger – red
- Contact with the hazard WILL CAUSE serious injury or even death
- Warning – orange
- Hazardous situations that COULD cause serious injury or death
- Caution – yellow
- Hazards nearby that could cause minor or moderate injuries (e.g., slippery when wet)
- Notice – blue
- Information about things to keep you safe (e.g., keep the area clear, wear personal protective equipment or wash your hands)

- Safety Instructions – green
- General safety information (e.g., where to find a first aid kit, where to take shelter during a storm, or reminder to fasten your seatbelt)

Pictures

- Symbols describe hazards and precautions needed
- Examples



Safety glasses required



Dangerous voltage



Pinching hazard



Hearing protection required

Best Practices

- Signs provide safety reminders in the work area. You can also find safety information in:
- company policies and procedures manual
- bulletin board postings
- standard operating procedures
- safety training
- Ask if you are unsure about the meaning of a sign
- Report and address issues to qualified personnel
- Sign placement and size should be based on the distance to the hazard and how long it will take someone to react
- Some signs, such as exit signs, are illuminated for visibility during an emergency
- Signs should ALWAYS be supported by controls

Supervisor Supplement

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 proper area and 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, and ask the workers if they have any questions about what the signs mean or what they 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

DON'T

– Explain your purpose (safety) – Distract workers – Assume people don't know the – Assume they know what is wrong risks and how to fix it – Lead with the positive – Make it personal – Be timely and specific – Be vague/general – Express concern – Write while observing – Be personable – Restate what they say to you – Thank the person

Safety Signs: Know What They Mean



Hydrogen Sulfide (H2S) Overview

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 gas is heavier than air, so you should expect to find it in low areas, especially sewer lines, pits and cellars. Hydrogen sulfide is highly flammable and toxic, even at low levels. If you ignite hydrogen sulfide, the fire will flash back to the source of the gas. H_2S smells like rotten eggs and may be noticeable at low levels. **Do not rely solely on smell to detect H_2S.** Doing so is very dangerous because the sense of smell is quickly paralyzed by the gas.

Health Effects

Since hydrogen sulfide can impair your sense of smell, the first indication you may detect 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 an air-purifying respirator with specialized canisters/cartridges for hydrogen sulfide that is present below 100 parts per million (ppm). A full-face respirator will provide eye protection.

Consider the area immediately dangerous to life and health (IDLH) and exit immediately if hydrogen sulfide is present above 100 ppm. Escape-only air packs may be available for you to use **only** when exiting a toxic atmosphere. You should only return to the area if you have appropriate respiratory protection, emergency equipment, training and staff on-site.

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. **1. Ensure your own safety.**
2. Call for emergency assistance immediately.
3. Perform a non-entry rescue using pre-placed winches or ropes, if possible.
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.

Do **not** attempt to enter the area to perform a rescue unless you are properly trained, equipped and authorized.

Carbon Monoxide

Uses and Sources

Carbon monoxide (CO) is used in:

- Chemical manufacturing
- Food packaging (by displacing oxygen to extend the shelf life of food)
- Metal extraction (particularly in the production of iron and steel)
- Production of synthetic fuels

The most common source of carbon monoxide is the burning of fuels.

Mechanics, firefighters, longshore workers, diesel engine operators, forklift operators, and tunnel and toll booth attendants are typically exposed to carbon monoxide due to their proximity to combustion sources like engines and fires.

Characteristics

CO is a colorless, non-irritating, odorless and tasteless gas found in both outdoor and indoor air. It is typically found in its gaseous form but can also be shipped as a non-liquefied or liquefied compressed gas. In its refrigerated (cryogenic) liquid form, CO remains colorless.

CO gas is less dense than air. It will rise and displace oxygen in higher locations first.

CO is highly flammable and burns a violet flame. Containers of carbon monoxide will be marked as flammable, compressed gas, acutely toxic and a health hazard.

Health Hazards

Carbon monoxide primarily affects the cardiovascular system, lungs, blood and central nervous system. The primary route of exposure is inhalation, but skin and eye contact can pose risks when dealing with its liquid form.

Symptoms of CO exposure may include headache, rapid breathing, nausea, weakness/exhaustion, dizziness, confusion, hallucinations, skin discoloration, chest pain and fainting. **Overexposure to CO can occur before symptoms become noticeable.**

Infants, the elderly and individuals with chronic heart disease, anemia or respiratory problems are more susceptible to CO poisoning. The severity of carbon monoxide poisoning depends on the concentration of CO and the duration of exposure.

Physical Hazards

Contact with liquid CO can cause severe frostbite.

- Carbon monoxide can be easily ignited by heat, sparks and flames. Vapors from a liquid spill are initially heavier than air and can spread along the ground to an ignition source and cause flashback to the source of a leak.
- Prolonged exposure to fire or intense heat can cause containers to rupture violently and become projectile hazards.

Controls

To prevent injuries from CO poisoning, use a hierarchy of controls including engineering controls, administrative controls and personal protective equipment (PPE).

Engineering controls are the first line of defense. Use ventilation systems (forced air and dilution ventilation) to maintain safe air quality and air monitoring systems to detect CO levels.

Administrative controls play a vital role in ensuring safety. These include:

- Employee training on the signs and symptoms of CO exposure
- Equipment maintenance
- Processes and procedures for working with CO
- Worker rotation
- Access control
- Emergency procedures

Use ***PPE*** when working with CO gas or liquid. Follow your company's PPE requirements. Respiratory protection, which may include Supplied-Air Respirators (SARs), is necessary when CO concentrations exceed exposure limits.

Monitoring Requirements

To monitor carbon monoxide levels in the workplace, area monitors or handheld meters may be used. Keep occupational carbon monoxide exposure below 50 ppm (55 mg/m^3). The American Conference of Governmental Industrial Hygienists (ACGIH) recommends the level not exceed 25 ppm. Jurisdictions may enforce stricter regulations.

Emergencies

In the event of an emergency involving carbon monoxide, protect yourself first.

1. Evacuate to a safe area (crosswind and upwind).
2. Once you are safely out of the contaminated area, immediately call for help before attempting any rescue.
3. Put on a self-contained breathing apparatus before attempting a rescue.
4. When rescuing a victim, drag them rather than carry them.
5. After you have safely removed an unconscious victim from a carbon monoxide-enriched area, begin rescue breathing or cardiopulmonary resuscitation (CPR).
6. Transport the victim to a physician as soon as possible.

Fire or Explosion Emergencies

Remember that if there is a leak or spill of liquid CO, there is a risk of flashback fire and explosions. Prolonged exposure to fire or intense heat may cause containers to violently rupture or become projectile.

Do not enter closed spaces unless you are properly trained and equipped. Ensure the space is ventilated before entering.

Isolate a spill or leak area for at least 100 meters (330 feet) in all directions. In the event of a fire involving a tank, rail car or highway tank, isolate the area for 800 meters (1/2 mile) in all directions. Consider an evacuation of the same area.

Hazard Communication for Construction Part 1: 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 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 Labeling 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: irritant/toxic).

Responsibilities

Chemical **manufacturers** must:

- Evaluate the hazards of the chemicals that they manufacture
- Label products according to the HazCom Standard
- Provide a Safety Data Sheet (SDS) with each chemical that they ship

Importers/distributors of chemicals must provide a label and SDS with each chemical that they ship.

Companies must:

- Identify and list all 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 that includes hazard classification, the written program, SDSs and labels, and training

Hazardous Chemical Inventory

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

Written Program

Key elements of the written program include:

- The hazardous chemicals present at the jobsite
- Who is responsible for each aspect of the program
- Where written materials will be made available to employees

It must also explain how information will be shared at multi-employer jobsites, including how the site owner, general contractor, and subcontractors coming onsite will communicate. The program must describe how the jobsite meets the requirements for container labels and other forms of warning, access to SDSs, and the provision of employee information and training. The program must also outline how employees will be informed of non-routine task hazards and describe 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

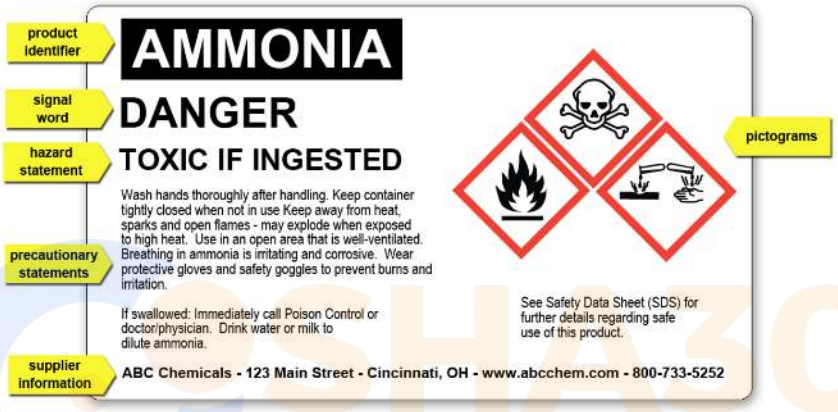
Expect to learn about where hazardous chemicals are present and where to find the written program, hazardous chemical inventory and SDSs. Training will also include the physical and health hazards of chemicals, how you can protect yourself from chemical hazards and how to detect the presence or release of a hazardous chemical.

Hazard Communication for Construction Part 2: How to Use Labels and Safety Data Sheets

Hazard Warning Labels

Labels must be clear and legible, in English (plus other languages, if desired), and prominently displayed.

Replace labels promptly if they become faded, damaged, or obscured. Acceptable replacements include the original manufacturer's label or approved formats like the National Fire Protection Association (NFPA) 704 or a Hazardous Materials Identification System (HMIS) label.



Labels include:

1. Product name or identifier.
2. Pictograms (symbols) convey information about hazard classes, transportation requirements, or toxicity (example: oxidizing chemicals have a circle with flames).
3. Signal words ("Danger" is more severe than "Warning").
4. Hazard statements describing physical, health, and environmental hazards.
5. Supplemental information.
6. First aid statements.
7. Precautionary measures (labels contain four types of precautionary statements: "prevention," "response," "storage," and "disposal").
8. Name, address, and telephone number of the supplier.

Pictograms

Pictograms on labels include the harmonized hazard symbols plus other graphic elements, such as borders, background patterns, or colors that are intended to convey specific information. There are 9 pictograms total.

Note: The use of the Environment pictogram is not mandatory. The Exclamation Mark pictogram will not be displayed with the skull and crossbones, corrosion, or health hazard pictograms.

Exclamation Mark	Flame	Health Hazard
		
– Skin and eye irritants – Skin sensitizers – Acute toxicity (harmful) – Narcotic effects – Respiratory tract irritants	– Flammables – Pyrophorics – Self-heating materials – Substances that emit flammable gas – Self-reactives – Organic peroxides	– Carcinogenicity – Mutagenicity – Reproductive toxicity – Respiratory sensitizers – Target organ toxicity – Aspiration toxicity
Flame Over Circle	**Exploding Bomb**	**Gas Cylinder**
		
– Oxidizers	– Explosives – Self-reactives – Organic peroxides	– Gases under pressure
Corrosive	**Skull and Crossbones**	**Environment**
		
– Substances that can corrode or burn skin, eyes, and metal	– Acute toxicity (fatal)	– Aquatic toxicity

Safety Data Sheets (SDSs)
The chemical manufacturer, importer, or distributor and must provide Safety Data Sheets with the first shipment and anytime information changes.

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.

SDSs must be in English (other languages are optional) and readily accessible to employees in their work area.

Sections of the SDS

Section 1: Identification includes the product identifier, any other means of identification, the recommended use of the chemical (as well as restrictions on use), supplier details, and an emergency phone number for accidents or incidents.

Section 2: Hazard Identification provides the substance's classification and label elements (including hazard and precautionary statements, hazard symbols, and signal words). It explains prevention, response, storage, and disposal guidelines; identifies target organs affected; and includes Hazardous Materials Identification System (HMIS) label information.

Section 3: Composition/Information on Ingredients contains information on the chemical identity, common names, and synonyms; Chemical Abstracts Service (CAS) or European Commission (EC) number; impurities and stabilizing additives; and identity/concentration of hazardous ingredients above thresholds.

Section 4: First-Aid Measures contains essential information for handling emergencies involving chemical exposure.

Section 5: Firefighting Measures provides guidelines for extinguishing small fires and identifies when professional firefighting services are needed. It details the chemical's behavior when exposed to hazards, such as flammables catching fire or chemicals reacting with water. Necessary protective equipment for firefighters is also included.

Section 6: Accidental Release Measures includes information about what to do in the event of an accidental release, including required personal protective equipment (PPE), emergency procedures, required environmental precautions, and methods and materials for containment and cleanup.

Section 7: Handling and Storage covers precautions for safe handling as well as the conditions for safe storage (including incompatibilities). It may recommend using the chemical in a well-ventilated area or a spray booth or storing flammable substances in a flammable locker.

Section 8: Exposure Controls/Personal Protection defines the minimum controls (exposure limits, engineering controls, PPE) needed to use a substance safely.

Section 9: Physical and Chemical Properties includes basic physical and chemical property information such as vapor pressure, density, flash point, and odor/appearance.

Section 10: Stability and Reactivity addresses chemical stability conditions of a substance, including the possibility of hazardous reactions from the substance and any hazardous decomposition products.

Section 11: Toxicological Information details a substance's toxicological effects, likely routes of exposure, and the effects of toxicity (immediate, delayed, and chronic).

Section 12: Ecological Information includes ecological considerations, such as degradability and ecotoxicity.

Section 13: Disposal Considerations describes how to safely handle and dispose of residues.

Section 14: Transport Information provides information on how to safely transport the substance and includes its UN number, shipping name, and other required items.

Section 15: Regulatory Information details regulatory information including safety, health, and environmental regulations specific to the product.

Section 16: Other Information includes any other relevant information, including information about the preparation and revision of the SDS itself.

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: 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 (abdominal pain)
- 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 and skin absorption.

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

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. Heat stress occurs when our bodies are unable to maintain a safe internal temperature.

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.

Conditions for Heat Stress

Some conditions make it difficult for our body to cool itself, making heat stress more likely. High **humidity** means there is a lot of water in the air that makes it harder for sweat to evaporate off your skin.

Radiant heat is the heat that objects, such as fires, ovens and pavement, give off. Exposure to radiant heat makes it harder for the body to cool down.

Direct sunlight can cause heat stress because you don't have protection from the radiant heat of the sun. When the air is still, it is not moving heat away from you and it is harder for sweat to evaporate.

The **heat index** is a measure of the level of discomfort the average person can expect due to the temperature and humidity of the air.

Exertion is another factor that can increase the likelihood of heat stress. The greater the heat index and the more you exert yourself, the more water you need to drink to replace what you lose from sweating. Light exertion involves sitting or standing with minimal arm and leg movement. Moderate exertion involves actions that require continuous, modest intensity, such as light pushing/pulling or normal walking. Heavy exertion involves intense upper-body work, such as carrying loads or sawing.

Health and Safety Concerns

Health Concerns

Medical conditions, medications and supplements may make people more sensitive to sun damage and heat stress. Read the labels on everything you take and consult a doctor if you have questions or concerns.

Long-term, prolonged exposure to heat can cause swelling and permanent damage to the body's tissues and organs. People who have underlying medical conditions are at an increased risk for heat exhaustion, heat stroke and organ damage or failure. Talk to your physician about

any heat stress you may experience on the job and work with your employer to make sure you can work safely.

Sunburn

Sunburn happens when skin is burned by UV rays, which are strongest in late morning and the afternoon. You can burn even on cloudy days, and all skin colors can burn. Overexposure to the sun can cause skin cancer. To treat sunburn:

- 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

- Heat rash is also known as prickly heat. It is likely to occur in hot, humid environments when sweat ducts become plugged. This uncomfortable **skin rash** may cause discomfort which may reduce work performance. To treat heat rash:
- Keep skin cool and dry
- Let skin air-dry after bathing

Heat cramps

Heat cramps are painful spasms of the muscles due to body's loss of water and electrolytes. To treat heat cramps:

- Rest briefly and cool down
- Drink liquids with electrolytes, such as sports drinks

Heat exhaustion

- Symptoms of heat exhaustion include:
- Sweating more (clammy, moist skin)
- Developing a headache
- Having dark urine
- Feeling nauseated/dizzy
- Fainting

To treat heat exhaustion, rest in a cool place and drink liquids. Prompt treatment is important because untreated heat exhaustion could lead to heat stroke.

Heat stroke

Heat stroke is characterized by:

- Red skin
- Sweating that suddenly stops
- Vomiting
- Rapid heartbeat
- Confusion/delirium
- Convulsions
- Loss of consciousness

Death can occur! If you or someone around you experience heat stroke, get medical help **immediately.** While you wait for help:

- Move the victim to a 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.

Safety Concerns

Sweat may cause slips. Heat lowers alertness. Irritability can distract and people may rush and overlook safety procedures to get out of the heat.

Reducing the Likelihood of Heat Stress

Use the hierarchy of controls to avoid heat stress.

1. To **eliminate** sources of heat, your employer may seal steam/heat leaks or intrusions.
2. **Substitution** may involve using alternative processes that produce less heat such as cutting pipes manually rather than using torches. Substitution may also involve using equipment to perform manual tasks, such as lifting or material handling.
3. **Engineering controls** may include air conditioning, canopies, tents or umbrellas, fans/blowers (if heat can escape the area), misters and seat coolers, insulation, windows and ventilation.
4. As an **administrative control**, your employer should have a written program that explains how to prevent heat stress and respond to emergencies. Other administrative controls include letting people work in the shade, scheduling shifts to reduce heat exposure time, enforcing mandatory breaks, medical monitoring, and requiring people to work pairs or groups.
5. **Personal protective equipment (PPE)** may include insulated suits, heat-reflecting clothing, infrared-reflecting face shields, cooling neck wraps, cooling packs or inserts for liners or pockets, and cooling vests. Be aware that some types of PPE, such as respirators, impermeable clothing and head coverings, can increase the risk of heat-related illness.

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.

Make hot jobs easier, lessen job duration, take frequent short breaks, and postpone non-essential tasks.

Lifestyle and tasks that are unrelated to work can affect your susceptibility to heat stress. Exhaustion reduces heat tolerance, so get plenty of **sleep**. Eat **small, frequent meals** rather than large meals and choose foods that have higher water content to help reduce internal heat.

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.

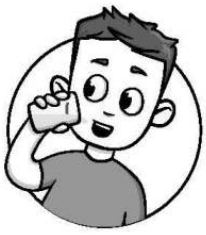
Rest Areas

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.

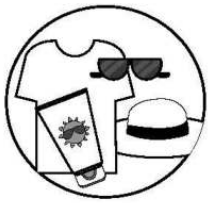


HEAT STRESS

Prevention



Stay hydrated



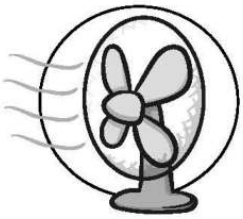
Sun protection



Cold compress/ shower



Take breaks in the shade



Use a fan

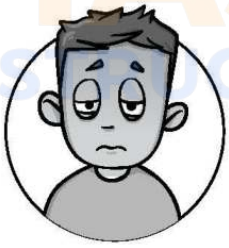
Symptoms



Heavy sweating



Dizziness

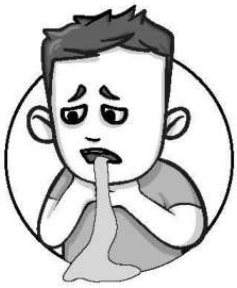


Red skin



Nausea

Call for medical advice if...



Vomiting



Fainting or unconscious



Confusion

